

ISSN: 2349-6495(P) | 2456-1908 (O)



# International Journal of Advanced Engineering Research and Science

(IJAERS)

An Open Access Peer-Reviewed International Journal



Journal DOI: 10.22161/ijaers

Issue DOI: 10.22161/ijaers.99

AI PUBLICATIONS

Vol.- 9 | Issue - 9 | Sep 2022  
editor@ijaers.com | <http://www.ijaers.com/>

# International Journal of Advanced Engineering Research and Science

(ISSN: 2349-6495(P)| 2456-1908(O))

DOI: 10.22161/ijaers

Vol-9, Issue-9

September, 2022

*Editor in Chief*

Dr. Swapnesh Taterh

*Chief Executive Editor*

S. Suman Rajest

---

Copyright © 2022 International Journal of Advanced Engineering Research and Science

Publisher

*AI Publication*

Email: [editor.ijaers@gmail.com](mailto:editor.ijaers@gmail.com); [editor@ijaers.com](mailto:editor@ijaers.com)

Web: [www.ijaers.com](http://www.ijaers.com)

## **International Editorial/ Reviewer Board**

### **Editor in Chief**

- **Dr. Swapnesh Taterh (Chief-Editor)**, Amity University, Jaipur, India

### **Chief Executive Editor**

- **S. Suman Rajest**, Vels Institute of Science, Technology & Advanced Studies, India  
chief-executive-editor@ijaers.com

### **Associate Editors**

- **Dr. Ram Karan Singh**, King Khalid University, Guraiger, Abha 62529, Saudi Arabia
- **Dr. Shuai Li**, University of Cambridge, England, Great Britain

### **Editorial Member**

- **Behrouz Takabi**, PhD, Texas A&M University, Texas, USA
- **Dr. Gamal Abd El-Nasser Ahmed Mohamed Said**, Port Training Institute (PTI), Arab Academ For Science, Technology and Maritime Transport, Egypt
- **Dr. Hou, Cheng-I**, Chung Hua University, Hsinchu Taiwan
- **Dr. Ebrahim Nohani**, Islamic Azad University, Dezful, IRAN.
- **Dr. Ahmadad Nabih Zaki Rashed**, Menoufia University, EGYPT
- **Dr. Rabindra Kayastha**, Kathmandu University, Nepal
- **Dr. Dinh Tran Ngoc Huy**, Banking and Finance, HCM, Viet Nam
- **Dr. Engin NAS**, Duzce University, Turkey
- **Dr. A. Heidari**, California South University (CSU), Irvine, California, USA
- **Dr. Uma Choudhary**, Mody University, Lakshmangarh, India
- **Dr. Varun Gupta**, National Informatic Center, Delhi, India
- **Dr. Ahmed Kadhim Hussein**, University of Babylon, Republic of Iraq
- **Dr. Vibhash Yadav**, Rajkiya Engineering College, Banda. UP, India
- **Dr. M. Kannan**, SCSVMV University, Kanchipuram, Tamil Nadu, India
- **José G. Vargas-Hernández**, University of Guadalajara Periférico Norte 799 Edif. G201-7, Núcleo Universitario Los Belenes, Zapopan, Jalisco, 45100, México
- **Dr. Sambit Kumar Mishra**, Gandhi Institute for Education and Technology, Baniatangi, Bhubaneswar, India
- **DR. C. M. Velu**, Datta Kala Group of Institutions, Pune, India
- **Dr. Deependra Pandey**, Amity University, Uttar Pradesh, India
- **Dr. K Ashok Reddy**, MLR Institute of Technology, Dundigal, Hyderabad, India
- **Dr. S.R.Boselin Prabhu**, SVS College of Engineering, Coimbatore, India
- **N. Balakumar**, Tamilnadu College of Engineering, Karumathampatti, Coimbatore, India
- **R. Poorvadevi**, SCSVMV University, Enathur, Kanchipuram, Tamil Nadu, India
- **Dr. Subha Ganguly**, Arawali Veterinary College, Sikar, India
- **Dr. P. Murali Krishna Prasad**, GVP College of Engineering for Women, Visakhapatnam, Andhra Pradesh, India
- **Anshul Singhal**, Bio Instrumentation Lab, MIT, USA
- **Mr. Lusekelo Kibona**, Ruaha Catholic University, Iringa, Tanzania
- **Sina Mahdavi**, Urmia Graduate Institute, Urmia, Iran
- **Dr. N. S. Mohan**, Manipal Institute of Technology, Manipal, India
- **Dr. Zafer Omer Ozdemir**, University of Health Sciences, Haydarpasa, Uskudar, Istanbul, TURKIYE
- **Bingxu Wang**, 2721 Patrick Henry St Apt 510, Auburn Hills, Michigan, United States
- **Dr. Jayashree Patil-Dake**, KPB Hinduja College of Commerce, Mumbai, India

- **Dr. Neel Kamal Purohit**, S.S. Jain Subodh P.G. College, Rambagh, Jaipur, India
- **Mohd Muntjir**, Taif University, Kingdom of Saudi Arabia
- **Xian Ming Meng**, China Automotive Technology & Research Center No.68, East Xianfeng Road, Dongli District, Tianjin, China
- **Herlandi de Souza Andrade**, FATEC Guaratingueta, State Center for Technological Education Paula Souza - CEETEPS
- **Dr. Payal Chadha**, University of Maryland University College Europe, Kuwait
- **Ahmed Moustafa Abd El-hamid Elmahalawy**, Menoufia University, Al Minufya, Egypt
- **Prof. Mark H. Rummeli**, University & Head of the characterisation center, Soochow Institute for Energy Materials Innovations (SIEMES), Suzhou, Jiangsu Province, China
- **Dr. Eman Yaser Daraghmi**, Ptuk, Tulkarm, Palestine
- **Holmes Rajagukguk**, State University of Medan, Lecturer in Sisingamangaraja University North Tapanuli, Indonesia
- **Dr. Menderes KAM**, Dr. Engin PAK Cumayeri Vocational School, DÜZCE UNIVERSITY (University in Turkey), Turkey
- **Dr. Jatin Goyal**, Punjabi University, Patiala, Punjab, India | International Collaborator of GEITEC / UNIR / CNPq, Brazil
- **Ahmet İPEKÇİ**, Dr. Engin PAK Cumayeri Vocational School, DÜZCE UNIVERSITY, Turkey
- **Baarimah Abdullah Omar**, Universiti Malaysia Pahang (UMP), Gambang, 26300, Malaysia
- **Sabri UZUNER**, Dr. Engin PAK Cumayeri Vocational School Cumayeri/Duzce/Turkey
- **Ümit AĞBULUT**, Düzce University, Turkey
- **Dr. Mustafa ÖZKAN**, Trakya University, Edirne/ TURKEY
- **Dr. Indrani Bhattacharyya**, Dr. B.C. Roy College of Pharmacy and Allied Health Sciences, Durgapur, West Bengal, India
- **Egnon Kouakouc**, Nutrition/Health at University Felix Houphouet Boigny Abidjan, Ivory Coast
- **Dr. Suat SARIDEMİR**, Düzce University, Faculty of Technology, Turkey
- **Dr. Manvinder Singh Pahwa**, Director, Alumni Relations at Manipal University Jaipur, India
- **Omid Habibzadeh Bigdarvish**, University of Texas at Arlington, Texas, USA
- **Professor Dr. Ho Soon Min**, INTI International University, Jln BBN 12/1, Bandar, Baru Nilai, 71800 Negeri Sembilan, Malaysia
- **Ahmed Mohammed Morsy Hassan**, South Egypt Cancer Institute, Assiut University, Assiut, Egypt
- **Xian Ming Meng (Ph.D)**, China Automotive Technology & Research Center, No.68, East Xianfeng Road, Tianjin, China
- **Ömer Erkan**, Konuralp Campus, Düzce-Turkey
- **Dr. Yousef Daradkeh**, Prince Sattam bin Abdulaziz University) PSAU), KSA
- **Peter JO**, IPB University, Indonesia
- **Nazmi Liana Binti Azmi**, Raja Perempuan Zainab II Hospital, 15586 Kota Bharu, Kelantan, Malaysia
- **Mr. Sagar Jamle**, Oriental University, Indore, India
- **Professor Grazione de Souza**, Applied Mathematics, Rio de Janeiro State University, Brazil
- **Kim Edward S. Santos**, Nueva Ecija University of Science and Technology, Philippines.

## **Vol-9, Issue-9, September 2022**

(10.22161/ijaers.99)

Detail with DOI (CrossRef)

### ***Active Learning Strategy Applied to Control Theory Teaching***

*Elias J. R. Freitas, Leonardo S. Prado, Marcos V. F. Silva, Vinícius A. Alvarenga, Adrielle C. Santana*

 DOI: [10.22161/ijaers.99.1](https://doi.org/10.22161/ijaers.99.1)

Page No: 001-008

### ***Active methodologies for teaching entrepreneurship: a proposal for higher education***

*Bruna Carara Nandi, Simone Meister Sommer Bilessimo, Juarez Bento da Silva, Leticia Rocha Machado, Isabela Nardi da Silva*

 DOI: [10.22161/ijaers.99.2](https://doi.org/10.22161/ijaers.99.2)

Page No: 009-022

### ***Environmental injustice caused by wind farms: A systematic literature review***

*Romário Nunes da Silva, Anderson Fernandes de Alencar, Horasa Maria Lima da Silva Andrade, Luciano Pires de Andrade*

 DOI: [10.22161/ijaers.99.3](https://doi.org/10.22161/ijaers.99.3)

Page No: 023-033

### ***Maternal mortality associated with COVID-19: An integrative literature review***

*Lucas Costa de Gois, Sabrina Brenda Castelo Branco Silva, Ana Emília Araújo de Oliveira, Ananda Karina Meneses Flor, Débora Lorena Melo Pereira, Alexandre Maslinkiewicz, Julianne de Area Leão Pereira da Silva, Alan Jefferson Alves Reis, Stéfano Vasconcelos Pôrto, Thaís Gonçalves Nunes, Fábio Freitas de Sousa Passos Galvão, Bruna Victoria de Sousa Sá, Andresa de Araújo Sales, Vanessa carvalho fontinele, Stálin Santos Damasceno, Gabriel Gardhel Costa Araujo, Idna de Carvalho Barros Taumaturgo*

 DOI: [10.22161/ijaers.99.4](https://doi.org/10.22161/ijaers.99.4)

Page No: 034-043

### ***Aspects between Dengue and COVID-19 coinfection: An integrative literature review***

*Lucas Costa de Gois, Sabrina Brenda Castelo Branco Silva, Glória Stéphanly Silva de Araújo, Kathllyn Joyce de Jesus Oliveira, Bruna Victoria de Sousa Sá, Stálin Santos Damasceno, Alexandre Maslinkiewicz, Julianne de Area Leão Pereira da Silva, Stéfano Vasconcelos Pôrto, Jean Carlos Leal Carvalho de Melo Filho, Júlio César Cardozo Dias, Kleiton Vieira da Silva, Rômulo Gueth Borges do Nascimento, Maria Clara Leite Barros Miranda, Lizandra Ellem Silva de Souza, Gabriel Gardhel Costa Araujo, Idna de Carvalho Barros Taumaturgo*

 DOI: [10.22161/ijaers.99.5](https://doi.org/10.22161/ijaers.99.5)

Page No: 044-052

### ***Management and Planning of Basic Life Support: School Community Guidance***

*Lena Cláudia Maia Alencar, Creusa Barbosa dos Santos Trindade, Valeria Regina Cavalcante dos Santos*

 DOI: [10.22161/ijaers.99.6](https://doi.org/10.22161/ijaers.99.6)

Page No: 053-067

***Evaluation of Passive Fire Safety Methods in Hostel Building: A Case Study of Bells University Male Silver Hostel***

Abass A. D, Olagunju Omotawurayo, Olajide Paul, Adeogun Erioluwa, Adeyemo Adeola, Muhammed Maryam, Ilugbekhai Chinonso, Iyare Oluwafemi

 DOI: [10.22161/ijaers.99.7](https://doi.org/10.22161/ijaers.99.7)

Page No: 068-077

***Multiprofessional action towards workers' health: Literature review***

Gleison Faria, Francisco Leandro Soares de Souza, Dhieniffer Naiara da Silva, Gesnaquele Souza da Cruz, Alexandra Alves de Carvalho, Márcia Gisele Peixoto Kades, João Paulo Santos Carvalho, Claudio Henrique Marques Pereira, Suzana Nogueira, Taís Loutarte Oliveira, Juliana Peixoto dos Santos, Rogério Krause, Douglas Basso Sales, Hayslla Mikaella do Couto Araujo, Juliana Alves Rodrigues Cleverson de Oliveira Santos, Karolaine Oliveira Ferreira, Francielly Maira Bordon, Wellington Ferreira de Souza, Eliza Aparecida Javarini Alves, Renata Gatto de Morais, Rhamayana Maria da Conceição, Shayanne de Sousa Silva, Valdair Nunes do Nascimento, Giselen Maleski Cargnin, Marco Rogério da Silva, Alan Vieira Lopes campos, Sarah Gabrielle dos Santos Pacífico Campos, Mateus Duarte Vieira, Hingreedy Fischer da Silva, Welesmar Barros dos Santos, Cleitineia da Silva Souza

 DOI: [10.22161/ijaers.99.8](https://doi.org/10.22161/ijaers.99.8)

Page No: 078-085

***Ethnogastronomy: A brief exploratory review***

Monica Helena Panetta, Jorge Luiz Schirmer de Mattos, Wagner Lins Lira

 DOI: [10.22161/ijaers.99.9](https://doi.org/10.22161/ijaers.99.9)

Page No: 086-094

***What I as a Patient/Family need to know about Bariatric and Metabolic Surgery: A Booklet for Lay People***

Clayton Alencar Moreira, Silvestre Savino Neto, Silvia Ferreira Nunes

 DOI: [10.22161/ijaers.99.10](https://doi.org/10.22161/ijaers.99.10)

Page No: 095-109

***Strategic Management and the use of Indicators by the Leaderships of a Public Hospital***

Tatiana da Silva Mendes, Creusa Barbosa dos Santos Trindade, Silvia Ferreira Nunes, Heliana Helena Moura Nunes, Luciana Rodrigues Ferreira, Eliane Moura da Silva, Mariseth Carvalho de Andrade, Edilson Ferreira Calandrini, Fabiana Morbach da Silva, Valeria Regina Cavalcante dos Santos

 DOI: [10.22161/ijaers.99.11](https://doi.org/10.22161/ijaers.99.11)

Page No: 110-119

***Quilombolas Territories: Resistance and Recognition***

Simone Francisca Ramos de Sousa, Renato Ramos de Almeida, Luana Pereira Rodrigues, Jose Henrique Santos Souza, Nilton de Almeida Araújo

 DOI: [10.22161/ijaers.99.12](https://doi.org/10.22161/ijaers.99.12)

Page No: 120-126

***Main Public Tourism Policies in Brazil as a Tool for the Development of Tourism on the Amazon Frontier: A Review***

Fabio Robson Casara Cavalcante, Gilmara Ferreira de Lima, Carlos Alberto Paraguassú-Chaves, Ana Maria Morais da Fonseca Cavalcante, Carla Dolezel Trindade, Simão Aznar Filho, Ruy Drummond Smith, Simão Dolezel Aznar, Fabrício Moraes de Almeida, Lenita Rodrigues Moreira Dantas

 DOI: [10.22161/ijaers.99.13](https://doi.org/10.22161/ijaers.99.13)

Page No: 127-145

***The inclusion and evolution of isms and dades in higher education Institutions***

A. Pereira Júnior, A. O. Ferreira, R. G. B. S. Gatinho, A. N. Pontes, N. E. S. Beltrão, G. P. Morales

 DOI: [10.22161/ijaers.99.14](https://doi.org/10.22161/ijaers.99.14)

Page No: 146-162

***Antioxidant, anti-inflammatory and antimicrobial activities promoted by hydroalcoholic extract of Laguncularia racemosa (l) c.f. leaves Gaert***

Jhonatta Alexandre Brito Dias, Antonio Carlos Vital Júnior, Fábio Miguel Santos Costa, Priscilla Yevellin Barros de Melo Lima, Helimarcos Nunes Pereira, Iranildo José da Cruz Filho, Cristiane Moutinho Lagos de Melo, Teresinha Gonçalves da Silva, Ivone Antônia de Souza

 DOI: [10.22161/ijaers.99.15](https://doi.org/10.22161/ijaers.99.15)

Page No: 163-176

***The logistical challenges to implement the environmental management system in a natural gas company in the North Region***

Darlene Ribeiro Pires, Alexandra Amaro de Lima

 DOI: [10.22161/ijaers.99.16](https://doi.org/10.22161/ijaers.99.16)

Page No: 177-190

***Hydrogen production by water electrolysis using TEA.PS-BF<sub>4</sub> ionic liquid and alternative electrocatalysts***

Márcia R. Becker, Sergio A. Arguello, Janine C. Padilha

 DOI: [10.22161/ijaers.99.17](https://doi.org/10.22161/ijaers.99.17)

Page No: 191-196

***The training of health students during the COVID-19 pandemic: Changing scenarios***

Adriana Duarte de Souza Carvalho da Silva, Enderson Rodrigues de Carvalho, Master Leandro Henrique Tavares Pauletti

 DOI: [10.22161/ijaers.99.18](https://doi.org/10.22161/ijaers.99.18)

Page No: 197-199

***Innovation as humanity's resource: How play can make the UN's 2030 goals achievable***

Waldir Ventura Filho, Júlio Francisco Blumetti Facó, Alexandre Acácio de Andrade, Lina Maria Moreira Garai da Silva

 DOI: [10.22161/ijaers.99.19](https://doi.org/10.22161/ijaers.99.19)

Page No: 200-208

***Food Feasibility and Safety in Animal Protein Production in Urban and Periurban Area***

James Lima Chaves, Jairton Fraga Araújo, Luciano Sergio Ventin Bomfim, Alexandre Boleira lopo

 DOI: [10.22161/ijaers.99.20](https://doi.org/10.22161/ijaers.99.20)

Page No: 209-216

***Data-Driven Decision Making in the Public Sector: A Systematic Review***

Rodrigo Speckhahn Soares da Silva, Claudelino Martins Dias Junior, Rogério Tadeu de Oliveira Lacerda

 DOI: [10.22161/ijaers.99.21](https://doi.org/10.22161/ijaers.99.21)

Page No: 217-229

***The use of technology in the classification of obstetric risk: An integrative literature review***

Michele de Pinho Barreiros, Hanna Ariane Monteiro Carrera, Elisângela da Silva Ferreira, Maria Elizabete de Castro Rassy, Regina Racquel dos Santos Jacinto, Carla Monique Lavareda Costa, Luiza Karla Alves de Paula, Karla Vanessa Silva dos Santos, Cristiane Patrícia Siqueira Monteiro, Fabiane Lima da Silva, Anne Caroline Gonçalves Lima, João Victor Elyakim Pantoja Magno, Jhennifer Pereira Rodrigues, Andressa Torres Oliveira, Elane Magalhães Oliveira, Júlio Éliton Lima Guimarães, Janaína Cunha Romeiro, Josiane Macedo de Oliveira Rupf, Creusa Barbosa dos Santos Trindade, Adams Brunno Silva, Luciana Gonçalves de Oliveira, Anna Thalita de Souza Cardoso, Caroline Saraiva Farias, Ana Caroline Guedes Souza Martins, Heliana Helena de Moura Nunes

 DOI: [10.22161/ijaers.99.22](https://doi.org/10.22161/ijaers.99.22)

Page No: 230-236

***Integration of Acupuncture as a Rehabilitation Model Applied in the Integral University Clinic of the State University of the Ecatepec Valley***

Angèlica Castañeda Duarte, Miguel Alberto Gutiérrez Nava, Irma García Moreno, Ana Lilia González Santiago,

 DOI: [10.22161/ijaers.99.23](https://doi.org/10.22161/ijaers.99.23)

Page No: 237-243

***Approach to death in the school context: a study anchored in the school's organizational documents***

Maria de Fátima da Silva Monteiro, Maria Regina Teixeira Ferreira Capelo

 DOI: [10.22161/ijaers.99.24](https://doi.org/10.22161/ijaers.99.24)

Page No: 244-248

***Determination of Elastic and Mechanical Properties in CA-50 Steel by using Ultrasonic Waves***

Álvaro Barbosa de Carvalho Júnior, Maria Helena Teles Lopes, Maurílio José Inácio, Samara Guedes Ramos, Debora Santos Rodrigues, Gustavo Dias Froes, Vinícius Marques Botelho Fonseca, Jairo Andrei Vieira de Oliveira

 DOI: [10.22161/ijaers.99.25](https://doi.org/10.22161/ijaers.99.25)

Page No: 249-255

***Agribusiness at the interface of a liberal economy***

Warley Lopes Martins

 DOI: [10.22161/ijaers.99.26](https://doi.org/10.22161/ijaers.99.26)

Page No: 256-262

***Metabolic Syndrome in Quilombola Populations Environmentally Exposed to Organophosphate Pesticides in the State of Pará- Brazil***

Amanda Cavalcante Lopes, Núbia Rocha Marques, Rosivaldo de Alcantara Mendes, Kleber Raimundo Freitas Faial, Antônio Marcos Mota Miranda

 DOI: [10.22161/ijaers.99.27](https://doi.org/10.22161/ijaers.99.27)

Page No: 263-269

***Territorial Identity: Challenges and perspectives in the quilombola communities of Gurugi and Mituaçu***

Marcley da Luz Marques, Ângelo Giuseppe Chaves Alves, Júlia Figueredo Benzaquen, Horasa Maria Lima da Silva Andrade, Wagner Lins Lira

 DOI: [10.22161/ijaers.99.28](https://doi.org/10.22161/ijaers.99.28)

Page No: 270-279



***Detecting Anemia Based on Palm Images using Convolutional Neural Network***

Ahmad Saiful Rizal, Alfian Futuhul Hadi, Sudarko, Supangat

 DOI: [10.22161/ijaers.99.29](https://doi.org/10.22161/ijaers.99.29)

Page No: 280-287

***The difficulties of implementing palliative care***

Mariângela Ferraz Rodrigues Araújo, Ana Paula Saldanha Santos, Andressa Jordânia Alves de Amorim, Francielly Aparecida Lemos Walder, Ivan Paoletti Pisani, Thalyta Eduarda de Menezes Gouvea, Bruna Rafaela Gomes de Sousa Oliveira, Pamela Nery do Lago, Simone Aparecida de Souza Freitas, Luciana Moreira Batista, Danielle Cristina de Oliveira Silva Saturnino, Luciana de Moraes Lisboa, Aline da Silva Fernandes, Diva Maria de Oliveira, Carolina Costa Pinto, Elessandra Antônia Santos de Rezende, Nicolle Silva de Menezes, Ana Paula Caetano Pereira, Ronaldo Gomes Rodrigues, Fabíola Fontes Padovani, Laiana Otto da Costa, Raquel Resende Cabral de Castro e Silva, Ângelo Aparecido Ninditi, João Eduardo Pinho, Maria Emília Lúcio Duarte, Darlan dos Santos Damásio Silva, Juliane Guerra Golfetto, Leticia do Nascimento, Rita de Cássia Almeida Sales, Kiwisunny Galvão Franzoi, Hirlla Karla de Amorim, Kelly Monte Santo Fontes, Rafaela Bezerra Gama Guimarães, Fabiana Nascimento Silva, Marcelo Dangllys Duarte Fernandes, Lisyenne Pinheiro Costa Silva, Hilma Keylla de Amorim, Tatiana Lamounier Silva, Leonardo Oliveira Silva, Michelly Angelina Lazzari da Silva, Edma Nogueira da Silva, Ana Patrícia da Cruz, Tatiana Alves Costa, Raiane Almeida Silva, Ana Luiza Loiola Santos, Juliana Grazielle Lobato Alexandre, Fernando Henrique da Silva Costa, Eugênio Barros Bortoluzi, Maria Ivanilde de Andrade, Daniel da Silva Costa Lazzari, Claudiomiro da Silva Alonso, Daniele Estéfany de Souza Pires Silva, Andrea de Sousa Quintela

 DOI: [10.22161/ijaers.99.30](https://doi.org/10.22161/ijaers.99.30)

Page No: 289-296

***Antiulcer, analgesic and hepatoprotective activities of hydroalcoholic root extract of *Jurinea Dolomiaea* Boiss against carbon tetrachloride induced hepatopathy in rats***

Mushtaq Ahmad Bhat, Fairooz Ahmad Khan, Quazi Saifuddin, Dr.H.C.Kataria

 DOI: [10.22161/ijaers.99.31](https://doi.org/10.22161/ijaers.99.31)

Page No: 297-303

***Affirmative actions for people inserted in the socio-territorial space of the countryside in the Bachelor's Degree in Agroecology at UFRPE***

Pamela Karina de Melo Gois, Ângelo Giuseppe Chaves Alves, Wagner Lins Lira

 DOI: [10.22161/ijaers.99.32](https://doi.org/10.22161/ijaers.99.32)

Page No: 304-313

***The green fair as an instrument of autonomy for family farmers in agroecological transition in the municipality of Paripiranga-Ba, Brazil: A case study***

Carlos Allan Pereira dos Santos, Horasa Maria Lima da Silva Andrade, Luciano Pires de Andrade

 DOI: [10.22161/ijaers.99.33](https://doi.org/10.22161/ijaers.99.33)

Page No: 314-322

***Sudowest Goiano Expansion and Agricultural Contracts as Strategic Instruments for Access to Land***

Sara Menezes Maia, Warley Lopes Martins, Liliane Vieira Martins Leal

 DOI: [10.22161/ijaers.99.34](https://doi.org/10.22161/ijaers.99.34)

Page No: 323-337

***People's Health Surveillance in the Construction of Coexistence with the Semi-Arid in Times of Pandemic COVID-19***

*Gislei Siqueira Knierim, Gáudia Maria Costa Leite Pereira, Luciano Pires de Andrade, Ana Maria Dubeux Gervais*

 DOI: [10.22161/ijaers.99.35](https://doi.org/10.22161/ijaers.99.35)

Page No: 338-348

***Quality of Life of Diabetic patients with chronic wounds in Home Care***

*Allan Bruno Alves de Sousa Santos, Victória Maria Pontes Martins, Jessica Andrade Limeira, Saulo Leite de Paula, Vítor Diego de Pontes Simões, Jéssica Vieira Gomes dos Santos, Bruno Eduardo de Menezes Pequeno, João Miguel da Silva Sá, Nayla Carvalho Rocha, Karina de Souza Silva, Tais Gomes Rosestolato, Edvania do Nascimento Souza Santos, Kely Ferreira da Cruz da Silva, Amanda Gabriel Pimentel, Daniel Ávila Silva Monteiro, Andréia Santos de Carvalho Pinheiro, Wallace da Silva de Paula, Noenia Alves de Araújo, Railany de Oliveira Santana, Isabelly Raiane Silva dos Santos, Rafaela Oliveira Santana Pinheiro, Pamella Semiramys Silvestre da Silva, Maria Cintia Alves Costa, Maricélia Rubim da Silva, Paloma Leal Nobre, Rinária de Quadro Figueiredo Guedes, Marcos Tadeu de Sá Machado, Bárbara Pereira Gomes*

 DOI: [10.22161/ijaers.99.36](https://doi.org/10.22161/ijaers.99.36)

Page No: 349-354

***Landraces seeds: A study from the identification of the physiological quality of common bean***

*Rafael dos Santos Balbino, Ana Maria Dubeux Gervais, Luciano Pires de Andrade, Horasa Maria Lima da Silva Andrade*

 DOI: [10.22161/ijaers.99.37](https://doi.org/10.22161/ijaers.99.37)

Page No: 355-365

***The Challenges of Interdisciplinarity in Graduate Graduation***

*Luciana Souza de Oliveira, Lucia Marisy Souza Ribeiro de Oliveira, Júlio Jose Torres dos Santos, Andrea Araújo de Aquino, Andrea Reis de Souza Ribeiro, Valmir Nogueira de Souza*

 DOI: [10.22161/ijaers.99.38](https://doi.org/10.22161/ijaers.99.38)

Page No: 366-373

***Analytics Hierarchy Process for Decision-making in Network Infrastructure Replacement***

*Vinicius de Marchi Borri, Fernando Gasi, Alessandra Akkari*

 DOI: [10.22161/ijaers.99.39](https://doi.org/10.22161/ijaers.99.39)

Page No: 374-377

***Trail Analysis with and without Inoculation of Azospirillum brasilense in the Corn Crop in GURUPI-TO***

*David Willker de Sousa Santos, Weder Ferreira dos Santos, Clóvis Maurilio de Souza, Joênes Mucci Peluzio, Layanni Ferreira Sodrê Santos, Fernando Barnabé Cerqueira, Talita Pereira de Souza Ferreira, Leonardo Alves Lopes, Cícero Antônio Sobreira Fidelis, Magno de Oliveira, Antônio Henrique Camilo Ribeiro, João Victor Rodrigues Fernandes, Matheus Rodrigues de Andrade*

 DOI: [10.22161/ijaers.99.40](https://doi.org/10.22161/ijaers.99.40)

Page No: 378-384

***Epidural dexamethasone showed a better analgesic profile over epidural betamethasone as adjuvant in acute neuropathic lumbar pain***

*Antonio T Kitayama, Celia S Oliveira, Natalia V de Moraes, Claudia R Lauretti, Helton A. Defino, Gabriela R. Lauretti*

 DOI: [10.22161/ijaers.99.41](https://doi.org/10.22161/ijaers.99.41)

Page No: 385-391

***Study on absenteeism and underuse of specialized consultations and exams in the municipalities of the Rio Caetés Region, Pará, Amazon***

Rejane Brandão Pinto, Ilma Pastana Ferreira, Heliana Helena de Moura Nunes, Silvia Ferreira Nunes, Rosane Gomes Alves Lopes, Valéria Regina Cavalcante dos Santos

 DOI: [10.22161/ijaers.99.42](https://doi.org/10.22161/ijaers.99.42)

Page No: 392-394

***Integrative and Complementary Health Practices in the Unified Health System and the use of Medicines in the Rural Population of Municipalities in Rio Grande do Sul***

Carina Suzana Pereira Corrêa, Guilherme Mocelin, Cézane Priscila Reuter, Suzane Beatriz Frantz Krug

 DOI: [10.22161/ijaers.99.43](https://doi.org/10.22161/ijaers.99.43)

Page No: 395-402

***Role of Sericulture in Uplifting Socio-Economic Status of Casual Workers and Constructors: A Case Study of Sheema, Kiruhura, Kween and Mukono District in Uganda***

Sabunyo Noah, Clet Wandui Masiga

 DOI: [10.22161/ijaers.99.44](https://doi.org/10.22161/ijaers.99.44)

Page No: 403-408

***The Importance Audit of Pharmacist in the management of a Hospital Unit***

Leonardo dos Santos Camargo, Ramon dos Santos Camargo, Beatriz Oliveira Neres, Vinicius Fonseca dos Santos, Brenda Romagnha Brandenburg, Igor Alves de Souza, Kamila Roldi Corrêa, Renan Rocha Camilato Knopp, Ana Maria Alves Petri, Iagor Francisco Costa, Jayne Buelone Barreto, Kenia Guimarães Macieira Fernandes, Daniel Rodrigue Silva

 DOI: [10.22161/ijaers.99.45](https://doi.org/10.22161/ijaers.99.45)

Page No: 409-413

***Analysis of the Association of Psychological Symptoms with Successful Aging Strategies and Spirituality in Elderly People***

Rita de Kássia Wichmann Gallas, Sabina Maria Stedile, Viviana Rodrigues de Alcântara, Deise Claudiane Rodrigues Antunes, Kelen Lord Kleemann, Marcele Medina Silveira, Marcelo Wüst, Henrique Zimmermann Kunert, Geraldine Alves dos Santos

 DOI: [10.22161/ijaers.99.46](https://doi.org/10.22161/ijaers.99.46)

Page No: 414-422

***Clinical and Pharmacological Characteristics of Patients with Chronic Kidney Failure on Dialysis: A Study at the Dialysis Center of the Municipality of Ariquemes, Brazilian Amazon***

Carlos Alberto Paraguassú-Chaves, Geovana Cruz dos Santos, Nelson Pereira da Silva Junior, Carla Dolezel Trindade, Simão Aznar Filho, Ruy Drummont Smith, Simão Dolezel Aznar, Lenita Rodrigues Moreira Dantas, Fabrício Moraes de Almeida

 DOI: [10.22161/ijaers.99.47](https://doi.org/10.22161/ijaers.99.47)

Page No: 433-444

***Administration of the Reference Service in Newborn Screening in Pará: Experience Report***

João Victor Moura Rosa, Tâmilis Feitosa Leal, Lidineusa Machado Araujo, Ilma Pastana Ferreira, Ana Lúcia da Silva Ferreira, Claudia Ozela El-Husny, Felipe Valino dos Santos, Elizabeth Ferreira de Miranda, Michelle da Silva Pereira, Fernanda Rafaela de Souza Rebelo da Costa

 DOI: [10.22161/ijaers.99.48](https://doi.org/10.22161/ijaers.99.48)

Page No: 445-449

***Interection design and thechnologies developed by brazilian healthtechs***

*Cássia Regina D'Antonio Rocha da Silva, Ana Karla de Souza Abud, Sílvio Mário Felix Dantas*

 DOI: [10.22161/ijaers.99.49](https://doi.org/10.22161/ijaers.99.49)

Page No: 450-462

***The assistance provided by the nurse to the patient with the onset of preeclampsia and preeclampsia: Literature review***

*Gleison Faria, Suzana Nogueira, Márcia Gisele Peixoto Kades, Paulo Henrique Campos da Silva, Francisco Leandro Soares de Souza, Taís Loutarte Oliveira, Jackson Firigolo, Alexandra Alves de Carvalho, Thais Antunes Betin, Cleci da Silva, Thauany Ferreira Tavares, Francielly Maira Bordon, Wellington Ferreira de Souza, Vitória de Oliveira Peres, Iana Carbonera Solcia, Giselen Maleski Cargnin, Marco Rogério da Silva, Cleverson de Oliveira Santos, Mateus Duarte Vieira, Welesmar Barros dos Santos, Moises Sobral Pereira, Natielen Aparecida de Paula, Samira Sbardelatti Regis Pereira, Cleitineia da Silva Souza, Letícia Ferreira Gomes, Sueli Onofre, Elizamar de Souza Lima, Letícia Aparecida de Moura Freitas, Francisco Jonábio Castro Lima, Emilia Costa Rodrigues, Hingreedy Fischer da Silva, Tatiana Moreira de Almeida, Deusirene Sousa Rodrigues*

 DOI: [10.22161/ijaers.99.50](https://doi.org/10.22161/ijaers.99.50)

Page No: 463-470

***Business Incubators and Sustainability: A Literature Review***

*Samuel Carvalho de Azevedo Marques<sup>1</sup>, Hugo Saba<sup>2</sup>, Ingrid Winkler<sup>3</sup>, Aloisio Santos Nascimento Filho<sup>4</sup>*

 DOI: [10.22161/ijaers.99.51](https://doi.org/10.22161/ijaers.99.51)

Page No: 471-482

***Environmental Taxation: Importance and International and National Experiences of its Application***

*Isa Guimarães Duarte, Caio Coêlho de Oliveira, Alessandra Renata Freitas Fontes*

 DOI: [10.22161/ijaers.99.52](https://doi.org/10.22161/ijaers.99.52)

Page No: 483-489

***Epidemiology and Risk Factors of Brucellosis in Veterinary Medicine Professionals and Academics in the Middle-North Region of Mato Grosso State, Brazil***

*Carolina De Carli Nogueira, Karina da Silva Rodrigues, Vanessa de Almeida Raia, Bruno Gomes de Castro*

 DOI: [10.22161/ijaers.99.53](https://doi.org/10.22161/ijaers.99.53)

Page No: 490-495

***The Advantages and Challenges of Distance Learning***

*Liciana Dias da Silva, Dionê Pereira de Souza, Camila Karem de Oliveira Rodrigues, Elizeth Gonzaga dos Santos Lima, Jéssica Gonçalves de Matos, Elen Caroline Tessaro, Fernando Cezar Vieira Malange*

 DOI: [10.22161/ijaers.99.54](https://doi.org/10.22161/ijaers.99.54)

Page No: 496-505

***There is no Candomblé Without Leaves: The importance of nature in the religion's rites***

*Ricardo Carneiro Bastos, Jorge Luiz Schirmer de Mattos, Wagner Lins Lira, José Nunes da Silva*

 DOI: [10.22161/ijaers.99.55](https://doi.org/10.22161/ijaers.99.55)

Page No: 506-512

***Problem-based learning: A teaching-learning strategy for teaching “Extensão Rural” in the “Medicina Veterinária” graduate course***

Anderson Fernandes de Alencar, Óscar Emerson Zúñiga Mosquera, José Nunes da Silva, Julia Figueredo Benzaquen, Tarcísio Augusto Alves da Silva, Walter Santos Evangelista Júnior, Luis Claudio Monteiro de Mattos, Laeticia Medeiros Jalil, Maria Rita Ivo de Melo Machado, Francinete Francis Lacerda, Marcos Antonio Bezerra Figueiredo, Ana Maria Dubeux Gervais, Jorge Luiz Schirmer de Mattos

 DOI: [10.22161/ijaers.99.56](https://doi.org/10.22161/ijaers.99.56)

Page No: 513-525

***Human Embryology teaching mediated through a virtual environment room***

Lidiane de Fátima de Oliveira Souza, Carlos Alberto Sanches Pereira, Brian França dos Santos

 DOI: [10.22161/ijaers.99.57](https://doi.org/10.22161/ijaers.99.57)

Page No: 526-534

***Geoconservation: Research and extension in the context of the Iron Quadrangle, Brazil***

José Alves Ferreira Neto, Igor Henrique Fernandes Silva, Juscelina Rosiane Ferreira, Rafael Aldighieri Moraes

 DOI: [10.22161/ijaers.99.58](https://doi.org/10.22161/ijaers.99.58)

Page No: 535-543

***Healthy eating through an alternative food network at Agricultural Fair***

Ariandeny Silva de Souza Furtado, Wagner Lins Lira, Tania Maria Sarmento Silva

 DOI: [10.22161/ijaers.99.59](https://doi.org/10.22161/ijaers.99.59)

Page No: 544-552

***Teaching and Practices in Higher Education in Agroecology from the Interdisciplinary Viewpoint***

Luciana Souza de Oliveira, Lucia Marisy Souza Ribeiro de Oliveira, Bruno Cezar Silva, Hesler Piedade Caffé Filho, Maria Auxiliadora Tavares da Paixão, Andrea Reis de Souza Ribeiro, Valmir Nogueira de Souza

 DOI: [10.22161/ijaers.99.60](https://doi.org/10.22161/ijaers.99.60)

Page No: 553-565

***Experimental study of pervious concrete***

Priya Jagtap, Oshin Victor, Rakesh Verma

 DOI: [10.22161/ijaers.99.61](https://doi.org/10.22161/ijaers.99.61)

Page No: 566-572

***Modeling Volatility for High-Frequency Data of Cryptocurrency Bitcoin Price using Generalized Autoregressive Conditional Heteroskedasticity (GARCH) Model***

Nashirah Abu Bakar, Sofian Rosbi

 DOI: [10.22161/ijaers.99.62](https://doi.org/10.22161/ijaers.99.62)

Page No: 573-579

***Gamification as an Individual Skills Development Strategy: A Systematic Review***

Leonardo Vinicius Cunha Segala, Caroline de Lima Ericeira Façanha

 DOI: [10.22161/ijaers.99.63](https://doi.org/10.22161/ijaers.99.63)

Page No: 580-588

***ESG indicator metrics used by organisations to assess the degree of sustainability in companies***

João Alvarez Peixoto, Andréia Bem Machado, Marc François Richter

 DOI: [10.22161/ijaers.99.64](https://doi.org/10.22161/ijaers.99.64)

Page No: 589-600

***Marketing Greenwashing E os Danos Aos Consumidores***

*Munirah Muhieddine Rizatti*

 DOI: [10.22161/ijaers.99.65](https://doi.org/10.22161/ijaers.99.65)

*Page No: 601-603*

***Seroprevalence of Cattle Respiratory Viral Pathogens in Paranatinga, Mato Grosso State, Brazil***

*Maycon J. Heidmann, Cristiano G. do Nascimento, Liria H. Okuda, Edviges M. Pituco, Eliana de Stefano, Adriana H. de C. N. Romaldini, Bruno G. de Castro*

 DOI: [10.22161/ijaers.99.66](https://doi.org/10.22161/ijaers.99.66)

*Page No: 604-608*

***Analysis of accidents caused by problems in the drainage infrastructure of highways in Brazil***

*William Wilson dos Santos, Paulo Afonso Lopes da Silva, Antônio Carlos Rodrigues Guimarães*

 DOI: [10.22161/ijaers.99.67](https://doi.org/10.22161/ijaers.99.67)

*Page No: 609-614*

***The Agroecological Approach and Interdisciplinarity in the Scope of University Teaching, Research and Extension***

*Jorge Luiz Schirmer de Mattos, Luis Claudio Monteiro de Mattos, Laetícia Medeiros Jalil, Tarcísio Augusto Alves da Silva, Ana Maria Dubeux Gervais, José Nunes da Silva, Julia Figueredo Benzaquen, Anderson Fernandes de Alencar, Walter Santos Evangelista Júnior, Maria Rita Ivo de Melo Machado, Francinete Francis Lacerda, Marcos Antonio Bezerra Figueiredo, Óscar Emerson Zuñiga Mosquera*

 DOI: [10.22161/ijaers.99.68](https://doi.org/10.22161/ijaers.99.68)

*Page No: 615-630*

***Sympathetic ablation combined to dorsal ganglion modulation was cost-effective for Complex Regional Pain Syndrome-I***

*Carlos A. F. Trindade, Célia S Oliveira, Thiago S Serra, Helton A. Defino, Gabriela R. Lauretti*

 DOI: [10.22161/ijaers.99.69](https://doi.org/10.22161/ijaers.99.69)

*Page No: 631-638*

# Active Learning Strategy Applied to Control Theory Teaching

Elias J. R. Freitas<sup>1</sup>, Leonardo S. Prado<sup>2</sup>, Marcos V. F. Silva<sup>2</sup>, Vinícius A. Alvarenga<sup>2</sup>,  
Adrielle C. Santana<sup>3</sup>

<sup>1</sup>Robotics and Intelligent Systems Research Group, Instituto Federal de Educação, Ciência e Tecnologia de Minas Gerais - IFMG, Campus Ibirite, MG, Brazil Email: [elias.freitas@ifmg.edu.br](mailto:elias.freitas@ifmg.edu.br)

<sup>2</sup>Instituto Federal de Educação, Ciência e Tecnologia de Minas Gerais - IFMG, Campus Avançado de Itabirito, MG, Brazil

<sup>3</sup>Department of Control and Automation Engineering, Universidade Federal de Ouro Preto, Ouro Preto, MG, Brazil

Received: 02 Aug 2022,

Received in revised form: 26 Aug 2022,

Accepted: 01 Sep 2022,

Available online: 09 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**—Active learning, Engineering fields, Student perception, Case Study.

**Abstract**— This work presents an active learning strategy applied to the Control Theory course for engineering students. It shows the importance of new approaches to classic teaching in this area. Background: Active learning strategies seek to make the student the center of the learning process, enabling them to develop skills to learn, to question reality, have a critical reflection on the subject, learn how to work in a team, and promote the dissemination of innovative ideas. The strategy proposed aims to promote an alternative to traditional classes of control theory, leaving the teacher as the center of learning and placing greater relevance on the active participation and responsibility of the student during their learning. This strategy consists of dynamic classes based on small challenges and a final project challenge. In the latter, each group must identify the system involved, simulate it, design a controller based on some control techniques studied, and implement it through operational amplifiers or microcontrollers. In addition, students must prepare a report and answer some theoretical questions. Results obtained and the students' evaluation regarding their learning show the importance of using an active learning methodology in engineering courses.

## I. INTRODUCTION

TODAY'S Society is increasingly globalized, connected, and dynamic. However, when observing teaching, especially at the higher level, there is a large gap between what is taught or the way it is taught and what is required by this society. Thus, it is not uncommon to find situations in which the student does not have the ability to put into practice a certain concept or solve a practical problem.

To solve such a problem, more effective teaching tools are needed. According to Camargo & Daros (2018), if we understand that being qualified can act, then we need teaching tools that provide the opportunity for the student

to act from the knowledge acquired in their studies. Corroborating this teaching need, the Cognitive Sciences present the mental model concept, which are cognitive structures applied to characterize the ways in which people understand and interact with the world. According to Moreira (2016), from the point of view of these mental models, it is possible to say that learning consists of to build mental models of what is being taught while teaching is to facilitate the building and reviewing of mental models. Thus, it is important the production of tools and methodological actions that allows the development of the mental models or the review of those that the students already have.

A methodology or tool that put the student in the center of the learning process, that is, in which the student participate actively, is called Active Learning Methodology. Clearly, the student always takes part of the learning process, but, often, their role is simply watch, listen, take notes, or memorize a subject, which does not contribute to the evolution of their mental model.

Some works in engineering point out that the use of active methodologies provide several benefits to the students with the development of demanded competencies, such as: more motivation, deeper knowledge of the concepts, ability to apply the concepts, ability to project, critical thinking, team- work, problem-solving, analysis, communication and collaboration (Jayaram, 2014; Hosseinzadeh & Hesamzadeh, 2012; Hernández-de Menéndez et al., 2019).

These benefits can be also perceived in the comparative study of the satisfaction on learning process in active learning and traditional classrooms presented by Hyun et al. (2017). Authors surveyed sixteen classes of courses in business and education, and they note that active learning influences positively. In (Freitas & Fortes, 2020), the authors also present a study of on satisfaction learning, involving 115 engineering students, that confirm the increase in their motivation and learning on active learning classrooms. Furthermore, it's observed that there is an expectation from these students that the classes should not remain only at the theoretical level but should make it possible to apply the knowledge acquired in real problems (about 83% students informed that it is a privileged way to facilitate his learning).

A case study in a Vehicle Dynamics course presented by Hernández-de Menéndez et al. (2019) also observed as a result that, through an active methodology, learners had the opportunity to acquire and practice different technical skills in a controlled/supervised manner, analyze how a system works in practice, test and observe different responses and have a deeper understanding of the elements' interactions. The students can also make mistakes without assuming the economical responsibility for fixing the equipment.

In (Elmôr Filho et al., 2019), the authors describe the main idea for twelve active learning strategies and methods: peer instruction, just-in-time teaching, think-pair-share, in- class exercises, thinking-aloud pair problem-solving, groups with different tasks, constructive controversy, jigsaw, groups challenges, teaching cases and problem-based learning. But, how to effectively adapt such methods to engineering courses? Some works address this issue.

Freitas et al. (2013) present a methodology based on the "Motivation through Challenge", where, along the classes, the students perform the speed control of a conveyor belt prototype triggered by a direct current motor, using scrap material. In the work of (de Araújo et al., 2016) the authors present a hybrid Problem Based Learning model applied to the undergraduate course of Agricultural and Environmental Engineering, in which the students should perform research about the problems in their field of study and present their own solutions. Using a project-based learning methodology where the students of the Master of Aerospace Engineering degree of the Universidad Politécnica de Madrid are required to perform a preliminary design of a Space Mission, the work of (López-Fernández et al., 2019) demonstrated that the motivation of students was enhanced compared to a teaching centered approach.

In turn, Wiggins et al. (2017) propose a method to assess student perspective of engagement in an active learning class- room. And Tharayil et al. (2018) list strategies to mitigate student resistance to active learning, e.g., explain course and activities expectations, assume an encouraging demeanor, design activities for participation, and use incremental steps. Authors also emphasize the importance of course planning to obtain an effective learning strategy.

The main contribution of this work is to present the planning and application of an active learning methodology to promote an alternative to traditional classes of control systems in higher education. Here, the teacher is not at the center of learning anymore and greater importance is placed on the active participation and responsibility of the student during their learning process.

Specifically, the methodology applied aims to develop in the students a critical and problem-analytic capacity, to increase students' motivation and commitment, to make the students able to develop and analyze control systems (from the identification of these systems until the design of a controller, using the tools presented in control theory), and to integrate content already learned in other subjects such as, electronics and electrical circuits, with subject-specific content.

We present an experience with the application of an active learning methodology in the subject Controle Analógico (Analog Control) of the undergraduate course of Electrical Engineering of the Instituto Federal de Minas Gerais, Campus Avançado Itabirito, in Brazil.



## II. METHODS

The first step for the application of the learning methodology of this work is the planning and surveying of a concept map of the subject chosen, Controle Analógico, as can be seen in Fig. 1.

This subject belongs to the set of mandatory subjects of the Electrical Engineering course, being offered in the 8<sup>o</sup> term of the course. Thus, in general, the students already have a sound knowledge of math, physics, and electronics. However, the motivation for the application of an active methodology was, in this case, the union between the perception of the need the students had to apply their knowledge and the desire to make the content of the subject more concrete.

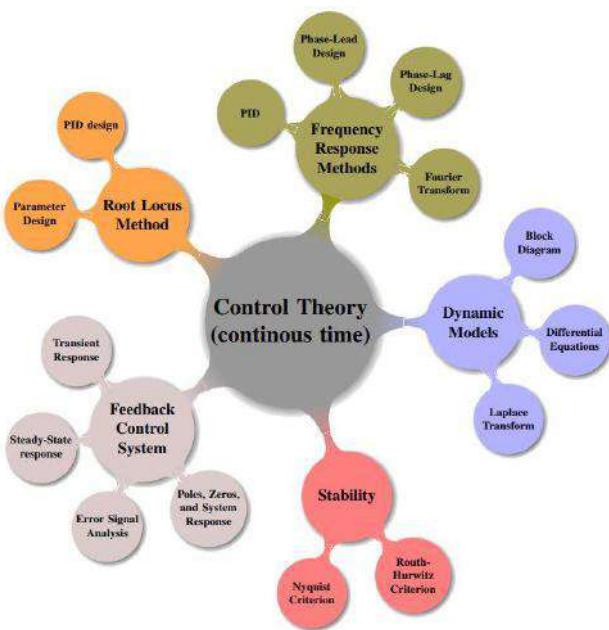


Fig. 1: Summary of the conceptual map of the Control Theory course.

### A. Overview of the methodology

The methodology proposed can be summarized in Fig. 2. As the subject present new concepts for the students, it was adopted, in the beginning, short lectures of each topic of the subject. Those lectures had the duration of one hour, interspersed with one of the activities proposed: quizzes or challenges.

In general, the quizzes focus on the fast and interactive verification of the concepts taught using straight questions and answers, besides to promote an engagement of the students (Plump & LaRosa, 2017). Some quizzes were performed in a practical way, where the student should simulate and verify the result of the question.

The challenges along the classes had great importance in the adopted methodology. They are part of the

building/assimilation of the content by the student. In the same way of an approach based in problems, the first challenge proposed to the student is, usually, poorly structured, that is, lack elements to be solved in class. Thus, based on the student’s questions, the challenge is structured and then, a solution related to the topic studied is implemented. In this methodology there were partial challenges with simpler activities and a more complex final challenge, proposed by the end of the term, to evaluate the general knowledge of the students about all the topics studied in the subject.

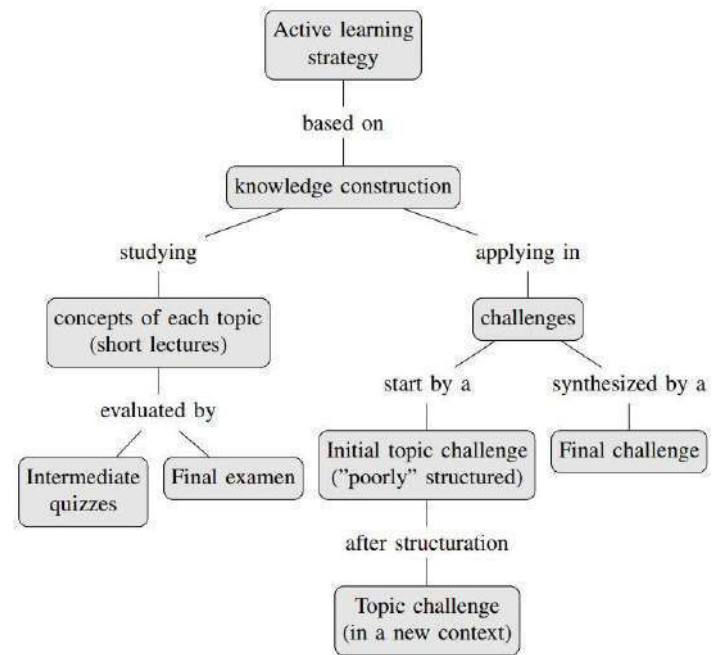


Fig. 2: Summary of the active learning strategy proposed.

### B. Challenges

An example of a partial challenge proposed was the identification of a physical second order system built using amplifier circuits (see example available in our GitHub repository) in the free application Circuit simulator available in (Falstad & Sharp, 2021). First, the students performed measurements of this system output by applying a unit step input. After, they understood that it was a system similar to a second order one, as they saw in the lecture and then, they found its mathematical model through the measurement of the damped oscillations, the overshoot, etc. Finally, the students made a report using their conclusions and analysis performed during the challenge.

Following the methodology, by the end of the subject, the student has a final challenge, where they should apply the knowledge acquired along the term and be prepared for the second individual test. It is expected that the student be capable of analyze and identify a system as well as

perform the project of a controller so that the output of the system follows some desired requirements.

The Fig. 3 illustrates the scheme of a plant proposed using operational amplifiers used in one final challenge. In the beginning, the students were encouraged to seek a controller that satisfied the requirements using only a closed-loop gain and to verify if this gain was capable to obtain the results by analyzing its root locus. After this analysis, the students were asked to perform the controller design using, for example, the frequency response of the plant, and then, perform a PID controller design using the Ziegler-Nichols method. The requirements for the system output given a step input were: (i) null steady state error, (iii) settling time less than 4ms (considering a 2% error) and (iii) overshoot less than 10%.

In another semester a different final challenge was proposed, where students had to develop a controller for a ball and beam system illustrated in Fig. 4. This system is composed of a sensor, responsible for measuring the distance of the ball to the center; a servomotor, responsible for the actuation (change of the base position); and a microcontroller board in which the controller obtained by Root-Locus and a PID design is discretized and implemented by the students.

It was also built a guide to help the students to analyze the system containing analysis of internal and external stability, analysis by Nyquist criterion, how to find the plant model, discretization, etc.

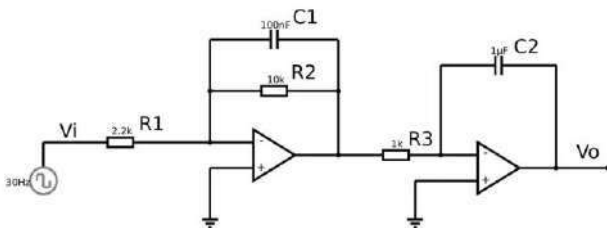


Fig. 3: Scheme of the circuit built as the plant of one of final challenges.

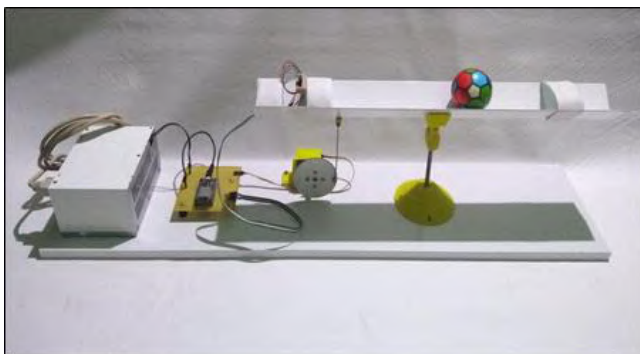


Fig. 4: Ball and Beam as the plant of one final challenge.

C. Evaluation

An important active methodology aspect is the student evaluation, which should be part of their learning process (Pironel & Vallilo, 2017), that is, the evaluation should be thought as a manner to favor and stimulate the students to think. Thus, it was proposed evaluation activities and their scores, during the term, were distributed according to the Table I. It is possible to observe in the table the scores for the individual exercises (in the form of quizzes) that, together with the challenges performed in groups, compose a total of 50% of the subject’s grade.

Table I: Evaluation activities and their corresponding scores.

| Score percentage | Assessment activity  |
|------------------|----------------------|
| 25%              | 1 <sup>st</sup> test |
| 25%              | 2 <sup>nd</sup> test |
| 6%               | Quizzes              |
| 24%              | Practical challenges |
| 20%              | Final challenge      |

Finally, aiming to improve and speed up the communication between the teacher and the students, it was researched between several tools, the one that could meet this expectation. Then, it was chosen the Google Classroom platform. In this platform, all the students have access to the subject content, the activities and they also can send their results, receive their grades, and post their doubts and questions related to the subject.

III. RESULTS

In this section it will be presented some results obtained by the students during the execution of the quizzes, partial challenges, and final challenge as well as their evaluation of their experience with the methodology proposed.

A. Methodology results

It was performed a practical quiz using the software Octave in order to make more solid the knowledge and to encourage the students to find the answers by themselves. The quiz was about the step response of a second order system with variations of its damping coefficient ( $\zeta$ ) and natural frequency ( $\omega_n$ ). Thus, the students obtained a classic figure, common in many control systems books, illustrated in Fig. 5.

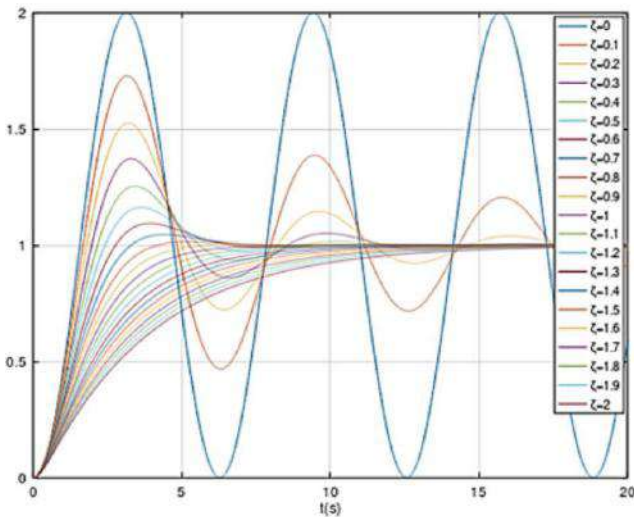


Fig. 5: Result of a practical quiz: step response of a second order system by varying the damping coefficient.

For the partial challenge exemplified in the Section Methods (the second order system with amplifiers), it is expected that the student plot in Octave the step response of the second order system that they modeled and compare with the data collected from the physical system. The same is expected from the first stage of the final challenge, where the students need to obtain the transfer function that model the plant mathematically according to Equation 1.

$$\frac{V_o}{V_i} = \frac{R_2}{R_1 R_2 R_3 C_1 C_2 s^2 + R_1 R_3 C_2 s} \tag{1}$$

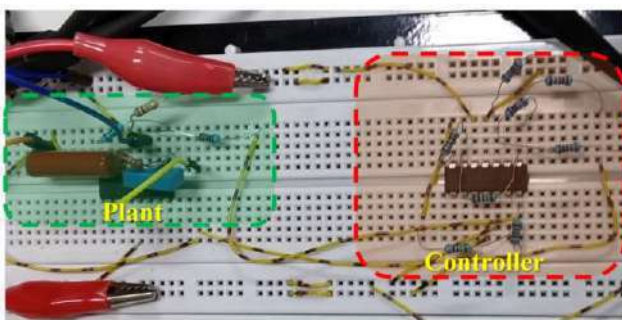


Fig. 6: Complete circuit with the plant and controller designed using operational amplifiers in a final challenge.

The student perceives that the model response follows the practical one as designed. This allows the student to feel that they did a good job and that what was learned can be applied in the real world, motivating the study of the theoretical content. Following with the challenge, the student observed, through the root locus analysis, that only a proportional controller is not enough to ensure that the system behaves as required. Now, the challenge is to

design a controller using some technique learned as, for example, the frequency response of the plant. With the model of the controller, the students did the design of its circuit, using operational amplifiers and then, built the complete circuit, in the simulator, with the plant and the controller together.

A PID controller design using the Ziegler-Nichols technique (for a PI controller) was also implemented. The students observed that this method did not ensure the settling time required, and a fine-tuning of the gains was necessary. With this they learned that a PID controller design can be simple and also how to make an empirical tuning, often used in the industrial controllers. An issue pointed out by a student was the practical aspect of the PID controller assembly using operational amplifiers, as shown in Fig. 6. It was noted that the integration time can cause a lot of noise in the signal leading to the decision to perform an implementation of the PID, in parallel (see simulation and scheme in the material provided in our GitHub repository). Thus, in the physical circuit, the gains could be easily adjusted using potentiometers.

In the challenge, using a ball and beam system, the approximated model is described by the Equation 2:

$$H(s) = \frac{H_0}{s^2(\tau s + 1)}, \tag{2}$$

where  $H_0$  is obtained by geometric parameters and  $\tau$  is the time constant of the servomotor. The discretized controller becomes a difference equation given in Equation 3 and implemented in the microcontroller by the students:

$$u[k] = A \cdot e[k - 1] + B \cdot e[k] - C \cdot u[k - 1], \tag{3}$$

where  $u$  is the discrete controller action,  $e$  is the error measured between the desired position and the actual ball's position,  $k$  is the discrete time, and  $A$ ,  $B$  and  $C$  are positive constants obtained by the discretization process from the analog controller design using, e.g., poles placement method.

The Fig. 7 illustrates the measurement of the ball's position and the control action signal during the experiment. The Fig. 8 shows a screenshot of the video of the experiment, provided in <https://youtu.be/XzO4Rm7Hi-4> (also available in our GitHub repository).

In both challenges the students verified if the project requirements were satisfied and built the physical systems. Comparing the results of the simulated and the physical systems, they validated the controller designed and verified the stability of the system.

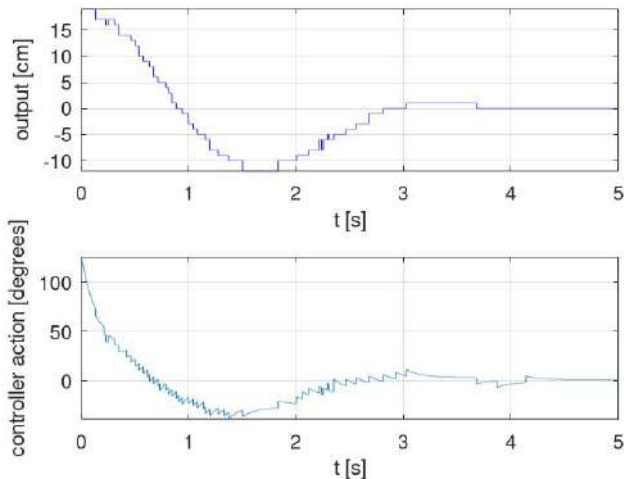


Fig. 7: Step response from 16 cm to zero (center position) and the controller action calculated by the microcontroller.

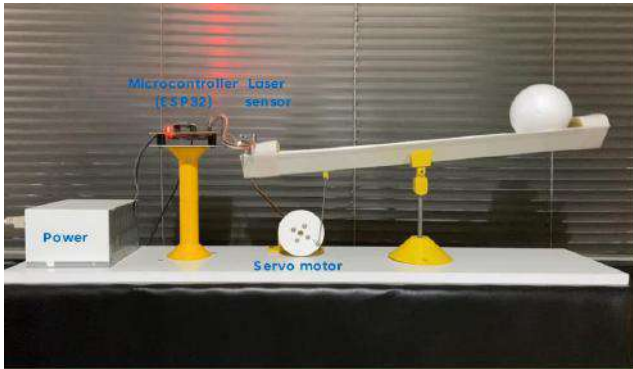


Fig. 8: Screenshot of experimental results video available in <https://youtu.be/XzO4Rm7Hi-4>.

**B. Student’s evaluation of the methodology**

As it was initially proposed, we aimed to verify with this methodology the motivation, the student’s analysis and learning abilities and provide an interface with other subjects of the course. Thus, as made by (Jayaram, 2014), we provided an online quiz for the students to fill in an anonymous and voluntary way.

In Fig. 9 it is possible to see the students’ evaluation of the methodology through three principal questions:

- Q1: Has the methodology improved your ability to analyze a (control system related) problem?
- Q2: Did the methodology provide integration with other subjects in the course?
- Q3: Did the dynamics of the classes (theory interspersed with quizzes, challenges, simulations, and practical setups) improved the learning?

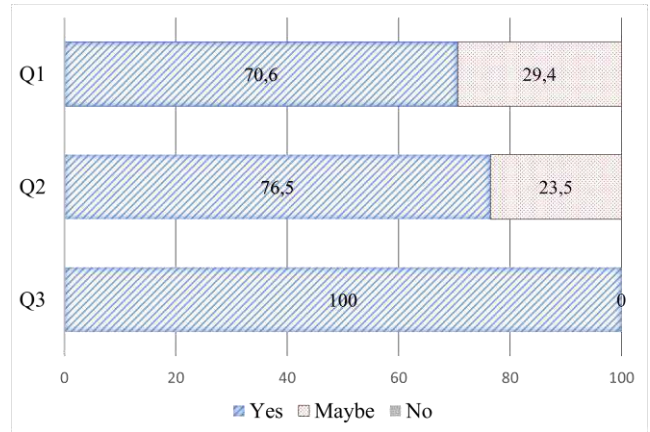


Fig. 9: Students’ evaluation regarding three questions: Q1: Has the methodology improved your ability to analyze a problem? Q2: Did the methodology provide integration with other subjects in the course? Q3: Did the dynamics of the classes (theory interspersed with quizzes, challenges, simulations, and practical setups) improved the learning?

Analyzing the collected data, in two reduced classes (seventeen students in total), it can be seen that the result related to the learning was relevant for the students. Most of them believe that the adopted methodology contributed to improve their learning and evaluate their learning at the end of the subject as good (63.2%) and very good (36.8%). This is also reflected by the commitment to study reported by students as being very good (21%), good (52.7%) and satisfying (26.3%). Following, it is the report of four students (translation from Brazilian Portuguese):

- Student 1: The learning was very good, because the development of the practical works generated a motivation and fondness by the subject and in solving the proposed problems. Thereby, there was also a greater participation of the students and of the teacher in the learning.
- Student 2: The use of different challenges allows a better hold of the content studied. Works performed in teams create experiences similar to those that the students will find in the job market and the problems involving real control situations bring a different motivation from that you normally have with the traditional methods.
- Student 3: Effective methodology, once the professor always requires the active attention and participation of the students. I believe that the laboratory class made the difference to this subject.
- Student 4: The association of the good organization of the content with the teacher’s concern for the students’ learning provided us with a good performance throughout the course, absorbing as much as possible what was passed on to us.

It was possible to note a different perception of the

teacher’s participation in the classroom, considered by 73.7% of students as a facilitator, requiring the student to develop and raise doubts to contribute to the discipline. Instead, 26.4% considered the teacher a content provider.

Regarding the critical analysis of the problems, five students reported that the subject made it possible to improve the control systems analysis while two students reported that, maybe, it helped a little. Concerning the interface with other subjects, only four of the students believe that the subject contributed only a little with the multidisciplinary and reported that the total amount of hours of the subject should be greater giving more time for this kind of interaction.

In general, the Google Classroom platform was also evaluated as good (26.4%) or very good (73.7%) by the students

C. Grades

Final grades are ranked on a scale of 0–100, where 0-39 is unsatisfactory, 40-59 is weak, 60-69 satisfactory, 70-79 good, 80-89 excellent, and 90-100 outstanding. Figures 10a and 10b show the histograms and boxplots from final grades of the available classes while Table II summarizes the main information from the data. The mean (and the median) of the final grades in Class 1 is considered good while in the Class 2 it falls in the satisfactory range.

We use these grades to evaluate the following hypothesis: the strategy proposed it’s not sensible to the change of the final project. Thus, the grades of students (Class 1 and Class 2) are statistically compared using a two-sided Student’s t-test to check this hypothesis. Statistical significance was defined as a p-value below a critical  $\alpha$ -value of 5%. The premises of normality and homoscedasticity of the data were verified by Shapiro-Wilk (Shapiro & Wilk, 1965) test and Fligner-Killeen (Fligner & Killeen, 1976) test, respectively. The t-test returned a p-value equal to 0.609 ( $t[15] = 0.523$ ), thus we can conclude that there is not statistical evidence to reject our hypothesis. Moreover, the effect size obtained by Cohen- test (Cohen, 1988) is equal to 0.258, which it is considered a small effect here.

Table II: Summary of the final grades.

|        | Min.  | 1st Qu. | Median | Mean  | 3rd Qu. | Max   |
|--------|-------|---------|--------|-------|---------|-------|
| Class1 | 38.30 | 66.03   | 78.00  | 70.20 | 78.85   | 84.80 |
| Class2 | 50.00 | 60.02   | 66.35  | 66.93 | 74.70   | 82.60 |

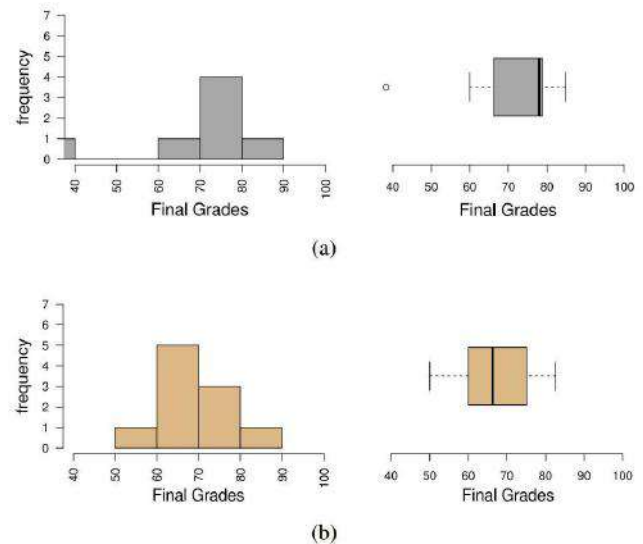


Fig. 10: Histograms (left) and boxplots (right) of final grades. (a) Class 1. (b) Class 2.

IV. CONCLUSION

This work presented an experience applying an active learning methodology in the control systems field. The methodology proposed was well evaluated by the students and the results obtained in the challenges were fruitful. Thus, the methodology presented is an option to the usual control systems expository classes evidencing the importance in using an active learning methodology in engineering undergraduate courses.

An important point raised by the students was the need for an increase in the total amount of hours of the Controle Analógico subject because the time to accomplish the final challenge was short, which made most of the students to work only on the circuits simulations. A solution for this issue could be to focus on the physical implementation of the control systems previously projected, in the final months.

As next steps we intend to begin a teaching project, involving the students, in the development of control systems learning kits which can be used to help the students in the execution of the challenges, allowing them more interaction with a real implementation and practical challenges related to control systems projects. Furthermore, we aim to build the structure to implement the ball and beam system as part of a remote lab so that the challenges can be applied in remote teaching and by professors of other institutions.

## V. AVAILABILITY OF DATA AND MATERIALS

The data that support this study are available in <https://github.com/Adrielle-Santana/Active-learning-in-control-theory>.

### REFERENCES

- [1] Camargo, F., & Daros, T. (2018). A sala de aula inovadora-estratégias pedagógicas para fomentar o aprendizado ativo. Penso Editora.
- [2] Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd Edition). New York: Routledge. Retrieved from <https://www.taylorfrancis.com/books/9781134742707> doi: 10.4324/9780203771587
- [3] de Araújo, W. J., Lopes, R. P., Oliveira Filho, D., de Barros, P. M. M., & de Oliveira, R. A. (2016). Aprendizagem por problemas no ensino de engenharia. *Revista Docência do Ensino Superior*, 6(1), 57–90.
- [4] Elmôr Filho, G., Sauer, L., Almeida, N., & Villas-Boas, V. (2019). Uma nova sala de aula é possível: aprendizagem ativa na educação em engenharia. Rio de Janeiro: LTC.
- [5] Falstad, P., & Sharp, I. (2021). *Electronic circuit simulator*. Retrieved from <https://www.falstad.com/circuit/>
- [6] Fligner, M. A., & Killeen, T. J. (1976, mar). Distribution-
- [7] Free Two-Sample Tests for Scale. *Journal of the American Statistical Association*, 71(353), 210. Retrieved from <https://www.jstor.org/stable/2285771?origin=crossref> doi: 10.2307/2285771
- [8] Freitas, E. J. d. R., Faria, M. M., Dias, R., & de Oliveira, J. C. R. (2013). Controle de velocidade de uma esteira transportadora. In *Proceedings of international conference on engineering and computer education* (Vol. 8, pp. 152–155).
- [9] Freitas, E. J. d. R., & Fortes, L. S. (2020). Aprendizagem ativa aplicada a` engenharia: Um estudo sobre a percepção do aprendizado. *Revista de Ensino de Engenharia*, 39.
- [10] Hernández-de Menéndez, M., Guevara, A. V., Martínez,
- [11] J. C. T., Alcántara, D. H., & Morales-Menéndez, R. (2019). Active learning in engineering education. a review of fundamentals, best practices and experiences. *International Journal on Interactive Design and Manufacturing (IJIDeM)*, 13(3), 909–922.
- [12] Hosseinzadeh, N., & Hesamzadeh, M. R. (2012). Application of project-based learning (pbl) to the teaching of electrical power systems engineering. *IEEE Transactions on education*, 55(4), 495–501.
- [13] Hyun, J., Ediger, R., & Lee, D. (2017). Students' satisfaction on their learning process in active learning and traditional classrooms. *International Journal of Teaching and Learning in Higher Education*, 29(1), 108–118.
- [14] Jayaram, S. (2014). Implementation of active cooperative learning and problem-based learning in an undergraduate astrodynamics course. In *52nd aerospace sciences meeting* (p. 0065).
- [15] López-Fernández, D., Ezquerro, J. M., Rodríguez, J., Porter, J., & Lapuerta, V. (2019). Motivational impact of active learning methods in aerospace engineering students. *Acta Astronautica*, 165, 344–354.
- [16] Moreira, M. A. (2016). A teoria da aprendizagem significativa subsídios teóricos para o professor pesquisador em ensino de ciências. Porto Alegre, Brasil.
- [17] Pironel, M., & Vallilo, S. A. M. (2017). O papel da avaliação na metodologia de ensino-aprendizagem-avaliação de matemática através da resolução de problemas. *Perspectivas para Resolução de Problemas*, 1, 279–304.
- [18] Plump, C. M., & LaRosa, J. (2017). Using kahoot! in the classroom to create engagement and active learning: A game-based technology solution for e-learning novices. *Management Teaching Review*, 2(2), 151–158.
- [19] Shapiro, S. S., & Wilk, M. B. (1965, dec). An Analysis of Variance Test for Normality (Complete Samples). *Biometrika*, 52(3/4), 591. Retrieved from <https://www.jstor.org/stable/2333709?origin=crossref> doi: 10.2307/2333709
- [20] Tharayil, S., Borrego, M., Prince, M., Nguyen, K. A., Shekhar, P., Finelli, C. J., & Waters, C. (2018). Strategies to mitigate student resistance to active learning. *International Journal of STEM Education*, 5(1), 1–16.
- [21] Wiggins, B. L., Eddy, S. L., Wener-Fligner, L., Freisem, K., Grunspan, D. Z., Theobald, E. J., Crowe, A. J. (2017). Aspect: A survey to assess student perspective of engagement in an active-learning classroom. *CBE—Life Sciences Education*, 16(2), ar32.

# Active methodologies for teaching entrepreneurship: a proposal for higher education

Bruna Carara Nandi<sup>1</sup>, Simone Meister Sommer Bilessimo<sup>2</sup>, Juarez Bento da Silva<sup>3</sup>,  
Leticia Rocha Machado<sup>4</sup>, Isabela Nardi da Silva<sup>5</sup>

<sup>1</sup>Graduate Program in Information and Communication Technologies, Federal University of Santa Catarina, Brazil

Email: brunacararanandi@gmail.com

<sup>2</sup>Graduate Program in Information and Communication Technologies, Federal University of Santa Catarina, Brazil

Email: simone.bilessimo@gmail.com

<sup>3</sup>Graduate Program in Information and Communication Technologies, Federal University of Santa Catarina, Brazil

Email: juarezbs.silva@gmail.com

<sup>4</sup>Federal University of Rio Grande do Sul, Brazil

Email: leticiarmachado@gmail.com

<sup>5</sup>University of Deusto, Spain

Email: isabela.nardi@deusto.es

Received: 01 Aug 2022,

Received in revised form: 26 Aug 2022,

Accepted: 03 Sep 2022,

Available online: 09 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** *Entrepreneurship; Active  
methodology; Information and  
Communication Technologies.*

**Abstract—** *Innovation is essential to avoid the obsolescence of the educational system. In a highly competitive scenario, an interdisciplinary training and professionals prepared to deal with the most diverse types of problems and situations are necessary. In this context, this work aims to present a proposal for the application of active methodologies in the teaching of entrepreneurship in higher education, using a virtual teaching and learning environment. For this, a case study was carried out in a blended class of entrepreneurship of the undergraduate course at a University of Santa Catarina. Thus, in the research, active methodologies, educational strategies and specific questionnaires were used to measure the entrepreneurial potential and students' perception of the applied proposal. The activity of creating podcasts, problem-based learning and writing the teaching plan were well evaluated by most students. Moodle proved to be an indispensable tool for better organization and clarity of the proposal, facilitating understanding by the students. In general, the application of the proposal showed benefits such as: global improvement of content understanding, development of critical and entrepreneurial thinking, theoretical content learning through real/palpable situations.*

## I. INTRODUCTION

Innovation, in the educational field, is an indispensable component in relation to good teaching and learning practices. Debeauvais [1] considers educational innovation as “a way of increasing the operational efficiency of the educational system”. In turn, Hofman et al. [2] states that educational innovation is represented by “substantial changes with the introduction of new types of learning”.

Anyway, it is clear that the different concepts of innovation in the educational field have the same common goal: a global improvement of the system.

Innovation must be part of the educational space in order to avoid the obsolescence of the teaching and learning system. The “new” student has greater access to information and communication technologies, making information flow more easily [3]. The teaching and

learning process has been studied, questioned and modified since the educational beginnings [4][5]. For a long time, passivity was present in teaching as a conceived and accepted form of learning. The student's role consisted of receiving and absorbing the information transmitted by the teacher, an authoritative figure in the classroom [4][6].

In teaching entrepreneurship, the learning process follows the same line. Teaching in this area of study was embedded in traditional learning for most of the time [7][8][9].

Therefore, it is known that educational problems such as: disinterest on the part of students, lack of practices and simulations and lack of connection between theoretical content and reality, can have several negative consequences [10][11][12]. Antunes [13] highlights that student who do not allow real openings during the teaching and learning process, will possibly be students with low potential in key elements for society such as: self-realization, preparation for work or preparation for the conscious exercise of life. citizenship.

Bell and Bell [14] argue that entrepreneurship education has been seen as a factor of competitiveness and prosperity by world nations. The same authors supported by Harkema and Schout [15] and by Åsvoll and Jacobsen [16] state that teaching entrepreneurship is the key to the growth and development of a country's economy. Insulander, Ehrlin and Sandberg [17] ensure that teaching entrepreneurship is extremely important for the formation of creative, determined and assertive citizens. Desai [18] supports the claim that the best way to equip students with the skills to lead and thrive in a world economy would be through teaching entrepreneurship. Rahman and Day [19] reiterate that entrepreneurship education is seen as an engine for job creation and economic success in both developed and developing countries.

Currently, it is known that educational challenges and practices that encourage student protagonist must be an integral part of learning, from the beginning of the content to be taught, with the teacher being a mediator of learning and no longer the active subject [20][21]. However, there is still a lot of divergence of opinion in the literature regarding the best method or best practice of teaching for entrepreneurship, precisely because the impact of teaching methods is still uncertain, among other factors [22][23][24].

Active methodologies present themselves as an opportunity to improve the teaching and learning process, inducing a greater focus on the student, developing autonomy, engagement and motivation during the process [25][26].

In this context, the general objective of the research was to present a proposal for the application of active methodologies in the teaching of entrepreneurship in higher education, using a virtual teaching and learning environment.

Thus, the article is divided into 6 sections. The first represents the introduction and contextualization of the research. The second focuses on teaching entrepreneurship, especially in the Brazilian reality. The third section aims to bring the definition of active methodology and its applications. In the fourth section, that of methodology, the investigation instruments are presented, as well as the stages of development. The fifth section presents the results and discussion of the data. Finally, in the sixth section, the final considerations are presented.

## II. ENTREPRENEURSHIP: CONCEPT AND EDUCATIONAL PERSPECTIVES

Entrepreneurship has been highlighted on the world stage, as it is closely linked to job creation and economic progress in developed and developing countries [27].

However, there is still much to be investigated regarding the teaching of entrepreneurship, especially in Brazil. The level of education does not actively influence the intention to open and establish new ventures in Brazil, according to research carried out by the Global Entrepreneurship Monitor [28]. However, according to data available in Data SEBRAE [29], approximately 40.5% of the experts interviewed in the Profile of Entrepreneurs survey stated that education and training for entrepreneurship it is a limiting factor regarding “the chances of achieving entrepreneurship with more economic and social impact, given the general and technical training that entrepreneurs receive, thus making it difficult to deal with business”.

In the Global Entrepreneurship Monitor report [28], there has been a change in the factors that limit the opening and maintenance of new ventures from 2018 to 2019. In 2018, the three factors listed by the experts were: government policies; education and training and financial support. In 2019, the limiting factors were: government policies; economic climate/institutional and social political context/corruption and financial support. The reason for the change is due to the political situation and the current strong crisis in the country. Thus, in the GEM reports, experts still present their recommendations for improving the entrepreneurial environment in Brazil, and in both reports, “education and training” is raised as a condition for improving the environment. This situation shows that regardless of the factors listed, education will always be



the basis for a favorable entrepreneurial environment and for the development of the entrepreneurs themselves.

Regarding initial entrepreneurs, there is a significant change in the scenario exposed in 2018 to 2019: even entrepreneurs with higher education or higher are smaller in number, they are the most active in relation to involvement with initial entrepreneurship. This data leads us to believe that, in the coming years, we will possibly see a high rate of entrepreneurs with higher education or higher in relation to established businesses.

In this context, it is noted that Brazilians, despite having high rates of opening new businesses and presenting themselves as a people with high entrepreneurial capacity and a history of persistence, have, above all, problems regarding the minimum population education, which is a serious social problem.

In basic education, the social problem in relation to low minimum education in the population is reflected in actions for teaching entrepreneurship. The lack of training of Brazilians in relation to the subject can be seen as a challenge to be faced by citizens since basic education, in which only a few years ago timid incentives were created for the insertion of concepts of entrepreneurship in this school phase.

Even though it is necessary to teach entrepreneurship in basic education, it was in higher education that it developed in Brazil. The teaching of entrepreneurship has been implemented and gaining ground since the 1980s. Initially, only business and administration schools had in their curriculum actions aimed at teaching entrepreneurship. However, this picture has been changing in recent years, due to the new ways of creating value that have been developed by entrepreneurship.

An example would be the fact that entrepreneurship is not just about creating new businesses, creating value only in this way, it is also about developing essential skills for any citizen such as: identification and problem solving, notions of financial mathematics, interpersonal relationships, proactivity, among others, being another way to create value through entrepreneurship. Evans, Parks and Nichols [30] states that it has become common to apply the discipline of entrepreneurship in the most varied higher education courses, aiming at the development of entrepreneurial skills.

Data from the report "Entrepreneurship in Brazilian Universities" carried out in 2016 by SEBRAE and Endeavor Brasil, show that 65% of university professors were satisfied with the work carried out within the HEIs regarding entrepreneurship. However, only 36% of students show the same satisfaction. It can be seen that there is a lack of alignment in the education system, where

students are not receiving the education, they believed they would receive, creating a disappointment, and teachers, at times, are accommodated with the situation.

Another important point is the current era of instantaneity. Students enter HEIs with a more dynamic profile, with access to all and any information in real time, with cell phones and mobile data available, making it difficult, at times, for the education system to keep up with the speed of changes in the students' profile and their interactions with information and communication technologies.

Regarding the student's intention to undertake, the data still remains timid, one in four students who enter higher education intends to open their own business [29]. Therefore, it is clear that 75% of higher education students have no intention of starting a business. A fact that deserves to be highlighted is that students are usually not interested in starting a business because they have no experience or close contact with entrepreneurs. Students inserted in an entrepreneurial ecosystem, for the most part, demonstrate full intention to undertake [29].

This factor shows the importance of inserting the student, from the beginning of their training, in entrepreneurial experiences and practical activities, which is a well-formulated path to economic development.

However, it is clear that even entrepreneurial students from HEIs do not have the ambition to innovate, especially when it comes to disruptive innovations [29]. In this context, the relevance of the HEIs in stimulating the culture of innovation, research and discovery within the university education system itself enters again.

### III. ACTIVE LEARNING METHODOLOGIES

The active learning method was created by Reginald William Revans [25], a physicist turned economist and educator, who encountered several challenges along the way of synthesizing the method [31]. The reported difficulty concerns resistance to new ways of promoting learning, since traditional learning was widely accepted and used, and any others were impracticable. However, Revans persisted and proved how much more effective his method was than the traditional one and, consequently, contributed strongly to a more complete learning and training of the student.

The work carried out by Freeman et al. [32], evaluated 225 studies referring to data from the world education system such as: test scores, test scores, passing and failing, failures, among others, in order to compare the efficiency of active learning versus traditional learning. The authors found some interesting results, in particular: performance

with active learning on tests, exams and exams of the same nature was superior when compared to traditional learning; the chance of failure of a student of traditional learning is 1.5 times greater than a student who was instructed by the active learning method. In this context, the superiority of active learning compared to traditional learning is shown.

Over the years, active learning has evolved and adapted to the reality of the times. In the beginning, when created, planned and applied by Revans, the method had seven basic precepts that guaranteed its efficiency and its good practices. Currently, the meaning of active learning, in the most simplistic way possible, would be for the student to manage their own learning, being basically guided and supported by the teacher.

The adaptation of any methods is necessary due to the constant updating of their methodologies and educational apparatus. As an example, firstly, we can mention the insertion of technologies at a given moment in history, then their rapid evolution and, consequently, the constant adaptation of methods. According to Kenski [33] “the attributes of the new digital technologies make it possible to use human capabilities in different learning processes”, thereby enhancing learning, if used well.

In this context, it is extremely important to use active methodologies that make up the active learning framework, and even more importantly, to verify which methodologies fit the reality of the content to be taught and of the students who must absorb this teaching.

Currently, it can be seen that there are a multitude of active learning methodologies that constitute and focus on active learning. Over the years, many other methods have emerged and methodologies have been integrated and include new technologies and educational instruments.

However, despite the creation of many active methodologies, they must respect and provide: the true empowerment of students; minimally interfere in the process by specialized external facilitators; using real problems with genuine difficulty and urgency; pulling people out of their comfort zones by having them operate in unfamiliar environments and deal with unfamiliar problems; and reflecting on these experiences and the assumptions behind their actions, including implementing solutions to the real problem being addressed [31].

#### IV. METHODOLOGICAL PROCEDURES

The present study is of an applied nature and a qualitative approach. As for the classification of the research in reference to the objectives, it is observed as exploratory research, since the aim would be, in addition to creating a greater proximity to the object of study, also

to carry out a data collection, using pre-defined questionnaires, or that is, standardized data collection techniques [34]. Regarding the technical procedures for research design, at first, bibliographic research was used, in order to review the main ideas that guide the theme of this work [35]. The due importance given to bibliographic research comes from the comprehensiveness of information that it makes available to the researcher, being basically impossible, without this technical procedure, to have access to most of the data due to the great dispersion of the same [34].

In a second moment, the survey and the case study were used. According to Marconi and Lakatos [36], the survey carried out by questionnaire is classified as a type of extensive direct observation, having as some advantages: coverage of a greater number of people simultaneously, greater freedom in the moment of the answer due to anonymity and greater uniformity. in the assessment due to impartiality. It also has some disadvantages: high rate of non-answers, impossibility of assistance when filling out the questionnaire (there may be misinterpretation of the questions) and the possibility of influence between the questions.

Following the guidance of Gil [37], the case study follows the following basic steps for its formulation: “formulation of the problem; definition of the case unit; determination of the number of cases; elaboration of the protocol; data collect; data evaluation and analysis; and preparation of the report”, these being the steps also followed by this research. Thus, the major stages of the research were 3, as shown in Figure 1.

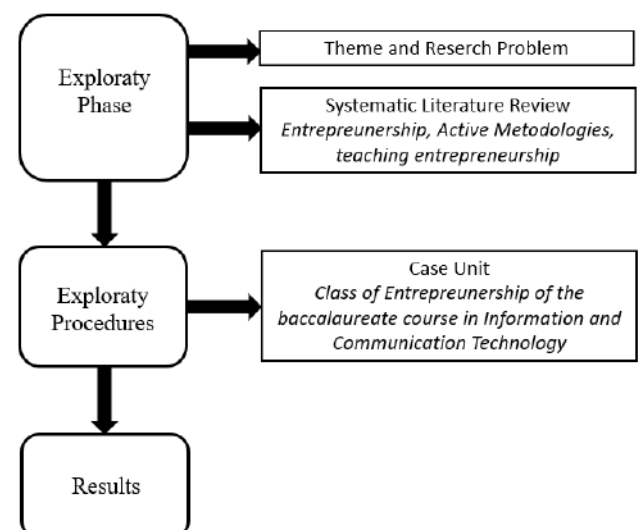


Fig.1. Research steps

Stage 1 – Exploratory Phase: Initially, in the exploratory phase, we sought to create a basis for the

research. With this, the theme and the research problem were delimited. From this, to achieve the objectives of this work, the following themes were verified in the literature: entrepreneurship, active methodologies, teaching entrepreneurship in basic and higher education, educational innovation, realistic entrepreneurial training. A systematic literature review was also carried out on the topic “active methodologies in teaching entrepreneurship” in order to identify the most used methodologies in this field of work.

Stage 2 – Exploratory Procedures: Afterwards, after choosing the method and methodology in the previous stage, it was time to put the methodological procedures into practice. In this case, the research was classified mostly according to the guidelines of Gil [37]. In sequence, the case unit was defined, the number of cases was also defined and the proposal was structured. It was followed by the application of active methodologies in the blended class of entrepreneurship of the baccalaureate course in Information and Communication Technology, and at the same time data collection took place, point by point of the application.

Stage 3 – Results and discussion: Finally, in the results and discussions stage, the data were collected and interpreted, and therefore presented and discussed. The final considerations and suggestions for future research closed this work, becoming an essential part for the sequence of studies on the subject.

The course, offered in the 2019/2 semester, had 25 enrollment registrations, with only 20 students participating at some point and only 16 completing the course. The other students were considered dropouts. Of these 20 active students, two belonged to the Computer Engineering course, two to the Physiotherapy course, one to the Energy Engineering course and fifteen to the Information and Communication Technology course.

Classes started on August 5, 2019 and ended on December 2, 2019. The face-to-face meetings took place on Mondays, at night, with a class duration of 1 hour and 40 minutes, at the institution itself. The non-face-to-face activities took place in “free” time and corresponded to two credits per week (100 minutes), so that the students could carry out the activities proposed by the discipline. This discipline belongs to the first phase of the course. Data collection took place throughout the course, through point-to-point observation of the application and results. However, in two moments there was greater grouping of data: in the application of the entrepreneurial potential scale and in the application of the student perception questionnaire.

In the first week of class, the students were asked to sign the Free and Informed Consent Term (ICF) which aimed to expose to the student all the information inherent to the consent to the application of the entrepreneurship teaching proposal through active methodologies, to that the student made his decision about participating in the research in a fair and informed manner. In sequence, the questionnaire referring to the “Scala do Potencial Empreendedor” developed by Santos [38] was applied, which aims to measure and identify the entrepreneurial potential in each student, by measuring each trait or characteristic common to all successful entrepreneurs, thus creating a basis for comparison with them. According to Santos [38] the application of the scale is important in “students, or people undergoing training to improve their business performance, will be able to identify areas where further training is needed”. After applying the entrepreneurial potential scale, work began on the contents organized into ten topics in Moodle. Work was done point by point and active methodologies were applied together with educational strategies throughout the semester.

At the end of the course, the students' perception questionnaire was applied, which evaluated several factors in relation to the applied proposal, the active methodologies and educational strategies used, thus showing the return on the learning experience in entrepreneurship.

## V. RESULTS AND DISCUSSION

The present investigation aimed to present a proposal for the application of active methodologies in the teaching of entrepreneurship in higher education, using a virtual teaching and learning environment. The proposal in question focused on providing a differentiated way of teaching entrepreneurship, using as a basis the application of active methodologies and, as a complement to the proposal, some educational strategies, combined with the entrepreneurial potential scale and a questionnaire of students' perception. All contents were structured in topics in a Virtual Teaching and Learning Environment (AVEA) used by the University.

The proposal elaboration process followed the logical sequence from the systematic review, verifying the most cited methodologies in the literature for teaching entrepreneurship, selecting the methodologies according to the possibility of application and, finally, developing the proposal in a structured way in Moodle (tables from 1 to 6). It is necessary to emphasize that this work did not focus on the evaluation of the pedagogical part of the proposal.

Table 01. Structuring the proposal – Case-Base Learning

| Active Methodologies | Modules and Activities carried out based on the active methodology outlined                                    |
|----------------------|----------------------------------------------------------------------------------------------------------------|
| Case-based learning  | <b>Module - Introduction to Entrepreneurship</b>                                                               |
|                      | Group case study;                                                                                              |
|                      | Open questions – Analysis of strengths and weaknesses on the concept’s “entrepreneur” and “intrapreneur”;      |
|                      | <b>Module - Presentation of Innovative Technologies</b>                                                        |
|                      | Preparation of Podcasts – choice of relevant topics and podcast about the most innovative ICTs in these areas; |
|                      | Self-assessment of the activity of creating podcasts;                                                          |
|                      | Open-ended questions about the student's perception of the activity of creating podcasts;                      |
|                      | Individual case study;                                                                                         |
|                      | <b>Module - Success/Failure</b>                                                                                |
|                      | Group case study;                                                                                              |
|                      | Open questions – Referring to the case study to verify the students' positioning regarding some questions;     |

Table 02. Structuring the proposal – Problem-based learning

| Active Methodologies   | Modules and Activities carried out based on the active methodology outlined                                                                      |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Problem-based learning | <b>Module - Problem-based Entrepreneurship: Animals at [name of institution]</b>                                                                 |
|                        | Presentation of a real and current problem of the Araranguá campus and development of solutions and action plans regarding this initial problem; |
|                        | Evaluation between teams on the solutions presented and their presentation;                                                                      |

Table 03. Structuring the proposal – Flipped classroom

| Active Methodologies | Modules and Activities carried out based on the active methodology outlined                              |
|----------------------|----------------------------------------------------------------------------------------------------------|
| Flipped classroom    | <b>Module - Entrepreneurial Potential Scale</b>                                                          |
|                      | Assessment of the entrepreneurial profile of the students in the class to verify points for improvement; |
|                      | <b>Module - Introduction to Entrepreneurship</b>                                                         |
|                      | Availability of content;                                                                                 |
|                      | <b>Module - Presentation of Innovative Technologies</b>                                                  |
|                      | Availability of material for the preparation of podcasts;                                                |
|                      | <b>Module - Prototype Business Plan - Business Idea</b>                                                  |
|                      | Inverted classroom – content availability;                                                               |
|                      | <b>Module - Model canvas</b>                                                                             |
|                      | Availability of content;                                                                                 |
|                      | <b>Module - Problem-based Entrepreneurship: Animals at [name of institution]</b>                         |
|                      | Availability of content;                                                                                 |
|                      | <b>Module - Innovation Environments</b>                                                                  |
|                      | Availability of content;                                                                                 |
|                      | <b>Module - Business Creation Mechanism</b>                                                              |
|                      | Availability of content;                                                                                 |

Table 04. Structuring the proposal – Gamification

| Active Methodologies | Modules and Activities carried out based on the active methodology outlined                                               |
|----------------------|---------------------------------------------------------------------------------------------------------------------------|
| Gamification         | <b>Module - Prototype Business Plan - Business Idea</b>                                                                   |
|                      | Continuous feedback immediately after the activity, providing an evaluation of the experience and continuous improvement; |
|                      | <b>Module - Canvas Template</b>                                                                                           |
|                      | Self-assessment regarding the preparation of the CANVAS and                                                               |

|  |                                                                                                                                                                                                                                                                                                                 |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | presentations                                                                                                                                                                                                                                                                                                   |
|  | <b>Module - Problem-based Entrepreneurship: Animals at [name of institution]</b>                                                                                                                                                                                                                                |
|  | Continuous feedback immediately after the activity, providing an evaluation of the experience and continuous improvement. It was also proposed to the students that the best ideas would be part of a document that would be taken to the campus management, proposing solutions and actions for the situation; |
|  | <b>Module - Business Creation Mechanism</b>                                                                                                                                                                                                                                                                     |
|  | Used in the student's own competition format with their own results. Questionnaire available with a grade, and students could retake them as many times as necessary, even surpassing their own scores                                                                                                          |

Table 05. Structuring the proposal – Project based learning

| Active Methodologies                                                                                        | Modules and Activities carried out based on the active methodology outlined                                                                                         |
|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Project based learning                                                                                      | <b>Module - Prototype Business Plan - Business Idea</b>                                                                                                             |
|                                                                                                             | Synthesis of the initial idea of an innovative enterprise;                                                                                                          |
|                                                                                                             | Evaluation of ideas between teams;                                                                                                                                  |
|                                                                                                             | Open-ended questions about the experience of recording video presentation of ideas;                                                                                 |
|                                                                                                             | <b>Module - Model canvas</b>                                                                                                                                        |
|                                                                                                             | Continuation of the development of the innovative business idea formulated in the activity of the previous topic. Development of the idea business model framework; |
|                                                                                                             | Evaluation of staff between teams;                                                                                                                                  |
|                                                                                                             | <b>Module - Final Podcast - Innovation Environments</b>                                                                                                             |
| Preparation of Podcasts – choice of Brazilian innovation environments and presentation of them via podcast; |                                                                                                                                                                     |

|  |                                                                                                                                                                                                                                    |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>Module - Business Plan - Final Version</b>                                                                                                                                                                                      |
|  | Completion of the project that started with the idea of an innovative business, through the elaboration of the CANVAS and, finally, creation of the business plan and presentation to other colleagues in the business as a whole; |
|  | Elevator speech (Pitch) – Students had to defend their business ideas with a maximum time of 5 minutes, simulating a sale of the business formulated to investors;                                                                 |

Table 06. Structuring the proposal – Game-based learning

| Active Methodologies | Modules and Activities carried out based on the active methodology outlined                                                                                                                                                          |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Game-based learning  | <b>Module - Business Creation Mechanism</b>                                                                                                                                                                                          |
|                      | Questionnaire developed on the moodle platform itself with different forms of answers: true or false, filling in the blanks, choosing an option, among others, raising the level of difficulty of the activity on business creation; |
|                      | <b>Module - Innovation Environments</b>                                                                                                                                                                                              |
|                      | Development of a JMatch, where students had to correlate columns of information about the topic;                                                                                                                                     |

Regarding the active methodologies used to structure the proposal, the ones that could be applied in the context of the class and the university were selected, among the most used for teaching entrepreneurship, found in the literature. Therefore, the active methodologies selected were: project-based learning, problem-based learning, elevator speech (and elevator pitch), gamification (gamification), flipped classroom (flipped classroom) and game-based learning (game-based learning).

It was decided to add to the proposal the active case-based learning methodology (Case based learning). According to Boldureanu et al. [39], it is necessary to expose real and successful cases of entrepreneurship, as well as the trajectory of these cases in teaching entrepreneurship for higher education. It is also known that there is a greater correlation between theory and practice during the study of real cases [40]. In view of the above,

we opted for the insertion of this active methodology, indispensable in the context of teaching entrepreneurship.

In order to complement the applications of active methodologies, some educational strategies were selected to work together with the application, such as: assessment between teams and self-assessment, creation of a podcast and the use of open questions. The objective of using other evaluation strategies, different from the standard strategies, was to try to evaluate the activities based on active methodologies proposed in a qualitative way.

The evaluation between teams used the already known and studied precepts of “peer review”. Students formed teams of three to four students, as guided by Timp-Pilon [41], due to the format being more effective for students. After carrying out some specific work, the teams were asked to evaluate each other, following a simple questionnaire, so that the student was guided as to what he should observe, making the evaluation work more dynamic.

The use of this evaluation methodology makes the process more productive and helps the teacher to have a broader view regarding the execution and product of the activity. In this way, the students themselves are able to perceive the different ideas that may arise in the same situation, and work them together, highlighting the strengths and weaknesses of each work. The fact that they use writing to express these feedbacks makes them develop the group lexicon and improve their own inter-team relationship and communication. According to a study by Burke Money Penny, Evans and Kraha [42], students who participated in a peer assessment/team assessment report that the method is effective, helpful to the teaching-learning system, improves communication and writing skills. Self-assessment was used in some moments of this proposal with the aim of instilling in the student a critical thinking about their own products and qualitatively evaluating their work.

From another perspective, with regard to the creation of podcasts, it focused on the creation of content by the students themselves. As stated by Solano and Sánchez [43]: the creation of podcasts by students “generates an enriching experience regarding the use of new technologies”. The experience involved both planning, data collection by bibliographic research, content generation and editing, making the experience attractive to students. These, finally, looked for ways to expose the content in a way that would become interesting and stimulating to their classmates. In short, the students learned the content by developing it in a different format, which they eventually taught to their colleagues.

Finally, the use of open questions in some activities aimed to capture the student's view of what was requested or seen during the activity. It was a way of understanding how the student perceived the active experience, in a simple and targeted format.

### **Student Perception Questionnaire**

The questionnaire applied was an adaptation of the questionnaire used by Santos [44] in his work, which aimed at the integration of technology in basic education through the use of online laboratories.

The purpose of applying this adapted questionnaire was to analyze the students' perception of the proposal offered for teaching entrepreneurship in higher education, using activities based on active methodologies and, for the purpose of complementation, educational strategies relevant to the proposal.

The questionnaire was divided into five evaluative groups, namely: regarding usability, regarding the perception of learning, regarding satisfaction, regarding usefulness, and finally, two open questions were used in order to analyze the students' opinion. Of the 16 students who completed the course, only 11 students answered the perception questionnaire, expressing their opinions, understandings and preferences regarding the proposal.

In the usability category, five questions were made available for students to answer in this assessment category. The focus of this category was to evaluate the students' perception of the usability of Moodle, and the deliveries made during the execution of the proposal. The answers were varied, filling the entire range of the Likert scale used for this category. It is identified, in the five questions of the category, that the concentration of the answers was mostly in the options “partially agree” and, in one question, in the option “totally agree”. Of the eleven responding students, 45% said they did not find any problems using the Moodle platform and 55% said that it was easy to use Moodle during the course. Again, 45% of the students stated that the time available to do the Moodle activities was sufficient. With this, it is clear that the students, in general, reacted well to the use of the Moodle platform, even with some reservations.

This result is quite interesting since this is a first semester discipline of the ICT course, with this, many students had their first contact with the platform in the same semester in which this teaching proposal for entrepreneurship occurred. Some of the students from other courses already had contact with Moodle, however, 36% of the students stated that the period of adaptation to the tool made it difficult to carry out the activities. A solution to this issue would be mandatory training for students, already in the first days of class of the course,

valuing the standardization of knowledge about the platform and how to use it in the best way. De Lima, Guerra and Fiorin [45] show in their work that an improvement in the Moodle interface would already be possibly efficient to improve students' adaptation to the platform, making it more attractive and adapted to the student's reality.

Regarding the perception of learning, the questionnaire had 22 questions in this evaluative category, and it was decided to divide it into four pages of answers, so that the process did not become so extensive as to encourage students to withdraw from the questionnaire. The purpose of this category was to evaluate how much the proposal, combined with the Moodle platform, really contributes to student learning in the discipline of entrepreneurship. The questions in the category related to the students' perception mentioned: the contents used, the methodologies used, the way in which these contents and activities are made available and the perception of what was learned as a whole by the student. Regarding the first six questions made available to the students, it was observed that most of the answers focused again between "totally agree" and "partially agree". Thus, approximately 81% of students agreed that the use of active methodologies for teaching entrepreneurship was an effective experience and 45% strongly agreed with this statement. Based on the students' responses, 64% stated that the content available in Moodle improved their understanding of the theoretical part of entrepreneurship and 91% of the students agreed that the proposal helped to correlate the theoretical part with the students' daily lives.

Therefore, there is a possible improvement of the proposal regarding the use of more activities that propose this correlation between theory and practice/daily life of the students, making the understanding of the content even easier and possible better performance on the part of the students. Some authors claim that teaching in a way that brings reality into the classroom makes the student have a truly effective experiential learning [46][47][48][49].

The following eleven questions mostly dealt with activities based on active methodologies and the educational strategies used in the proposal. Regarding the specific question: "the active methodologies used contributed to my learning", the eleven students who responded stated that they agreed (45% totally agreed and 55% partially agreed) and no student disagreed in any way, evidencing the acceptance of the proposal regarding use of active methodologies for teaching entrepreneurship. All activities based on active methodologies showed good returns, in general, as well as some unfavorable opinions. It can be understood that the activities were not a matter of unanimous acceptance. It is noticed that each student

identified himself less or more with a certain activity, making the proposal more interesting.

The feedback on the podcast activities drew attention, as, at the time of carrying out the activity-specific questionnaire, it was judged to be a great, innovative, fun activity, and that most enjoyed it. However, in the perception questionnaire, 45% of the students disagreed with the statement that the podcast activity was a fun and innovative way to learn the contents of the discipline. In the meantime, an idea emerges that possibly the students' perceptions would be better portrayed if all the questionnaires were applied soon after the activity was carried out, and not at the end of the course.

The question still arises that a perception questionnaire performed sometime after the activities have been carried out can lead to differences of opinion, perhaps due to lack of clarity regarding the feeling and perception that occurred at the time of the activity. However, the elevator speech activity showed a good return from the responding students, 72% agreed that carrying out this activity made students review the entire process to think of a better way to present the final business idea. The same 72% also agreed that they learned, in a way, how to prepare for a dynamic business presentation, in case there is a need for the future. The SEBRAE videos on business creations, arranged in Moodle, in increasing order of knowledge, also had a good response, together with Moodle's own mixed questionnaire activity, and the students stated that it was an important part of the proposal for training in entrepreneurship.

In the last five questions about perception of learning, students were asked about their general understanding of the activities. Again, in all five questions, there was a higher response count in the "strongly agree" and "partially agree" options. In general, 91% of the students agreed that they felt better prepared to exercise the concepts of entrepreneurship, and 72% agreed that activities based on active methodologies contributed to a better assimilation of the contents. A total of 45% of the students agreed that the proposal can be considered innovative, when compared to the methodologies of the other subjects of the course.

The evaluative category "as for satisfaction" aimed to identify the perception in relation to the students' satisfaction with the proposal, communication between colleagues, motivation, among others. Seven questions were made available in this category. Again, the answers followed the previous pattern, mostly between the options "totally agree" and "partially agree". In general, students were satisfied with the proposal, with 63% agreeing that

the use of active methodologies was relevant for their studies.

Furthermore, 63% of the students stated that they would indicate the proposal to their other teachers and that the proposal increased their motivation to learn new content. An interesting point was that the proposal, according to 72% of the respondents, partially improved communication between colleagues in the classroom. It is believed that this improvement occurred due to the activities being carried out mostly in groups, in order to force a type of integration. One possibility for future uses would be for the subject teacher to choose the groups, enriching the discussion and the final product. In this same context, 27% of respondents disagreed that the proposal improved communication between colleagues. It is noticed that two students, of the three who represent the 27% discordant, are not part of the ICT course, with this, it appears that this lag in interpersonal relationships may have been strongly impacted by this factor. Therefore, it makes sense in this context to use integration activities with students in the first weeks of the course, in order to get to know each other better and create bonds during the course. Respondents, 72% of the students, agreed that the proposal better met their learning expectations than it would if the subject were taught using the traditional method. However, this answer is presented as a speculation, because we would not be able to be really sure that this method better meets the students' expectations until the same class has both educational methods for this same subject (active and traditional) and can compare them in practice.

The purpose of the evaluative category on utility was to know how useful was the use of this proposal, even compared to traditional teaching methods, which students were already used to in other subjects. The category consisted of six questions. As for the answers, again, there was the same pattern of majority answers in the classes "I totally agree" and "I partially agree". Respondents agree that, 91% of the total, the use of Moodle and the content available in it can really improve the performance of a face-to-face/expository class. It is known that the use of both face-to-face reinforcement and anticipation of content in a virtual way is a well-known way of working, being a well-known and widely used example, the active methodology of the inverted classroom. A detail that deserves to be highlighted is that 73% of the respondents agreed that similar learning outcomes can be achieved by the traditional methodology. This statement really makes sense, since it specifically questioned the learning result, considering that both by the traditional method and by the active method, the student will learn the content. What primarily differs between the two methods is the role of

the student, where the student makes the choices and the teacher intermediates them. What is expected is that the motivation for the active method will be greater, and that it will also be innovative and fun to learn, but that it will reach the greater good: synthesis of knowledge.

The use of open questions was the way found to give more strength and voice to the students' opinions, providing more reliable feedback to their opinions. Two questions were used: "which activity did you most enjoy doing? Explain why" and "what changes or improvements would you consider for this teaching proposal?".

Ten answers were counted for this first question, and the respondents listed that, among the activities applied, the activities that the students liked best were: the creation of a podcast and the Animal activity at the university, which used the active PBL methodology. The main reasons for choosing podcasts were: a positive, fun and innovative experience, which comes very close to the reality of the current generation and where public speaking, editing and general knowledge skills were improved. Regarding the animal activity at [name of institution], the strengths were: it presented itself as a palpable, real and local problem, and that thinking and mobilizing the class to find solutions to this real problem was very interesting for the students (figure 2).

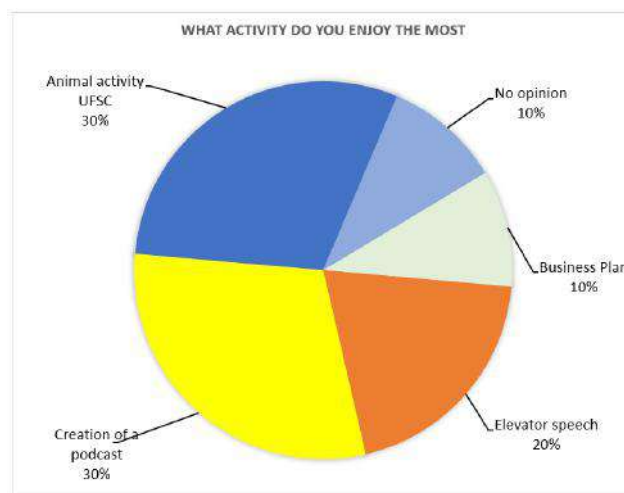


Fig. 2. Graph of activities that students liked the most.

Regarding the second open question, eight responses were counted. All the answers were diverse and very enriching for the improvement of the proposal. As a result, 25% of the students believe that more time in the execution of activities would help to develop them in a better way, since most students work during business hours and take the course at night, not having enough time during week to devote full time to these activities. One of the respondents believes that a better exposure of the



content or reinforcement of the same in the face-to-face class would help the student to be better placed on the course floor, as students disperse a little when all the content is on the online platform. One way out of this improvement for this situation would be a very detailed delimitation of how the discipline works. If in doubt, the student would consult this "itinerary", making it easier to navigate the contents.

Another respondent believes that an interesting option would be to carry out fewer activities in the discipline's Moodle and focus more on classroom presentations, aiming at the development of the student's social part. In all, 25% of the students raised the question of participation, since there is no point in innovating in relation to the teaching methodology if students do not get involved and participate. The critical point for the success of any learning methodology is participation, since, without student participation, it is difficult to exchange and generate consolidated knowledge.

One option for this issue would be the use of initial recognition and dynamic activities among students to encourage them to get to know each other better, making the environment lighter and more reliable. Also make the teacher choose the work teams, mixing the profiles in order to necessarily improve the rapport, enriching the products of the activities.

Due to the results and discussions presented, it is understood that the proposal structured in Moodle, based on active methodologies and educational strategies, showed good acceptance by the students, as shown in the students' responses to the perception questionnaire. Some important qualities for the teaching and learning scenario of entrepreneurship, also important for the creation and maintenance of the entrepreneurial spirit and for the formation of the student as a citizen, were worked and developed during the proposed application. Some of these qualities are: problem solving, public speaking, resourcefulness in public, critical sense, use of continuous feedback, organization, creativity, cooperation, empathy, among others.

## VI. FINAL CONSIDERATIONS

Through this research, it was possible to observe that there is much to be developed and work in the field of teaching entrepreneurship, given the importance and value of professionals with a good training in the area and who are prepared to deal with the job market.

It was possible to understand, through this case study, together with information retrieved in the literature, that active methodologies do not fully contribute if there is no

commitment from everyone during the teaching and learning process. With this, there is no point in innovating in the methodology, if there is no student participation and teacher mobilization to make it happen.

A point to be highlighted, which is interesting, is the use of different methodologies, aiming at increasing the possibility of reaching students in the classroom. It is known that each student is unique, having their personal preferences and worldviews. Therefore, the more diversified a proposal can present itself, the greater the possibility of scope and, consequently, the possibility of satisfaction on the part of the students. We can be sure of this by analyzing the results of the perception questionnaire of the applied proposal, where each student preferred an activity for different reasons.

The research was guided by the following research question: "How can the application of a teaching proposal based on active methodologies, using a virtual teaching and learning environment, contribute to the teaching of entrepreneurship in higher education?" Thus, to validate the question listed, a proposal for the use and application of active methodologies was elaborated, together with some educational strategies, in Moodle, aimed at higher education.

Through the application of the activities that made up the proposal, it was possible to obtain some returns on this issue. The results showed that the use of the proposal in higher education can bring benefits, such as: greater participation and engagement of students with the contents taught in the discipline; development of critical and entrepreneurial thinking; global improvement in understanding the concepts of the topic; possibility of greater interaction among the students of the class; learn concepts and actions with real and palpable situations; learn or improve editing application handling skills; improve on oratory.

The use of the virtual teaching and learning environment was essential for the organization of the proposal. Moodle made the distribution of content and delimitation of topics very interesting, making the contents not merge, resolving possible doubts that could arise on the part of the students. The possibility of creating games and other activities within the platform itself is another strong point.

Some improvements were noticed during the process of application of the proposal, both by the students and by the others involved. This process of identifying improvements is vital for the updating and continuous improvement of the process to occur, a determining factor for success with new educational practices. The notes were: longer time to perform activities in Moodle; better alignment of the

content of face-to-face classes with the content available in Moodle for consultation in non-face-to-face pedagogical activities of the discipline; promotion actions aimed at greater integration of students from other courses; better dose the amount of activities available in Moodle and classroom activities, carried out in the classroom. It is important to mention that the focus of this work was not to analyze the pedagogical part of the proposal.

The set of students that form a class is a unique arrangement. Each class has its particularities, in this case, facilities or difficulties in the face of an educational proposal. With this, it becomes even more interesting, in addition to the kick-off achieved with the application of this proposal, a deeper reflection on what is really effective for each unique arrangement or class.

The main objective of this work was achieved from the elaboration of the proposal, according to the evidence presented, during all points of this work and gains presented in this conclusion, making the proposal susceptible to use at any time.

An interesting way to obtain a profile of the class would be to hold an open conversation with the students, on the first day of class, in order to briefly know their preferences and difficulties. With this, it becomes easier to think of a personalized proposal for each class, having as main objective an effective learning focused on the students.

Another question that is interesting for future work would be to work better on the correlation between the results of the entrepreneurial potential scale and the application of the proposal itself. An example of this question would be the identification of a student with a low score in the “information” category of the entrepreneurial potential scale. The “information” category mentions the thirst for knowledge on the subject, the interest in learning about entrepreneurship. In this case, would the student not have difficulties in getting involved in the proposal due to the fact that he or she does not want to search for more on the subject or go deeper into it? Or even, would the student not change this score to become interested in the proposal? These are interesting and important questions that would complement future work.

### ACKNOWLEDGEMENTS

Acknowledgments: This work was carried out with the support of the Fundação de Amparo à Pesquisa e Inovação do Estado de Santa Catarina (FAPESC), through resources from the Public Call Notice FAPESC/CAPES N° 21/2021 – Accreditation of Higher Education Institutions with emerging *stricto sensu* graduate programs and being

consolidated in priority areas in the state of Santa Catarina, Termo de Grant CP 21/2021 FAPESC.

### REFERENCES

- [1] Debeauvais, M. (1974). The popularity of the idea of innovation: a tentative interpretation of the texts. *Prospects*, v. IV, no. 4, p. 494–502. Available at: <<https://link.springer.com/article/10.1007/BF02217366>>. Access on: 21 Oct. 2019
- [2] Hofman, R.H. et al. (2013). Educational Innovation, Quality, and Effects: An Exploration of Innovations and Their Effects in Secondary Education. *Educational Policy*, vol. 27, no. 6, p. 843–866, Nov. 2013. Available at: <<http://journals.sagepub.com/doi/10.1177/0895904811429288>>. Accessed on: 1 Aug. 2018
- [3] Ribeiro, T.M.; Born, G. (2015). The new student. *Free Text: Language and Technology*. v.8, n.1, pp.51-61. Federal University of Minas Gerais.
- [4] Revans, R.W. (1983). *ABC of Action Learning*. 1. ed. New York: Routledge.
- [5] Ferreira, E.D.; Moreira, F.K. (2019). Active Learning Methodologies: Reports of Experiences in the Use of the PEER Instruction. In: XVII International Colloquium on University Management, Mar del Plata. *Anais ... Mar del Plata*: 2019. Available at: <[https://repositorio.ufsc.br/bitstream/handle/123456789/181135/102\\_00146.pdf?sequence=1&isAllowed=y](https://repositorio.ufsc.br/bitstream/handle/123456789/181135/102_00146.pdf?sequence=1&isAllowed=y)>. Accessed on: 11 Jan. 2019
- [6] Winfield, S.S; Black, G.S. (2005). Active Versus Passive Course Designs: The Impact on Student Outcomes. *Journal of Education for Business*, vol. 81, no. 2, p. 119–123, 7 Nov. Available at: <<https://www.tandfonline.com/doi/full/10.3200/JOEB.81.2.119-128>>. Accessed on: 1 Jun. 2019
- [7] Zapalska, A.M.; Perry, G. (2002). Collaborative Learning Instrument in Teaching Entrepreneurship Issues. *Journal of Teaching in International Business*, v. 13, p. 57–76. Available at: <[https://www.researchgate.net/publication/254378246\\_Collaborative\\_Learning\\_Instrument\\_in\\_Teaching\\_Entrepreneurs\\_hip\\_Issues](https://www.researchgate.net/publication/254378246_Collaborative_Learning_Instrument_in_Teaching_Entrepreneurs_hip_Issues)>. Accessed on: 19 Jul. 2019
- [8] Cooper, S.; Bottomley, C.; Gordon, J. (2004). Stepping Out of the Classroom and Up the Ladder of Learning: An Experiential Learning Approach to Entrepreneurship Education. *Industry and Higher Education*, vol. 18, no. 1, p. 11–22. Available at: <<https://journals.sagepub.com/doi/abs/10.5367/000000004773040924?journalCode=ihea>>. Accessed on: 28 Nov. 2020
- [9] Rincón Diez, V.; Zorrilla C.P. (2015). Development of new business ideas through active learning. *Option*, v. 31, p. 790–805, 2015. Available at: <<https://www.scopus.com/inward/record.uri?eid=2-s2.0-84961782788&partnerID=40&md5=6cbf4abb1829527eeb4897c59d278deb>>. Access on: 30 Jun. 2019
- [10] McCord, M.; Houseworth, M.; Michaelsen, L.K. (2015). The Integrative Business Experience: Real Choices and Real Consequences Create Real Thinking. *Decision Sciences*

- Journal of Innovative Education, v. 13, no. 3, p. 411–429, 2015. Available at: <[https://www.researchgate.net/publication/280917031\\_The\\_Integrative\\_Business\\_Experience\\_Real\\_Choices\\_and\\_Real\\_Consequences\\_Create\\_Real\\_Thinking](https://www.researchgate.net/publication/280917031_The_Integrative_Business_Experience_Real_Choices_and_Real_Consequences_Create_Real_Thinking)>. Access on: 12 Apr. 2020
- [11] Meintjes, A.; Henrico, A.; KROON, J. (2015). Teaching Problem-Solving Competency in Business Studies at Secondary School Level. *South African Journal of Education*, v. 35, no. 3, 2015. Available at: <[https://www.researchgate.net/publication/283129885\\_Teaching\\_problem-solving\\_competency\\_in\\_Business\\_Studies\\_at\\_secondary\\_school\\_level](https://www.researchgate.net/publication/283129885_Teaching_problem-solving_competency_in_Business_Studies_at_secondary_school_level)>. Accessed on: 7 Jul. 2019
- [12] Whitlock, A.M. (2019). Elementary School Entrepreneurs. *Interdisciplinary Journal of Problem-Based Learning*, v. 13, no. 1, 31 Jan. 2019. Available at: <<https://docs.lib.purdue.edu/ijpbl/vol13/iss1/7>>. Accessed on: 11 Aug. 2019
- [13] Antunes, C. (2011). Professor Bonzinho = Aluno Difícil: A questão da indisciplina na sala de aula. 9. ed. Petrópolis: Editora Vozes.
- [14] Bell, R.; Bell, H. (2016). An Enterprise Opportunity for Entrepreneurial Students: Student Enterprise Development and Experience Assessed through the Student Voice. *Education & Training*, v. 58, p. 751–765, 2016. Available at: <[https://www.researchgate.net/publication/305721940\\_An\\_Enterprise\\_Opportunity\\_for\\_Entrepreneurial\\_Students\\_Student\\_Enterprise\\_Development\\_and\\_Experience\\_Assessed\\_through\\_the\\_Student\\_Voice](https://www.researchgate.net/publication/305721940_An_Enterprise_Opportunity_for_Entrepreneurial_Students_Student_Enterprise_Development_and_Experience_Assessed_through_the_Student_Voice)>. Access on: 23 Sep. 2019
- [15] Harkema, S. J. M.; Schout, H. (2008). Incorporating Student-Centred Learning in Innovation and Entrepreneurship Education. *European Journal of Education*, v. 43, n. 4, p. 513–526. Disponível em: <<https://onlinelibrary.wiley.com/doi/abs/10.1111/j.14653435.2008.00372.x>>. Acesso em: 17 jan. 2018.
- [16] Åsvoll, H.; Jacobsen, P.J. (2012). A Case Study: Action Based Entrepreneurship Education How Experience Problems Can Be Overcome and Collaboration Problems Mitigated. *Journal of Entrepreneurship Education*, vol. 15, no. Spec. Issue, p. 75–97, 2012. Available at: <<https://www.scopus.com/inward/record.uri?eid=2-s2.0-84887590826&partnerID=40&md5=57d06256ee57b0fda8f7ba5dcbf8c2f>>. Accessed on: 20 Aug. 2018
- [17] Insulander, E.; Ehrlin, A.; Sandberg, A. (2015). Entrepreneurial Learning in Swedish Preschools: Possibilities for and Constraints on Children's Active Participation. *Early Child Development and Care*, v. 185, no. 10, p. 1545–1555. Available at: <[https://www.researchgate.net/publication/273486457\\_Entrepreneurial\\_learning\\_in\\_Swedish\\_preschools\\_possibilities\\_for\\_and\\_constraints\\_on\\_children's\\_active\\_participation](https://www.researchgate.net/publication/273486457_Entrepreneurial_learning_in_Swedish_preschools_possibilities_for_and_constraints_on_children's_active_participation)>. Accessed on: 5 Jan. 2020
- [18] Desai, R. (2012). Teaching sustainable innovation technologists. *International Journal of Innovation Science*, v. 4, no. 1, p. 25–33. Available at: <<https://www.scopus.com/inward/record.uri?eid=2-s2.0-84859466155&doi=10.1260%2F1757-2223.4.1.25&partnerID=40&md5=7302f3594e320ab35868a0a87d93e>>. Accessed on: 13 Jul. 2019
- [19] Rahman, H.; Day, J. (2014). Involving the Entrepreneurial Role Model: A Possible Development for Entrepreneurship Education. *Journal of Entrepreneurship Education*, vol. 17, no. 2, p. 163–171. Available at: <<https://www.scopus.com/inward/record.uri?eid=2-s2.0-84931363036&partnerID=40&md5=02bd668d890fe15e3b3aee2072b9b42>>. Access on: 22 Sep. 2019
- [20] Alvarenga, CF et al. (2012). Challenges of Higher Education for Public School Students: a Study at UFLA. *Contemporary Thought in Administration Magazine*, v. 6, no. 1, p. 55. Available at: <<http://www.redalyc.org/articulo.oa?id=441742844005%0AComo>>. Accessed on: 12 Jun. 2018
- [21] Groccia, J.E. (2018). What Is Student Engagement? *New Directions for Teaching and Learning*, v. 2018, no. 154, p. 11–20. Available at: <<https://onlinelibrary.wiley.com/doi/abs/10.1002/tl.20287>>. Accessed on: 11 Jul. 2019
- [22] Audet, J. (2004). L'Impact de deux projets de session sur les perceptions et intentions entrepreneuriales d'étudiants en administration. *Journal of Small Business and Entrepreneurship*, vol. 17, no. 3, p. 221–238. Available at: <<https://www.tandfonline.com/doi/abs/10.1080/08276331.2004.10593321>>. Accessed on: 18 Feb. 2020
- [23] Pittaway, L. (2016). The Role of Inquiry-Based Learning in Entrepreneurship Education. *Industry and Higher Education*, vol. 23, no. 3, p. 153–162. Available at: <[https://www.researchgate.net/publication/233690584\\_The\\_Role\\_of\\_Inquiry-Based\\_Learning\\_in\\_Entrepreneurship\\_Education](https://www.researchgate.net/publication/233690584_The_Role_of_Inquiry-Based_Learning_in_Entrepreneurship_Education)>. Access on: 26 Sep. 2019
- [24] Ramsgaard, M.B; Christensen, M.E. (2018). Interplay of Entrepreneurial Learning Forms: A Case Study of Experiential Learning Settings. *Innovations in Education and Teaching International*, v. 55, no. 1, p. 55–64. Available at: <<http://dx.doi.org/10.1080/14703297.2016.1228468>>. Accessed on: 13 Jul. 2020
- [25] Revans, R.W. (1983). *ABC of Action Learning*. 1. ed. Nova York: Routledge.
- [26] Filatro, A.; Cavalcanti, C.C. (2018). *Innovative methodologies in face-to-face, distance and corporate education*. 1. ed. São Paulo: Saraiva Educação SA.
- [27] Passoni, D.; Michels, E. (2018). *Empreendedorismo: Estado da Arte*. 1 ed. ed. Capivari de baixo: FUCAP.
- [28] Global Entrepreneurship Monitor. (2019). *Entrepreneurship in Brazil 2019 - Executive Report GEM* Entrepreneurship in Brazil - Executive Report . [sl: sn]. Available at: <[https://ibqp.org.br/PDF\\_GEM/Executive\\_Report\\_on\\_Entrepreneurship\\_in\\_Brazil\\_2019.pdf](https://ibqp.org.br/PDF_GEM/Executive_Report_on_Entrepreneurship_in_Brazil_2019.pdf)>. Accessed on: 19 Jul. 2018
- [29] Brazilian Support Service for Micro and Small Businesses. (2019). *Profile of Entrepreneurs*. Available at: <<https://datasebrae.com.br/perfil-dos-empresarios/>>. Accessed on: 12 Nov. 2019

- [30] Evans, R.S; Parks, J.; Nichols, S. (2007). The Idea to Product@program: An educational model uniting emerging technologies, student leadership and societal applications. *International Journal of Engineering Education*, v. 23, no. 1, p. 95–104. Available at: <[https://www.researchgate.net/publication/233487452\\_The\\_Idea\\_to\\_ProductR\\_Program\\_An\\_Educational\\_Model\\_Uniting\\_Emerging\\_Technologies\\_Student\\_Leadership\\_and\\_Societal\\_Applications](https://www.researchgate.net/publication/233487452_The_Idea_to_ProductR_Program_An_Educational_Model_Uniting_Emerging_Technologies_Student_Leadership_and_Societal_Applications)>. Accessed on: 11 Jan. 2019
- [31] Boshyk, Y.; Dilworth, R.L. (2010). *Action Learning - History and Evolution*. London: Palgrave Macmillan UK.
- [32] Freeman, S. et al. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences of the United States of America* v.111, p.8410.
- [33] Kenski, V.M. (2003). Technology-mediated learning. *Educational Dialogue Magazine*, v. 4, no. 10, p. 47–56, 2003. Available at: <[www.siteeducacional.com.br](http://www.siteeducacional.com.br)>. Accessed on: 3 Dec. 2019
- [34] Laird, J.R et al. (1996). Inhibition of neointimal proliferation with low-dose irradiation from a  $\beta$ -particle-emitting stent. *Circulation*, v. 93, no. 3, p. 529–536, Feb. 1996. Available at: <<https://www.ahajournals.org/doi/full/10.1161/01.cir.93.3.529>>. Accessed on: 19 Jan. 2020
- [35] Pizzani, L. et al. (2012). A arte da pesquisa bibliográfica na busca do conhecimento. *RDBCI: Revista Digital de Biblioteconomia e Ciência da Informação*, v. 10, n. 1, p. 53, 10 jul. 2012. Disponível em: <<http://periodicos.sbu.unicamp.br/ojs/index.php/rdbci/article/view/1896>>. Acesso em: 23 jan. 2019.
- [36] Marconi, M.A.; Lakatos, I.N. (2003). *Fundamentals of Scientific Methodology*. 5th ed. São Paulo: Editora Atlas.
- [37] Gil, AC. (2002). *How to design research projects*. São Paulo, Atlas.
- [38] Santos, P. (2008). *A Scale to Identify Entrepreneurial Potential*. Federal University of Santa Catarina, 2008. Available at: <<http://www.periodicos.ufsc.br/index.php/adm/article/view/7869>>. Access on: 10 Mar. 2019
- [39] Boldureanu, G. et al. (2020). Entrepreneurship education through successful entrepreneurial models in higher education institutions. *Sustainability (Switzerland)*, v. 12, no. 3, p. 1–33, 2020. Available at: <<https://www.mdpi.com/2071-1050/12/3/1267>>. Accessed on: 12 Jan. 2019
- [40] Swiercz, P.M.; Ross, K.T. (2003). Rational, Human, Political, and Symbolic Text in Harvard Business School Cases: A Study of Structure and Content. *Journal of Management Education*, vol. 27, no. 4, p. 407–430, Aug. 2003. Available at: <<http://journals.sagepub.com/doi/10.1177/1052562903252511>>. Accessed on: 30 Aug. 2019
- [41] Timp-Pilon, M. (2008). *Effective peer review groups: a writing center approach to creating and using peer review in the composition classroom*. Thesis (MA)--St. Cloud State University, 2008., 2008. Available at: <[https://nanopdf.com/download/strategies-for-effective-peer-review\\_pdf](https://nanopdf.com/download/strategies-for-effective-peer-review_pdf)>. Access on: 12 Apr. 2019
- [42] Burke Money Penny, D.; Evans, M.; Kraha. A. (2018). Student Perceptions of and Attitudes toward Peer Review. *American Journal of Distance Education*, v. 32, no. 4, p. 236–247, 2018. Available at: <<https://www.tandfonline.com/doi/abs/10.1080/08923647.2018.1509425?journalCode=hajd20>>. Accessed on: 19 Feb. 2020
- [43] Solano, I.; Sánchez, M. (2010) Learning anywhere: the educational podcast. *Pixel-Bit. Revista de Medios y Educación*, v. 1, no. 36, p. 125–139. Available at: <<https://www.redalyc.org/articulo.oa?id=36815128010>>. Access on: 11 Mar. 2019
- [44] De Lima, R. M.; Guerra, L. T. B.; Fiorin, (2015). A. Educação Ubíqua: Um Modelo de Adaptação para o Moodle. *Revista Eletrônica Argentina-Brasil Tecnologias da Informação e da Comunicação*, v. 1, n. 3, p. 1–16. Disponível em: <<https://revistas.setrem.com.br/index.php/reabtic/article/view/80/39>>. Access on: 12 jan. 2019.
- [45] Santos, A.C. (2018). *Integration of technology in basic education: a case study in biology classes using online laboratories*. Federal University of Santa Catarina, 2018. Available at: <<https://repositorio.ufsc.br/handle/123456789/191135>>. Accessed on: 12 Aug. 2019
- [46] Shurville, S.; Rospigliosi, (2009). A. Implementing Blended Self-Managed Action Learning for Digital Entrepreneurs in Higher Education. *Action Learning: Research and Practice*, vol. 6, no. 1, p. 53–61. Available at: <<https://www.tandfonline.com/doi/abs/10.1080/14767330902731335>>. Accessed on: 19 Apr. 2019
- [47] Yates, D.A.; WARD, C. (2009). Staying on the Cutting Edge of Student Active Learning through Real World Engagement. *American Journal of Business Education*, v. 2, no. 1, p. 101–114. Available at: <[https://www.researchgate.net/publication/292675890\\_Staying\\_On\\_The\\_Cutting\\_Edge\\_Of\\_Student\\_Active\\_Learning\\_Through\\_Real\\_World\\_Engagement](https://www.researchgate.net/publication/292675890_Staying_On_The_Cutting_Edge_Of_Student_Active_Learning_Through_Real_World_Engagement)>. Accessed on: 31 Jan. 2019
- [48] Vega, G. (2010). The Undergraduate Case Research Study Model. *Journal of Management Education*, vol. 34, no. 4, p. 574–604, 2010. Available at: <<https://journals.sagepub.com/doi/10.1177/1052562909349923>>. Accessed on: 22 Jan. 2019
- [49] Mccord, M.; Houseworth, M.; Michaelsen, L. K. (2015). *The Integrative Business Experience: Real Choices and Real Consequences Create Real Thinking*. *Decision Sciences Journal of Innovative Education*, v. 13, n. 3, p. 411–429, 2015. Disponível em: <[https://www.researchgate.net/publication/280917031\\_The\\_Integrative\\_Business\\_Experience\\_Real\\_Choices\\_and\\_Real\\_Consequences\\_Create\\_Real\\_Thinking](https://www.researchgate.net/publication/280917031_The_Integrative_Business_Experience_Real_Choices_and_Real_Consequences_Create_Real_Thinking)>. Acesso em: 12 abr. 2020.

## Environmental injustice caused by wind farms: A systematic literature review

## Injustiça Ambiental causada por parques eólicos: Uma revisão sistemática da literatura

Romário Nunes da Silva<sup>1</sup>, Anderson Fernandes de Alencar<sup>2</sup>, Horasa Maria Lima da Silva Andrade<sup>3</sup>, Luciano Pires de Andrade<sup>4</sup>

<sup>1</sup>Universidade Federal Rural de Pernambuco, Brasil

Email: romario.nunes@gmail.com

<sup>2</sup>Universidade Federal do Agreste de Pernambuco, Brasil

Email: anderson.alencar@ufape.edu.br

<sup>3</sup>Universidade Federal Rural de Pernambuco, Brasil

Email: horasaa@gmail.com

<sup>4</sup>Universidade Federal do Agreste de Pernambuco, Brasil

Email: luciano.andrade@ufape.edu.br

Received: 02 Aug 2022,

Received in revised form: 26 Aug 2022,

Accepted: 01 Sep 2022,

Available online: 09 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— Rural communities, Sustainable development, Energy, Sustainability.

**Palavras-Chave**— Comunidades rurais, Desenvolvimento Sustentável, Energia, Sustentabilidade.

**Abstract**— The recent concern with energy security and environmental impacts, resulting from the expansion of current consumption, has induced the diversification of matrices and among them, the advances of wind energy are noticeable, as it is an inexhaustible source and already consolidated in the market. However, wind farms present challenges to be faced, so that their negative impacts are minimized, since their implementation together with rural territories configures an intrinsic and complex relationship between nature and society. In this sense, the present study aims to investigate whether the expansion of wind energy generating enterprises has caused environmental injustice to rural communities. For this, a Systematic Literature Review was carried out, based on the search for theoretical-empirical articles in the Scielo, Scopus, DOAJ and Web of Science databases. The studies underwent a screening, aiming to answer the following problem-question: has the expansion of wind farms caused environmental injustice in rural communities in Brazil? From the analysis of the selected experiences, it appears that in most cases, the implementation of wind farms caused environmental injustice, especially to rural communities, which often did not participate in the sharing of economic success, leaving only the impacts socio-environmental. Therefore, State interventions are necessary to change the current scenario and avoid future conflicts.

**Resumo**— A recente preocupação com a segurança energética e com os impactos ambientais, decorrentes da expansão do consumo atual têm induzido a diversificação das matrizes e dentre elas é perceptível os avanços da energia eólica, pois se trata de uma fonte inesgotável e já

*consolidada no mercado. Entretanto, os parques eólicos apresentam desafios a serem enfrentados, de modo que seus impactos negativos sejam minimizados, uma vez que, a sua implantação juntamente à territórios rurais configura uma relação intrínseca e complexa entre a natureza e a sociedade. Nesse sentido, o presente estudo tem por objetivo investigar se a expansão de empreendimentos geradores de energia eólica tem acarretado injustiça ambiental a comunidades rurais. Para isso, foi realizada uma Revisão Sistemática da Literatura, a partir da busca de artigos teórico-empíricos, nas bases de dados da Scielo, Scopus, DOAJ e Web of Science. Os estudos passaram por uma triagem, visando responder o seguinte problema-questão: a expansão dos complexos eólicos tem causado injustiça ambiental em comunidades rurais do Brasil? A partir da análise das experiências selecionadas, verifica-se que na maioria dos casos, a implantação de parques eólicos acarretou injustiça ambiental, em especial às comunidades rurais, que por muitas vezes não participaram da partilha do sucesso econômico, só restando-lhes os impactos socioambientais. Portanto, faz-se necessária intervenções do Estado para mudar o panorama atual e evitar futuros conflitos.*

## I. INTRODUÇÃO

Em escala global, as maiores partes das fontes energéticas são provenientes de fontes fósseis não renováveis, a exemplo do petróleo, carvão mineral e do gás mineral (Freitas & Dathein, 2013). Em função disso, problemas em relação ao esgotamento, bem como o aumento da emissão de gases que intensifica o efeito estufa têm causado preocupação às autoridades políticas e à sociedade (Drumm *et al.*, 2014).

No intuito de promover um desenvolvimento mais sustentável, esforços governamentais e não governamentais têm incentivado o uso de formas de energias mais limpas (Anenberg *et al.*, 2013), as quais não dependem de recursos naturais considerados finitos, e normalmente produzem baixo impacto ambiental (Freitas, 2015; Twidell & Weir, 2015). De forma geral, o cenário de evolução das fontes de energias renováveis é promissor, pois há muito potencial de produção (Farias, 2016). Dentre essas fontes, a que usa a tecnologia eólica se destaca por ser inesgotável e já consolidada no mercado, sendo economicamente viável e apresentando caráter competitivo (Dantas *et al.*, 2019).

Todavia, apesar da viabilidade da instalação dos parques eólicos, em alguns casos, os agenciadores desse setor ignoram os impactos ambientais, sociais, econômicos e tecnológicos provocados desde o período de instalação até ao período de operação (Cuadra, 2019). Galvão *et al.* (2020) salientam que os complexos geradores de energia eólica apresentam desafios a serem superados, ou mesmo, minimizados, pois, por muitas vezes a sua presença configura uma relação intrínseca e complexa com a

sociedade e natureza. Nesse sentido, Feil e Schreiber (2017) ressaltam que as causas dos impactos negativos dos parques eólicos devem ser investigadas e minimizadas e que apoie ou abranja de fato a ideia de sustentabilidade e desenvolvimento sustentável. Gorayeb e Brannstrom (2016) alertam que diferentemente de outros empreendimentos energéticos, o processo de licenciamento ambiental de parques eólicos é bastante célere, facilitado pela Resolução n. 279 de 27 de julho de 2001, que considera as usinas eólicas como empreendimentos de impacto ambiental de pequeno porte. Portanto basta que os empreendedores apresentem um Relatório Ambiental Simplificado (RAS), para a obtenção da concessão da licença ambiental prévia.

Diante dos argumentos supracitados, o presente estudo tem por objetivo investigar se a expansão de empreendimentos geradores de energia eólica tem acarretado injustiça ambiental a comunidades rurais do Brasil, assim como, colaborar com o debate em torno do Desenvolvimento Sustentável e da Sustentabilidade.

### *Produção de energia eólica no Brasil*

Desde a década de 1920, no Brasil, pesquisas têm sido desenvolvidas na busca por alternativas energéticas que possibilitem o desenvolvimento socioeconômico e ambiental (Mauad *et al.*, 2017). Mais recentemente, diversas alternativas foram analisadas, principalmente aquelas formadas por usinas eólicas, solares e biomassa. Dentre estas, a energia eólica se destaca como uma das que mais avança em termos de tecnologia e aplicação, pois não emite gases poluentes, e ao mesmo tempo faz uso de um combustível inesgotável - o vento. Portanto, esta se trata

de uma tecnologia inovadora, com custos relativamente elevados em relação às fontes tradicionais, responsáveis pela geração de eletricidade (Freire & Fontgalland, 2022).

No Brasil, a energia eólica teve seu primeiro indício em 1992, através da operação comercial do primeiro aerogerador, resultado de uma parceria entre o Centro Brasileiro de Energia Eólica (CBEE) e a Companhia Energética de Pernambuco (CELPE), a partir do financiamento do instituto de pesquisa dinamarquês Folkecenter. Ademais, a turbina eólica, com potência de 225 KW, instalada nesse período no arquipélago de Fernando de Noronha (Pernambuco), não foi apenas a primeira a entrar em operação comercial no país, mas na América do Sul (Júnior & Rodrigues, 2015).

Recentemente, no ano de 2021, a Agência Nacional de Energia Elétrica (ANEEL), declarou que o Brasil atingiu um recorde de expansão de usinas eólicas, com potência instalada de 20,1 gigawatts, correspondendo a 11 % da matriz energética do país. Dados registrados no boletim da Associação Brasileira de Energia Eólica (ABEEólica) também referente ao ano 2021 demonstram que a região Nordeste tem sido a mais próspera na produção, com crescimento de 104,4%, seguido da região Sul com 14,04%. Em relação às Unidades Federativas com maior capacidade de produção, destacam-se: Rio Grande do Norte (6.082,824 MW), Bahia (5.395,545 MW), Ceará (2.438,14 MW), Piauí (2.354,65 MW), Rio Grande do Sul (1.835,89 MW) e Pernambuco (798,365 MW) (ABEEÓLICA, 2021). Para o futuro, especificamente, para o ano de 2050, o Greenpeace Internacional e o Conselho Europeu de Energia Renovável – EREC estimam um cenário otimista, onde a participação da energia hidrelétrica na matriz brasileira cairá para 45,65%, e a eólica atinja 20,38% (Greenpeace Internacional & EREC, 2010).

Segundo Simas e Pacca (2013), o sucesso da energia eólica se deve a fatores como a perspectiva na geração de empregos e renda aos municípios, existência de potencial eólico, simplicidade na aplicação, que consiste em sistemas modulares flexíveis e pequenas obras de construção civil. Além disso, há possibilidades de aprimoramento técnico, aumento da capacidade da unidade, baixo impacto ambiental em comparação com outras tecnologias elétricas, e, principalmente, o apoio político do estado aos Municípios com maior potencial de produção.

#### *Injustiça ambiental*

O Relatório de Brundtland – Nosso Futuro Comum, publicado em 1987 pela Comissão Mundial sobre Meio Ambiente e Desenvolvimento, e amplamente divulgado na Conferência das Nações Unidas sobre o Meio Ambiente e

o Desenvolvimento, realizada no Rio de Janeiro, em 1992 contribuiu na popularização do conceito de Desenvolvimento Sustentável (Brundtland, 1987). Entretanto, essa popularização, assim como, a sua aplicabilidade não passou imune às críticas que surgiram em direção às evidências e questionamentos produzidos por diversos campos do saber, como os expressados por Foladori (2001) e Montibeller Filho (2004), os quais o encaram como um mito. Tais críticas orientam estudos provenientes da Ecologia Política, amparados por trabalhos e pela ação política dos seus estudiosos, na investigação dos conflitos ambientais distributivos ao indicarem como as assimetrias de poder determinam aqueles a quem os impactos indesejáveis do desenvolvimento devem atingir (Acselrad, 2004; Martínez-Alier, 2007).

A expansão dos empreendimentos de produção de energia eólica, por exemplo, se justifica na agenda ambiental, além de prometer renda e empregos aos povos que habitam aqueles territórios a terem os complexos instalados. Porém, são justamente, esses povos, que, por muitas vezes desfavorecidos economicamente, que são os mais acometidos pela redução drástica dos direitos do uso da terra e dos recursos naturais, podendo levar a sua remoção desse território tudo isso em nome de um interesse nacional ou global (Fairhead & Leach; Scoones, 2012).

ACSELRAD (2004) destaca que, ao incluir os princípios da Sustentabilidade em um determinado empreendimento, não se pode deixar de considerar a dimensão social, de modo que o enfrentamento a uma crise ambiental não promova injustiça social.

A injustiça ambiental é definida como:

[...] o mecanismo pelo qual sociedades desiguais, do ponto de vista econômico e social, destinam a maior carga dos danos ambientais do desenvolvimento às populações de baixa renda, aos grupos sociais discriminados, aos povos étnicos tradicionais, aos bairros operários, às populações marginalizadas e vulneráveis (Porto, 2004, p. 122).

Martínez-Alier (2007) lembra que a distribuição desigual dos efeitos de danos ambientais que afetam, com mais rigidez, grupos sociais menos favorecidos ou minorias étnicas, demonstra que a transferência dos custos ambientais para as partes mais precárias contribui para expropriação dos recursos naturais, beneficiando alguns em detrimento de outros.

Em função da injustiça ambiental, os territórios e seus povos podem ser acometidos por processos denominados de: despossessão ou espoliação, que se trata do uso de

recursos econômicos que seriam coletivos por uma classe econômica, em detrimento de outra socialmente, politicamente e economicamente mais fraca; exclusão, que uma forma de movimento da dinâmica de exclusão/inclusão, que exclui para incluir; e a desterritorialização/reterritorialização e precarização territorial, processos de mobilidade geográfica pressionada pelo capitalismo financeiro (Haesbaert, 2004; Harvey, 2004; Leal, 2011).

## II. MATERIAL E MÉTODOS

Como procedimento metodológico, utilizou-se a Revisão Sistemática da Literatura, que possibilita maximizar a busca, oferecendo ao pesquisador um suporte ao identificar e analisar estudos de forma organizada (Costa & Zoltowski, 2014). Esta pesquisa pode ser caracterizada como exploratória descritiva, com delineamento baseado nas seguintes recomendações científicas: a) definição do problema e proposta da revisão; b) definição dos descritores e combinações para identificação dos estudos; c) definição dos critérios de inclusão e exclusão, bem como do período; d) identificação, seleção e a análise da qualidade dos estudos; e) análise dos dados e síntese dos resultados (De-La-Torre-Ugarte-Guanilo *et al.*, 2011; Galvão & Pereira, 2014).

A busca dos estudos ocorreu em maio de 2022, considerando as publicações de artigos entre os anos de 1992 e 2022, a partir dos termos indexadores “*windy energy*”, *impact*, nas bases de dados da Scielo, Scopus, DOAJ (*Directory of Open Access Journals*) e *Web of Science*. Tais termos foram interligados pelo operador booleano *AND*. Este recorte histórico foi definido, tendo em vista que o ano de 1992 foi um “divisor de águas” para a expansão dos complexos eólicos em vários países em desenvolvimento, onde, muitos destes instalaram suas primeiras turbinas eólicas, dentre eles o Brasil, no arquipélago de Fernando de Noronha/Pernambuco (Gouvêa & Silva, 2018).

Para seleção dos estudos, considerou-se como critérios de inclusão: estudos de conhecimento teórico-empírico, nacionais, revisado por pares e que atendam o objetivo da pesquisa. Já os critérios de exclusão foram: estudos internacionais, as duplicatas, cartas, revisão, relatos, bibliométricos e outros documentos de dados secundários, assim como os que não atendam o escopo da pesquisa. Tais critérios foram elaborados com o intuito de responder o seguinte problema-questão: A expansão dos complexos eólicos tem causado injustiça ambiental em comunidades rurais do Brasil?

Ao realizar a busca, foram identificados 240 estudos, porém, foram eliminados 56 trabalhos que se tratavam de

repetições, revisões, relatórios, bibliométricos, citações e outros de dados secundários, restando, portanto, 184 trabalhos. A próxima etapa da seleção foi a leitura dos títulos, e a partir disso, foram excluídos 158 trabalhos que não atenderem o escopo da pesquisa. Em seguida foi realizada a leitura dos resumos, que identificou 12 trabalhos que não apresentaram aderência com o estudo. Por fim, foi realizada a leitura dos estudos remanescentes na íntegra, onde, foram selecionadas 9 experiências que apresentaram alinhamento com os critérios de inclusão, e serão utilizadas na presente revisão (Fig. 1).

## III. RESULTADOS E DISCUSSÃO

Ao organizar os dados dos estudos selecionados, nota-se de imediato, o quão recentes são as pesquisas voltadas aos impactos socioeconômicos ocasionados pelos parques eólicos a comunidades tradicionais. Mesmo considerando um recorte de 30 anos para resgate de estudos, todas as 9 experiências selecionadas se deram a partir do ano de 2015. Na última década, principalmente após o ano de 2009, houve um “*boom*” nos investimentos dos parques eólicos, muito em detrimento dos leilões realizados pelo Governo Federal. No ano de 2015, por exemplo, as instalações foram provenientes das seguintes contratações: PROINFA, Leilões de Energias Renováveis, Leilões de Energia de Reserva, Leilões de Energia Nova, Leilões de Fontes Alternativas e Mercado Livre (Neto *et al.*, 2020). Os investimentos se expandiram pelo interior do país, o que gerou conflitos com os povos desses territórios. Tais conflitos estimulou o crescimento do número de pesquisas que analisaram esses impactos e suas implicações.

Quanto às localizações geográficas das experiências, destacam-se as Unidades Federativas da região Nordeste, em especial os estados do Ceará, Rio Grande do Norte, Piauí, Pernambuco e Paraíba. Já a região Sul fica representada pelo Rio Grande do Sul (Quadro 1). Segundo Mendonça (2019), as regiões Nordeste e Sul atraem mais parques eólicos devido às condições favoráveis, em especial as áreas litorâneas, onde há diferença na pressão, com ventos mais fortes e frequentes. Entretanto, Traldi (2018) relata a potencialidade do interior da região Nordeste, particularmente em alguns municípios localizados na delimitação do semiárido, onde, os parques em instalação poderiam representar 82% na capacidade de geração de energia eólica no Nordeste brasileiro.



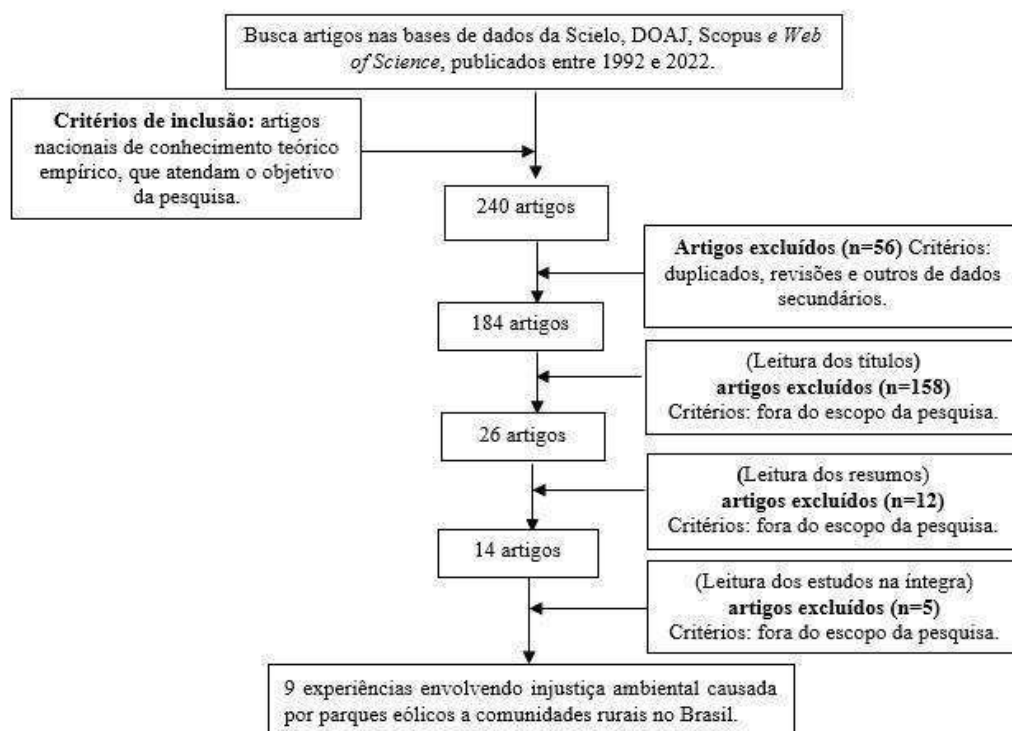


Fig. 1: Procedimentos de busca dos artigos e os critérios de inclusão e exclusão.

Fonte: Dados da pesquisa (2022).

Quadro 1: Panorama geral dos estudos selecionados.

| Autor(es)/ano                | Local de estudo                             | Objetivo                                                                                                                                                                                                                                                                                 | Principais resultados                                                                                                                             |
|------------------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Cardoso e Collischonn (2015) | Santa Vitória do Palmar (Rio Grande do Sul) | Compreender o crescimento da produção de energia eólica, as características das áreas em que se implantaram parques ou complexos eólicos e os impactos dos objetos técnicos relacionados à paisagem.                                                                                     | -Atmosfera de otimismo pela comunidade local (progresso, aumento do poder econômico do município e à modernidade).                                |
| Campêlo e Albuquerque (2016) | Marcolândia (Piauí)                         | Constatar a questão da sustentabilidade da geração deste tipo de energia, concomitante com a atividade econômica originalmente desenvolvida, e as medidas mitigadoras utilizadas a fim de minimizar os impactos socioambientais causados com a implantação e operação do empreendimento. | -Aumento do poder de compra da população local.                                                                                                   |
| Moreira et al. (2017)        | Itarema e Acaraú (Ceará)                    | Investigar os impactos socioambientais e econômicos na instalação e funcionamento de parques eólicos                                                                                                                                                                                     | -Diminuição de renda de famílias;<br>-Devastação da vegetação local e do manguezal;<br>-Ruído das torres e do óleo utilizado para sua manutenção. |

|                              |                                                                |                                                                                                                                             |                                                                                                                                                                      |
|------------------------------|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Traldi (2018)                | João Câmara/Rio Grande do Norte; e Caetité (BA)                | Discutir alguns dos principais impactos socioeconômicos e territoriais da implantação e da operação de parques eólicos.                     | -Empregos temporários;<br>-Comprometimento do direito da terra;<br>-Discrepância entre valores pagos pelo arrendamento.                                              |
| Costa et al. (2019)          | Beberibe e Trairi (Ceará)                                      | Analisar e comparar os aspectos ambientais, sociais, econômicos e tecnológicos originados com a implantação dos parques eólicos.            | -Desgastes das vias de acesso;<br>-Impactos à flora e à fauna;<br>-Alterações nos níveis de pressão sonora;<br>-Fissuras nas casas.                                  |
| Nascimento et al. (2020)     | São José do Sabugi (Paraíba)                                   | Identificar os impactos socioambientais da instalação do Parque Eólico.                                                                     | -Danos à vegetação local;<br>-Interferência no lazer e na fonte de renda;<br>-Modificações na rotina do ambiente;<br>-Insatisfação quanto a questão econômica.       |
| Araújo et al. (2020)         | Vários municípios do litoral (Ceará)                           | -Entender os materiais de licenciamento para parques eólicos e o conteúdo das preocupações das comunidades anfitriãs sobre parques eólicos. | -Alteração da disponibilidade da água doce;<br>-Privatização de terras;<br>-Ruído;<br>-Exploração sexual e uso de drogas;<br>-Filhos sem pai;<br>-Violência.         |
| Santana e Silva (2021)       | Caetés (Pernambuco)                                            | Discutir a problemática da produção de energia eólica no contexto discursivo do desenvolvimento sustentável.                                | -Ruídos;<br>-Rachadura nas residências;<br>-Danos à saúde mental;<br>-Pouco esclarecimento dos contratos;<br>-Perdas na produtividade agropecuária;<br>-Êxodo rural. |
| Nino, Anjos e Estrada (2022) | Santa Vitória do Palmar, Rio Grande e Chuí (Rio Grande do Sul) | Avaliar se havia indícios de mudanças de percepção e comportamento entre os produtores que aderiram ao projeto                              | -Falta de consciência ambiental dos agricultores<br>-Renda econômica vantajosa, segura e regular.                                                                    |

Fonte: Dados da pesquisa (2022).

#### Casos do semiárido

Em Marcolândia/Piauí, Campêlo e Albuquerque (2016), investigaram uma comunidade em que 92 agricultores assinaram um contrato de arrendamento de 20 anos com a empresa administradora do complexo eólico local. Tais agricultores recebem R\$ 1.000,00 mensal por cada torre instalada em sua propriedade. Os autores enfatizam que a instalação das torres não impediu a

continuidade da agropecuária, pois os plantios da mandioca e a criação de bovinos ocorrem no mesmo território de forma integrada. Portanto, além de agregar valor às suas terras, os agricultores agora celebram a renda extra. Assim, os autores concluem que a instalação desse complexo no município impactou positivamente, contribuindo com o aumento da renda local, historicamente carente. Há de se ressaltar que no estudo os

autores não relataram nenhum impacto negativo em relação às questões ambientais e sociais, que por muitas vezes, já são esperados por esse tipo de empreendimento e as suas reflexões não acontecerem de forma mais profunda.

Já Traldi (2018) se aprofundou mais nesses impactos e notou que, em relação a contratação de mão de obra, os moradores de João Câmara/Rio Grande do Norte e Caetité/Bahia reclamam que em grande maioria, os empregos são temporários (enquanto duram as obras de implementação) e direcionados a trabalhadores de fora, principalmente pela falta de qualificação da mão de obra local. Com a alta na imigração temporária, o custo de vida é impulsionado, elevando os preços de produtos de primeira necessidade e dos aluguéis. Outra questão observada foi a disparidade da remuneração mensal paga pelas empresas por cada torre instalada nas propriedades. Em Caetité/BA, por exemplo, a empresa Renova Energia pagava em torno de R\$ 460,00/torre/mês, em 2013. Já a empresa Gestamp instalada em João Câmara/RN pagava valores que variavam entre R\$1.200,00/torre/mês e R\$1.500,00/torre/mês, no mesmo ano. A autora ressalta que mesmo havendo diferença na potência dos equipamentos, a diferença impressiona.

Além disso, a chegada dos parques nesses dois municípios elevou o preço das terras locais, as tornando objetos de disputa. Muitos latifundiários assediam os moradores menos favorecidos economicamente para comprar as suas terras e depois arrendar aos parques. A quantidade d'água dos territórios também foi afetada pela presença dos parques, os quais demandam muito consumo, principalmente no período de instalação, que retiraram de poços locais. É importante ressaltar que esses municípios avaliados já enfrentavam escassez de água. Por fim, apesar de não detalhar como se deu a delimitação da amostragem, a autora considerou ouvir diversos atores. Ademais, a integração de dados e a profundidade das análises realizadas nesse estudo colaborou com um maior entendimento da problemática. Entretanto, as pesquisas de campo aconteceram em apenas dois municípios, que talvez, não considere todas as peculiaridades do semiárido, delimitação que a autora se propôs estudar.

No Estado da Paraíba, mais precisamente no município de São José do Sabugi, Nascimento *et al.* (2020) avaliaram os impactos socioambientais ocasionados pelo parque eólico mediante a percepção da comunidade local, e verificaram também que a geração de empregos na comunidade deixou a desejar, pois a maior parte da mão de obra contratada foi de fora. Além disso, os entrevistados relatam que os mais pobres não conseguiram assinar nenhum convênio, e os contratos ficaram com os que tem maior poder aquisitivo, portanto, não houve nenhum

impacto na renda. Porém, a melhoria das estradas é tida como um ponto positivo para a comunidade, todavia, houve um aumento considerável no movimento de transportes, causando algumas vezes, acidentes e interferindo na rotina dos moradores.

Em relação aos ruídos, no momento da pesquisa isso não era um problema. Na verdade, no início era comum, entretanto, foram realizadas algumas manutenções e esse problema foi sanado. Quanto ao impacto ambiental, os moradores relataram o desmatamento da vegetação local que aconteceu na fase de implantação do parque, principalmente de umbuzeiros, localizados nas margens das estradas. Alguns agricultores reclamam que antes obtinham renda extra a partir da venda dos frutos dessas árvores. De forma geral, os moradores entrevistados estão frustrados por não comungarem dos ganhos financeiros, só restando-lhes as consequências dos impactos socioambientais. Há de se ressaltar que essa comunidade estudada é pequena, com poucas famílias, e muitas delas são desfavorecidas economicamente. Os autores ressaltam que das 8 famílias que vivem lá, 4 participaram da entrevista, sendo que 3 se recusaram a responder a entrevista e 1 não se encontrava. Por fim, o estudo cumpre com o que promete, que é o aprofundamento na análise dos impactos a partir da percepção dos moradores.

Ao investigarem o caso de comunidades rurais próximas de parques eólicos no município de Caetés/Pernambuco, Santana e Silva (2021) fazem uma reflexão de como esses empreendimentos se utilizam da pauta ambiental, se apresentando como “energia limpa” e ao mesmo tempo promovendo injustiça ambiental. A princípio, os autores identificaram dois grupos: 1) o que foi contemplado com o contrato das torres; 2) e o que não foi contemplado com o contrato, mas foi atingido pelos impactos negativos. Todavia, as reclamações partiram dos dois grupos. Segundo os moradores entrevistados, os ruídos das hélices têm afetado o bem estar e a saúde de alguns moradores. Inclusive, há relatos de êxodo rural devido ao barulho dessas turbinas. Também, as rachaduras se fazem presentes em algumas residências, pois, muitas torres estão instaladas em até 100 metros de distância. Nesses casos, os moradores aguardam o dinheiro da indenização para poder ir embora também, pois, temem que esses impactos sejam recorrentes. Os moradores que assinaram o contrato, alegam que os itens deste não foi bem esclarecido, assim como os impactos dos parques, e assinaram na ingenuidade, pois possuíam pouco entendimento das palavras constatadas nele, e isso foi feito de forma célere.

Ademais, os moradores reclamam do não cumprimento de promessas da construção de escola, quadra, praça e centro de atendimento social pela empresa administradora,

e, relatam ainda, que as turbinas causaram prejuízos financeiros, pois a dinâmica dos cultivos de milho sofreu interferência, e a quantidade de leite foi reduzida, decorrente dos sustos que as vacas sentiam com as sombras das hélices. Os autores não destacam o tamanho do universo desses agricultores impactados, nem tampouco justificam se o tamanho da amostragem analisada é representativo estatisticamente, porém, se aprofundam no debate sobre injustiça ambiental, elaborando bem a elucidação do seu conceito e exemplificando com os dados obtidos.

#### *Casos do litoral cearense*

Moreira *et al.* (2017) se propuseram a levantar a percepção de dez moradores das comunidades de Volta do Rio, Praia do Morgado e Espriado, comunidades circunvizinhas aos parques eólicos, localizados nos municípios de Itarema e Acaraú, litoral do Estado do Ceará, sobre os impactos socioambientais e econômicos. Apesar de não explicarem se a amostragem dos entrevistados é representativa estatisticamente, os autores se aprofundaram nas reflexões acerca da análise do contexto, análise do processo e análise do conteúdo.

Durante as entrevistas os moradores reclamaram que os donos de latifúndios foram os que tiveram preferência no arrendamento das terras. Os relatos continuam em direção às promessas não cumpridas por mais de 7 anos pela empresa administradora do parque eólico, como por exemplo, o calçamento da estrada, a construção de quadra de esporte, de escolas e maior distribuição de energia para a comunidade. Os impactos ambientais relatados mencionam a destruição de uma mata fechada e do mangue, contaminação dos lagos e rios grandes por óleo, recursos que eram de onde os pescadores tiravam seu sustento, além de desativar um campo que era utilizado para recreação das crianças. Quanto ao incômodo com os ruídos, os moradores relatam que isso ocorre algumas vezes, quando se necessita manutenção. Por fim, para os entrevistados, a instalação do parque eólico só foi vantajosa para os mais ricos, donos de grandes terras, e os demais moradores não tiveram as promessas atendidas, ficando apenas com o ônus.

Nos municípios de Beberibe e Trairi, Costa *et al.* (2019), destacam que a maior intensidade dos impactos se deu no período de instalação, o que acarretou a diminuição da fauna e da flora (principalmente em áreas de dunas), desgastes das vias de acesso e descaracterização da paisagem natural. Nesse sentido, os moradores reclamam que, com o aumento do trânsito de automóveis pela estrada local, aumentou também, a quantidade de poeira, o que tem acarretado problemas respiratórios. Além disso, houve produção de ruídos, limitação do direito de “ir e vir” e

fissuras nas casas da população local. Os autores destacam que os impactos econômicos foram expressivos no período de construção, porém foram diminuindo gradativamente com o passar dos anos em detrimento dos empregos temporários necessários nessa fase. Este estudo apresentou um bom delineamento da amostragem, assim como, uma integração de dados de documentos e análises técnicas e estatísticas, o que contribuiu para uma melhor interpretação dos fatos.

Em comunidades localizadas nos municípios de Aracati, Acaraú, Amontada e Itapipoca, Araújo *et al.* (2020) entrevistaram moradores que relataram problemas como: a contaminação e redução da água doce; problemas com o ruído que é interminável e se assemelha ao de um helicóptero; aumento da poeira das estradas; descaracterização da paisagem natural; restrição ao acesso nas localidades das torres; arrendamento de terra apenas da elite; poucas vagas de empregos e temporárias; problemas advindo da rotatividade da mão de obra como a exploração sexual, violência contra a mulher, uso de drogas e filhos sem pai. Nesse caso, esses filhos são denominados de “filhos do vento”, pois os trabalhadores vão embora e as jovens da comunidade os criam sozinhas. Os autores enfatizam que alguns desses parques foram instalados em áreas vazias, porém, isso não isentou as comunidades dos impactos, pois descaracterizou a paisagem natural e espaços que antes serviam de recreação, fonte de água e de renda. Portanto, a instalação desses parques não levou progresso às comunidades estudadas, as quais têm sido acometidas apenas com as adversidades oriundas desses empreendimentos.

#### *Casos do Rio Grande do Sul*

Em Santa Vitória do Palmar/Rio Grande do Sul, Cardoso e Collischonn (2015) destacam que o parque eólico lá instalado é visto por 100% dos entrevistados como um “elixir” para o desenvolvimento do espaço rural local, principalmente à noite, quando as luzes vermelhas das turbinas estão ligadas. Além disso, a maioria dos entrevistados (65%) consideram que o parque foi muito bom para o município, porém, dos 20 entrevistados, apenas 3 relataram melhora na renda da família. Os autores destacam problemas em relação às estradas mais movimentadas, aumento de morte de animais na pista e outras modificações na paisagem. Nesse território, a produção se dá em forma de consórcios, no qual os moradores que possuem torres em suas propriedades recebem uma remuneração mensal e a interferência nas atividades agropecuárias, como por exemplo, produção de arroz, criação de ovelhas e bovinos foi praticamente nula, porém é evidente a mudança nas rodovias, a partir da instalação de redes de distribuição de energia, gerando

riscos, e a criação de uma paisagem industrial nos campos que anteriormente eram ocupados com pecuária extensiva.

Apesar das mudanças, os moradores não consideram que o ruído seja um problema e uma possível justificativa para isso é a tecnologia de ponta utilizada na implantação do parque, pois nas turbinas não constam as caixas de engrenagens inclusas nos sistemas mais antigos, o que reduz consideravelmente os ruídos mecânicos. Em geral, a perspectiva da população rural entrevistada sobre esse parque é satisfatória, porém este o estudo não deixou claro como se deu a delimitação da amostragem, portanto, não se pode afirmar que esses entrevistados reflitam de fato a realidade local.

Recentemente, Nino *et al.* (2022) divulgaram uma pesquisa realizada entre os anos 2016 e 2017, que avaliou se havia indícios de mudanças de percepção e comportamento entre os produtores que aderiram ao projeto em comunidades rurais dos municípios de Santa Vitória do Palmar, Rio Grande e Chuí. Os moradores tinham muitas dúvidas no início, no entanto, com a receita gerada pelos parques eólicos, os agricultores se mostraram felizes, principalmente, por conseguirem alavancar maiores investimentos em atividades agrícolas e não agrícolas. Além disso, os parques trouxeram melhorias para as estradas, segurança pessoal e patrimonial por meio do monitoramento contínuo das instalações. O otimismo dos agricultores é reforçado ao manifestarem o interesse em ampliar suas propriedades na expectativa de que mais aerogeradores pudessem ser instalados.

A construção dos parques eólicos causou algum desconforto devido aos problemas gerados durante a instalação das estruturas, porém, logo desapareceu quando os agricultores começaram a receber uma renda econômica vantajosa, segura e regular. Apesar desses agricultores participarem de uma atividade de apelo mais sustentável, eles não adquiriram uma consciência ambiental, pois, muitos se classificam como conservadores e minimizam as perdas decorrentes do uso irregular dos recursos hídricos, do uso intensivo de agrotóxicos, da eliminação de matas ciliares ou da conservação da biodiversidade, além de criticarem a atuação dos órgãos ambientais como o IBAMA. Portanto, mesmo esses parques trazendo bons resultados que fortalecem essas comunidades rurais, sem impactá-los socioeconomicamente, estes não foram capazes de gerar mudar a perspectiva ambiental por parte dos agricultores. Em suma, o estudo apresenta uma boa representação da amostragem, faz uso de uma metodologia bem estruturada e faz reflexões profundas sobre o tema.

#### IV. CONCLUSÃO

A análise das experiências demonstrou que na maioria dos casos, a implantação de parques eólicos acarretou injustiça ambiental, pois os povos das comunidades rurais não tiveram seus anseios econômicos atendidos, e além disso, são obrigados a conviver com os impactos socioeconômicos e ambientais gerados por estes. Um dos efeitos da injustiça ambiental é a desterritorialização, portanto, empreendimentos que se justificam no debate do desenvolvimento sustentável têm falhado, especialmente na dimensão social. Na maior parte das experiências ficou nítido que a distribuição “dos louros” ficam apenas entre a elite, latifundiários e os empreendedores, e a população menos favorecida não tem acesso às benesses. Em algumas experiências ficou claro que, quando as comunidades rurais são inseridas na partilha econômica, estas são fortalecidas e convivem em harmonia com esses empreendimentos.

Em tempos em que a energia é escassa e as mudanças climáticas são proeminentes, se faz necessário que o Estado estimule o uso de fontes mais limpas e que não emitam CO<sub>2</sub>, entretanto, está claro que o licenciamento desses empreendimentos eólicos é brando e é imprescindível a imposição de limites, de modo que estes façam os ajustes necessários para reparar as injustiças provocadas à população rural mais carente. Além disso, que esses complexos eólicos e seus associados obtenham consciência ambiental e assumam em conjunto, de fato, a defesa de um desenvolvimento mais sustentável. Portanto, práticas como a destruição da vegetação e da fauna, o uso exaustivo da água e a sua contaminação devem ser atenuadas e/ou extintas.

A expansão dos parques eólicos nos últimos anos tem alcançado cada vez mais novas comunidades rurais, e a prospecção do setor é otimista. Portanto, caso não haja intervenções no modo de como se dá a relação parques/natureza/sociedade, diante do que já se conhece, provavelmente surjam novos casos de injustiça ambiental. Enfim, com este estudo espera-se ter contribuído com o debate em torno da mitigação desses impactos e no fomento de políticas públicas que visem melhorias socioambientais que contribuam para o Desenvolvimento Sustentável.

#### REFERÊNCIAS

- [1] ABEEÓLICA - Associação Brasileira de Energia Eólica. *Dados ABEEÓLICA – Boletim anual*. (2021). Disponível em: <https://abeeolica.org.br/energia-eolica/dados-abeeolica/?ano=2021>. Acesso em: 31 maio, 2022.
- [2] Acsehrad, H. *Justiça ambiental: ação coletiva e estratégias argumentativas*. (In.) Acsehrad, H., Herculano, S. & Pádua,

- J. A. (org.) (2004). *Justiça ambiental e cidadania*. Rio de Janeiro: Relume Dumará; Fundação Ford.
- [3] Anenberg, S., Balakrishnan, K., Jetter, J., Masera, O., Mehta, S., Moss, J. & Ramanathan, V. (2013). Cleaner Cooking Solutions to Achieve Health, Climate, and Economic Cobenefits. *Environ. Sci. Technol.* 47(9), 3944-3952.
- [4] Brasil. Ministério de Minas e Energia. Agência Nacional de Energia Elétrica. *Brasil bate recorde de expansão de usinas eólicas em um ano; marca anterior era de 2014*. 2022. Disponível em: <https://www.gov.br/aneel/pt-br/assuntos/noticias/2022/brasil-bate-recorde-de-expansao-de-usinas-eolicas-em-um-ano-marca-anterior-era-de-2014>. Acesso em: 31 maio, 2022.
- [5] Brundtland, G. H. (1987). *Relatório Brundtland: nosso futuro comum*. Comissão Brundtland/ONU.
- [6] Costa, A. B. & Zoltowski, A. P. C. (2014). Como escrever um artigo de revisão sistemática. In: Koller, S. H., Couto, M. C. P. P. & Hohendorff, J. V. (Eds.). *Manual de produção científica*. Porto Alegre: Penso, 55-70.
- [7] Cuadra, L., Campo-Estrella, I., Alexandre, E. & Salcedo-Sanz, S. (2019). A study on the impact of easements in the deployment of wind farms near airport facilities. *Renewable Energy*, 135, 566-588.
- [8] Dantas, E. J. A., Rosa, L. P., Silva, N. F. & Pereira, M. G. (2019). A energia eólica na costa nordeste brasileira, do sopro da esperança à convergência turbulenta: o caso dos parques eólicos de Galinhos. *Sustentabilidade*, 11(14), 1-24. Disponível em: <https://www.mdpi.com/2071-1050/11/14/3802>. Acesso em: 25 jun. 2021.
- [9] De-La-Torre-Ugarte, M. C., Takahashi, R. F. & Bertolozzi, M. R. (2011). Revisão sistemática: noções gerais. *Revista da Escola de Enfermagem da USP*, 45(5), 1260-1266. doi: 10.1590/S0080-62342011000500033
- [10] Drumm, F.C., Gerhardt, A. E., Fernandes, G.D., Chagas, P., Socolotti, M. S. & Kemerich, P. D. C. (2014). Poluição Atmosférica Proveniente da Queima de Combustíveis Derivados do Petróleo em Veículos Automotores. *Revista Eletrônica em Gestão, Educação e Tecnologia Ambiental*, 18(1), 66-78.
- [11] Fairhead, J., Leach, M. & Scoones, I. (2012). Green Grabbing: a new appropriation of nature? *The Journal of Peasant Studies*, 39. Disponível em: <https://www.tandfonline.com/doi/full/10.1080/03066150.2012.671770?scroll=top&needAccess=true>. Acesso em: 24 maio, 2022.
- [12] Farias, L. T. S. (2016). Energia Alternativa: Impactos da Energia Eólica para a Comunidade Local. *Revista Especialize On-line IPOG*, 1(11).
- [13] Feil, A. A. & Schreiber, D. (2017). Sustentabilidade e desenvolvimento sustentável: desvendando as sobreposições e alcances de seus significados. *Cadernos Ebape.BR*, 15(3), 667-681. doi: 10.1590/1679-395157473.
- [14] Foladori, G. (2001). *Limites do desenvolvimento sustentável*. São Paulo: Nacional.
- [15] Freire, A. I. & Fontgalland, I. L. (2022). Perspectivas e desafios econômicos da geração de energia eólica na região Nordeste do Brasil. *Research, Society and Development*, 11 (1).
- [16] Freitas, G. C. & Dathein, R. (2013). As energias renováveis no Brasil: uma avaliação acerca das implicações para o desenvolvimento socioeconômico e ambiental. *Revista Nexos Econômicos*, 7(1), 71-94.
- [17] Galvão, T. F. & Pereira, M. G. (2014). Revisões sistemáticas da literatura: passos para sua elaboração. *Epidemiologia e Serviços de Saúde*, 23, 183-184. doi: 10.5123/S1679-49742014000100018
- [18] Galvão, M. L. M., Santos, M. A., Silva, N. F. & Silva, V. P. (2020). Conexões entre Energia Eólica, Pobreza e Sustentabilidade Social no Semiárido Brasileiro. *Sustentabilidade*, 12(3), 1-25. Disponível em: <https://www.mdpi.com/2071-1050/12/3/864/htm>. Acesso em: 28 mai. 2022.
- [19] Gorayeb, A. & Brannstrom, C. (2016). Caminhos para uma gestão participativa dos recursos energéticos de matriz renovável (parques eólicos) no nordeste do Brasil. *Mercator*, 15, 101-115.
- [20] Gouvêa, R. L. P. & Silva, P. A. (2018). Desenvolvimento do setor eólico no Brasil. *Banco Nacional do Desenvolvimento*, 25(49), 81-118. Disponível em: [https://web.bndes.gov.br/bib/jspui/bitstream/1408/16081/1/PRArt\\_Desenvolvimento%20do%20setor%20e%20C3%B3lico%20no%20Brasil\\_compl.pdf](https://web.bndes.gov.br/bib/jspui/bitstream/1408/16081/1/PRArt_Desenvolvimento%20do%20setor%20e%20C3%B3lico%20no%20Brasil_compl.pdf). Acesso em: 27 mai. 2022.
- [21] GREENPEACE INTERNATIONAL & CONSELHO EUROPEU DE ENERGIA RENOVÁVEL – EREC. (2010). *[r]evolução energética: a caminho do desenvolvimento limpo*. São Paulo: Greenpeace, 40p. Disponível em: <http://www.greenpeace.org/brasil/Global/brasil/report/2010/11/revolucaoenergeticadeslimpo.PDF>. Acesso em: 03 jun. 2022.
- [22] Haesbaert, R. (2015). Precarização, reclusão e “exclusão” territorial. *Terra Livre*, 2(23), 35-51.
- [23] Harvey, D. (2004). O “novo” imperialismo: sobre rearranjos espaciotemporais e acumulação mediante despossessão. *Margem esquerda*, 5, 31-41.
- [24] Junior, J. C. G. F. & Rodrigues, M. G. (2015). Um estudo sobre a energia eólica no Brasil. *Ciência Atual-Revista Científica Multidisciplinar do Centro Universitário São José*, 5(1).
- [25] Leal, G. F. (2011). *Exclusão social e ruptura dos laços sociais: análise crítica do debate contemporâneo*. Florianópolis: Editora da UFSC.
- [26] Martínez-Alier, J. (2007). O ecologismo dos pobres: conflitos ambientais e linguagens de valoração. São Paulo: Contexto.
- [27] Mauad, F. F., Ferreira, L. D. & Trindade, T. C. (2017). *Energia renovável no Brasil: Análise das principais fontes energéticas renováveis brasileiras*. São Carlos: EESC/USP.
- [28] Mendonça, I. M., Lopes, I. F., Castro Santos, J. L. & Fracetti, T. A. P. (2019). Perspectivas de geração de energia eólica no Brasil. *Brazilian Journal of Development*, 5(10), 18598-18611.
- [29] Montibeller Filho, G. (2004). *O mito do desenvolvimento sustentável: meio ambiente e custos sociais no moderno*

*sistema produtor de mercadorias*. 2. ed. Florianópolis: Ed. da UFSC.

- [30] Neto, J. A., Queiroz, F. C. B. P., Queiroz, J. V., Lima, N. C. & Da Silva, C. L. (2020). Evolução e perspectivas do setor eólico no Brasil: análise dos principais estados produtores. *Revista em Agronegócio e Meio Ambiente*, 13(4), 1409-1432.
- [31] Porto, M. F. Saúde pública e (in)justiça ambiental no Brasil. In: Acselrad, H., Herculano, S., Pádua, J. A. (org.). (2004). **Justiça Ambiental e cidadania**. Rio de Janeiro.
- [32] Simas, M. & Pacca, S. (2013). Energia eólica, geração de empregos e desenvolvimento sustentável. *Estudos avançados*, 27(77), p. 99-116, 2013.
- [33] Twidell, J. & Weir, T. (2015). *Renewable energy resources*. Abingdon: Routledge, 816p.

## Maternal mortality associated with COVID-19: An integrative literature review

## Mortalidade materna associada ao COVID-19: Uma revisão integrativa da literatura

Lucas Costa de Gois<sup>1</sup>, Sabrina Brenda Castelo Branco Silva<sup>1</sup>, Ana Emília Araújo de Oliveira<sup>2</sup>, Ananda Karina Meneses Flor<sup>3</sup>, Débora Lorena Melo Pereira<sup>4</sup>, Alexandre Maslinkiewicz<sup>5</sup>, Julianne de Area Leão Pereira da Silva<sup>6</sup>, Alan Jefferson Alves Reis<sup>7</sup>, Stéfano Vasconcelos Pôrto<sup>8</sup>, Thaís Gonçalves Nunes<sup>8</sup>, Fábio Freitas de Sousa Passos Galvão<sup>3</sup>, Bruna Victoria de Sousa Sá<sup>1</sup>, Andresa de Araújo Sales<sup>9</sup>, Vanessa carvalho fontinele<sup>10</sup>, Stálin Santos Damasceno<sup>11</sup>, Gabriel Gardhel Costa Araujo<sup>12</sup>, Idna de Carvalho Barros Taumaturgo<sup>13</sup>

<sup>1</sup>Acadêmicos de enfermagem, Universidade Estadual do Piauí, Brasil  
Email: [lucasgoisradenf@gmail.com](mailto:lucasgoisradenf@gmail.com)

<sup>2</sup>Enfermeira, Vigilância Epidemiológica no município de Campina Grande -PB, Brasil

<sup>3</sup>Acadêmicos de medicina, Uninovafapi, Brasil

<sup>4</sup>Enfermeira, Universidade Federal do Maranhão, Brasil

<sup>5</sup>farmacêutico, especialista em Farmácia Hospitalar FAVENI, Brasil

<sup>6</sup>Enfermeira, Hospital da Ilha/São Luís-Ma, Brasil

<sup>7</sup>Enfermeiro, Hospital Escola da Universidade Federal de Pelotas (UFPeL), Brasil

<sup>8</sup>Estudantes de medicina, PUC-GO, Brasil

<sup>9</sup>Acadêmica de enfermagem, Estácio de Sá, Brasil

<sup>10</sup>Enfermeira, Centro Universitário Uninovafapi, Brasil

<sup>11</sup>Enfermeiro, Mestrando em ciências da Saúde FAMED, FURG, Brasil

<sup>12</sup>Fisioterapeuta, Mestre em Educação Física (UFMA), Brasil

<sup>13</sup>Enfermeira, doutora em Biologia celular e Molecular (ULBRA), Brasil

Received: 06 Aug 2022,

Received in revised form: 30 Aug 2022,

Accepted: 03 Sep 2022,

Available online: 10 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Palavras-chave**— *Complicações na Gravidez, COVID-19, Mortalidade Materna.*

**Keywords**— *Complicações na Gravidez, COVID-19, Mortalidade Materna.*

**Abstract**— *COVID-19 is a respiratory disease caused by the SARS-CoV-2 virus that, in severe cases, progresses with extremely clinically relevant complications, directly impacting the morbidity and mortality of the population. The disease was first discovered in Wuhan, China, in December 2019. Thus, the studies were published in the years 2020, 2021 and 2022, being the equivalent of 41.67% in the year 2020, 50.00% in the year 2021 and about 8.33% in the year 2022. Therefore, most of the jobs were from Mexico with 33.33%, against 25.00% from Iran, 16.67% in Brazil, 16.67 % in the United States and 8.33% in Italy. In view of the exposed results, it was highlighted that the infection by COVID-19 in pregnant women negatively affected maternal health, being responsible for maternal injuries and/or death. Some epidemiological and clinical risk factors were associated with negative outcomes, as well as barriers to*



*accessing health care.*

**Abstrata** — A COVID-19 é uma doença respiratória provocada pelo vírus SARS-CoV-2 que, em casos graves, progride com complicações de extrema relevância clínica, impactando de forma direta na morbidade e mortalidade da população. A doença foi descoberta pela primeira vez em Wuhan, na China, em dezembro de 2019. Desse modo, os estudos foram publicados nos anos de 2020, 2021 e 2022 sendo o equivalente de 41,67% no ano de 2020, 50,00% no ano de 2021 e cerca de 8,33% no ano de 2022. Diante disso, a maioria dos trabalhos eram do México com 33,33%, contra 25,00% do Irã, 16,67% no Brasil, 16,67% dos Estados Unidos e 8,33% na Itália. Diante dos resultados expostos, destacou-se que a infecção por COVID-19 em mulheres grávidas afetou negativamente a saúde materna, sendo responsável por agravos e/ou óbito materno. Alguns fatores epidemiológicos e de risco clínico foram associados a desfechos negativos, como também as barreiras de acesso aos cuidados de saúde.

## I. INTRODUÇÃO

A COVID-19 é uma doença respiratória provocada pelo vírus SARS-CoV-2 que, em casos graves, progride com complicações de extrema relevância clínica, impactando de forma direta na morbidade e mortalidade da população. A doença foi descoberta pela primeira vez em Wuhan, na China, em dezembro de 2019. Desde então, desenvolveu - se com alta transmissibilidade e se espalhou globalmente em um curto espaço de tempo, conforme previsto pela Organização Mundial da Saúde (OMS), em março de 2020, a COVID-19 tornou-se em uma pandemia. No Brasil, a doença foi relatada pela primeira vez em 26 de fevereiro de 2020, no estado de São Paulo (ANVISA, 2020; Garcia Filho et al., 2020).

Desse modo, o vírus é transmitido de pessoa para pessoa através da troca de partículas através da fala, tosse ou cuspir de indivíduos infectados. Sendo assim, essas partículas são caracterizadas em duas maneiras, sendo classificadas em partículas maiores (gotículas), ou em partículas menores (aerossóis), sendo a última mais presente em unidades hospitalares no qual são realizados protocolos invasivos nos pacientes enfermos pela doença (ANVISA, 2020).

Apenas idosos e portadores de condições crônicas como hipertensão arterial e diabetes mellitus formavam o grupo que mais necessitava de atenção no início da pandemia pelo alto risco de agravamento e letalidade. No entanto, quando estudos mais extensos foram realizados, ficou claro que gestantes e nutrízes também se enquadravam nessa categoria de indivíduos de alto risco devido à sua propensão ao agravamento e à rápida evolução clínica em casos que variam de leves a grave (Brasil, 2021).

Acredita-se que as mudanças físicas e biológicas provocadas pela gravidez podem representar um alto risco para o COVID-19. Particularmente naquelas gestantes que estão por volta da 32ª ou 33ª semana de gravidez, possuem o potencial de progredir para formas graves de COVID-19 com desregulação respiratória, necessitando muitas das vezes da necessidade de um parto precoce (Brasil, 2021).

Dessa forma, independentemente da duração ou localização da gravidez, a morte da mãe durante a gravidez ou até 42 dias após o parto é referida como morte materna. Essa morte pode ser causada por qualquer fator relacionado ou exacerbado pela gravidez ou por ações tomadas em relação a ela (Dias et al., 2021).

A maioria das mortes maternas que ocorrem no Brasil são causadas por condições que poderiam ter sido evitadas com acompanhamento gestacional recomendado, como infecções, pré-eclâmpsia, complicações respiratórias ou abortos inseguros. Diante disso, o pré-natal deve começar o mais cedo possível e ser realizado com alto padrão, visando o bem-estar materno e fetal. Porém, vale a pena salientar que devemos levar em conta não apenas os casos biológicos e de saúde, mas também os fatores sociais que dificultam o acesso ao sistema de saúde durante a gravidez e o parto. Esses fatores incluem falta de informação, deslocamento extenso, falta de aceitação e preconceitos distorcidos (Brasil, 2021).

Para calcular a taxa de mortalidade, utiliza-se a razão de mortalidade materna, relação entre o número de mortes maternas por cada 100 mil nascidos vivos. De acordo com o gráfico gerado pelo Observatório da Criança e do Adolescente, os coeficientes de mortalidade materna nos anos de 2018 e 2019 foram parecidos (56,3 e 55,3), mas houve um aumento no ano de 2020, com taxa de 67,9. Em 2020, com a descoberta do vírus da COVID-19,

verificou-se outra ameaça à saúde de gestantes e recém-natos. Essa doença respiratória de rápida disseminação, gerou inseguranças nas gestantes, desencadeada pela falta de estudos que mostrassem o real risco a esse grupo (Brasil, 2020; Souza & Amorim, 2021)

As mortes maternas por COVID-19 dobraram de 2020 para 2021, com taxas, respectivamente, de 7,24% e 14,04% de óbitos de mulheres nesse perfil infectadas pelo coronavírus (Francisco, Lacerda, & Rodrigues, 2021)

Nessa perspectiva, a pandemia instigou milhares de publicações sobre a temática da COVID-19 em diversas áreas do conhecimento, ganhando destaque o âmbito da saúde. Diante disso, essas pesquisas contribuem para a formação de novas políticas públicas e para uma comunicação científica efetiva. Nessa contexto, os estudos com foco na saúde da mulher gestante acometida pela COVID-19, analisando os fatores positivos e negativos visto no processo de adoecimento que possibilite uma identificação precoce dos riscos de mortalidade materna é de grande importância para uma melhoria no atendimento dessas pacientes. Por fim, essa pesquisa teve como objetivo analisar publicações recentes na literatura sobre a mortalidade materna associada ao COVID-19.

## II. METODOLOGIA

Desse modo, este estudo se refere a uma pesquisa bibliográfica, tendo uma abordagem qualitativa de uma revisão integrativa da literatura. A revisão integrativa é formada por cinco etapas, sendo elas: identificação do problema, busca na literatura, avaliação dos dados, análise dos dados e apresentação da revisão. Sendo assim, a procura de artigos respondeu às seguintes perguntas que orientaram este estudo: qual a evidência mais atual na literatura sobre a Mortalidade materna associada ao COVID-19? O que é visto com mais frequência nas conclusões obtidas? (Souza, Silva & Carvalho, 2010).

Sendo assim, foi executado um estudo de revisão, tendo como base periódicos publicados na Biblioteca Virtual de Saúde (BVS) e na base de dados PUBMED. Nesse contexto, os critérios de inclusão foram: artigos originais de estudos primários, sendo nos idiomas inglês/espanhol/português, exemplificando com ênfase na Mortalidade Materna Associada ao COVID-19 e artigos publicados nos últimos cinco anos, partindo da combinação dos seguintes descritores: Mortalidade Materna, Complicações na Gravidez e COVID-19. Já em relação aos critérios de exclusão foram todos os estudos que não se enquadraram dentro dos critérios de inclusão. e que não se estabeleceram na questão norteadora desta pesquisa.

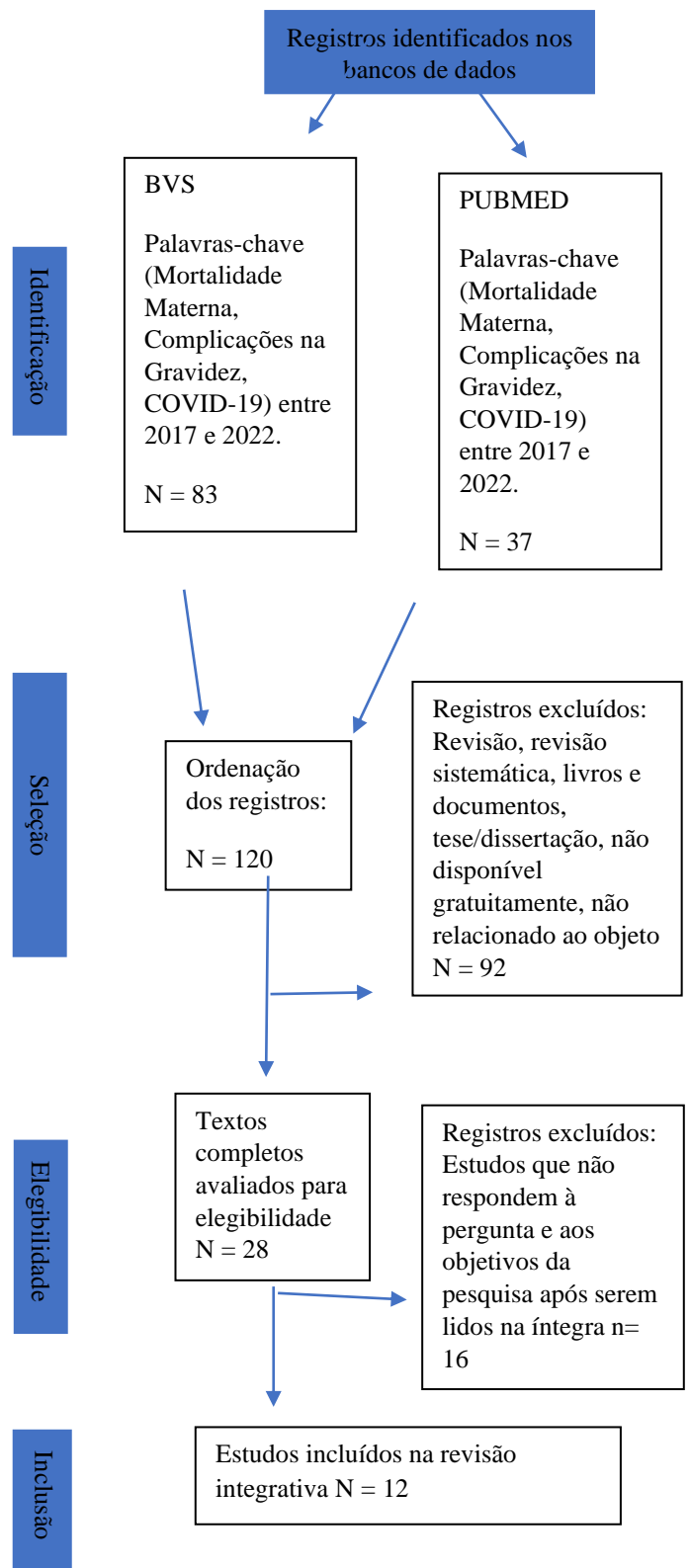


Fig.1. Fluxograma de seleção dos estudos primários, de acordo com a recomendação PRISMA. Teresina – PI, Brasil, 2022.

Fonte: autores, 2022.

Dessa forma, essa pesquisa em questão teve como tema escolhido Mortalidade materna associada ao COVID-19. Diante disso, a pandemia causada pelo vírus SARS-CoV-2, repercutiu em uma crise de saúde mundial, sendo que, as mulheres durante o período gestacional se tornam uma população de alto risco para o desenvolvimento de condições graves da doença.

No tocante, este estudo juntou 120 artigos para uma averiguação minuciosa, dos quais oito se enquadraram dentro dos critérios propostos anteriormente. Nessa perspectiva, as análises adquiridas foram organizadas em quadros, analisados e interpretados conforme o objetivo do presente estudo, tendo como base para os próximos passos a literatura preconizada anteriormente. Dessa maneira, a figura 01 caracteriza o meio que foi utilizado para a obtenção dos artigos durante a coleta nas plataformas.

### III. RESULTADOS

Nessa perspectiva, abaixo apresentam-se os resultados dessa pesquisa, dividido em dois quadros sendo a Quadro 01, de caracterização dos artigos, e a quadro 02, de análise do exposto em cada um dos artigos. Já a Quadro 01 apresenta 1 artigo na revista Archives of Gynecology and Obstetrics, 4 na revista International Journal of Gynecology & Obstetrics, 1 na revista Journal of Global Health, 2 na revista American Journal of Obstetrics & Gynecology, 1 na revista Morbidity and Mortality Weekly Report e por fim 3 artigos na revista Ultrasound in Obstetrics & Gynecology.

Desse modo, os estudos foram publicados nos anos de 2020, 2021 e 2022 sendo o equivalente de 41,67% no ano de 2020, 50,00% no ano de 2021 e cerca de 8,33% no ano de 2022. Diante disso, a maioria dos trabalhos eram da México com 33,33%, contra 25,00% do Irã, 16,67% no Brasil, 16,67% nos Estados Unidos e 8,33% na Itália. Assim, os conteúdos das pesquisas encontradas referiam-se sobre Mortalidade materna associada ao COVID-19: uma revisão integrativa da literatura (Quadro 2).

### IV - DISCUSSÃO

#### **Alterações fisiológicas e vulnerabilidade social como fatores de risco.**

Evidências científicas surgiram recentemente sugerindo que mulheres grávidas e seus fetos são uma categoria vulnerável com alto risco de infecção por SARS CoV-2. Além disso, o vírus pode determinar desfechos ruins tanto em gestantes infectadas quanto em seus fetos/recém-nascidos com taxa de internação em terapia intensiva unidades (UTI) de até 35%. A explicação para a

suscetibilidade ao SARS-CoV-2 em mulheres grávidas depende de mudanças anatômicas que ocorrem durante a gestação: o aumento da dimensão do diâmetro transversal da caixa torácica, bem como a elevação do nível do diafragma, podem causar efeitos prejudiciais na tolerância à hipóxia materna. A ocorrência de transmissão vertical da infecção foi avaliada para todos os neonatos por meio do teste RT-PCR em líquido amniótico, sangue de cordão umbilical e placenta, coletados imediatamente após o nascimento (Di Guardo, Di Grazia, Di Gregorio, Zambrotta, Carrara, Gulino, Tuscano & Palumbo, 2020).

O risco de um resultado adverso foi associado a variáveis relacionadas com as vulnerabilidades sociais, bem como com o acesso aos cuidados de saúde barreiras: viver em áreas periurbanas; em município não coberto pela ESF; ou a mais de 100 km do hospital onde foi diagnosticada Síndrome do Desconforto Respiratório Agudo (SDRA) e notificado; além de ser negro ou ter dados faltantes para etnia. Obesidade e idade igual ou superior a 35 anos também foram associados ao aumento da admissão hospitalar de mulheres grávidas com infecção por SARS-CoV-2 no Reino Unido. Além disso, barreiras a para acesso a cuidados pré-natais e pós-parto no Brasil foram agravados pela pandemia de COVID-19, levando à redução de consultas e exames de rotina (Menezes, Takemoto, Pereira, Katz, Amorim, Salgado, Melo, Diniz, Sousa, Magalhães, Knobel & Andreucci, 2020).

Estudos existentes encontraram mortalidade maior ou semelhante em mulheres grávidas em comparação com mulheres não grávidas, demonstrando resultados mistos. Embora o sistema imunológico materno proteja a mãe da infecção, é suprimido para uma gravidez bem sucedida, de modo a tolerar o feto, que é considerado “estranho”. Na imunossupressão, por um lado, a inibição da replicação viral pelo sistema imunológico é restrita. Por outro lado, a imunossupressão pode inibir a produção de citocinas pró-inflamatórias, por exemplo, interleucina-6, que se mostrou um preditor adequado de COVID-19 grave devido ao seu papel na síndrome de liberação de citocinas e na síndrome do desconforto respiratório agudo. Portanto, o imunocomprometimento está associado ao aumento do risco de mortalidade (Leung & Paiva, 2021).

A gravidez também é considerada um fator de risco para pneumonia grave devido às suas condições “imunológicas” únicas e alterações cardiopulmonares fisiológicas como a elevação do diafragma, aumento do consumo de oxigênio e edema da mucosa do trato respiratório). Tornando as gestantes uma população vulnerável. Em relação à relação entre COVID-19 e desfechos da gravidez, os resultados de uma revisão sistemática mostraram que 69,4% foram partos cesariana e 30,6% por parto vaginal. Dos 256

recém-nascidos, quatro foram positivos no teste transcriptase reversa-reação em cadeia da polimerase reversa (RT PCR) e houve dois natimortos e um óbito neonatal.

A gravidade da COVID-19 na gravidez foi classificada de acordo com as diretrizes da Society for Maternal and Fetal Medical Association da seguinte forma: doença leve foi categorizada por sintomas como febre, fadiga, tosse e as características menos comuns da

COVID-19; doença grave foi categorizada como taquipneia (frequência respiratória >30 respirações por minuto), hipóxia (saturação de oxigênio em ar ambiente de 93% ou PaO<sub>2</sub>/FiO<sub>2</sub> <300 mm Hg) ou envolvimento pulmonar >50% na radiografia; e o estágio crítico da doença foi caracterizado por insuficiência respiratória, choque ou disfunção de vários órgãos.

No entanto, mães com IMC mais alto e multiparidade podem desenvolver coronavírus na forma

*Quadro 1: Caracterização dos artigos. Teresina – PI 2022 (n=12).*

| Nº | TÍTULO                                                                                                                                                            | AUTORIA                       | BASE     | ANO  | PAÍS           | REVISTA                                                         |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------|------|----------------|-----------------------------------------------------------------|
| 1  | Poor maternal–neonatal outcomes in pregnant patients with confirmed SARS-Cov-2 infection: analysis of 145 cases                                                   | Di Guardo, F. et al.          | PUBMED   | 2021 | Itália         | Archives of Gynecology and Obstetrics.                          |
| 2  | Risk factors for adverse outcomes among pregnant and postpartum women with acute respiratory distress syndrome due to COVID-19 in Brazil                          | Menezes, M. O. et al.         | MEDLINE  | 2020 | Brasil         | International Journal of gynecology & obstetrics                |
| 3  | Is pregnancy a risk factors for in-hospital mortality in reproductive-aged women with SARS-CoV-2 infection? A nationwide retrospective observational cohort study | Leung, C., & de Paiva, K. M.  | PUBMED   | 2021 | Brasil         | International Journal of Gynecology & Obstetrics                |
| 4  | The severity of COVID-19 among pregnant women and the risk of adverse maternal outcomes                                                                           | Samadi, P. et al.             | PUBMED   | 2021 | Irã            | International Journal of Gynecology & Obstetrics                |
| 5  | Characteristics and outcomes of COVID-19 pneumonia in pregnancy compared with infected nonpregnant women                                                          | Vizheh, M. et al.             | PUBMED   | 2021 | Irã            | International Journal of Gynecology & Obstetrics                |
| 6  | COVID-19 mortality among pregnant women in Mexico: A retrospective cohort study                                                                                   | Ríos-Silva, M. et al.         | PUBMED   | 2020 | México         | Journal of Global Health,                                       |
| 7  | Clinical course of severe and critical coronavirus disease 2019 in hospitalized pregnancies: a United States cohort study 2019                                    | Pierce-Williams, R. A. et al. | ELSEVIER | 2020 | Estados Unidos | <a href="#">American Journal of Obstetrics &amp; Gynecology</a> |
| 8  | Maternal death due to COVID-19                                                                                                                                    | Hantoushadeh, S. et al.       | ELSEVIER | 2020 | Irã            | <a href="#">American Journal of Obstetrics &amp; Gynecology</a> |
| 9  | COVID-19–Associated Deaths After SARS-CoV-2 Infection During Pregnancy — Mississippi, March 1, 2020–October 6, 2021                                               | Kasehagen, L. et al           | PUBMED   | 2021 | Estados Unidos | Morbidity and Mortality Weekly Report                           |

|    |                                                                                                                                                                                                                    |                                |        |      |        |                                       |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------|------|--------|---------------------------------------|
|    |                                                                                                                                                                                                                    |                                |        |      |        |                                       |
| 10 | Pregnant women with SARS-CoV-2 infection are at higher risk of death and pneumonia: propensity score matched analysis of a nationwide prospective cohort (COV19Mx)                                                 | Martinez-Portilla, R. J et al. | PUBMED | 2020 | México | Ultrasound in Obstetrics & Gynecology |
| 11 | Comorbidity, poverty and social vulnerability as risk factors for mortality in pregnant women with confirmed SARS-CoV-2 infection: analysis of 13 062 positive pregnancies including 176 maternal deaths in Mexico | Torres-Torres, J et al         | PUBMED | 2021 | México | Ultrasound in Obstetrics & Gynecology |
| 12 | Increased levels of soluble fms-like tyrosine kinase-1 are associated with adverse outcome in pregnant women with COVID-19                                                                                         | Torres-Torres, J et al         | PUBMED | 2022 | México | Ultrasound in Obstetrics & Gynecology |

Fonte: Autores, 2022.

Quadro 2: Análise de conteúdo dos artigos. Teresina – PI 2022 (n=12).

| Nº | OBJETIVO                                                                                                                                                    | CONCLUSÃO                                                                                                                                                                                                                                                                                                                                                    |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Analisar desfechos materno-neonatais ruins em gestantes acometidas pela infecção por SARS-CoV-2.                                                            | A infecção por COVID-19 em gestantes parece afetar negativamente os resultados maternos e neonatais. No entanto, é importante ressaltar que a maioria dos casos de morte materna ocorreu em pacientes com sintomas graves e parâmetros altamente alterados relacionados à infecção por SARS-CoV-2.                                                           |
| 2  | Avaliar se os fatores de risco clínicos e sociais estão associados a desfechos negativos para a doença de COVID-19 entre gestantes e puérperas brasileiras. | Fatores de risco clínico e social e barreiras de acesso aos cuidados de saúde estão associados com desfechos adversos entre casos maternos de SDRA COVID-19 no Brasil.                                                                                                                                                                                       |
| 3  | Examinar o efeito da gravidez na mortalidade hospitalar relacionada à doença de coronavírus 2019 (COVID-19).                                                | Com o ajuste para intervenção que se mostrou um fator independente associado à mortalidade, a gravidez pareceu ter um efeito favorável na infecção por SARS-CoV-2. Dado o estado imunossuprimido da gravidez, esse achado está de acordo com o hipotético papel protetor de uma resposta imune mais fraca que inibe a produção de citocina pró-inflamatória. |
| 4  | Avaliar a relação entre a gravidade da doença por coronavírus 2019 (COVID-19) durante a gravidez e o risco de desfechos maternos adversos.                  | Gestantes com doença grave e crítica apresentaram alta taxa de cesariana, parto e admissão na UTI, havendo oito casos de mortalidade materna.                                                                                                                                                                                                                |
| 5  | Comparar as características clínicas e paraclínicas e os resultados de gestantes e mulheres não grávidas com COVID-19.                                      | Gestantes com COVID não apresentam maior risco de complicações obstétricas em comparação com mulheres não grávidas.                                                                                                                                                                                                                                          |
| 6  | Identificar os fatores de risco para as complicações e óbito em mulheres em idade fértil e gestantes com suspeita de COVID-19.                              | Pacientes grávidas não apresentam maior risco de complicações ou morte por COVID-19 do que pacientes não grávidas. A presença de diabetes mellitus e doença crônica aumenta o risco de morte em mulheres em idade fértil, mas não especificamente em pacientes grávidas.                                                                                     |

|    |                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7  | Descrever a evolução clínica da doença grave e crítica por coronavírus 2019 em gestantes hospitalizadas com teste laboratorial positivo para síndrome respiratória aguda grave.                                                                                                       | Em mulheres grávidas com doença grave ou crítica por coronavírus 2019, a admissão no hospital ocorreu normalmente cerca de 7 dias após o início dos sintomas e a duração da hospitalização foi de 6 dias (6 [grupo grave] vs 12 [grupo crítico]). As mulheres com doença crítica apresentaram alta taxa de síndrome do desconforto respiratório agudo e houve 1 caso de parada cardíaca, mas não houve casos de cardiomiopatia ou mortalidade materna. A hospitalização de gestantes com doença grave ou crítica por coronavírus 2019 resultou em parto durante o curso clínico da doença em 50% dessa coorte, geralmente no terceiro trimestre. Não houve óbitos perinatais nesta pesquisa. |
| 8  | Descrever os desfechos maternos, perinatais e óbitos em uma série de casos de gestantes com COVID-19                                                                                                                                                                                  | O estudo relatou as mortes maternas devido à doença COVID-19. Até que surjam dados de vigilância rigorosamente coletados, é prudente estar ciente do potencial de morte materna entre mulheres grávidas diagnosticadas com doença de COVID-19 no segundo ou terceiro trimestre.                                                                                                                                                                                                                                                                                                                                                                                                              |
| 9  | Avaliar as características dos óbitos e o momento da infecção, para os períodos anteriores à predominância da variante SARS-CoV-2 B.1.617.2 (Delta) altamente transmissível (março de 2020 a junho de 2021) e durante a predominância da variante Delta (julho 2021–outubro de 2021). | Não foi realizada uma revisão aprofundada sobre se a morte estava relacionada à gravidez (por qualquer causa relacionada ou agravada pela gravidez), de modo que esses dados não podem ser comparados com as taxas de mortalidade relacionadas à gravidez.                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 10 | Comparar os resultados relacionados ao COVID-19 entre mulheres grávidas e não grávidas após ajuste para potenciais fatores de risco para desfechos graves.                                                                                                                            | Após o ajuste para fatores demográficos e médicos de base, a gravidez é um fator de risco para morte, pneumonia e internação em UTI em mulheres infectadas por SARS-CoV-2 em idade reprodutiva.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 11 | Avaliar a associação de comorbidades e determinantes socioeconômicos com mortalidade e doença grave por COVID-19 em mulheres grávidas no México.                                                                                                                                      | A idade materna avançada, diabetes pré-existente, hipertensão crônica, obesidade, alta vulnerabilidade social e baixo nível socioeconômico são fatores de risco para COVID-19.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 12 | Investigar a associação das concentrações séricas de sFlt-1 e PlGF com a gravidade do COVID-19 na gravidez.                                                                                                                                                                           | O sFlt-1 MoM é maior em gestantes com COVID-19 grave e tem a capacidade de prever eventos adversos graves na gravidez, como pneumonia grave, internação em UTI, sepse viral e morte materna.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

Fonte: Autores, 2022.

mais grave. Foi constatado que 33,7% das gestantes com coronavírus apresentam condições subjacentes, sendo a mais comum o diabetes mellitus gestacional (DMG) (17,7%) (Samadi, Alipour, Ghaedrahmati & Ahangari, 2021).

Os resultados adversos mais comuns da gravidez foram aumento da cesariana, sofrimento fetal, trabalho de parto prematuro, baixo peso ao nascer e internação na unidade de terapia intensiva neonatal. Em uma revisão sistemática com 89 gestantes e seus recém-nascidos, encontrou-se casos de sofrimento fetal, ruptura prematura

de membranas, e trabalho de parto prematuro foram as principais complicações do pré-natal.

Os resultados do teste SARS-CoV-2 foram positivos em 8 (15,7%) recém nascidos, incluindo um par de gêmeos. Com exceção de um, todos os neonatos infectados nasceram de cesariana. As duas mortes neonatais foram de duas gestações gemelares diferentes e ambos os recém-nascidos testaram positivo para SARS CoV-2. Mostrando que a possibilidade de transmissão vertical não pode ser descartada. (Vizheh, Muhidin,

Aghajani, Maleki, Bagheri, Hosamiudsari, Aleyasin & Teerã, 2021).

Comparamos pacientes grávidas com suspeita de COVID-19 e teste positivo versus aquelas com teste negativo. A análise bivariada mostrou que as gestantes com teste positivo eram mais velhas do que os pacientes com teste negativo e apresentavam maior frequência de obesidade. Foi-se descoberto que as mulheres grávidas positivas para a infecção não apresentaram risco aumentado de mortalidade ou complicações em relação a um grupo de controle de mulheres em idade fértil que não estavam grávidas, mas positivo para coronavírus. Da mesma forma, as gestantes com COVID-19 confirmado não apresentaram maior risco de morte do que as gestantes com teste negativo (Silva, Zamora, Cano, Trujillo & Huerta, 2020).

Observou-se que 90% das mulheres com doença crítica foram encaminhadas para parto cesariano, com a idade gestacional média de 37 semanas de gestação para mulheres com doença e 32 semanas de gestação para mulheres com doença crítica.

Um desafio atual está na previsão de pacientes que apresentam COVID-19 que progredirá para desenvolver doença crítica. Há relatos de casos que indicaram cardiomiopatia, complicações como parto prematuro e necessidade de parto são comuns em mulheres com em estado grave ou crítico por coronavírus (Williams, Burd, Felder, Khoury, Bernstein, Ávila, Penfield, Roman, DeBolt, Stone, Bianco, Kern-Goldberger, Hirshberg, Srinivas, Jayakumar, Brandt, Anastasio, Birsner, O'Brien, Sedev, Dolin, Schnettler, Suhag, Ahluwalia, Navathe, Khalifeh, Anderson & Berghella, 2020).

Identificação de preditores para desfechos críticos em gestantes acometidas por COVID-19. Um levantamento realizado no Irã apontou que, entre 9 mulheres grávidas com covid em estado grave, 7 de 9 morreram, 1 de 9 permanece gravemente doente e dependente de ventilação e 1 de 9 se recuperou após hospitalização prolongada. Mostrando que a mortalidade materna por COVID-19 não é zero e sugeriram cautela contra a complacência e suposições precoces de proteção com a gravidez. Nesta série de casos documentando 7 mortes entre 9 mulheres grávidas com COVID-19 grave, quando comparadas com seus cônjuges, filhos ou familiares que moram na mesma casa, as gestantes foram os únicos óbitos relatados (Hantoushzadeh, Shamshirsaz, Aleyasin, Seferovic, Aski, Arian, Pooransari, Ghotbizadeh, Aalipour, Soleimani, Naemi, Molaei, Ahangari, Salehi, Oskoei, Pirozan, Darkhaneh, Laki, Farani, Atrak, Miri, Kouchek, Shojaei, Hadavand, Keikha, Hosseini, Borna,

Ariana, Shariat, Fatemi, Nouri, Nekooghadam & Aagaard, 2020).

No entanto, no estado de Mississippi, pesquisadores encontraram 15 mortes associadas ao COVID-19 após a infecção por SARS-CoV-2 durante a gravidez (nove mortes por 1.000 infecções por SARS-CoV-2). Todos os falecidos foram admitidos em unidade de terapia intensiva e 14 necessitaram de ventilação mecânica invasiva. Sete foram submetidas a cesariana de emergência (incluindo duas à beira do leito). Três morreram durante a gravidez, resultando em um aborto espontâneo com 9 semanas e dois natimortos com 22 e 23 semanas de gestação, e 12 morreram após um nascimento vivo (Kasehagen, Byers, Taylor, Kittle, Roberts, Collier, Rust, Ricaldi, Green, Zapata, Beauregard & Dobbs, 2021).

Uma análise realizada no México incluiu dados de 5.183 grávidas e 5.183 não grávidas com COVID-19, a taxa de mortalidade foi de 1,5% em gestantes e 0,8% em não gestantes.

Gravidez, idade materna, diabetes mellitus, etnia indígena, obesidade, hipertensão, imunossupressão, doença renal crônica, tabagismo, baixo nível seguro de saúde foram preditores independentes significativos para morte. Em comparação às mulheres não grávidas em idade fértil, as mulheres grávidas tiveram maior risco de morte, pneumonia e intubação na UTI (Portilla, Sotiriadis, Torres-Torres, Sosa, Mandujano, Bernabe, Jimenez, Martin, Figueiras & Poon, 2021).

Já uma posterior análise realizada, novamente na cidade do México obteve um dos maiores coortes até o momento sobre a doença de coronavírus 2019 (COVID-19) na gravidez. Houve 176 (1,35%) mortes maternas por COVID-19 entre 13.062 gestantes consecutivas positivas para SARS-CoV-2. As gestantes que faleceram por ao COVID-19, em comparação com aqueles que não morreram eram mais velhas e tinham maiores taxas de comorbidades, como diabetes pré-existente, hipertensão crônica, obesidade, doença renal crônica e asma. Mulheres que morreram, em comparação com aquelas que não morreram tiveram uma taxa significativa de viver em situação de vulnerabilidade social, pobreza e pobreza extrema.

Os fatores de risco identificados associados à pneumonia grave foram idade materna avançada, diabetes preexistente, hipertensão crônica, imunossupressão e obesidade; idade materna avançada e imunossupressão também foram fatores de risco para internação em UTI e intubação, enquanto mulheres usuárias de serviços públicos de saúde apresentaram menor risco de serem internadas em UTI (Torres, Portilla, Sosa, Gutierrez, Paredes, Bernal, Jimenez, Morales, Zepeda & Poon, 2022).

Além disso dentre os preditores para prever doença grave a Tirosina quinase-1 solúvel tipo fms (sFlt-1) é maior em mulheres grávidas sintomáticas com pneumonia grave por doença de coronavírus, em comparação com aquelas com pneumonia não grave por COVID-19, sendo preditor de pneumonia grave, internação em unidade de terapia intensiva, sepse viral e morte materna. A tirosina quinase-1 solúvel do tipo fms (sFlt-1) e o fator de crescimento placentário (PIGF) são marcadores de disfunção endotelial. Das 113 mulheres incluídas, 31 (27,43%) tiveram pneumonia grave por COVID-19, incluindo cinco (4,42%) casos resultando em morte materna.

Os principais achados deste estudo são que, em gestantes sintomáticas com COVID-19, maior sFlt-1 MoM (tirosino quinase) está associado a um aumento de 1,8 vezes nas chances de pneumonia grave, um aumento de 2,2 vezes nas chances de admissão na UTI, um aumento de 2,3 vezes nas chances de sepse viral e um aumento de 5,5 vezes nas chances de morte materna. A superexpressão de sFlt-1 demonstrou desempenhar um papel importante na patogênese de várias doenças, especialmente aquelas caracterizadas por desequilíbrio angiogênico, inflamação, disfunção endotelial e hipertensão (Torres, Sosa, Poon, Paredes, Gutierrez, Nunez, Reyes, Sona, Alfonso, Bernal, Portilla, Pacheco, 2022).

#### IV. CONCLUSÃO

Diante dos resultados expostos, destacou-se que a infecção por COVID-19 em mulheres grávidas afetou negativamente a saúde materna, sendo responsável por agravos e/ou óbito materno. Alguns fatores epidemiológicos e de risco clínico foram associados a desfechos negativos, como também as barreiras de acesso aos cuidados de saúde.

Nesse sentido, diante das complicações para a gestação e o feto, faz-se necessário ações efetivas no ciclo gravídico- puerperal, como a importância da realização do pré-natal, recomendação da vacina do Covid-19 para mulheres grávidas prevenindo dessa forma, doenças graves e óbitos, por serem categoria vulnerável com alto risco de infecção por SARS CoV-2, apresentando também altas taxas de comorbidades. Para futuras pesquisas recomenda-se ampliar a produção científica sobre a temática, estudando os determinantes da mortalidade materna e com foco na mortalidade associada ao COVID-19, no enfrentamento desse grave evento.

#### REFERÊNCIAS

- [1] Agência Nacional de Vigilância Sanitária. (2020). Gerência de Vigilância e Monitoramento em Serviços de Saúde. Gerência Geral de Tecnologia em Serviços de Saúde. Nota Técnica n. 04, de 21 de março de 2020. Orientações para serviços de saúde: medidas de prevenção e controle que devem ser adotadas durante a assistência aos casos suspeitos ou confirmados de infecção pelo novo coronavírus (sars-cov-2). ANVISA
- [2] Brasil (2021). Ministério da Saúde. Secretaria de Atenção Primária à Saúde. Departamento de Ações Programáticas e Estratégicas. Manual de recomendações para a assistência à gestante e puérpera frente à pandemia de Covid-19 [recurso eletrônico] / Ministério da Saúde, Secretaria de Atenção Primária à Saúde, Departamento de Ações Programáticas e Estratégicas. 2. ed. Brasília
- [3] Brasil (2021). Ministério da Saúde. Fundação Oswaldo Cruz. Covid-19: infecção pelo coronavírus na gestação. Portal boas práticas em saúde da mulher, da criança e do adolescente, 1-28.
- [4] Brasil. (2021). Ministério da Saúde. Fundação Oswaldo Cruz. Boletim observatório da COVID-19. Semanas epidemiológicas.
- [5] Dias, A., Chead, D. D., Lima, M. F., Ricardes, R. & Santos, S. (2021). Fóruns de discussão e matriciamento de profissionais de saúde da Secretaria de Estado da Saúde de São Paulo para o enfrentamento à morte materna e infantil durante a pandemia de COVID-19. BEPA.18(208), 17-21.
- [6] Di Guardo, F., Di Grazia, F. M., Di Gregorio, L. M., Zambrotta, E., Carrara, G., Gulino, F. A., ... & Palumbo, M. (2021). Poor maternal–neonatal outcomes in pregnant patients with confirmed SARS-Cov-2 infection: analysis of 145 cases. *Archives of gynecology and obstetrics*, 303(6), 1483-1488.
- [7] Garcia Filho, C.; Vieira, L. J. E. S., & Silva, R. M. (2020). Buscas na internet sobre medidas de enfrentamento à COVID-19 no Brasil: descrição de pesquisas realizadas nos primeiros 100 dias de 2020. *Epidemiologia e Serviços de Saúde*, 29(3).
- [8] Hantoushzadeh, S., Shamshirsaz, A. A., Aleyasin, A., Seferovic, M. D., Askı, S. K., Arian, S. E., ... & Aagaard, K. (2020). Maternal death due to COVID-19. *American journal of obstetrics and gynecology*, 223(1), 109-e1.
- [9] Francisco, R., Lacerda, L., & Rodrigues, A. S. (2021). Obstetric Observatory BRAZIL – COVID-19: 1031 maternal deaths because of COVID-19 and the unequal access to health care services. *Clinics (São Paulo, Brazil)*, 76, e3120. <https://doi.org/10.6061/clinics/2021/e3120>.
- [10] Kasehagen, L., Byers, P., Taylor, K., Kittle, T., Roberts, C., Collier, C., ... & Dobbs, T. (2021). COVID-19–associated deaths after SARS-CoV-2 infection during pregnancy—Mississippi, March 1, 2020–October 6, 2021. *Morbidity and Mortality Weekly Report*, 70(47), 1646.
- [11] Leung, C., & de Paiva, K. M. (2022). Is pregnancy a risk factor for in-hospital mortality in reproductive-aged women with SARS-CoV-2 infection? A nationwide retrospective



- observational cohort study. *International Journal of Gynecology & Obstetrics*, 157(1), 121-129.
- [12] Martínez-Portilla, R. J., Sotiriadis, A., Chatzakis, C., Torres-Torres, J., Espino y Sosa, S., Sandoval-Mandujano, K., ... & Poon, L. C. (2021). Pregnant women with SARS-CoV-2 infection are at higher risk of death and pneumonia: propensity score matched analysis of a nationwide prospective cohort (COV19Mx). *Ultrasound in Obstetrics & Gynecology*, 57(2), 224-231.
- [13] Menezes, M. O., Takemoto, M. L., Nakamura-Pereira, M., Katz, L., Amorim, M. M., Salgado, H. O., ... & Brazilian Group of Studies for COVID-19, Pregnancy. (2020). Risk factors for adverse outcomes among pregnant and postpartum women with acute respiratory distress syndrome due to COVID-19 in Brazil. *International Journal of gynecology & obstetrics*, 151(3), 415-423.
- [14] Pierce-Williams, R. A., Burd, J., Felder, L., Khoury, R., Bernstein, P. S., Avila, K., ... & Berghella, V. (2020). Clinical course of severe and critical coronavirus disease 2019 in hospitalized pregnancies: a United States cohort study. *American journal of obstetrics & gynecology MFM*, 2(3), 100134.
- [15] Ríos-Silva, M., Murillo-Zamora, E., Mendoza-Cano, O., Trujillo, X., & Huerta, M. (2020). COVID-19 mortality among pregnant women in Mexico: A retrospective cohort study. *Journal of Global Health*, 10(2).
- [16] Samadi, P., Alipour, Z., Ghaedrahmati, M., & Ahangari, R. (2021). A gravidade do COVID-19 entre mulheres grávidas e o risco de resultados maternos adversos. *Jornal Internacional de Ginecologia e Obstetrícia*, 154 (1), 92-99.
- [17] Souza, A. S. R. & Amorim, M. M. R. (2021). Mortalidade materna pela COVID-19 no Brasil. *Rev. Bras. Saúde Matern. Infant.* 21(1):S257-61.
- [18] Torres-Torres, J., Martínez-Portilla, R. J., Espino-y-Sosa, S., Estrada-Gutierrez, G., Solis-Paredes, J. M., Villafan-Bernal, J. R., ... & Poon, L. C. (2022). Comorbidity, poverty and social vulnerability as risk factors for mortality in pregnant women with confirmed SARS-CoV-2 infection: analysis of 13 062 positive pregnancies including 176 maternal deaths in Mexico. *Ultrasound in Obstetrics & Gynecology*, 59(1), 76-82.
- [19] Vizheh, M., Muhidin, S., Aghajani, F., Maleki, Z., Bagheri, F., Hosamirudsari, H., ... & Tehranian, A. (2021). Characteristics and outcomes of COVID-19 pneumonia in pregnancy compared with infected nonpregnant women. *International Journal of Gynecology & Obstetrics*, 153(3), 462-468.

## Aspects between Dengue and COVID-19 coinfection: An integrative literature review

## Aspectos entre a coinfeção Dengue e COVID-19: Uma revisão integrativa da literatura

Lucas Costa de Gois<sup>1</sup>, Sabrina Brenda Castelo Branco Silva<sup>1</sup>, Glória Stéphany Silva de Araújo<sup>1</sup>, Kathllyn Joyce de Jesus Oliveira<sup>2</sup>, Bruna Victoria de Sousa Sá<sup>1</sup>, Stálin Santos Damasceno<sup>3</sup>, Alexandre Maslinkiewicz<sup>4</sup>, Julianne de Area Leão Pereira da Silva<sup>5</sup>, Stéfano Vasconcelos Pôrto<sup>6</sup>, Jean Carlos Leal Carvalho de Melo Filho<sup>7</sup>, Júlio César Cardozo Dias<sup>8</sup>, Kleiton Vieira da Silva<sup>9</sup>, Rômulo Gueth Borges do Nascimento<sup>10</sup>, Maria Clara Leite Barros Miranda<sup>11</sup>, Lizandra Ellem Silva de Souza<sup>12</sup>, Gabriel Gardhel Costa Araujo<sup>13</sup>, Idna de Carvalho Barros Taumaturgo<sup>14</sup>

<sup>1</sup>Acadêmicos de enfermagem, Universidade Estadual do Piauí, Brasil

<sup>2</sup>Acadêmica de Biomedicina, Centro Universitário Nobre, Brasil

<sup>3</sup>Enfermeiro, Especialista em Gestão em Saúde (UESPI), Brasil

<sup>4</sup>farmacêutico, especialista em Farmácia Hospitalar FAVENI, Brasil

<sup>5</sup>Enfermeira, Hospital da Ilha/São Luís-Ma, Brasil

<sup>6</sup>Estudante de medicina, PUC-GO, Brasil

<sup>7</sup>Médico, Unifacid, Brasil

<sup>8</sup>Biomédico, Pitágoras, Brasil

<sup>9</sup>Graduando em Odontologia, Uninassau, Brasil

<sup>10</sup>Graduado em Odontologia, UFPI, Brasil

<sup>11</sup>Acadêmica de medicina, Uninovafapi, Brasil

<sup>12</sup>Enfermeira, Centro universitário de Juazeiro do Norte, Brasil

<sup>13</sup>Fisioterapeuta, Mestre em Educação Física (UFMA), Brasil

<sup>14</sup>Enfermeira, doutora em Biologia celular e Molecular (ULBRA), Brasil

Received: 07 Aug 2022,

Received in revised form: 26 Aug 2022,

Accepted: 01 Sep 2022,

Available online: 10 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— COVID-19, Dengue, Infection,  
Pandemic, SARS-COV-2.

**Abstract**— The disease caused by the new coronavirus (COVID-19), initially investigated in the city of Wuhan, located in China, during 2019 later spread worldwide, affecting millions of individuals, therefore, it triggered the pandemic event, perpetuated with consequences in areas population and economic. However, Dengue is an arboviral pathology with endemic proportions in tropical areas, spread through *Aedes aegypti* because it spreads the infectious agent. Therefore, the clinical picture emerges that culminates in an increase in body temperature, bleeding events, cephalalgia or pruritus. Thus, the studies were published in the years 2020 to 2021, being the equivalent of 36.36% in the year 2020, and about 63.64% in the year 2021. In this way, the contents of the research found referred to Aspects between Dengue and COVID-19 coinfection. Both have similar clinical manifestations, so their main difference is the

*respiratory compromise that is more evident in COVID-19.*

**Abstrata**— A enfermidade proporcionada pelo novo coronavírus (COVID-19), inicialmente averiguada no município de Wuhan, situado na china, durante 2019 posteriormente disseminou-se mundialmente, afetando milhões de indivíduos, portanto, desencadeou o evento pandêmico, perpetuado a consequências em âmbitos populacionais e econômicos. Entretanto, a Dengue trata-se de uma patologia arboviral com proporções endêmicas em áreas tropicais, propagada por intermédio do *Aedes aegypti* pois difunde o agente infeccioso. Portanto, emerge o quadro clínico que culmina em aumento da temperatura corpórea, eventos hemorrágicos, cefalalgia ou prurido. Desse modo, os estudos foram publicados nos anos de 2020 a 2021 sendo o equivalente de 36,36% no ano de 2020, e cerca de 63,64% no ano de 2021. Dessa maneira, os conteúdos das pesquisas encontradas referiam-se sobre os Aspectos entre a coinfeção de Dengue e COVID-19. Ambas possuem manifestações clínicas semelhantes, sendo assim, sua principal diferença é o comprometimento respiratório que na COVID-19 é mais evidenciado.

## I. INTRODUÇÃO

A enfermidade proporcionada pelo novo coronavírus (COVID-19), inicialmente averiguada no município de Wuhan, situado na china, durante 2019 posteriormente disseminou-se mundialmente, afetando milhões de indivíduos, portanto, desencadeou o evento pandêmico, perpetuado a consequências em âmbitos populacionais e econômicos (Sreepadmanabh et al., 2020).

A infecção relacionada ao SARS-CoV-2 ocasionou elevado quantitativo de óbitos, pois milhões de vidas situam-se ceifadas. O quadro viral propicia o estado febril, associado a cefaleia, mialgia, tosse seca, disfunções orgânicas, acentuadas evacuações, anosmia ou cansaço, entretanto, o diagnóstico requer métodos imunocromatográfico ou de biologia molecular (Rai et al., 2021).

Entretanto, a Dengue trata-se de uma patologia arboviral com proporções endêmicas em áreas tropicais, propagada por intermédio do *Aedes aegypti* pois difunde o agente infeccioso. Portanto, emerge o quadro clínico que culmina em aumento da temperatura corpórea, eventos hemorrágicos, cefalalgia ou prurido (Jayarajah et al., 2021).

A Dengue pode apresentar o aspecto moderado ou severo, cujo microrganismo ocasionador consistiu o vírus da dengue (DENV) que classifica-se em 1,2,4 e 4 segundo a sorovar, carregado através do *Aedes albopictus*. A detecção laboratorial ocorre em virtude de parâmetros sorológicos, imunoenaios como o Elisa e reação de cadeia de polimerase via transcriptase reversa (RT-PCR) (Uno & Ross, 2018).

A ocorrência simultânea de COVID-19 e Dengue pode perpetuar a saturação de setores terapêuticos, todavia, a detecção de ambas enfermidades virais situa-se laboriosa (Harapan et al., 2021). No entanto, o presente estudo destina-se a descrever o impacto da coinfeção através de SARS-CoV-2 e DENV, bem como as principais consequências resultantes.

## II. METODOLOGIA

A presente pesquisa evidencia uma revisão de literatura integrativa com abordagem qualitativa. De acordo a Mendes et al. (2008), o estudo literário no âmbito de integração visa investigar, analisar e compilar arquivos científicos vigentes, vinculados a temática almejada. O questionamento norteador constitui: “Quais os principais efeitos ocasionados pela concomitância da Dengue e COVID-19?”.

As bases de dados PubMed e Scientific Electronic Library (SciELO), associaram-se a aplicabilidade de descritores derivados dos Descritores em Ciências da Saúde (DeCS), como COVID-19 pandemic, SARS CoV 2 Infection, COVID-19 ou Dengue, que permeia o operador booleano AND. Portanto, a população averiguada compreende pacientes portadores de COVID-19 e Dengue, durante o período de 2019 a 2021.

A obtenção de arquivos científicos, fundamentou-se em avaliação de título e resumo. O procedimento de abrangência de dados sucedeu-se entre julho a agosto de 2022, pois compreende artigos que estabeleçam as consequências clínicas resultantes das enfermidades COVID-19 e Dengue, em língua inglesa ou espanhola, com periodicidade correspondente a 2 anos. No entanto, os

arquivos com aspecto duplicado ou resumos incompletos foram descartados e adquiriu-se 11 artigos conforme exprime a figura 1.

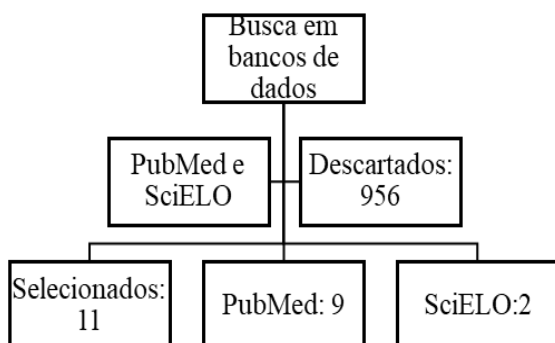


Fig.1. Exibe o processo de busca de dados, bem como o quantitativo de artigos integrados e inviáveis.

Fonte: Autoria própria (2022).

A variável com aspecto de independência abrange o gênero. Entretanto, ressalta-se a execução de princípios éticos através da efetivação de credibilidade para os arquivos científicos vigentes por intermédio dos critérios APA.

### III. RESULTADOS

Sendo assim, abaixo é visto os resultados desse estudo, dividido em duas tabelas, sendo a Tabela 01, de caracterização dos artigos, e a Tabela 02, de análise dos objetivos e conclusões expostas em cada um dos artigos. Dessa forma, na Tabela 01 apresenta 1 artigo na revista International Journal of Infectious Diseases, 1 na Revista The Lancet, 2 na J Med Virol., 1 na Environmental Research, 1 na Infectious disease Reports, 1 na Revista Scientific Reports, 1 na Revista da Sociedade Brasileira de Medicina Tropical, 1 na Am. J. Trop. Med. Hyg., 1 na CASUÍSTICA e 1 na InterAmerican Journal of Medicine and Health.

Desse modo, os estudos foram publicados nos anos de 2020 a 2021 sendo o equivalente de 36,36% no ano de 2020, e cerca de 63,64% no ano de 2021. Dessa maneira, os conteúdos das pesquisas encontradas referiam-se sobre os aspectos entre a coinfeção de dengue e COVID-19.

Tabela 1: Caracterização dos artigos. Teresina – PI 2022 (N=11).

| Nº | TÍTULO                                                                                      | AUTORIA                                                                                                                                                                                                                                                                                                                                                     | ANO  | REVISTA                                      |
|----|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------------------------------------------|
| 1  | Reação sorológica cruzada e coinfeção de Dengue e COVID-19 na Ásia: Experiência da Idonésia | Sri Masyenia, Marsha S. Santoso, Putu Dyah Widyaningsih, DG Wedha Asmara, Firzan Nainu, Harapan Harapan, R Tedjo Sasmono                                                                                                                                                                                                                                    | 2021 | International Journal of Infectious Diseases |
| 2  | COVID-19 encoberto e Dengue falso positivo: sorologia em Cingapura                          | Hai Nguyen Thanh, Truong Nguyen Van, Huong Ngo Thi Thu, Binh Nghiem Van, Binh Doan Thanh, Ha Phung Thi Thu, Anh Nguyen Thi Kieu, Nhung Nguyen Viet, Guy B Marks, Greg J Fox, Thu-Anh Nguyen                                                                                                                                                                 | 2020 | The Lancet                                   |
| 3  | Dengue e COVID-19, epidemias sobrepostas? Uma análise da Colômbia                           | Jaime A. Cardona-Ospina, Kovy Arteaga-Livias, Wilmer E. Villamil-Gómez, Carlos E. Pérez-Díaz, D. Katterine Bonilla-Aldana2, Álvaro Mondragon-Cardona, Marco Solarte-Portilla, Ernesto Martinez, Jose Millan-Oñate, Eduardo López-Medina, Pio López, Juan-Carlos Navarro, Luis Perez-Garcia, Euler Mogollon-Rodriguez, Alfonso J. Rodriguez-Morales, Alberto | 2020 | J Med Virol.                                 |

|    |                                                                                                                                                                        |                                                                                                                                                 |      |                                                      |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------------------------------------------|
|    |                                                                                                                                                                        | Paniz-Mondolfi                                                                                                                                  |      |                                                      |
| 4  | Pandemia de COVID-19, epidemia de Dengue e vulnerabilidade às mudanças climáticas em Bangladesh: Avaliação de cenários para gestão estratégica e implicações políticas | Md Mostafizur Rahman, Md Bodrud-Doza, Mashura Shammi, Abu Reza Md Towfiqul Islam, Abu Sadat Moniruzzaman Khan                                   | 2021 | Environmental Research                               |
| 5  | Possível erro de diagnóstico entre COVID-19 e Dengue Infecção usando teste sorológico rápido                                                                           | Siti Qamariyah Khairunisa, Ilham Harlan Amarullah, Siti Churrotin, Anisa Lailatul Fitria, Mochammad Amin, Maria Inge Lusida, Soegeng Soegijanto | 2021 | Infectious disease Reports                           |
| 6  | Diferenciando a doença do coronavírus 2019 (COVID-19) da Gripe e Dengue                                                                                                | Tun-LinnThein, LiWeiAng, Barnaby EdwardYoung, Mark I-Cheng Chen, Yee-Sin Leo, David Chien Boon Lye                                              | 2021 | Scientific Reports                                   |
| 7  | Impacto de epidemias concomitantes de Dengue, Chikungunya, Zika e COVID-19                                                                                             | Creuza Rachel Vicente, Theresa Cristina Cardoso da Silva, Larissa Dell'Antonio Pereira, Angelica E. Miranda                                     | 2021 | Revista da Sociedade Brasileira de Medicina Tropical |
| 8  | Relato de caso: COVID-19 grave e dengue em um bebê indonésio                                                                                                           | Anggraini Alam, Sri Sudarwati, Dzulfikar Djalil Lukmanul Hakim, Sally Mahdiani                                                                  | 2021 | Am. J. Trop. Med. Hyg.                               |
| 9  | Impacto da pandemia de COVID-19 na incidência de Dengue febre no Peru                                                                                                  | Rubí Plasencia-Dueñas, Virgilio E. Failoc-Rojas, Alfonso J. Rodriguez-Morales                                                                   | 2021 | J Med Virol.                                         |
| 10 | Coinfecção Dengue e SARS-CoV-2 em pacientes HIV positivo                                                                                                               | Carolina P. Salvo, Natalia Di Lella, Florencia Solveyra López, Jorge Hugo, Julieta Gigena Zito, Andrés Vilela                                   | 2020 | CASUÍSTICA                                           |
| 11 | Análise das internações e da mortalidade por doenças febris, infecciosas e parasitárias durante a pandemia da COVID-19 no Brasil                                       | Nikolas Lisboa Coda Dias, Álvaro A. Faccini-Martínez, Stefan Vilges de Oliveira                                                                 | 2020 | InterAmerican Journal of Medicine and Health         |

Fonte: Autoria própria (2022).

Tabela 2: Análise dos objetivos e conclusões dos artigos. Teresina – PI 2022 (N=11).

| Nº | OBJETIVO                                                                                                                                          | CONCLUSÃO                                                                                                                                                  |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Delinear e comparar três casos de suspeita de infecção mista COVID-19-dengue com base em dados clínicos.                                          | Forneceu evidências de reatividade cruzada entre DENV e SARS-CoV-2, que propicia a sorologias falso-positivas para COVID-19 entre os pacientes com Dengue. |
| 2  | Descrever dois pacientes em Cingapura com resultados falsos positivos de sorologia rápida testes para dengue, que mais tarde foram confirmado com | Enfatizar a necessidade urgente de um diagnóstico rápido, com testes para SARS-CoV-2 sensível e acessível para proteger a saúde do público.                |

|    |                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | síndrome respiratória aguda grave (SARS-CoV-2).                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 3  | Analisar tendências para a dengue e COVID-19 na Colômbia durante as 20 primeiras semanas epidemiológicas (SE) de 2020.                                                           | Como ambas as condições podem potencialmente levar a resultados fatais, especialmente em pacientes com comorbidades crônicas, infecções sobrepostas e comorbidades a ocorrência pode aumentar o número de pacientes que necessitam de cuidados intensivos e ventilação mecânica.                                                                                                                                                                         |
| 4  | Avaliar o impacto potencial de um ataque simultâneo de riscos climáticos e surtos de doenças infecciosas e sua possível gestão estratégica em Bangladesh em diferentes cenários. | Construção de resiliência por meio de planejamento proativo e implementação de estratégias integradas, inclusivas e sustentáveis serão eficazes para garantir a saúde e a segurança socioeconômica para ameaças multiriscos no país.                                                                                                                                                                                                                     |
| 5  | Analisar os perfis de IgG e IgM de pacientes com COVID-19 usando um teste rápido sorológico SARS-CoV-2 e dengue, e 38 soros de indivíduos saudáveis (data pré-COVID-19).         | Na área endêmica da Dengue, muitas pessoas já experimentaram a Dengue e tem imunidade contra o vírus da dengue. Há também a possibilidade de reatividade cruzada de anticorpos entre COVID-19 e infecção por dengue. O que enfatiza a alta demanda por um método rápido com alta sensibilidade e especificidade que possa distinguir entre SARS-CoV-2 e dengue.                                                                                          |
| 6  | Derivar preditores precoces para diferenciar COVID-19 de influenza e dengue.                                                                                                     | A falta de ar foi o preditor mais forte nos modelos para diferenciar entre COVID-19 e influenza, seguidos de diarreia. Maior contagem de linfócitos foi preditiva de COVID-19. Tosse e maior contagem de plaquetas tiveram maior chance de COVID-19, enquanto dor de cabeça, dor, erupção cutânea e vômito/náusea foram indicativos de dengue.                                                                                                           |
| 7  | Avaliar as implicações epidemiológicas de infecções por arbovírus e doenças por coronavírus (COVID-19) co-ocorrências no Espírito Santo, Brasil.                                 | O Espírito Santo experimentou uma sobreposição de epidemias, especialmente em áreas urbanas.                                                                                                                                                                                                                                                                                                                                                             |
| 8  | Relatar um caso de uma criança de 10 meses com infecção dupla grave por COVID-19 e dengue que foi internado no hospital com uma doença semelhante à gripe.                       | As armadilhas deste caso são como diferenciar a manifestação clínica de Dengue em paciente com COVID-19 confirmado; a dificuldade de acompanhar o curso de Dengue do paciente em sala de isolamento de COVID-19; e diferenciar a Dengue grave da síndrome inflamatória multissistêmica-C quando o paciente estava em estado crítico. A criança se recuperou sem sequelas, mas o manejo de novas prováveis casos devem ser melhorados mais profundamente. |
| 9  | Comparar a padrões temporais da incidência de dengue antes e durante a Pandemia de 2019 (COVID-19) no Peru.                                                                      | O gradiente de casos de Dengue foi positivo em todas as regiões endêmicas durante o Pandemia do COVID-19. O número de casos de Dengue por milhão aumentou durante a pandemia de COVID-19 em todo o Peru e em várias regiões endêmicas, com exceção de Piura.                                                                                                                                                                                             |
| 10 | Apresentar o caso de um paciente HIV não tratado que desenvolveu infecção simultânea com dengue e SARS-CoV-2.                                                                    | A principal diferença entre as duas doenças é o comprometimento respiratório observado no SARS-CoV-2 e ausente na Dengue. A apresentação clínica semelhante pode levar a um atraso no diagnóstico de COVID-19, favorecendo má evolução da doença, além de mascarar o diagnóstico da dengue.                                                                                                                                                              |
| 11 | Avaliar as internações e a taxa de mortalidade das doenças febris indiferenciadas que ocorreram simultaneamente a COVID-19 no Brasil.                                            | A taxa de mortalidade (2020) teve acréscimo de 32,64%, 38,98%, 82,55% e 14,26% para as respectivas doenças. Os gastos e os tempos médios de permanência oscilaram proporcionalmente de acordo com as internações, sem importantes variações detectadas.                                                                                                                                                                                                  |

Fonte: Autoria própria (2022).

#### IV. DISCUSSÃO

##### Fatores de agravo da coinfeção dengue e covid-19

Os casos de coinfeção são ainda mais prevalentes em países que apresentam alta endemicidade de Dengue. Como é o caso apontado na Colômbia que apresentou em registros epidemiológicos do intervalo de 1º de janeiro a 30 de maio de 2020 (EW, 1-22), 55.585 casos de Dengue e 28.240 casos de COVID-19 confirmados. Nas primeiras Semanas Epidemiológicas (SE) 12 a Dengue tomou dimensões epidêmicas, nas semanas 13 a 22 permaneceu em zona de alerta, a COVID-19 somente ultrapassou os números de Dengue na SE 18 com uma margem maior de 5,8 do que na SE 22 (Ospina, Livias, Gómez, Díaz, Aldana, Cardona, Portilla, Martínez, Oñate, Medina, López, Navarro, Perez-Garcia, Rodriguez, Morales & Paniz-Mondolfi, 2020).

E quando analisado de forma departamental, evidenciou-se que algumas regiões do país, como Valle del Cauca, a COVID-19 e Dengue seguem relativamente altas, por outro lado também, em áreas da região costeira do Caribe da Colômbia, a exemplo da Cartagena, apresentaram casos de COVID-19 superiores em relação a Dengue, e de modo inverso as regiões de Huila e Tolima, tomando como destaque a Dengue (Ospina, Livias, Gómez, Díaz, Aldana, Cardona, Portilla, Martínez, Oñate, Medina, López, Navarro, Garcia, Rodriguez, Morales & Mondolfi, 2020).

Em concordância com esse trabalho, outro produzido no Brasil no estado do Espírito Santo indicou respectivamente, por meio de dados notificados à Secretaria de Saúde do Estado do Espírito Santo de janeiro a julho de 2020, Dengue, Chikungunya, Zika e COVID-19 apresentaram nos casos mais prováveis: 44.614, 8.092, 3.138 e 91.483; confirmados por laboratório: 6.814, 2.351, 650 e 84.278; incidência por 100.000 habitantes: 1.110,2, 201,4, 78,1 e 2.276,5. Desse modo, verifica-se que a Dengue sobressaiu em relação às outras ficando para trás apenas os casos de COVID-19 (Vicente, Silva, Pereira & Miranda, 2021).

Outro aspecto a ser considerado refere-se ao cenário pandêmico causado pela pandemia do coronavírus. Isso foi elucidado em uma pesquisa de análise descritiva e quantitativa de dados secundários das internações causadas por doenças febris indiferenciadas em que foi realizado um comparativo nos anos antecedentes a pandemia no período dos anos de 2017 a 2019 e em 2020, ano de início da pandemia. Assim, evidenciou médias 222,25 internações por leishmaniose visceral, 220,5 por leptospirose, 160,67 por malária e 3297,5 por dengue nos anos antecedentes a pandemia (Dias, Martínez & Oliveira, 2020).

Já em 2020, nos primeiros oito meses, início da pandemia do COVID-19 as internações corresponderam 125,38 internações por Leishmaniose visceral, 155,87 por Leptospirose, 113,25 por Malária e 4071,3 por Dengue. Com isso, enquanto Leishmaniose Visceral, Leptospirose e Malária, se destacaram pelo menor índice em internações em relação aos ao tempo na ordem de 43,59%, 29,31% e 29,51%, a Dengue, por outro lado, cursou com aumento de 23,47% no número de internações (Dias, Martínez & Oliveira, 2020).

É importante salientar que além de serem responsáveis por inúmeros óbitos e comprometer o sistema de saúde a coinfeção COVID-19 e dengue, refletiu fortemente em torno das questões sociais, principalmente, nas regiões endêmicas com potencial para desastres naturais como ciclones, inundações e deslizamentos. Uma vez que as repercussões se estenderam com aumento de doenças como Dengue, diarreia e cólera, a setores econômicos e até mesmo no âmbito alimentar. E esse impacto é experimentado mais fortemente pelas populações vulneráveis que ali residem, uma vez que trás à tona a necessidade de abrigos que podem aumentar ainda mais o risco de contaminação por COVID-19 (Rahman, Bodrud-Doza, Shammi, Islam & Khan, 2020; Vicente, Silva, Pereira & Miranda, 2021).

Fica evidente, assim, a necessidade da implantação de controle de vetores associados às medidas para prevenir COVID-19 e conscientização do risco de coinfeção e sua alta mortalidade por profissionais de saúde bem como a sua inserção conforme a demanda. (Masyeni, Santoso, Widyaningsih, Asmara, Nainu, Harapan & Sasmono, 2020; Plasencia-Dueñas, Failoc-Rojas, & Rodriguez-Morales, 2021; Dias, Martínez & Oliveira, 2020). Associado a isso, a existência de um planejamento estratégico de perfil inclusivo que integre setor público e privado, avaliação e informação sobre riscos das mudanças climáticas, planos de apoio econômico para as populações vulneráveis, monitorização de hotspots, vigilância de doenças baseadas no clima para minimizar danos futuros (Rahman, Doza, Shammi, Islam & Khan, 2020).

##### Desafios para o diagnóstico de coinfeção dengue e covid-19

A Dengue e COVID-19 possuem sintomatologias parecidas e com isso, tanto a detecção e o isolamento podem se tornar desafiadoras. (Rahman, Doza, Shammi, Islam & Khan, 2020). Em concordância, um estudo relatou um caso de uma criança com idade de 10 meses com dupla infecção COVID e dengue apresentando quadros graves dessas doenças com choque acompanhado de coagulação intravascular disseminada. A diferenciação do caso de

Dengue em um paciente com COVID-19 foi tida como fator dificultoso, pois o acompanhamento do curso da doença se tornava comprometido pelo isolamento submetido em razão da COVID-19, como também pela distinção da Dengue grave da síndrome inflamatória multissistêmica-C quando o paciente estava em estado crítico. (Alam, Sudarwati, Hakim, & Mahdiani, 2021).

Desse modo, é preciso ter cautela no tratamento submetido aos pacientes com dupla infecção como na identificação de sinais de má perfusão periférica que é indicativo inicial de choque durante a fase crítica da Dengue quando paciente se encontra em isolamento por COVID-19, estimativa do “período de estado crítico” em Dengue e COVID-19, levando em consideração principalmente a Síndrome inflamatória multissistêmica pediátrica nos casos infantis, é fundamental para uma intervenção precoce e prevenir morte. Faz-se importante haver acompanhamento contínuo e manejo no caso de dupla infecção (Alam, Sudarwati, Hakim, & Mahdiani, 2021).

Nessa mesma perspectiva, outra pesquisa também evidenciou um caso de coinfeção de Dengue e COVID-19 em um portador de HIV que residia com esposa e filho diagnósticos com dengue 15 dias antes da sua entrada no hospital. Apresentando sintomatologia de febre e dores musculares generalizadas em 72 horas de evolução, posteriormente evoluindo com tosse seca em 24 horas depois. Os exames laboratoriais apontaram leucopenia (3.800/mm<sup>3</sup>) com fórmula alterada (neutrófilos 44% e linfócitos 44%) e 116.000 plaquetas/ml, radiografia torácica não apontou achados de comprometimento pulmonar (Salvo, Lella, Lopez, Hugo, Zito & Vilela, 2020).

Ao realizar exame para COVID-19 com swab nasofaríngeo na admissão apresentou RT-PCR detectável, a investigação por Dengue foi iniciada em razão da sintomatologia evidenciada e histórico, assim, ELISA IgM e ATG NS1 positivos e PCR negativo. Em seguida, o diagnóstico por dengue foi confirmado com soroconversão de IgG para dengue. Esse trabalho aponta que a dengue e COVID tem manifestações clínicas semelhantes como febre, dores no corpo e em alguns casos erupções cutâneas e que ainda as evidências laboratoriais podem dificultar a discriminação inicial entre as duas doenças, assim, sua principal diferença é o comprometimento respiratório que a COVID-19 apresenta. Isso também implica em dizer que o diagnóstico pode ser atrasado para COVID-19 e ainda essa pode mascarar o diagnóstico de Dengue (Salvo, Lella, Lopez, Hugo, Zito & Vilela, 2020).

É importante levar em consideração casos de COVID-19 mesmo quando o diagnóstico para dengue for positivo para que se possa, dessa maneira, garantir uma maior segurança ao paciente. Assim, é relevante a disponibilidades de testes rápidos que sejam sensíveis e de fácil acesso, capazes de distinguir Dengue e COVID-19 principalmente no estágio inicial de infecção, a somar com melhoramento das competências laboratoriais, visto pela proteção a ser fornecida a saúde pública. Além disso, os profissionais de saúde devem estar cientes no que tange a coinfeção entre Dengue e COVID-19 bem como sua maior mortalidade, além disso, aprimorar diretrizes existentes para a diferenciação delas (Masyeni, Santoso, Widyaningsih, Asmara, Nainu, Harapan & Sasmono, 2020; Yan, Lee, Lam, Yan, Chua, Lim, Phang, Kew, Teng, Ngai, Lin, Foo, Pada, Ng & Tambyaha, 2020).

Deve-se, contudo, ter cautela a cerca do uso de testes rápidos para Dengue e COVID-19, pois pode levar ao diagnóstico errôneo, enquanto o padrão para COVID-19 é o PCR em tempo real, o da dengue é o teste rápido em razão de sua popularidade, simplicidade e acessibilidade. Dessa forma, os testes rápidos não podem ser usados exclusivamente. O uso de resultados NS1 deve ser instituído durante a pandemia como também considerar a infecção concomitante para evitar agravos. (Khairunisa, Amarullah, Churrotin, Fitria, Amin, Lusida & Soegijanto, 2021). É preciso a implantação de um plano de atuação que seja capaz de fortalecer as unidades de saúde com enfoque nas comunidades, ampliando o sistema de apoio de saúde online, seguro de saúde universal para todos, abrangendo as equipes de apoio à saúde e programas de desenvolvimento contínuo de conscientização sobre práticas de higiene (Rahman, Bodrud-Doza, Shammi, Islam & Khan, 2020).

Nesse sentido, um estudo demonstrou as principais diferenças entre os sintomas de COVID-19, influenza, Dengue; sendo a influenza por meio de modelos que correspondem a COVID-19 e influenza demonstrados pelos modelos de gripe 1 e 2 e COVID-19 versus Dengue modelos de dengue 1 e 2. O modelo de gripe 1 e modelo dengue 1 correspondem a dados demográficos e sintomas, já o modelo de gripe 2 e o modelo de dengue 2 abrange parâmetros, demografias e sintomas. Assim, o modelo 1 de gripe, a COVID-19 foi evidenciada por idade avançada, dispneia e quadro diarreico, à medida que a gripe teve sintomatologias como febre, tosse, coriza e vômitos/náuseas. Já o modelo 2 de gripe, a idade avançada, dispneia, diarreia e aumento na contagem de linfócitos eram característicos de COVID-19, à medida que a influenza se apresentava com tosse, coriza e



contagem reduzida de neutrófilos (Thein, Ang, Yo.ung, Chen, Leo & Lye, 2021).

No modelo 1 de Dengue, a idade avançada é um fator para acometimento por COVID-19, e sintomas como febre, cefaleia, dor nas articulações, erupção cutânea, vômitos/náuseas e sangramentos foram indicativos de dengue. O modelo 2 de dengue evidenciou que tosse, contagem de plaquetas mais alta, e contagem mais alta de linfócitos são prevalentes nos pacientes com COVID-19, ao passo que enquanto tosse, dor de cabeça, dor nas articulações, erupção cutânea e vômitos/náuseas foram indicativos de Dengue. Assim, este estudo permite ser uma ferramenta para auxiliar no diagnóstico dessas doenças, mas apresenta ressalva quanto ao diagnóstico de gripe e COVID-19, apresentado no modelo 1 de gripe, em que se deve considerar o hemograma completo como avaliação adicional do quadro (Thein, Ang, Young, Chen, Leo & Lye, 2021).

## V. CONCLUSÃO

A Dengue cursou com aumento de 23,47% no número de internações após a pandemia. A coinfeção de Dengue e COVID-19 refletiu fortemente em torno das questões sociais, principalmente, nas regiões endêmicas com potencial para desastres naturais. Ambas possuem manifestações clínicas semelhantes, sendo assim, sua principal diferença é o comprometimento respiratório que na COVID-19 é mais evidenciado.

Nesse sentido, é preciso ter cautela no tratamento submetido aos pacientes com dupla infecção como na identificação de sinais de má perfusão periférica que é indicativo inicial de choque durante a fase crítica da Dengue quando paciente se encontra em isolamento por COVID-19. É relevante a disponibilidades de testes rápidos que sejam sensíveis e de fácil acesso, capazes de distinguir Dengue e COVID-19.

Logo, fica evidente a necessidade da implantação de controle de vetores associadas às medidas para prevenir COVID-19 e conscientização do risco de coinfeção e sua alta mortalidade.

## REFERÊNCIAS

- [1] Alam, A., Sudarwati, S., Hakim, D. D. L., & Mahdiani, S. (2021). Case report: severe COVID-19 and dengue in an Indonesian infant. *The American Journal of Tropical Medicine and Hygiene*, 104(4), 1456.
- [2] Cardona-Ospina, J. A., Arteaga-Livias, K., Villamil-Gómez, W. E., Pérez-Díaz, C. E., Katterine Bonilla-Aldana, D., Mondragon-Cardona, Á., ... & Paniz-Mondolfi, A. (2021). Dengue and COVID-19, overlapping epidemics? An analysis from Colombia. *Journal of Medical Virology*, 93(1), 522-527.
- [3] Dias, N. L. C., Faccini-Martínez, Á. A., & Oliveira, S. (2021). Análise das internações e da mortalidade por doenças febris, infecciosas e parasitárias durante a pandemia da COVID-19 no Brasil. *InterAmerican Journal of Medicine and Health*, 4.
- [4] Harapan, H., Ryan, M., Yohan, B., Abidin, R. S., Nainu, F., Rakib, A., Jahan, I., Emran, T. bin, Ullah, I., & Panta, K. (2021). Covid-19 and dengue: double punches for dengue-endemic countries in Asia. *Reviews in Medical Virology*, 31(2).
- [5] Jayarajah, U., Lahiru, M., de Zoysa, I., & Seneviratne, S. L. (2021). Dengue infections and the surgical patient. *The American Journal of Tropical Medicine and Hygiene*, 104(1), 52.
- [6] Khairunisa, S. Q., Amarullah, I. H., Churrotin, S., Fitria, A. L., Amin, M., Lusida, M. I., & Soegijanto, S. (2021). Potential misdiagnosis between COVID-19 and dengue infection using rapid serological test. *Infectious Disease Reports*, 13(2), 540-551.
- [7] Masyeni, S., Santoso, M. S., Widyaningsih, P. D., Asmara, D. W., Nainu, F., Harapan, H., & Sasmono, R. T. (2021). Serological cross-reaction and coinfection of dengue and COVID-19 in Asia: Experience from Indonesia. *International Journal of Infectious Diseases*, 102, 152-154.
- [8] Mendes, K. D. S., Silveira, R. C. de C. P., & Galvão, C. M. (2008). Revisão integrativa: método de pesquisa para a incorporação de evidências na saúde e na enfermagem. *Texto & Contexto-Enfermagem*, 17, 758-764.
- [9] Plasencia-Dueñas, R., Failoc-Rojas, V. E., & Rodriguez-Morales, A. J. (2022). Impact of the COVID-19 pandemic on the incidence of dengue fever in Peru. *Journal of Medical Virology*, 94(1), 393-398.
- [10] Rahman, M. M., Bodrud-Doza, M., Shammi, M., Islam, A. R. M. T., & Khan, A. S. M. (2021). COVID-19 pandemic, dengue epidemic, and climate change vulnerability in Bangladesh: Scenario assessment for strategic management and policy implications. *Environmental research*, 192, 110303.
- [11] Rai, P., Kumar, B. K., Deekshit, V. K., Karunasagar, I., & Karunasagar, I. (2021). Detection technologies and recent developments in the diagnosis of COVID-19 infection. *Applied Microbiology and Biotechnology*, 105(2), 441.
- [12] Salvo, C. P., Di Lella, N., Solveyra López, F., Hugo, J., Gigena Zito, J., & Vilela, A. (2020). Coinfección Dengue y SARS-COV-2 en paciente HIV positivo. *MEDICINA (Buenos Aires)*, 80, 94-96.
- [13] Sreepadmanabh, M., Sahu, A. K., & Chande, A. (2020). COVID-19: Advances in diagnostic tools, treatment strategies, and vaccine development. *Journal of Biosciences*, 45(1), 1-20.
- [14] Thein, T. L., Ang, L. W., Young, B. E., Chen, M. I., Leo, Y. S., & Lye, D. C. B. (2021). Differentiating coronavirus

- disease 2019 (COVID-19) from influenza and dengue. *Scientific reports*, 11(1), 1-9.
- [15] Uno, N., & Ross, T. M. (2018). Dengue virus and the host innate immune response. *Emerging Microbes & Infections*, 7(1), 1–11.
- [16] Vicente, C. R., Silva, T. C. C. D., Pereira, L. D. A., & Miranda, A. E. (2021). Impact of concurrent epidemics of dengue, chikungunya, zika, and COVID-19. *Revista da Sociedade Brasileira de Medicina Tropical*, 54.
- [17] Yan, G., Lee, C. K., Lam, L. T., Yan, B., Chua, Y. X., Lim, A. Y., ... & Tambyah, P. A. (2020). Covert COVID-19 and false-positive dengue serology in Singapore. *The Lancet Infectious Diseases*, 20(5), 536.

# Management and Planning of Basic Life Support: School Community Guidance

## Gestão E Planejamento do Suporte básico de vida: Orientação da Comunidade Escolar

Lena Cláudia Maia Alencar<sup>1</sup>, Creusa Barbosa dos Santos Trindade<sup>2</sup>, Valeria Regina Cavalcante dos Santos<sup>3</sup>

<sup>1</sup>Médico (a). Mestrando (a) em Gestão em Serviços de Saúde na Amazônia da Fundação Santa Casa do Pará. ( FSCMPA). Belém, Pará - Brasil

<sup>2</sup>Doutora em educação em ciências e matemática -UFMT/ UFPA. Professora e orientadora do Programa de Pós-Graduação em Gestão e Saúde na Amazônia da Fundação Santa Casa de Misericórdia do Pará (FSCMPA). Fundação Santa Casa do Pará (FSCMPA). Belém, Pará – Brasil.

<sup>3</sup>Farmacêutica. Doutora em Ciências - em Medicina Tropical (FIOCRUZ/RJ). Professora e coorientadora do Programa de Pós-Graduação em Gestão e Saúde na Amazônia da Fundação Santa Casa de Misericórdia do Pará (FSCMPA) Belém, Pará - Brasil

Received: 01 Aug 2022,

Received in revised form: 27 Aug 2022,

Accepted: 02 Sep 2022,

Available online: 07 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— Support, Basic, Life, Health, Education.

**Palavras-chave**— Suporte, Básico, Vida, Saúde, Educação.

**Abstract**— *The objective of the study is to analyze how the process of implementation of the Basic Life Support Program (BLS) takes place, in the State Education Network, for the proposition of a didactic instrument to introduce the orientation and importance of the knowledge of BLS in the Community. School of the State Public Education Network of Pará. The main theoretical and methodological references supported in this project are the studies by CHEHUEN NETO et al. (2016) and PEDUZZI (2001), the guideline by BERNOCHE et al. (2019) and Law 13,722 of BRAZIL (2018). The study is bibliographic, qualitative and exploratory, based on action research. According to Brown (2001, p. 152): “action research is a term that applies to projects in which practitioners seek to effect transformations in their own practices. The product proposal is based on the creation of a didactic instrument to guide in a practical and effective way the school community of the State Education Network, in SBV to be developed by the researcher who will be responsible with the Santa Casa de Misericórdia do Pará Foundation (FSCMP) for this guidance in partnership with SEDUC (Secretariat of Education). This project is expected to promote the orientation of the importance of knowledge of the SBV in the School Community and its inclusion in the State Curriculum Matrix.*

**Resumo**— *O objetivo do estudo é analisar como se dá o processo de implantação do Programa de Suporte Básico de Vida (SBV), na Rede Estadual de Ensino, para a proposição de um Instrumento didático para introduzir a orientação e a importância do conhecimento do SBV na Comunidade Escolar da Rede Pública Estadual de Educação do Pará. Os principais referenciais teóricos e metodológicos sustentados neste projeto*

são os estudos de CHEHUEN NETO et al. (2016) e PEDUZZI (2001), a diretriz de BERNOCHE et al. (2019) e a Lei 13.722 de BRASIL (2018). O estudo é bibliográfico, qualitativo de caráter exploratório tomando como base a pesquisa-ação. De acordo com Brown (2001, p. 152): “pesquisa-ação é um termo que se aplica a projetos em que os práticos buscam efetuar transformações em suas próprias práticas. A proposta de produto está baseada na criação de um instrumento didático para orientar de modo prático e efetivo a comunidade escolar da Rede Estadual de Ensino, em SBV a ser elaborado pela pesquisadora que será responsável junto a Fundação Santa Casa de Misericórdia do Pará (FSCMP) por esta orientação em parceria com a SEDUC (Secretaria de Educação). Espera-se com este projeto promover a orientação da importância do conhecimento do SBV na Comunidade Escolar e inclusão do mesmo na Matriz Curricular do Estado.

## I. INTRODUÇÃO

O perfil epidemiológico da sociedade traz processos de adoecimento multidimensionais preveníveis, por isso precisam de parcerias intersetoriais para seu enfrentamento, portanto as estratégias de cogestão entre setores são bem-vindas e podem ainda ser desenvolvidas por meio de tecnologias diversificadas que auxiliem os usuários do serviço público, orientações que contribuam para a minimização e prevenção do adoecimento. Uma das estratégias necessárias para o fortalecimento de boas práticas em saúde é o conhecimento sobre Suporte Básico de Vida na Escola para capacitar os profissionais da educação visando orientar e prevenir possíveis eventos adversos na comunidade escolar.

Neste sentido, o presente estudo compreende que a orientação em SBV dar-se-á para um aumento da segurança de crianças, adolescentes e adultos dentro da área escolar, assim como na vida cotidiana, uma vez que oferecer este conhecimento é necessário para que os leigos possam lidar com situações emergenciais no dia a dia, com o intuito de atuar com manobras básicas para evitar sequelas irreversíveis ou até a morte de uma pessoa em situação de emergência. Assim sendo, é de fundamental importância orientar de como atuar nestas situações emergenciais (queda, fraturas, queimaduras, afogamentos, engasgos, etc.), e mostrará a importância do atendimento rápido e correto até a chegada de um atendimento médico especializado.

Nesta perspectiva, o projeto apresentado objetiva propor a implantação do SBV na Rede Estadual de Ensino, por meio de um Instrumento didático científico e tecnológico, que possa facilitar a inclusão destes conteúdos na matriz curricular da Educação Básica da Rede Pública Estadual de Educação do Pará. Assim sendo, a pesquisa é de caráter qualitativo na modalidade pesquisa-ação que possibilitará conhecer o nível de conhecimento, limitações e interesse da comunidade escolar sobre suporte básico de

vida. De forma específica objetivamos: analisar o nível de conhecimento, limitações e interesse da comunidade escolar sobre suporte básico de vida; construir uma tecnologia educacional que possa ser um instrumento na gestão e planejamento de ações orientativas para comunidade escolar acerca de suporte básico de vida e propor um plano de ação estratégico para disseminação do conhecimento com a tecnologia educacional junto a Rede Estadual de Ensino do Pará.

Esta proposta encontra-se embasada na vasta literatura sobre o tema em nível nacional e internacional, além do amparo legal do Estado Brasileiro com a Lei 13.722 de 4 de outubro de 2018 (BRASIL, 2018). Os resultados serão analisados por meio das ferramentas da análise de conteúdo (Bardin, 2011). As imersões preliminares sobre os resultados apontaram que há um percentual significativo de profissionais que não conhecem o SBV conforme explicitado no campo resultados preliminares o que nos permite afirmar que a pesquisa encontrou ancoragem para proposição do produto. Este estudo tem por objetivo propor a implantação do SBV na Rede Estadual de Ensino, por meio de um Instrumento didático científico e tecnológico.

## II. MÉTODO

### 2.1 TIPO DE ESTUDO

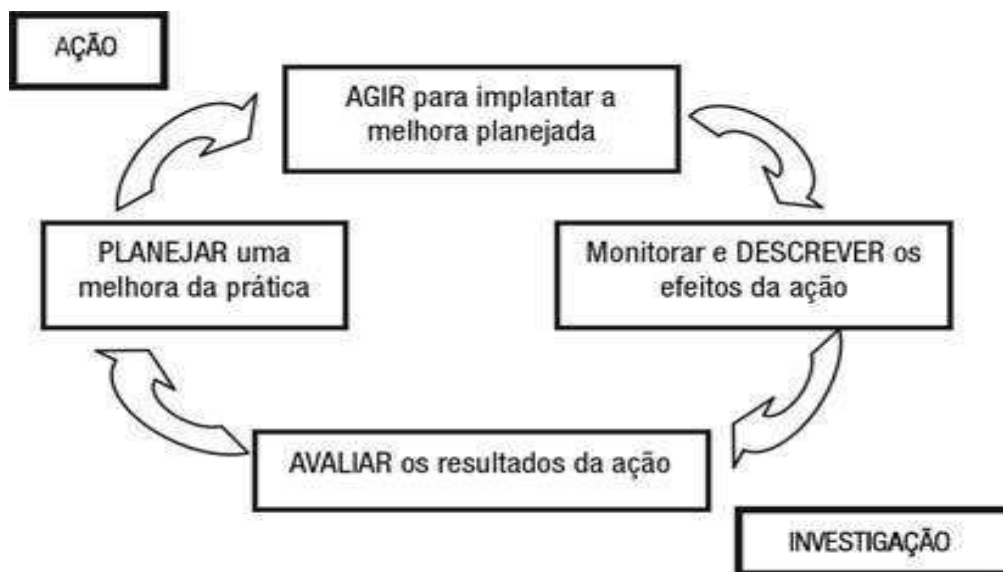
Para o desenvolvimento deste projeto, a primeira etapa é constituída de uma pesquisa bibliográfica, sendo para Lima e Pioto (2007), “a pesquisa bibliográfica implica em um conjunto ordenado de procedimentos de busca por soluções, atento ao objeto de estudo, e que, por isso, não pode ser aleatório”. Sendo assim, o uso dos descritores específicos do trabalho, assim como a fidelidade ao tema são imprescindíveis para uma pesquisa de qualidade.

Trata-se de um estudo qualitativo, tipo pesquisa-ação; será aplicado um formulário eletrônico, via *Google Forms* para o diagnóstico do conhecimento sobre o SBV entre a Comunidade Escolar. Na pesquisa de campo, métodos e técnicas de coleta de dados exigem atenção do pesquisador, como bem enfatiza Piana (2009), em que no caso do projeto atual precisou de adaptações por conta da Pandemia da COVID-19 e da paralização das aulas, por isso a escolha de utilização da plataforma online do Google.

O estudo é qualitativo de caráter exploratório tomando como base a pesquisa-ação. Desta maneira, na pesquisa qualitativa, o desenvolvimento da pesquisa é imprevisível, sendo o conhecimento do pesquisador parcial e limitado, por isso deve o mesmo eximir-se de julgamento e sem preconceitos com diferentes abordagens para que os atores pesquisados possam produzir informações ilustrativas e aprofundadas, de todo modo, importantes cientificamente, servindo ainda para a construção mais fidedigna de formulários com as realidades dos pesquisados, como bem explicita Gerhardt e Silveira (2009).

De acordo com Brown (2001): “pesquisa-ação é um termo que se aplica a projetos em que os práticos buscam efetuar transformações em suas próprias práticas...”. Neste sentido, Tripp (2005) destaca a que é importante que se reconheça a pesquisa-ação como um dos inúmeros tipos de investigação-ação, que é um termo genérico para qualquer processo que siga um ciclo no qual se aprimora a prática pela oscilação sistemática entre agir no campo da prática e investigar a respeito dela. Planeja-se, implementa-se, descreve-se e avalia-se uma mudança para a melhora de sua prática, aprendendo mais, no correr do processo, tanto a respeito da prática quanto da própria investigação.

As etapas definidas pelo autor se aplicam a esta proposta de pesquisa, pois o projeto titulado Gestão e Planejamento do Suporte Básico de Vida na Orientação da Comunidade Escolar se propõe a desenvolver as etapas evidenciadas no cronograma criado pelo autor que representa as fases que deveremos seguir para alcançar os objetivos propostos e elaborar um produto tecnológico que possa subsidiar a implantação do suporte básico de vida nas escolas da rede estadual de ensino do estado do Pará. Conforme organograma elabora do por Tripp (2005).



Organograma 1: Representação em quatro fases do ciclo básico da investigação-ação.

Fonte: TRIPP, David. Pesquisa-ação: uma introdução metodológica

A pesquisa-ação estuda a forma dinâmica e metodológica que permite uma interação entre pesquisadores e participantes da pesquisa, sendo coletiva e colaborativa, envolvendo os participantes com suas reflexões e capacidade crítica a respeito de um tema, culminando com a implementação em conjunto de ações.

## 2.2 POPULAÇÃO DO ESTUDO

A rede Pública Estadual de Ensino do Estado do Pará, consta com uma estrutura organizacional de 22 Unidades Regionais de Educação (URES) e 19 Unidades Seduc nas Escolas (USES), envolvendo 927 estabelecimentos. Participarão deste estudo os professores em educação da Escola Estadual de Ensino Fundamental e Médio Deodoro de Mendonça, que faz parte da USE4, e apresenta um quantitativo de 90 professores. Porém, devido a Pandemia e retorno das aulas presenciais em meados de setembro/2021, foram envolvidos alguns professores de outras escolas da USE4 para melhor avaliação do conhecimento destes professores da Rede Pública sobre o SBV.

## 2.3 CRITÉRIOS DE INCLUSÃO E EXCLUSÃO

Os critérios de inclusão para compor o projeto são: ser maior de idade, servidores da Rede Pública Estadual de Educação do Pará, atuantes na Escola Estadual de Ensino Fundamental e Médio Deodoro de Mendonça e/ou que façam parte da USE4 e que tenham aceitado voluntariamente participar do Estudo e concordado com os termos do TCLE (Apêndice A). Serão excluídos da pesquisa os servidores que não obedecerem aos critérios de inclusão e/ou no momento de a coleta de dados encontrarem-se de férias ou que estejam de licença da função, assim como aqueles que não puderem ter acesso à internet e ao formulário eletrônico, via *Google Forms* (Apêndice C).

## 2.4 LOCAL DE ESTUDO

O projeto será realizado em uma EEEFM - Escola Estadual de Ensino Fundamental e Médio (Escola Pública Estadual), de nome: Deodoro de Mendonça, situada na Avenida Governador José Malcher, nº 1600, bairro Nazaré, CEP: 66060-230, Belém- Pa.

Devido à Pandemia da COVID-19, será utilizado formulário eletrônico, via *Google Forms* (Apêndice C) contendo perguntas fechadas sobre reanimação cardiopulmonar (RCP) conforme às etapas descrita neste projeto

## 2.5 COLETA DE DADOS

Etapa 1: Gestão e Planejamento para a execução do Projeto. Reunião com a alta Gestão da Fundação Santa Casa de Misericórdia do Pará e a Secretaria de Educação do Estado do Pará para criação de um acordo de Cooperação entre ambos. (Anexo B). Tendo assim, sido solicitado à Escola Estadual de Ensino Fundamental e Médio Deodoro de Mendonça e a Diretora da USE4 uma relação dos seus Servidores e seus respectivos e-mails e telefones para contato, após os pesquisadores envolvidos no projeto terem assinado o Termo de Compromisso de Utilização de Dados – TCUD (Apêndice B).

Etapa 2: Foi enviado uma correspondência eletrônica e/ou via *whatsapp* com as informações acerca da pesquisa, TCLE, link para acesso ao questionário de coleta de dados através do *Google Forms* (Apêndice C), ambos disponíveis para acesso no link: <https://forms.gle/upkMb39X22p4pXni8> e Download em .PDF no *Google Drive* em: <https://drive.google.com/file/d/14ETQo9eYUyGADj1fA7f0WvdJjJVU5-R4/view?usp=sharing>;

Etapa 3: Avaliação do conhecimento dos profissionais participantes do estudo através da aplicação de um instrumento de coleta de dados, do tipo formulário, contendo perguntas fechadas com objetivo de avaliar se possuem conhecimento quanto ao Suporte Básico de Vida e sua importância para evitar desfechos desfavoráveis e até a morte.

Etapa 4: Construção do Produto Pedagógico como uma ferramenta que servirá como um material de apoio para ensinar de forma prática e com uma linguagem acessível, dentro da sala de aula, Professores e alunos da Comunidade Escolar.

Etapa 5: Planejar junto a SEDUC/PA a implantação do Produto na Rede de Ensino do Pará.

## 2.6 ANÁLISE DE DADOS

A análise dos dados será realizada a partir das ferramentas da pesquisa-ação tomando como referência os descritores da análise de conteúdos que de acordo com

Bardin (2011, p. 05) ocorre em três etapas: pré-análise, exploração do material e interpretação.

Seguindo esta linhagem científica os dados serão apresentados em categorias de análise e contribuirão para a criação de um instrumento didático, contendo informações educativas e acessíveis ao público leigo no que tange ao Suporte Básico de Vida, com o intuito de orientar e informar sobre a importância do mesmo no dia a dia da comunidade escolar, assim como do cumprimento da Lei 13.722, de 4 de outubro de 2018 (Lei Lucas).

Os dados foram organizados no programa Microsoft Excel 2016. Os gráficos e tabelas foram construídos com as ferramentas disponíveis nos programas Microsoft Word e Excel. As variáveis quantitativas foram descritas por mínimo, máximo e média e as variáveis qualitativas por frequência e porcentagem. O *software* Bioestat 5.5 foi utilizado para calcular os intervalos de confiança de 95% para a proporção das respostas relacionadas ao conhecimento sobre suporte básico de vida.

### III. ASPECTOS ÉTICOS

O estudo será realizado dentro dos preceitos éticos, respeitando as Normas de Pesquisa envolvendo Seres Humanos (Rs. 466/2012) do Ministério da Saúde (MS) e do Conselho Nacional de Saúde (CNS), assim como as Res, CNS/MS 510/2016 e Res. CNS/MS 580/2018. Sendo submetido à apreciação do Comitê de Ética e Pesquisa da Fundação Santa Casa de Misericórdia do Pará, conforme CAAE 48054821.0.0000.5171 e parecer aprovado de número 4.817.412 (Anexo A). As informações obtidas serão usadas unicamente para suprir os objetivos dessa pesquisa. O pesquisador se compromete em expor os resultados obtidos preservando a identidade dos sujeitos envolvidos. Os envolvidos no projeto serão estudados segundo os preceitos da Declaração de Helsinki V e do Código de Nuremberg. Caso o responsável do formulário coletado venha a integrar a casuística deste estudo e deseje acesso à pesquisa para que tenham

esclarecidas as intenções deste trabalho, bem como a destinação dos dados através dele obtidos, será apresentado um Termo de Consentimento Livre e Esclarecido – TCLE (Apêndice A), assim como se o mesmo for entrevistado.

Os dados manuseados serão guardados pela pesquisadora, por um prazo mínimo de 5 (cinco) anos e os resultados informados ao Sistema Único de Saúde (SUS) e a comunidade científica, através da publicação dos resultados apresentados em forma de Dissertação do Curso de Mestrado Profissional Gestão e Serviços em Saúde da FSCMP.

### IV. RESULTADOS PRELIMINARES

#### 4.1 CARACTERIZAÇÃO DO *LOCUS* DA PESQUISA

Este Estudo atendeu ao Princípio da Intersetorialidade previsto na Política Nacional de Atenção Básica. Conforme os seguimentos descritos abaixo

A Fundação Santa Casa de Misericórdia do Pará, é um órgão da administração indireta que está vinculada a Secretaria de Estado de Saúde Pública, com 368 anos, é certificada como Hospital de Ensino, conforme Portaria Interministerial MS/MEC nº 2378 de 26 de outubro de 2004 e efetivado seu processo de Contratualização junto ao SUS por meio da Portaria 2.859/MS, de 10 de novembro de 2006. Suas finalidades essenciais são: a Assistência e o Ensino, Pesquisa e a Extensão.

A Secretaria da Educação do Estado do Pará (SEDUC/PA) é formada por 22 Unidades Regionais de Educação (URE) distribuídas em todo o Estado, estas são responsáveis de programar, coordenar, orientar, executar, controlar e avaliar as atividades da Secretaria.

Foram contactados (Figura 1) para planejamento das ações do Projeto, a alta gestão da FSCMP e a Secretaria de Educação do Estado do Pará, para alinhar um Acordo de Cooperação entre as Instituições. (ANEXO B).



*Fig.1: Reunião da Alta Gestão da FSCMP com a SEDUC.*

Fonte: Própria do autor.

## 4.2 NÍVEL DE CONHECIMENTO DOS PARTICIPANTES

Para analisar melhor o nível de conhecimento dos participantes é importante caracterizá-los sócio demograficamente.

### 4.2.1 Caracterização Sociodemográfica

Tabela 1). A renda varia entre 5 e 7 mil reais, com média de cerca de 6 mil reais mensais (IBGE, 2010).

*Tabela 1 - Características sociodemográficas dos profissionais da educação da EEFM Deodoro de Mendonça e USE4, 2021, Belém - Pará.*

| Variável            | Frequência | Porcentagem |
|---------------------|------------|-------------|
| <b>Sexo</b>         |            |             |
| Feminino            | 25         | 64,1        |
| Masculino           | 14         | 35,9        |
| <b>Idade</b>        |            |             |
| De 20 a 39 anos     | 5          | 12,8        |
| De 40 a 59 anos     | 32         | 82,1        |
| De 60 a 69 anos     | 2          | 5,1         |
| <b>Etnia</b>        |            |             |
| Pardo               | 23         | 59,0        |
| Branco              | 12         | 30,8        |
| Negro               | 4          | 10,3        |
| <b>Estado Civil</b> |            |             |
| Casado              | 23         | 59,0        |



|                              |          |            |
|------------------------------|----------|------------|
| Solteiro                     | 9        | 23,1       |
| Outro                        | 2        | 5,1        |
| Viúvo                        | 1        | 2,6        |
| Divorciado                   | 4        | 10,3       |
| <b>Escolaridade</b>          |          |            |
| Ens. Fund. Incompleto        | 1        | 2,6        |
| <b>Ens. Médio Incompleto</b> | <b>1</b> | <b>2,6</b> |
| Superior Completo            | 6        | 15,4       |
| Pós-Graduação                | 31       | 79,5       |
| <b>Profissão</b>             |          |            |
| Professor                    | 23       | 59,0       |
| Pedagogo                     | 7        | 17,9       |
| Biólogo                      | 2        | 5,1        |
| Servidor público             | 2        | 5,1        |
| Especialista em Educação     | 1        | 2,6        |
| Fonoaudióloga                | 1        | 2,6        |
| Músico                       | 1        | 2,6        |

Fonte: Própria do autor.

As porcentagens são relativas ao total de participantes (n=39).

#### 4.2.2 Formação e conhecimentos relacionados a SBV

A Figura 2 resume as respostas relacionadas ao conhecimento de suporte básico de vida dos entrevistados. Vinte entrevistados (51,3%) não sabem o que é o suporte básico de vida, mais da metade deles (59%) não sabe identificar uma parada cardiorrespiratória; 66,7% não sabem realizar massagem cardíaca, porém, a maioria

(64%) sabem o telefone do serviço de emergência. Apenas nove (23%) tiveram orientações sobre o suporte básico de vida e apenas 5 (12,8%) se sentem em condições de prestar orientações sobre o assunto. Ao contrário, todos acham que é importante o conhecimento deste assunto pelos leigos (97,4%).

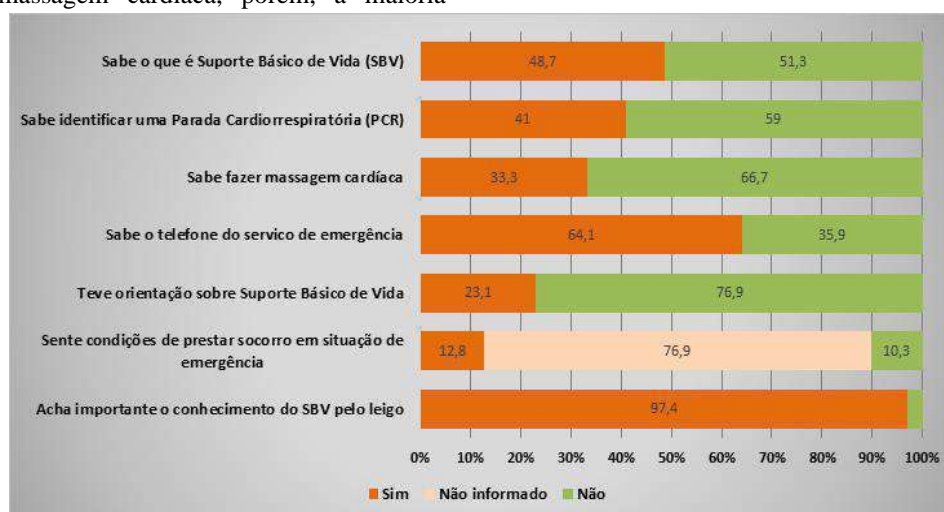


Fig.2: Conhecimentos relacionados ao SBV dos profissionais da educação da EEFM Deodoro de Mendonça e USE 4, 2021, Belém - Pará.

Fonte: Própria do autor.

As percentagens são relativas ao total de participantes (n=39).

Para acessar a generalidade das respostas, foram calculados os intervalos de confiança de 95% para as respostas, os quais são representados na

Tabela 2. Quanto mais estreito for este intervalo, maior a certeza relacionada àquela proporção de respostas na população que esta amostra representa.

*Tabela 2 - Intervalos de confiança das respostas relacionadas ao nível de conhecimento sobre SBV dos profissionais da educação da EEFM Deodoro de Mendonça, 2021, Belém - Pará.*

| Variável                                                            | Porcentagem | IC95%             |
|---------------------------------------------------------------------|-------------|-------------------|
| <b>Sabe o que é Suporte Básico de Vida (SBV)</b>                    |             |                   |
| Não                                                                 | 51,3        | 35,0 - 67,3       |
| Sim                                                                 | 48,7        | 32,7 - 65,0       |
| Não informado                                                       | 0,0         | 0,0 - 11,2        |
| <b>Sabe identificar alguém em Parada Cardiorrespiratória (PCR)</b>  |             |                   |
| Não                                                                 | 59,0        | 42,2 - 74,0       |
| Sim                                                                 | 41,0        | 26,0 - 57,8       |
| Não informado                                                       | 0,0         | 0,0 - 11,2        |
| <b>Sabe fazer massagem cardíaca</b>                                 |             |                   |
| Não                                                                 | 66,7        | 49,7 - 80,4       |
| Sim                                                                 | 33,3        | 19,6 - 50,3       |
| Não informado                                                       | <b>0,0</b>  | <b>0,0 - 11,2</b> |
| <b>Sabe o telefone do serviço de emergência</b>                     |             |                   |
| Sim                                                                 | 64,1        | 47,2 - 78,3       |
| Não                                                                 | 35,9        | 21,7 - 52,8       |
| Não informado                                                       | 0,0         | 0,0 - 11,2        |
| <b>Teve orientação sobre Suporte Básico de Vida</b>                 |             |                   |
| Não                                                                 | 76,9        | 60,3 - 88,3       |
| Sim                                                                 | 23,1        | 11,7 - 39,7       |
| Não informado                                                       | 0,0         | 0,0 - 11,2        |
| <b>Sente condições de prestar socorro em situação de emergência</b> |             |                   |
| Não informado                                                       | 76,9        | 60,3 - 88,3       |
| Sim                                                                 | 12,8        | 4,8 - 28,2        |
| Não                                                                 | 10,3        | 3,3 - 25,2        |
| <b>Acha importante o conhecimento do assunto pelo leigo</b>         |             |                   |
| Sim                                                                 | 97,4        | 84,9 - 99,9       |
| Não                                                                 | 2,6         | 0,1 - 15,1        |
| Não informado                                                       | 0,0         | 0,0 - 11,2        |

Fonte: Própria do autor.

As percentagens são relativas ao total de participantes (n=39). IC95%: Intervalo de confiança de 95% para a proporção.

A Figura 2 representa as respostas relacionadas ao desejo de participação em treinamentos relacionados ao suporte básico de vida. 87,2% dos entrevistados (34 pessoas) desejariam participar deste treinamento específico, e 48,7% deles (19 pessoas) responderam que desejam participar para salvar vidas. Dos cinco que não

desejam participar, três informaram que é devido a indisponibilidade de tempo e apenas dois devido à falta de interesse. No entanto, quando perguntados sobre aceitar em receber um manual relacionado ao SBV, 94,5% se manifestaram favoráveis.

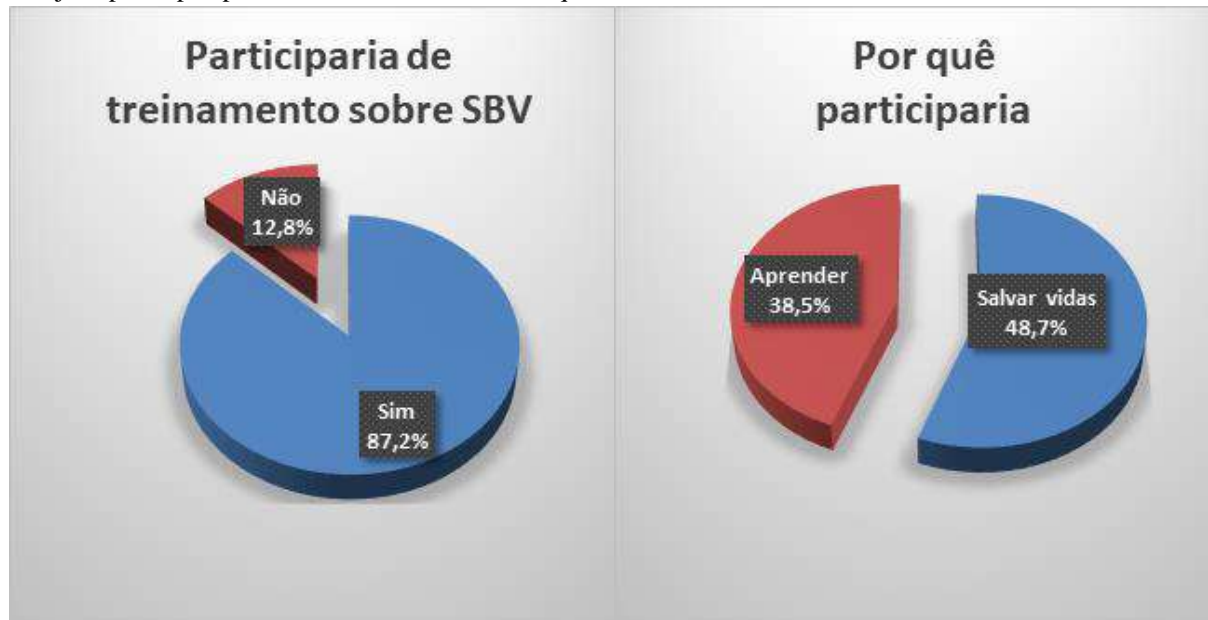


Fig.3: Desejo de participação em treinamento em SBV dos profissionais da educação da EEFM Deodoro de Mendonça, 2021, Belém - Pará.

Fonte: Própria do autor.

As percentagens são relativas ao total de participantes (n=39).

## V. CONSTRUÇÃO DO PRODUTO

As primeiras produções de histórias em quadrinhos surgiram nos Estados Unidos no fim do século XIX em jornais. Porém, Cavalcante, Novais e Ferreira (2019) apontam que os quadrinhos surgiram como gênero em 1895, por ocasião da criação da tirinha *The Yellow Kid*, publicada em Nova York por Richard Outcault, inicialmente com caráter cômico e posteriormente ganhando espaço de entretenimento após a segunda guerra mundial com quadrinhos voltadas para educação na década de 1940 (Vergueiro, 2016).

Sousa *et al.* (2019) salientam que as histórias em quadrinhos possibilitam abordar diferentes assuntos em qualquer disciplina ou nível de ensino como recurso de ensino.

Para este instrumento didático foi desenvolvido os seguintes métodos:

### Etapa 1. Definição do Conteúdo

Ao se projetar um HQ, prioritariamente precisa-se definir um tema (McLellan, 2020). Portanto o tema deste instrumento foi definido a partir dos objetivos da pesquisa:

### Suporte Básico de Vida- SBV.

Os conteúdos a serem tratados para alcance das competências em SBV foram definidos conforme as evidências científicas:

- ✓ Conhecimentos: sinais e sintomas de riscos de parada cardiorrespiratória, convulsões, fraturas e engasgamento e o suporte básico de vida- SBV.
- ✓ Habilidades: procedimento de checagem dos sinais.
- ✓ Atitudes: Condutas a serem executadas nas ocorrências para Suporte Básico de Vida – SBV.

### Etapa 2 Recursos Utilizados

Especificamente, na produção das histórias em quadrinhos foi utilizado o programa chamado *Corel Draw*, que permite a criação de cenários, personagens e diferentes formas de escrita por meio de opções de diálogos

### Etapa 3 Estrutura Narrativa

A temática se passa dentro de uma sala de aula, com personagens da Comunidade Escolar que durante um dia normal de aula, passaram por uma situação

emergencial e estes tiveram que prestar socorro a um aluno antes da chegada de um atendimento especializado.

#### Etapa 4 Personagens

Profissionais da Saúde - Optou-se por criar os personagens que representassem a FSMCP e o Projeto, profissionais da Diretoria de Ensino, Pesquisa e Extensão (DEPE), possibilitando a identificação dos mesmos em seus papéis e maior vinculação ao produto. Tal aproximação dos personagens, pode ser um dos fatores para estimular a leitura dos quadrinhos e otimizar a compreensão dos assuntos, pois quem os lê pode conseguir, através das capacitações, visualizar ou imaginar como esta situação seria em seu cotidiano.

Para o design destes personagens utilizou-se a

As propriedades psicológicas destas cores básicas são as seguintes:

|                                                                                                              | Positivo                                                                                                                    | Negativo                                                                      |
|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| <b>Vermelho</b><br>         | Coragem física, força, calor, energia, sobrevivência básica, "Lutar ou fugir", estímulo, masculinidade, emoção.             | Desafio, agressão, impacto visual, tensão.                                    |
| <b>Azul</b><br>            | Inteligência, comunicação, confiança, eficiência, serenidade, dever, lógica, frieza, reflexão, calma.                       | Frieza, indiferença, falta de emoção, hostilidade.                            |
| <b>Amarelo</b><br>        | Otimismo, confiança, autoestima, extroversão, força emocional, simpatia, criatividade.                                      | Irracionalidade, medo, fragilidade emocional, depressão, ansiedade, suicídio. |
| <b>Verde</b><br>          | Harmonia, equilíbrio, revitalização, amor universal, descanso, renovação, garantia, consciência ambiental, equilíbrio, paz. | Tédio, estagnação, brandura, prostração.                                      |
| <b>Violeta</b><br>        | Consciência espiritual, contenção, visão, luxo, autenticidade, verdade, qualidade.                                          | Introversão, decadência, supressão, inferioridade.                            |
| <b>Cor-de-Laranja</b><br> | Conforto físico, comida, calor, segurança, sensualidade, paixão, abundância, diversão.                                      | Privação, frustração, frivolidade, imaturidade.                               |
| <b>Cor-de-Rosa</b><br>    | Tranquilidade física, nutrição, calor, feminilidade, amor, sexualidade, sobrevivência das espécies.                         | Inibição, claustrofobia emocional, emasculação, fraqueza física.              |
| <b>Cinza</b><br>          | Neutralidade psicológica.                                                                                                   | Falta de confiança, desânimo, depressão, hibernação, falta de energia.        |
| <b>Preto</b><br>          | Sofisticação, glamour, segurança, segurança emocional, eficiência, substância.                                              | Opressão, frieza, ameaça, peso.                                               |
| <b>Branco</b><br>         | Higiene, esterilidade, clareza, pureza, limpeza, simplicidade, sofisticação, eficiência.                                    | Esterilidade, frieza, barreiras, hostilidade, elitismo.                       |
| <b>Castanho</b><br>       | Seriedade, calor, natureza, terra, confiabilidade, apoio.                                                                   | Falta de humor, peso, falta de sofisticação.                                  |

Fonte: Ribeiro, 2020, p.47

## VI. DISCUSSÃO

Os resultados preliminares da pesquisa demonstram a importância do conhecimento e treinamento do SBV. A maioria tem o interesse sobre o assunto e

foto dos mesmos e posteriormente a técnica de ilustração referente a representação dos traços da figura humana.

#### Etapa 5 Cores

A cor tem seus significados variando através dos tempos e consonante as diferentes culturas e forma de uso. Segundo Ribeiro (2020, p.47) uma cor pode ter um sentido numa determinada aplicação e outro sentido, completamente diferente, noutra aplicação. Em suma, o significado da cor é contextual – as cores só têm significado quando são utilizadas num contexto.

As cores de base foram assim escolhidas para associar cada atividade às suas respectivas personagens e situações.

apresenta o desejo de ser treinado com o objetivo de salvar vidas, coadunando com o objetivo desta pesquisa.

Chehuen Neto (2016) reforça a importância do ensinamento do SBV como atendimento inicial em

situações emergenciais, assim como entende que a capacitação e a informação do SBV são de grande valia, pois o primeiro atendimento pode definir a vida e minimizar sequelas em um Ser Humano.

Os participantes da pesquisa são oriundos da comunidade escolar, ambiente propício para o processo de ensino-aprendizagem de temáticas da saúde.

Grimaldi (2020), reforça que a Escola é o local onde as crianças e adolescentes passam a maior parte do seu dia, sendo comum a ocorrência de acidentes, mostrando o quão é importante a disseminação do conhecimento adequado acerca das intervenções que devem ser realizadas em casos de situações de emergenciais.

A escola é um equipamento social que possibilita a intersectorialidade na responsabilidade da atenção básica para a saúde, portanto é um meio adequado para inserção do ensino e treinamento de assuntos relevantes a sociedade, como o SBV, como apresentado nos resultados preliminares há uma carência do conhecimento e um desejo de aprender sobre o assunto.

Pereira KC (2017) ratifica que o ambiente escolar é favorável para a formação de cidadãos, por tanto entende a necessidade de trabalhar esta temática relativas a saúde com leigos e estes servirem de multiplicadores e atores na prevenção de agravos na saúde.

Os resultados também trazem um diagnóstico situacional da comunidade escolar quanto a temática, conforme acredita Galindo Neto NM (2019) que esta atividade trás de forma holística um raciocínio crítico-reflexivo sobre os anseios da comunidade escolar.

## VII. CONCLUSÃO

Esta pesquisa selecionou os servidores da educação, por serem estratégicos no processo da Educação na Saúde Coletiva. O território definido foi a comunidade escolar do estado do Pará, porém não limitado apenas a este, o produto possibilitará a abrangência ampla a nível nacional e internacional.

Quanto a inclusão da diversidade social, o mesmo poderá ser adaptado nas diversas linguagens, possibilitando alto impacto social no processo de salvar vidas.

Ainda como perspectiva esta pesquisa produzirá publicações científicas e produto pedagógico e tecnológico atendendo ao objetivo do programa de mestrado, bem como registrar o produto após sua validação junto ao público alvo.

## REFERÊNCIAS

- [1] 1ª Conferência Internacional sobre Promoção da Saúde (1ª CIPS). **Carta de Ottawa**. Ottawa, Canadá, 1986. Disponível em: <[http://bvsmms.saude.gov.br/bvs/publicacoes/carta\\_ottawa.pdf](http://bvsmms.saude.gov.br/bvs/publicacoes/carta_ottawa.pdf)>. Acesso em: 20 jun. 2020.
- [2] BARDIN, Laurence. **Análise de conteúdo**. São Paulo: Edições 70, 2011.
- [3] BERNOCHE, C. et al. **Atualização da Diretriz de Ressuscitação Cardiopulmonar e Cuidados Cardiovasculares de Emergência da Sociedade Brasileira de Cardiologia - 2019**. Arq. Bras. Cardiol., São Paulo, v. 113, n. 3, p. 449-663, 2019. Disponível em: <[https://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0066-782X2019000900449](https://www.scielo.br/scielo.php?script=sci_arttext&pid=S0066-782X2019000900449)>. Acesso em: 20 jun. 2020.
- [4] BOHN A. et al. **Teaching resuscitation in schools: Annual tuition by trained teachers is effective starting at age 10: A four-year prospective cohort study**. Resuscitation, v.83, n.5, p. 619-25. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/22286049/>. Acesso em: 02 nov. 2021.
- [5] BRASIL. Ministério da Saúde. **Portaria nº 2.446**, de 11 de novembro de 2014. Redefine a Política Nacional de Promoção da Saúde (PNPS). Brasília: Diário Oficial da União, 2014. Disponível em: <[https://bvsmms.saude.gov.br/bvs/saudelegis/gm/2014/prt2446\\_11\\_11\\_2014.html](https://bvsmms.saude.gov.br/bvs/saudelegis/gm/2014/prt2446_11_11_2014.html)>. Acesso em: 10 jun. 2020.
- [6] BRASIL. Presidência da República. **Decreto nº 6.286**, de 5 de dezembro de 2007. Institui o Programa Saúde na Escola – PSE, e dá outras providências. Brasília: Diário Oficial da União, 2007. Disponível em: <[http://www.planalto.gov.br/ccivil\\_03/\\_ato2007-2010/2007/decreto/d6286.htm](http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2007/decreto/d6286.htm)>. Acessado em 10 jun. 2020.
- [7] BRASIL. Presidência da República. **Lei nº 13.722**, de 4 de outubro de 2018. Torna obrigatória a capacitação em noções básicas de primeiros socorros de professores e funcionários de estabelecimentos de ensino públicos e privados de educação básica e de estabelecimentos de recreação infantil. Brasília: Secretaria-Geral, 2018. Disponível em: <[http://www.planalto.gov.br/ccivil\\_03/\\_ato2015-2018/2018/lei/L13722.htm](http://www.planalto.gov.br/ccivil_03/_ato2015-2018/2018/lei/L13722.htm)>. Acesso em: 10 jun. 2020.
- [8] BROWN, A.; DOWLING, P. **Doing research/reading research: a mode of interrogation for teaching**. Londres: Routledge Falmer, 2001.
- [9] CAVALCANTE, W.O; NOVAIS, A.L.F; FERREIRA, F.C.L. **Abordagem lúdica das questões de física: história em quadrinhos sobre cinemática**. Scientia Plena, v. 15, p. 1-7, 2019.
- [10] CHEHUEN NETO, J.A. et al. **Conhecimento e Interesse sobre Suporte Básico de Vida entre Leigos**. Int. j. cardiovasc. sci., [s.l.], v. 29, n. 6, p. 443-452, 2016. Disponível em: <<http://www.onlinejcs.org/sumario/29/pdf/v29n6a04.pdf>>. Acesso em: 20 jun. 2020.
- [11] EUROPEAN RESUSCITATION COUNCIL. **Guidelines for resuscitation 2010**. Lisboa: Conselho Português de Ressuscitação. Coimbra: Associação de Saúde Infantil de Coimbra; 2010.

- [12] FALKENBERG, M. B. et al. **Educação em saúde e educação na saúde:** conceitos e implicações para a saúde coletiva. *Ciênc. Saúde coletiva*, Rio de Janeiro, v. 19, n. 3, 2014. Disponível em: <[https://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S1413-81232014000300847](https://www.scielo.br/scielo.php?script=sci_arttext&pid=S1413-81232014000300847)>. Acesso em: 20 jun. 2020.
- [13] FERIOTTI, M. L. **Equipe multiprofissional, transdisciplinaridade e saúde:** desafios do nosso tempo. *Vínculo*, São Paulo, v. 6, n. 2, p. 179-190, 2009. Disponível em: <[http://pepsic.bvsalud.org/scielo.php?script=sci\\_arttext&pid=S1806-24902009000200007](http://pepsic.bvsalud.org/scielo.php?script=sci_arttext&pid=S1806-24902009000200007)>. Acesso em: 20 jun. 2020.
- [14] FERNANDES, J. M. G. et al. **Ensino de Suporte Básico de Vida para Alunos de Escolas Pública e Privada do Ensino Médio.** *Arq. Bras. Cadiol*, São Paulo, v. 102, n. 6, p. 593-601, 2014. Disponível em: <[https://www.scielo.br/scielo.php?pid=S0066-782X2014000600010&script=sci\\_arttext&tlng=p](https://www.scielo.br/scielo.php?pid=S0066-782X2014000600010&script=sci_arttext&tlng=p)>. Acesso em: 20 jun. 2020.
- [15] GALINDO NETO, N.M. et al. **Teachers' experiences about first aid at school.** *Rev Bras Enferm*, v71, s.4, p.1678-82. Disponível em:
- [16] GERHARDTE, T. E; SILVEIRA, D. T. **Métodos de pesquisa.** Porto Alegre: Editora da UFRGS, 2009.
- [17] GRIMALDI, M.R.M. et al. A escola como espaço para aprendizado sobre primeiros socorros. *Rev. Enferm*, v. 10, e20, p. 1-12, 2020. Disponível em: <https://periodicos.ufsm.br/reufsm/article/view/36176>. Acesso em: 02 nov. 2021.
- [18] [http://www.scielo.br/pdf/reben/v71s4/pt\\_0034-7167-reben-71-s4-1678.pdf](http://www.scielo.br/pdf/reben/v71s4/pt_0034-7167-reben-71-s4-1678.pdf). Acesso em: 02 nov. 2021.
- [19] LEVY Y, ELLIS TJ. **A guide for novice researchers on experimental and quasiexperimental studies in information systems research.** *IJIKM*, [S.l.], v. 6, p. 150-161, 2011. Disponível em: <<http://www.ijikm.org/Volume6/IJIKMv6p151-161Levy553.pdf>>. Acesso em: 24 jun. 2020.
- [20] PEDUZZI, M. **Equipe multiprofissional de saúde:** conceito e tipologia. *Rev. Saúde Pública*, São Paulo, v. 35, n. 1, p. 103-109, 2001. Disponível em: <[https://www.scielo.br/scielo.php?pid=S0034-89102001000100016&script=sci\\_abstract&tlng=pt](https://www.scielo.br/scielo.php?pid=S0034-89102001000100016&script=sci_abstract&tlng=pt)>. Acesso em: 20 jun. 2020.
- [21] PEREIRA, K.C. et al. **A construção de conhecimentos sobre prevenção de acidentes e primeiros socorros por parte do público leigo.** *Rev Enferm Cent-Oeste Min*, v.5, n.1, p. 1478-85. Disponível em: <http://www.seer.ufsj.edu.br/index.php/recom/article/viewFile/456/837>. Acesso em: 02 nov. 2021.
- [22] PERGOLA, A.; ARAUJO, I. E. M. **O leigo e o suporte básico de vida.** *Rev. esc. enferm. USP*, São Paulo, v. 43, n. 2, p. 335-342, 2009. Disponível em: <[http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0080-62342009000200012&lng=en&nrm=iso](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0080-62342009000200012&lng=en&nrm=iso)>. Acesso em: 20 jun. 2020.
- [23] PIANA, MC. **A construção do perfil do assistente social no cenário educacional** [online]. São Paulo: Editora UNESP; São Paulo: Cultura Acadêmica, 2009. 233 p. Disponível em: <<http://books.scielo.org/id/vwc8g/pdf/piana-9788579830389-06.pdf>>. Acesso em: 02 mai. 2021.
- [24] PPD, Equipe. **William Glasser.** [Internet], [20-?]. Disponível em: <<http://www.ppd.net.br/william-glasser/>>. Acesso em: 24 jun. 2020.
- [25] RIBEIRO, J. **A importância das cores na comunicação publicitária.** Dissertação apresentada ao IADE - Faculdade de Design, Tecnologia e Comunicação. Universidade Europeia. 2020, 138p.
- [26] SOUSA VD, DRIESSNACK M, MENDES IAC. **An overview of research designs relevant to nursing: part 1: quantitative research designs.** *Rev Latino-Am Enfermagem*, Ribeirão Preto, v.15, n.3, p. 502-507, 2007. Disponível em: <[https://www.scielo.br/pdf/rlae/v15n3/pt\\_v15n3a22.pdf](https://www.scielo.br/pdf/rlae/v15n3/pt_v15n3a22.pdf)>. Acesso em: 24 jun. 2020.
- [27] SOUSA, L.D. et al. **Histórias em quadrinhos nas aulas de produção textual.** *Revista Transformar*, v. 13, p. 54-66, 2019. Disponível em: <http://www.fsj.edu.br/transformar/index.php/transformar/article/view/224/0>. Acesso em: 14 out. 2021.
- [28] TAVARES A.; PEDRO, P; URBANO, J. **Ausência de formação em suporte básico de vida pelo cidadão: um problema de saúde pública? Qual a idade certa para iniciar?** *Rev. Por. Sau., Lisboa*, v. 34, n. 1, p. 101-104, 2016. Disponível em: <[http://www.scielo.mec.pt/scielo.php?script=sci\\_arttext&pid=S0870-90252016000100014&lng=pt&nrm=iso](http://www.scielo.mec.pt/scielo.php?script=sci_arttext&pid=S0870-90252016000100014&lng=pt&nrm=iso)>. Acesso em: 20 jun. 2020.
- [29] TRIPP, David. **Pesquisa-ação:** uma introdução metodológica. *Rev. Educação e Pesquisa*, São Paulo, v. 31, n. 3, p. 443-466, 2005
- [30] VERGUEIRO, W.C.S **Uso das HQs no ensino.** *In: RAMA, Angela; Vergueiro, Waldomiro Castro Santos (orgs.). Como usar as histórias em quadrinhos na sala de aula.* 4. ed. São Paulo: Contexto, 2016. p. 7-30.
- [31] BRASIL, Instituto Brasileiro de Geografia e Estatística. **Censo Demográfico 2010:** características da população e dos domicílios: resultados do universo. Rio de Janeiro: IBGE; 2011

## APÊNDICE C: QUESTIONÁRIO ONLINE

## Questionário Suporte Básico de Vida

## TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO (TCLE)

Eu estou sendo convidado a participar de um estudo denominado: "GESTÃO E PLANEJAMENTO DO SUPORTE BÁSICO DE VIDA: Orientação da Comunidade Escolar da Rede Estadual de Educação do Pará", cujos objetivos e justificativas são: Investigar o impacto das orientações do Suporte Básico de Vida (SBV) na comunidade escolar, compreendendo de que maneira um instrumento didático sobre SBV contribuirá para a orientação de crianças, adolescentes e adultos enquanto multiplicadores dos assuntos acerca deste tema tão importante, assim como a inclusão da Lei Lucas na matriz curricular do Estado do Pará.

A minha participação no referido estudo será no sentido de realizar um questionário sobre o que eu entendo sobre o SBV, sua importância e da aplicação da Lei Lucas.

Fui alertado de que, da pesquisa a se realizar, posso esperar alguns benefícios, tais como: ter conhecimento científico a respeito do Suporte Básico de Vida com linguagem acessível, prevenindo a deterioração do coração e do cérebro, com o intuito de minimizar as sequelas irreversíveis, diminuindo o risco de morte e salvando vidas.

Recebi, por outro lado, os esclarecimentos necessários sobre os possíveis desconfortos e riscos decorrentes do estudo, levando-se em conta que é uma pesquisa, e os resultados positivos ou negativos somente serão obtidos após a sua realização. Assim, como a possibilidade eu não conseguir alcançar os objetivos traçados no estudo e que terei todas as etapas explicadas com linguagem acessível, para me ajudar nisso.

Estou ciente de que minha privacidade será respeitada, ou seja, meu nome ou qualquer outro dado ou elemento que possa, de qualquer forma, me identificar, será mantido em sigilo.

A pesquisadora envolvida com o referido projeto é a Dra. Lena Cláudia Maia Alencar, e com ela poderei manter contato pelo telefone (91) 98121-4788.

É assegurada a assistência durante toda pesquisa, bem como me é garantido o livre acesso a todas as informações e esclarecimentos adicionais sobre o estudo e suas consequências, enfim, tudo o que eu queira saber antes, durante e depois da minha participação.

Os procedimentos utilizados nesta pesquisa obedecem aos Critérios da Ética na Pesquisa com Seres Humanos conforme resolução n. 466/2012 do Conselho Nacional de Saúde (CNS), Brasília/DF. Será garantido o sigilo quanto a sua identificação e das informações obtidas pela sua participação. Considerando a Resolução CNS n. 580/2018. O risco de vazamento de dados será sanado tendo os dados da(o) voluntária(o) identificados com um código, e não com o nome.

A participação nesta pesquisa não traz complicações legais e nenhum dos procedimentos usados oferece riscos à sua dignidade.

Sempre que você desejar serão fornecidos esclarecimentos sobre cada uma das etapas do estudo, através telefone do pesquisador responsável do projeto e, se necessário, por meio do telefone do Comitê de Ética em Pesquisa. A qualquer momento, considerando a Resolução CNS n. 510/2016, você poderá recusar a continuar participando do estudo e, também, poderá retirar seu consentimento, sem que para isto sofra qualquer penalidade ou prejuízo.

Enfim, tendo sido orientado quanto ao teor de todo o aqui mencionado e compreendido a natureza e o objetivo do já referido estudo, manifesto meu livre consentimento em participar, estando totalmente ciente de que não há nenhum valor econômico, a receber ou a pagar, por minha participação.

Caso você possua perguntas sobre o estudo, pode conversar a qualquer hora com a pesquisadora responsável da pesquisa Lena Cláudia Maia Alencar por meio do e-mail [babybelmed@uol.com.br](mailto:babybelmed@uol.com.br) ou, em horário comercial, com o Comitê de Ética e Pesquisa da Fundação Santa Casa de Misericórdia do Pará, no telefone DXX9140092264, e-mail [cep\\_fscm@gmail.com](mailto:cep_fscm@gmail.com) ou pessoalmente, no Centro de Estudo Dr. Carivaldo Boulhosa (Prédio Centenário), Belém-PA.

\*Obrigatório

1. Diante das explicações você acha que está suficientemente informado(a) a respeito da pesquisa que será realizada e concorda de livre e espontânea vontade em participar, como colaborador? \*

Marcar apenas uma oval.

- Sim (Li e CONCORDO em participar da pesquisa)
- Não (Li e NÃO CONCORDO em participar da pesquisa)

## IDENTIFICAÇÃO

Aqui você irá responder algumas perguntas para que possamos te conhecer melhor.

2. QUAL O SEU NOME COMPLETO? \*

\_\_\_\_\_

3. QUAL A SUA IDADE? \*

\_\_\_\_\_

4. QUAL A SUA COR/ETNIA? \*

Marcar apenas uma oval.

- Branca
- Pardo
- Negro
- Outros

5. QUAL O SEU GÊNERO? \*

Marcar apenas uma oval.

- Feminino
- Masculino
- Outro

6. QUAL SEU ESTADO CIVIL? \*

Marcar apenas uma oval.

- SOLTEIRO(A)
- CASADO(A)
- DIVORCIADO(A)
- VIÚVO(A)
- OUTRO

7. QUAL A SUA ESCOLARIDADE? \*

Marcar apenas uma oval.

- Ensino Fundamental Incompleto
- Ensino Fundamental Completo e Médio Incompleto
- Ensino Médio Completo
- Ensino Superior Incompleto
- Ensino Superior Completo
- Pós-Graduação

8. QUAL A SUA PROFISSÃO? \*

QUESTIONÁRIO  
SUPORTE BÁSICO DE  
VIDA

Aqui iremos questionar sobre o que você conhece sobre o Suporte Básico de Vida e seu interesse no assunto.

9. Você sabe o que é Suporte Básico de Vida (SBV)? \*

Marcar apenas uma oval.

- SIM
- NÃO

10. Você sabe identificar uma pessoa em Parada Cardiorrespiratória (PCR)? \*

Marcar apenas uma oval.

- SIM
- NÃO

11. Você sabe fazer Massagem Cardíaca em uma pessoa em Parada Cardiorrespiratória? \*

Marcar apenas uma oval.

- SIM
- NÃO

12. Você sabe qual o número de telefone do Serviço de Emergência em caso de uma Parada Cardiorrespiratória? \*

Marcar apenas uma oval.

- SIM
- NÃO

13. Você já teve alguma orientação sobre Suporte Básico de Vida? \*

Marcar apenas uma oval.

- SIM
- NÃO [Pular para a pergunta 16](#)



QUESTIONÁRIO  
SUPORTE BÁSICO DE  
VIDA

Aqui iremos questionar sobre o que você conhece sobre o Suporte Básico de Vida e seu interesse no assunto.

14. Qual local você recebeu essa Orientação? \*

\_\_\_\_\_

15. Você se sente em condições de prestar socorro em uma situação de emergência? \*

Marcar apenas uma oval.

- SIM
- NÃO

QUESTIONÁRIO  
SUPORTE BÁSICO DE  
VIDA

Aqui iremos questionar sobre o que você conhece sobre o Suporte Básico de Vida e seu interesse no assunto.

16. Você acha importante que o leigo em Suporte Básico de Vida, tenha conhecimento sobre esse assunto? \*

Marcar apenas uma oval.

- SIM
- NÃO

17. Você participaria de um treinamento para Suporte Básico de Vida? \*

Marcar apenas uma oval.

- SIM *Pular para a pergunta 18*
- NÃO *Pular para a pergunta 19*

QUESTIONÁRIO  
SUPORTE BÁSICO DE  
VIDA

Aqui iremos questionar sobre o que você conhece sobre o Suporte Básico de Vida e seu interesse no assunto.

18. Por que você participaria de um treinamento para Suporte Básico de Vida? \*

Marcar apenas uma oval.

- CURIOSIDADE *Pular para a pergunta 20*
- QUERO SALVAR VIDAS *Pular para a pergunta 20*
- QUERO APRENDER *Pular para a pergunta 20*

QUESTIONÁRIO  
SUPORTE BÁSICO DE  
VIDA

Aqui iremos questionar sobre o que você conhece sobre o Suporte Básico de Vida e seu interesse no assunto.

19. Por que você não participaria de um treinamento para Suporte Básico de Vida? \*

Marcar apenas uma oval.

- SEM INTERESSE
- NÃO GOSTO DO ASSUNTO
- SEM DISPONIBILIDADE

QUESTIONÁRIO  
SUPORTE BÁSICO DE  
VIDA

Aqui iremos questionar sobre o que você conhece sobre o Suporte Básico de Vida e seu interesse no assunto.

20. Você gostaria de receber uma Ferramenta Educativa sobre Suporte Básico de Vida? \*

Marcar apenas uma oval.

- SIM
- NÃO

# Evaluation of Passive Fire Safety Methods in Hostel Building: A Case Study of Bells University Male Silver Hostel

Abass A. D, Olagunju Omotawurayo, Olajide Paul, Adeogun Erioluwa, Adeyemo Adeola, Muhammed Maryam, Ilugbekhai Chinonso, Iyare Oluwafemi

Department of Architecture, Bells University of Technology, Ota, Ogun State

Correspondence email: [adabass@bellsuniversity.edu.ng](mailto:adabass@bellsuniversity.edu.ng), [tawuraolagunju@gmail.com](mailto:tawuraolagunju@gmail.com)

Received: 01 Aug 2022,

Received in revised form: 25 Aug 2022,

Accepted: 01 Sep 2022,

Available online: 11 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** Fire protection, Hostel building, Passive fire, Fire safety, Property

**Abstract—** When a fire breaks out, there is very little opportunity to flee. In minutes, a fire can grow and sometimes double in size. A fire can blaze out of control in less than 30 seconds, filling the region with heat and poisonous, thick black smoke, resulting in the loss of lives and property. This makes fire safety an important factors in build services. Fire safety methods play an aspect role in improving the structural stability of buildings during a fire. Student hostels require a fire protection system capable of protecting all residents from fire hazards. This study evaluates passive fire safety methods in hostel buildings. The study would provide first-hand information on the building and evaluate passive fire safety measures put in place. The study utilises qualitative analysis (observation method). Findings revealed that passive methods of fire safety implemented in the hostel building were not adequate to meet the standard building regulations. Thus, in the course of fire only active measures that are fully installed will aid the stoppage of fire. This study recommends that adequate passive fire protection measures should be implemented at the design stage to reduce the lost of lives and properties in the course of fire.

## I. INTRODUCTION

The frequent fire outbreaks in several buildings around the world, the issue of building fire safety has recently gained a lot of attention. Buildings can sustain substantial damage, their contents can be destroyed, and in extreme situations, the occupants can be killed. (Obasa, Mbamali, & Okolie, 2020). As a result, such a huge risk to humanity needs the immediate attention of all relevant parties in order to minimize this risk. The use and control of fire advanced man, bringing many benefits to man in a variety of ways; however, the multiple benefits of fire are sometimes overshadowed by its massive devastation capacity. As a result, despite current fire prevention

methods, it is widely assumed today that fire danger cannot be eliminated.

Fire is a possible life hazard in every structure, and it has the ability to cause a worst-case situation if sufficient fire control system is not in place to prevent fires. Building fire safety procedures are part of fire protection system, which aims in the reduction of fire risk to an acceptable degree through fire disaster prevention and mitigation. It is concerned with the adoption of both passive and active steps to limit the risk to life, damaging property, and ecological effects. A good protection system design is required so that the building is "alert" in the event of a fire and fire losses are minimized, particularly in public facilities and buildings that house a large number of

people. The consistent rise in fire-related incidents in student hostels emphasizes the importance of hostel administration and students following measures that ensure total protection of lives and property. The passive fire protection systems in the hostel structure are being investigated at Bells University of Technology Male Silver Hostel in Ota. The hostel has one hundred and eight (108) rooms, sixteen (16) utility spaces, six (6) common rooms, six (6) public bathrooms, one (1) hostel cafeteria, (one) 1 hostel office, and (one) 1 porter's lounge. The hostel has a capacity of six hundred and five (605), including students and porters. Electrical fires can occur in a hostel building due to faulty electrical outlets, the use of ungrounded plugs, the misuse of extension cables, the overloading of light fixtures, and the use of outdated wiring.

## II. LITERATURE REVIEW

A fire is a state, process, or occurrence of burning in which fuel or another component is lit and mixed with oxygen, producing light, heat, and flame. (Dictionary.com, LLC, 2022). This is due to the relatively weak chemical bonds in the oxygen molecule, and the new bonds formed are more stable, resulting in net energy production. A chain effect involving dioxygen in the environment and fuel often causes fire (wood or gasoline, for example). Wood and gasoline, of course, do not impulsively catch fire just because they exist in the presence of oxygen. To initiate the combustion reaction, the fuel must be heated to its combustion point. Because the design and use of a hostel accommodate a large number of people, efforts should be made to prevent the occurrence in such a facility. A student hostel is a structure used by educational institutions to house their enrolled students (Ayuba, Abdul, & Abdulrahman, 2018).

The research on fire disaster reasons leads us to the substantial result that dramatic rise in fire accidents in universities and other types of learning may be attributed to a variety of variables. Arson is an aspect, which is defined as an intentionally fire set by a person or a crowd on either confidential or general properties, often in opposition or retaliation against organizations or authority.. Some fires are started maliciously by people who want to express their displeasure or cause destruction. Secondary school fires in Kenya were started by arsonists as a form of protest against the school administration (Alade & Abdullahi, 2022). Defective electrical connections, the employment of incompetent electrical engineers or workers during implementation, the use of inferior electrical components to save money, overloading of electronic devices, and improper electrical

wire servicing are the top causes of electrical fires. Other causes include the reckless usage of gasoline and naked flames such as candles, as well as filling a petromax while the lamp is already lit. (Alade & Abdullahi, 2022). On a Thursday evening, for example, a fire broke out in the ladies' dorm of Offa Primary School in Kwara State's Offa Local Government Area, burning six rooms and other belongings. (Oyekola, 2020). These are just a few of the reasons why fire safety measures are so important in hostels.

Fire safety refers to the arrangement and plotting of infrastructure focus at decreasing the threat of fire or limiting the fire from spreading when it does occur. Fire safety includes the use of noncombustible building material, secure workplace application, fire protection training, fire protective gear, and other activities. The following are examples of fire safety measures:

- Guaranteeing that building codes are followed (International, national or local).
  - Guaranteeing adherence with fire code requirements (exists, stairs, distinguishing features and road signs, etc.) complying with electrical safety laws .
  - Fire risk evaluations whenever a construction, equipment, or operation is changed.
  - Improved stowage of highly combustible and toxic substances.
  - Construction of fire detection and automated or semi-automated fire alarm systems.
  - Sorting of appropriate forms of operational firefighting equipment and hydrants (Pontip, Ahmed, Erekpitan, & Detur, 2020)

Two types of fire prevention tactics are employed to achieve the goals: active and passive fire protection measures.

An active fire protection system is an inactive technique that must be initiated in the event of a fire in order to operate properly (steam rings around flanges, activation of water spray systems, sprinkler systems, deluge systems, fire water monitors, ). Passive Fire Protection measures are incorporated into the construction to offer solidity into the walls and floors, separating the building into sections with dangers or compartments. Such security is either gotten from by the materials used to construct the structure or is added to the building to enhance its fire resistance. The researchers are evaluating the passive fire prevention methods implemented at Bells University of Technology's Silver Hostel.

Plan of environment is a major passive prevention method. A plan of the premises (preferably in A4 page

format) should be exhibit at or near the approach point , noting the area of: stairways and escape paths, fire prevention infrastructure such as sources of water, first aid firefighting equipment, gasoline and electricity supply shut-off points, containers of gas tanks as well as other dangerous chemicals, the control panel for the automated detection and alarm system, and any ventilation system manage devices. During an occurrence of fire in a building, it produces a huge amount of smoke and fumes. Within a building, smoke and hot gases can travel vast distances and constitute a direct threat to human life. Escape routes must be provided to allow the occupants to reach safety. They must be sufficient and cable of being utilized safely and functioning at all times. Tall building escape routes should be adequately structured to allow residents to pause briefly while evacuating, to reduce the threat of smoke within stairs, and to serve as a staging place for firefighting actions. When analyzing the means of escape, it is vital to analyze the evacuation process. As indicated below, the evacuation procedure can be separated into numerous stages:

Phase 1: Evacuate the area or room to a common corridor, a safe stairwell, or a final exit.

Phase 2: evacuate through a common hallway to a protected stairway or a final exit; and

Phase 3: evacuate vertically by a protected staircase to a final exit and a predetermined assembly site.

Moving laterally away from the danger of the fire is part of Phases 1 and 2, while moving vertically from the top levels is part of Phase 3. Vertical transportation is frequently accomplished by secure stairways to a safe point outside the facility. An outdoor escape stairs may be used to evacuate the building(Elhefnawi, 2020). Except in the event of a tiny institution, which may be served by a single evacuation stairway under certain conditions, each storey of the structure should have at least escape routes. This measure is predicated on the likelihood that one of the emergency exits may be rendered inoperable in the event of a fire. Diverse and unconnected fire exits from a storey should exist. Aside from having at least two escape routes from each storey, escape pathways should be wide enough to allow for the removal of the population occupancy of the rooms or areas they serve, with a minimum width of 6 ft (1830 mm). In order to function as a means of escape, moving span one through an escape path from any position in a structure should be limited to the degree determined by the availability of different escape paths. A distinction is made for this purpose between: - travel from any site where escape is only possible in one way (commonly referred to as dead-end travel); and - travel from any location where escape is

feasible in numerous ways, using a different escape paths. Vertical fire exits are parts of the escape routes that connect the upper stories of the building to a safe refuge in the open air on the first floor. Vertical fire exits should be through fire-resistant stairwells in the structure. The enclosure to the stairwell at all storeys is protected, as is the provision of protected lobbies between the stair enclosure and the lodging, if necessary. An exterior evacuation stairway may be the only viable option for offering an alternative method of escape from a structure in some instances. Vertical escape routes must be protected from smoke and fire by enclosing them in fire-resistant architecture. Stairway protection also helps to keep fires from spreading between stories. To reduce smoke entry, doorways leading into a protected stairwell must have self-closing fire doors, according to fire resistant construction requirements. A protected hallway between the stair enclosure and the housing may be necessary in rare cases, such as when a structure is served by one stairway. Doors from rooms is advised to not, in general, open directly into exit stairwells. Only shielded corridors or lobbies should be used to connect rooms to the escape stairways. A toilet or bathroom, on the other hand, that is not used to store flammable components but may include a water heater and is disconnected from the rest of the building by fire-resistant architecture, may detach directly to the stair surroundings. Circulation paths in a storey should be kept as far away from escape stairways as possible. Emergency exit stairways should lead directly to a safe location on the ground in the open air. Fire doors, an important part of fire safety, are provided to limit the growth of fire and smoke within a structure. They are utilized in compartment wall openings and the enclosures of protected stairways and lifts. They are also common through and across a safe escape path. Fire doors with minimal standard fire periods of 30 and 60 minutes, accordingly, are designated by the door types FD30S and FD60S, and are fitted with cold smoke seals. (Building Control Alliance , 2013). The minimum room height is 300cm, and it must have a fire-resistant door that can withstand a 2 hour fire. A "safety zone," also known as a Fire Assembly Point, is an essential component of any emergency response plan. In order to give an easy location in the event of an emergency, it should be well-known and well marked. The Muster Point should be located far enough away from the structure to give heat and smoke protection in the case of a fire, but not so distant that it discourages from using it (Best Practice Guidance, 2018). Employees, guests, and building users should not be endangered by emergency vehicles responding to the event or by general/other traffic in the area, hence Fire Assembly Points should be directed away

from car access routes leading to the building. Fire Assembly Points should ideally be positioned so that they do not need crossing a road or going through busy areas..

### III. METHODOLOGY

The hostel appears to be located at the intersection of the silver female hostel and the male bronze hostel. The male silver hostel is a 3-floor facility with 108 rooms and a

variety of workspaces including the Bells consult, portal office, media room, and so on. This is an important survey that looks at data on passive fire measures used by built environment professionals to put out the fire in the men's silver hostel. The audit variables and signs show explicit data obtained from Google Maps indicating the existing developing region surrounding the hostel facility, as well as fundamental data obtained from field findings.

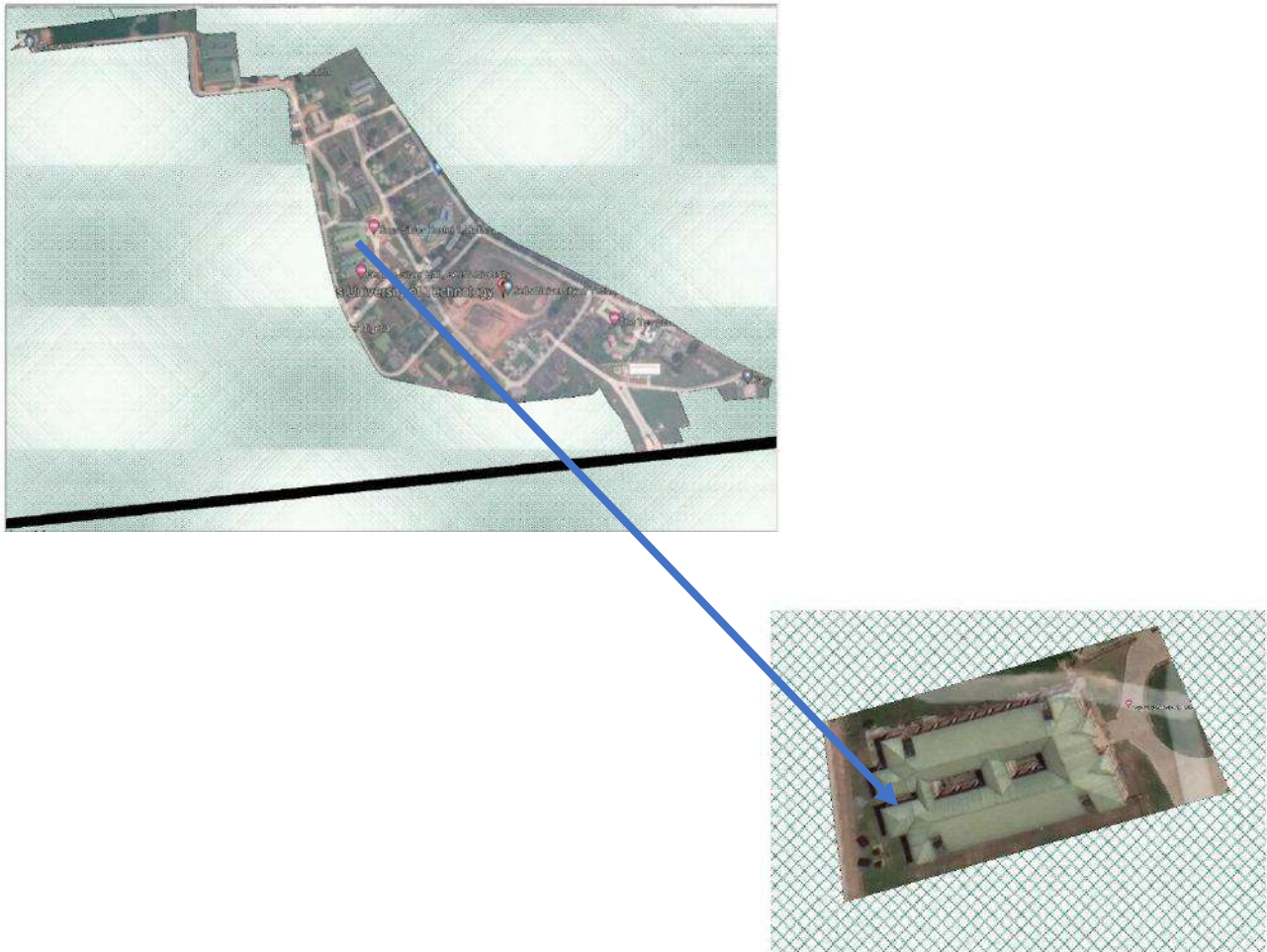


Fig.1: Layout of Bells University of Technology Ota showing the male Silver Hostel in Bells University

Source: Googlemap, 2022

### IV. RESULTS AND DISCUSSION

**Firewall:** It is a non-combustible fire separator that subdivides a structure or divides neighbouring structures to resist fire growth and has a fire-resistance rating as specified in this code as well as strength to maintain intact under fire circumstances for the required fire-rated period. Geopolymer bricks can be manufactured to be fire resistant. As a result, high-calcium fly ash geopolymer

may be employed as a fire-resistant material. (Iverson, 2017)

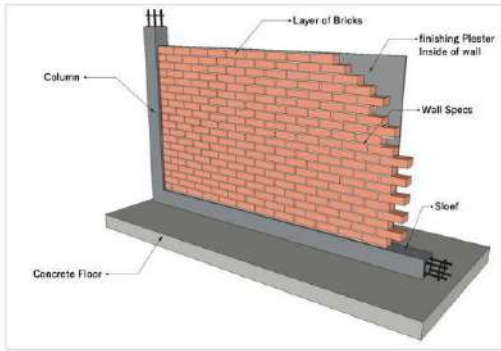


Fig.2: Traditional plastered brick wall as a means of passive fire protection

Source: Thermal Environment Control of Buildings using Installation of Plants and Metal Panels on Brick Walls,2021



Plate 1: Hostel perspective indicating the entrance through the access road

Source: Author's Fieldwork, 2022

It is suggested that Bells University administration should consider the arrangement of neighborhood-based fire apparatuses and educate individuals both staff and student on the proper manner of dealing with or utilizing bare fire and electrical apparatuses

The concentrate is thusly close by suggesting improvement of hostel fire preventive and control limits through legitimate instruction, sponsoring expenses of dynamic fire gear, and upholding consistency with the different structure security codes during the plan, development, and control of structures.



Plate 2: Image of First Floor plan of Silver ostel, Bellstech

Source: Author's Fieldwork, 2022

Fire entrances are important passive fire measures of fire protection framework and should generally be kept shut. The occupant ought to be made mindful of the fundamental job that such entries play, and of the significance of not setting or wedging them open. This message ought to be underscored by suitable "Fire Door-Keep Shut" signs shown on each fire entryway. A fire exit means by which evacuation is directly out of the hostel

facility should be utilized if there should be an occurrence of fire. Any construction with steps higher than three stories needs no less than two crisis passageways with a most extreme distance of 25 meters from all spots of individuals in a design block. The crisis exit should be flame resistant for roughly 2 hours, with programmable locking and advance notice signs situated at the highest point of the entry page. In the silver hotel, there is a

degree of criticality, and it does not relate to the essentials of the degree of the fire incidence. The crisis steps incorporate fire doors. However, the fire doorways in the design use steel materials that are not heat-resistant and not appropriate for use as fire doors.



Plate 3: Image showing the fire escape door, brick wall, and escape staircase in the building.

Source: Author's Fieldwork, 2022



Plate 5: Image of Escape Staircase in the building

Source: Author's Fieldwork, 2022



Plate 4: Image showing the escape route

Source: Author's Fieldwork, 2022

In the event of an emergency, tenants should be able to leave the silver hostel premises quickly and safely to a muster point via pathways that are safe from fire, smoke, and deterrents.. This must be accomplished through the fire escape route and staircase departure courses are unhampered. The fire doors should be kept shut as required and not be used as a normal through fare.

Table 1: Fire Resistance Rating

| Location                             | Fire resistance rating hours |
|--------------------------------------|------------------------------|
| Enclosures for exit access corridors | 1                            |
| Fire partition wall and fire wall    | 1. 2                         |
| Fire brick wall                      | 1. 4                         |
| Fire door                            | 1.5                          |
| Aluminum roof                        | 2- 4                         |

Source: Author's Fieldwork, 2022

An "electrical fire" is another hazard that can cause a fire. It is not simply a fire that started in an electrically powered device. If this were the case, an electric hob fire caused by overheating or improper wiring would be

classified as an electrical fire, which it is not. An electrical fire, on the other hand, is a fire that is directly caused by the flow of electric current or by static electricity.



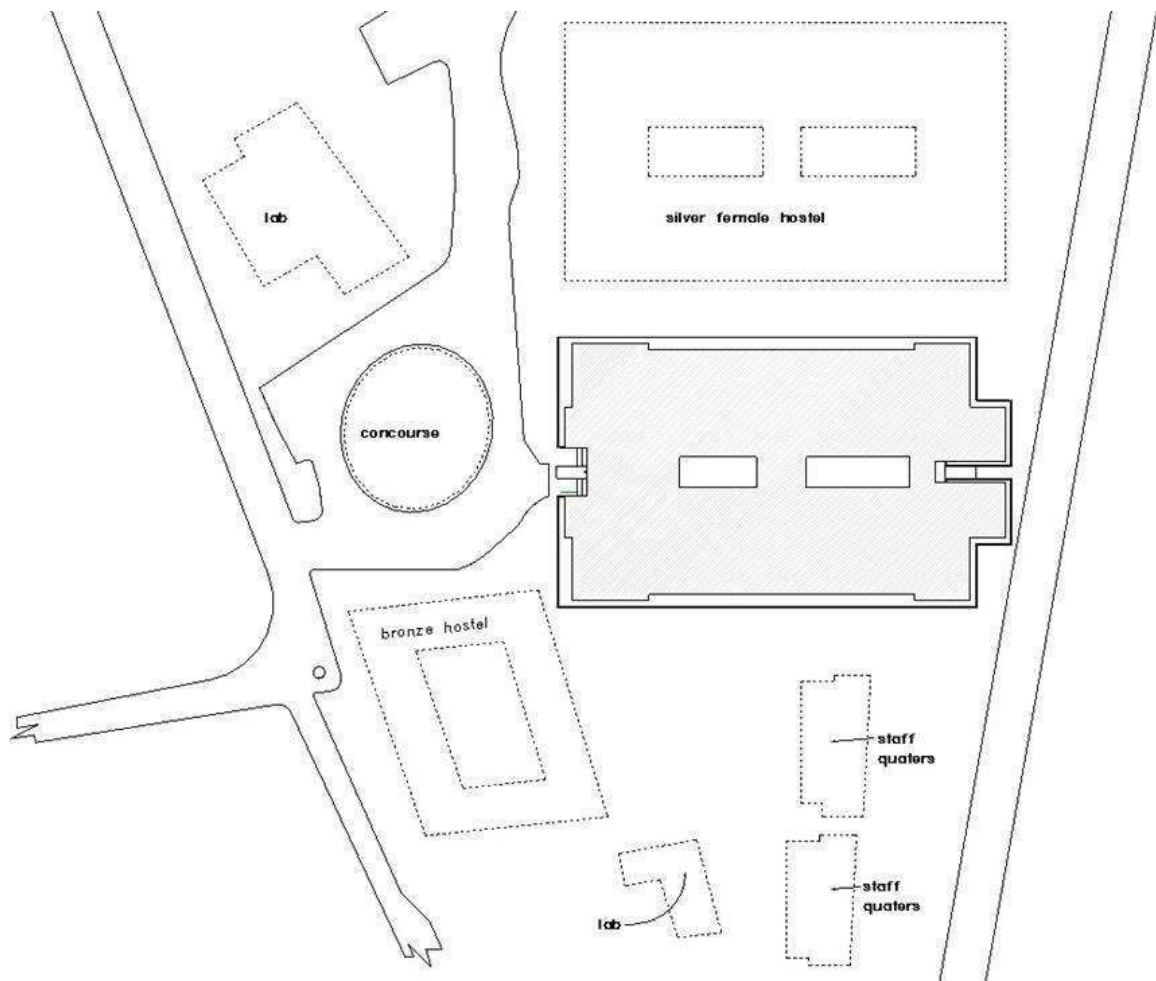
*Plate 6: Image Showing Existing Exposed Electrical Control Box Imposing Risk to the Occupant of Silver Hostel Facility, Bellstech*

Source: Author's Fieldwork, 2022

The silver hostel is 65 meters long but has entrances and exits at both ends. This is contrary to the recommended maximum crisis. A crisis leaves a stepping stool, which is a safe move toward sitting tight in the event of a fire. According to Minister of Public Works Regulation No.

45/PRT/M/2018, each state should have at least two crisis estimates that work with a few stories and a maximum distance of 30 m). At or near the entry, a layout of the premises (ideally an A4 page design) should be displayed.





*Plate 7: Image Indicating the Existing Facilities' Ambient Environment*

Source: Author's Fieldwork, 2022

The floor plan indicates the fire escape route of flights of stairs and getaway courses, The asphalt road behind the hostel and the water ladder should have a minimum width of 6 meters, a foot of 15 meters, and a foot of 4 meters at the dividing crossbar for the transfer of bombs. The distance between silver hostel and adjoining buildings is less than the recommended minimum distance of six

metres. Roof radiation dampers safeguard pipe infiltrations, which enter the roof film of an imperviousness to fire evaluation. It is just through the appropriate development and security of openings or entrances that an imperviousness to fire evaluated gathering can do what it is expected to do.

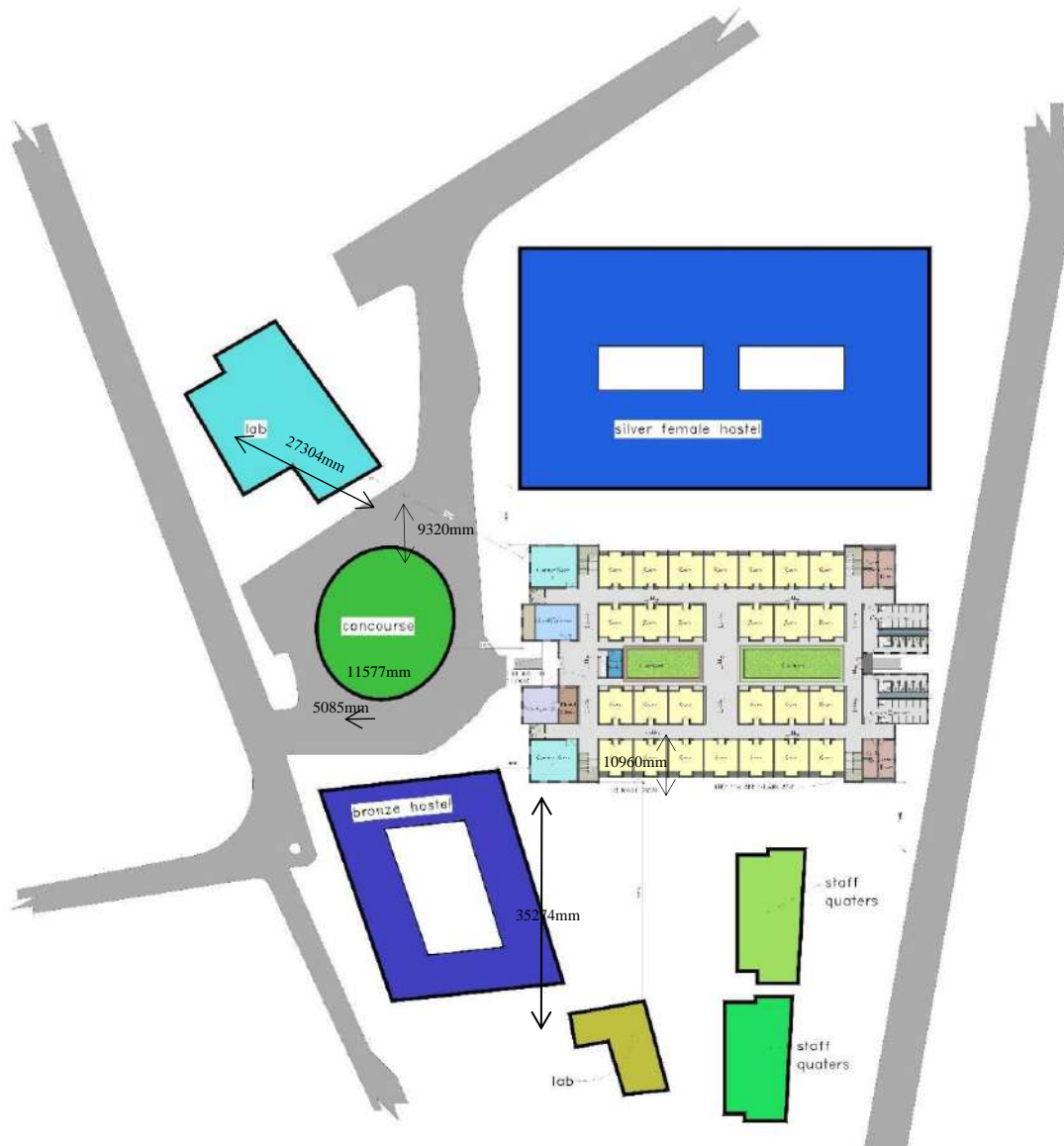


Plate 8: Showing the Distance Between Silver Hostel to the Surrounding Building

Source: Author’s Fieldwork, 2022

The distance between the bar and the surrounding structures satisfies fire safety principles. The structures are separated by 9.3 meters in the north, 6.0 meters in the east, 10.9 meters in the south, and 11 meters in the west. Site design is a direct game plan for preventing and mitigating fire hazards, and it includes design planning and execution, design division, nursery hydrant placement, open space placement, and other elements. The blacktop on Main Street should be the primary environment through which fire engines travel. The path should be made clear at all stages of development (except classes 1, 2, and 3).

to the firing motor. The black-top layer should constantly be liberated from metal boundaries, blocks, or layers that aid in the stacking of gear.

## V. CONCLUSION

The male silver hostel is the sole structure where the buildings are fewer than 6 meters apart, while the male silver hostel has various fire safety measures that do not satisfy the required standards, such as the staircases being more than 15 meters away, which is less than the 6 m interbuilding distance. There are two emergency staircases in the hostel and one emergency door made of non-fire rated material on the hotel building. The suggestions include expanding the middle of the structure with stairs to accommodate more pupils and changing the emergency door to one made of fire-resistant material.

## VI. RECOMMENDATION

This study recommends that fire-rated doors should be allocated at both ends of the existing fire escape stairwells. This has been identified in plate 7 has AA and BB. Furthermore, the fire escape door used in the building is not up to standard, fire-rated doors is what should be implemented. Creating a comprehensive fire safety system starts with the basic passive protection elements required by law. Fire-rated doors in hotels are imperative to keeping students safe and allowing them to safely evacuate the building in the case of an emergency. Fire doors play an important part in the passive safety of hotel employees and guests. Standard fire ratings range from 20 to 180 minutes, depending on code criteria. Fire-rated doors must be self-closing and firmly latching. To preserve the means of egress, they must remain closed during a fire.. We also noticed that the stair wells are not fire rated. We noticed that there was no allocation of a muster point in the building design. Even in the midst of an emergency, the muster point guarantees that everyone knows where to congregate. The location should be safe and free of additional dangers from the work site. Muster stations also make it easier to conduct head counts and other measures that need everyone to congregate in one location. Muster stations enable supervisors or other designated individuals to conduct a roll call in order to locate any missing employees who may still be present.

Furthermore, the administration of Bells University should examine the placement of neighborhood-based fire apparatuses and educate individuals on the correct mentality for dealing with or using bare fire and electrical apparatuses on the job site following the evacuation.

## REFERENCES

- [1] Alade, E. I., & Abdullahi, A. G. (2022). Application of Cause-and-Effect-Analysis for Evaluating Causes of Fire Disasters in Public and Private Secondary Schools in Ilorin Metropolis, Nigeria. *Archives of Current Research International*, 11.
- [2] Alao, M. K., Yahya, B. M., Wan Yousuf, B. W., Aliu, Ibadayo, & Ukpoireghe. (2020). Fire Safety Protection and Prevention Measures in Nigeria office buildings . *International Journal of Management and Humanities (IJMH)*, 7.
- [3] Ayuba, P., Abdul, C., & Abdulrahman, M.-H. (2018). Post-Occupancy Evaluation of Students Hostel Facilities in Federal Universities in North Central, Nigeria. *Scientific and Academic Publishing*, 5.
- [4] Best Practice Guidance. (2018). *Choosing a Fire Assembly Point*. Produced in Partnership with Lincolnshire Fire & Rescue .
- [5] Building Control Alliance . (2013). FIRE DOORS IN DWELLINGS. *BCA Technical Guidance Note 9*, 3.
- [6] Dictionary.com, LLC. (2022). *Dictionary.com*. Retrieved from <https://www.dictionary.com/browse/fire>
- [7] Elhefnawi, M. (2020). *ESCAPE ROUTE DESIGNS AND SPECIFICATIONS FOR OFFICEBUILDINGS – “CCIAT” BUILDING AS A CASE STUDY*. BAU JOURNAL - CREATIVE SUSTAINABLE DEVELOPMENT.
- [8] Ivison, J. T. (2017, January 5). *Fire Protection Engineer and code consultants*. Retrieved from Design and Construction of Firewalls: <http://www.johnivison.com/design-and-construction-of-firewalls/>
- [9] Kuligowski, E. D., Peacock, R. D., Reneke, P. A., Emily, W., Hagwood, C. R., Overholt, K. J., & Elkin, R. P. (2015). *Movement on Stairs During Building*. NIST Technical Note 1839 .
- [10] Obasa, O., Mbamali, I., & Okolie, K. (2020). *Critical Investigation of Causes and Effects of Fire Disaster on Building in Imo State*. IOSR Journal of Environmental Science, Toxicology and Food Technology ).
- [11] Oyekola, T. (2020). *Fire guts school hostel in Kwara, destroys apartments*. Retrieved from Punch: <https://punchng.com/fire-guts-school-hostel-in-kwara-destroys-apartments/>
- [12] Pontip, S., Ahmed, U., Erekpitan, O.-A., & Detur, G. (2020). An evaluation of fire safety measures in high-rise buildings in Nigeria. *Sustainable Cities and Society*, 3.

## Multiprofessional action towards workers' health:

### Literature review

## Atuação multiprofissional frente a saúde do trabalhador:

### Revisão de literatura

Gleison Faria<sup>1</sup>, Francisco Leandro Soares de Souza<sup>1</sup>, Dhieniffer Naiara da Silva<sup>1</sup>, Gesnaquele Souza da Cruz<sup>1</sup>, Alexandra Alves de Carvalho<sup>1</sup>, Márcia Gisele Peixoto Kades<sup>1</sup>, João Paulo Santos Carvalho<sup>1</sup>, Claudio Henrique Marques Pereira<sup>1</sup>, Suzana Nogueira<sup>1</sup>, Taís Loutarte Oliveira<sup>1</sup>, Juliana Peixoto dos Santos<sup>1</sup>, Rogério Krause<sup>1</sup>, Douglas Basso Sales<sup>1</sup>, Hayslla Mikaella do Couto Araujo<sup>1</sup>, Juliana Alves Rodrigues<sup>1</sup>, Cleverson de Oliveira Santos<sup>2</sup>, Karolaine Oliveira Ferreira<sup>2</sup>, Francielly Maira Bordon<sup>3</sup>, Wellington Ferreira de Souza<sup>3</sup>, Eliza Aparecida Javarini Alves<sup>3</sup>, Renata Gatto de Moraes<sup>3</sup>, Rhamayana Maria da Conceição<sup>3</sup>, Shayanne de Sousa Silva<sup>3</sup>, Valdair Nunes do Nascimento<sup>3</sup>, Giselen Maleski Cargnin<sup>4</sup>, Marco Rogério da Silva<sup>5</sup>, Alan Vieira Lopes campos<sup>6</sup>, Sarah Gabrielle dos Santos Pacífico Campos<sup>7</sup>, Mateus Duarte Vieira<sup>7</sup>, Hingreedy Fischer da Silva<sup>7</sup>, Welesmar Barros dos Santos<sup>7</sup>, Cleitineia da Silva Souza<sup>7</sup>

<sup>1</sup>Graduated/Undergraduate student at Unifacimed-Faculty of Biomedical Sciences of Cacoal – FACIMED – RO, Brazil. Email: [gleisonfaria@hotmail.com](mailto:gleisonfaria@hotmail.com)

<sup>2</sup>Graduated from Higher Education in Cacoal, FANORTE, Rondônia, Brazil

<sup>3</sup>São Lucas University Center, Ji-Paraná, Rondônia, Brazil

<sup>4</sup>Nurse at the Claretian University Center - CEUCLAR - Porto Velho – RO

<sup>5</sup>Nurse at the University of Vale do Rio dos Sinos – UNISINOS - São Leopoldo, Rio Grande do Sul, Brazil

<sup>6</sup>biochemist from Faculdade São Paulo, Rolim de Moura, Rondônia, Brazil

<sup>7</sup>Nursing student at Universidade Paulista, Jí - Paraná, Rondônia, Brazil

Received: 07 Aug 2022,

Received in revised form: 02 Sep 2022,

Accepted: 06 Sep 2022,

Available online: 12 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— Occupational care, worker's  
health and occupational risk.

**Palavras chaves** - Cuidado ocupacional,

**Abstract**— Professionals face various environmental, physical, mental risks, accidents and occupational diseases, and often face inadequate working conditions. The aim of this study is to describe the multiprofessional role in workers' health. The methodology is a narrative review of literature with an approach of exploratory, observational, retrospective studies that were searched in the literature 23 articles between 2010 to 2022. Results: Within an organization, the presence of nurses, doctors, physiotherapists, biochemists and other professionals can give employees greater security and better performance in their functions, as they must be monitored and must gain confidence where they can count on a professional nurse always available. Professionals face various environmental, physical, mental risks, accidents and occupational diseases, and often face inadequate working conditions. The health of the worker

**saúde do trabalhador e risco ocupacional.**

started to be seen in a worrying way when men realized the link between work and illness, which has existed since antiquity. Occupational nursing focuses on caring for workers, especially those who care about work. It is concluded that the ideas presented in this study lead to the conclusion that the multidisciplinary work of occupational health is extremely important in promoting the health and well-being of workers, as it has the technical knowledge and can act in the prevention of accidents and occupational diseases.

**Resumo**— Os profissionais enfrentam diversos riscos ambientais, físicos, mentais, de acidentes e doenças ocupacionais, e muitas vezes se deparam com condições inadequadas de trabalho. O objetivo deste estudo é descrever o papel multiprofissional na saúde do trabalhador. A metodologia trata-se de um estudo de revisão narrativa de literatura com abordagem de estudos exploratórios, observacionais, retrospectivos que foram buscados em literatura 23 artigos entre 2010 a 2022. Resultados: Dentro de uma organização, a presença de enfermeiros, médicos, fisioterapeutas, bioquímicos e entre outros profissionais pode dar aos colaboradores maior segurança e melhor desempenho nas suas funções, pois devem ser acompanhados e devem ganhar confiança onde podem contar com um enfermeiro profissional sempre disponível. Os profissionais enfrentam diversos riscos ambientais, físicos, mentais, de acidentes e doenças ocupacionais, e muitas vezes se deparam com condições inadequadas de trabalho. A saúde do trabalhador passou a ser vista de forma preocupante quando os homens perceberam a ligação entre trabalho e doença, que existe desde a antiguidade. A enfermagem do trabalho tem como foco o cuidado aos trabalhadores, principalmente aqueles que se preocupam com o trabalho. Conclui-se que as ideias apresentadas neste estudo levam à conclusão de que o trabalho multiprofissional da saúde do trabalho é de extrema importância na promoção da saúde e bem-estar dos trabalhadores, pois ele possui o conhecimento técnico e pode atuar na prevenção de acidentes e doenças ocupacionais.

## I. INTRODUCTION

Occupational care can be understood as a health area that focuses on the well-being and quality of life of workers, in order to reduce short, medium and long-term damage to their health, helping in the recovery of people with disabilities. occupational diseases. seeking rehabilitation to return to work as soon as possible (SILVA, 2018).

Within an organization, the presence of a multidisciplinary team can give employees greater security and better performance in their functions, as they must be monitored and must gain confidence where they can count on a professional nurse always available. Support them when needed and guide them on these issues. Conducting accident prevention campaigns, facilitating lectures and training, identifying problems, seeking solutions and providing first aid in the event of an accident are all steps that nurses must take (SOUZA et al., 2021).

Decision of the labor legislation on occupational safety and medicine contained in Ordinance 4 (NR-4) stipulates that public or private companies with employees subject to the Harmonization of Labor Laws (CLT) must maintain the Services of Professional Safety Engineering and Occupational Medicine Work - SESMT. Promote health and protect the integrity of workers in the workplace (PINTO, WINDT and CÉSPEDES, 2010).

Professionals face various environmental, physical, mental risks, accidents and occupational diseases, and often face inadequate working conditions. Regardless of the angle discussed, the involvement of the health sector is necessary to intercept, prevent, control and eliminate work-related occupational diseases and causes of death caused or aggravated by interference in work/occupation and pre-existing diseases (OLIVEIRA-JUNIOR AR et al. ., 2014).

The relevance of the chosen theme is due to a genuine need for a more concise theoretical understanding of the field of occupational nursing, with a particular focus on the role of occupational nurses in maintaining workers' health.

The role of the multidisciplinary team (doctors, nurses, physiotherapists, biochemists, among others) will be addressed in actions aimed at worker health, in order to guarantee the prevention of accidents, expose the possible risks existing in the work area and guide how to proceed in the future. the need for emergency care. With this understanding, it is possible to employ adequate measures in the execution of the work to protect the health of the worker, through the prevention of occupational diseases in their specificities and particularities related to the environment and the type of risk that the work offers.

This is a bibliographic study and the articles selected for research were searched in the following databases: VHL, Scielo, Lilacs and Google Scholar. Monographs and master's dissertations on the subject are also used, as well as textbooks in the area of occupational health and nursing. Data selection was based on the following descriptors: occupational care, worker health and occupational risk. The articles used addressed occupational risks, described the participation of nursing in workers' health and discussed the importance of preventing occupational diseases, based on the regulations in this area.

The objective of this study was to describe, through a bibliographic review, the actions carried out by multi-professionals in the worker's health to prevent accidents and occupational diseases.

## II. RESULTS AND DISCUSSION

### Work nursing

It is understood as a branch of public health that uses the same methods and knowledge used in the field to promote the health of workers; protect against risks arising from work activities; and protect against chemical, physical, biological and psychosocial factors; maintain their health with a higher degree of physical and mental health and rehabilitation of injuries, occupational or non-occupational diseases and labor rehabilitation (SILVA, 2005; SOUZA et al., 2021).

The health of the worker started to be seen in a worrying way when men realized the link between work and illness, which has existed since antiquity. With the advent of industrialization, interest grew in improving industrial productivity with a focus on worker health. In Brazil, this most prominent problem did not arise until the end of the 19th century. However, the importance of

occupational care was only recognized by companies in the 1970s, given the high number of accidents that occurred in the work environment (AZEVEDO, 2010).

Occupational nursing focuses on caring for workers, especially those who care about work. Its attention turns to workers of all occupational categories and sectors, regardless of their situation or location. Continuously seeking the well-being of workers and seeking to meet their needs while minimizing work-related harm is one of the main objectives of occupational care and plays a role in promoting, preventing and restoring health. The prevention of ergonomic risks and other health problems through individual and collective actions becomes possible when the nursing professional considers his work focused on the health of the worker (DIAS, et al., 2018).

Professionals with a postgraduate degree in occupational nursing are responsible for assisting workers, promoting and ensuring the health of workers, in addition to encouraging the prevention of accidents and occupational diseases and providing assistance to the injured and sick (SILVA; SECCO, et al. 2011 ).

Nursing in the field of worker health is responsible for education to help improve working conditions that are essential for workers to achieve quality of life. This area of action includes the systematization of the entire care process (history, diagnosis, planning, intervention and evaluation, as well as specific measures for workers' health – preventive, protective and rehabilitation measures). The application of this system provides a survey of the real and/or potential health needs of workers (SILVA; SECCO et al. 2011).

According to Silva; Secco et al. (2011), according to the Ministry of Labor and Employment, occupational nurses carry out hygiene, medicine and safety activities to enhance the health of workers. It is up to this professional to observe the safe and dangerous conditions in the work environment, make the observations and draw up with the SESMT team (if the company has, if there is no CIPA) a safety model to protect the health of employees. For example, an investigation of the frequency of illness/accidents and traumatic injuries affecting employees in a department reflects the need for special attention to avoid reporting additional cases. Therefore, the prevention of new events is up to the medical team (OLIVEIRA-JUNIOR AR et al., 2014).

### Worker doctor

Although many people only associate a professional doctor with regular checkups, he is much more than that. He is responsible for taking care of the health of workers, assessing occupational risks, recommending changes to the company and evaluating the frequency of each employee

to verify the impact of the role on their health. Every job has its risks. Specific risks that must be identified. It can be slightly loud noise, heat, cold, harmful substances such as bacteria, fungi and chemicals. Faced with these risks, we have to take some measures, some care, so that these situations do not cause damage or problems to the health of workers (SMCC, 2019).

Occupational physicians are responsible for administering the occupational medicine control program. This means that it will determine how often patients should be monitored and when regular checkups should be performed based on each specific risk. "Such periodic inspections can be done every six months, annually, or sometimes, depending on the risk, every two years. Ideally, this period should not be too long so that we are always in contact with our workers and always able to analyze the progress of their services and the relationship between their work and health (SMCC, 2019).

#### Worker physiotherapist

Occupational physiotherapists have become increasingly important in the industrial environment, always aiming to improve the worker's quality of life and prevent musculoskeletal injuries. The result of this intervention is an improvement in performance and productivity at work (BAÚ & KLEIN apud BARBOSA & MEJIA, 2018). Acting in the implementation of ergonomic programs, occupational kinesiotherapy, rehabilitating workers on leave due to RSI/WRMD, bringing an improvement in the company's performance, and a better physical and social well-being for its employees. Ergonomic risks to workers' health arise from inadequate movement and postures, transport of heavy equipment and in organization and assistance activities, shift changes and night work. These actions can cause the workers' health problems with posture, fatigue, hernias, fractures, sprains, bruises, low back pain and varicose veins (ZAPPAROLI & MARZIALE, 2006).

Therefore, the action of the occupational physical therapist becomes indispensable in the work environment, because he is the professional with qualifications and skills to develop work activities that help to improve working time and quality of life, reducing pain and possible labor absences ( HOUISS, 2009).

The physiotherapist must act with a broad vision, knowing how to recognize situations such as: suffered occupational health profile, low productivity, need for training, medical treatment, prolonged leaves, worker reintegration programs and compensation processes. In this way, companies become aware of the physiotherapist's contribution to their role in occupational health and their

contribution to the management of quality and health programs within the company (CAETANO et al., 2012).

#### Work accidents

An accident at work is the result of work performed on behalf of a company that results in personal injury or dysfunction resulting in death or loss or reduction, whether temporary or permanent, of the ability to work. From the point of view of prevention, industrial accidents are the most comprehensive, also including accidents that do not cause injuries and near misses, but cause loss of time or material damage. Workers are prone to accidents and infections at work. Ergonomics is the study of adapting work to individual characteristics in order to provide them with maximum comfort, safety and good development of work activities (RIBERO, 2011).

The consequences of accidents at work are not limited to excessively negative factors, but can have adverse economic and social impacts on the human side of the problem. The human aspect is the clearest, given the suffering of the injured person, depending on the accident itself, the type and duration of medical treatment, the rehabilitation plan and the possible lasting sequels of the accident (BARBOSA; RAMOS, 2012) RIBEIRO (2011) ), also highlighted that, for example, the ergonomic adequacy of workstations and production systems is essential to avoid mental and physical complications, accidents and fatigue, as the conditions and organization of work significantly interfere with the health of workers.

Perception and reversal of risks in the work environment

For Castillo, Oliveira et al. (2010), occupational risk can be defined as the probability of an accident or illness occurring during work activities. This stems from the worker's exposure to the risk factors to which he is exposed, whether environmental risks (physical, chemical, biologically hazardous substances or their associations) and operational risks: mechanical (or accidental) and ergonomic risks. Actions in the area of occupational health aim to maintain adequate standards of physical, psychological and social well-being of employees. In this sense, it is necessary to take measures to promote health and prevent health problems (CASTILHO; OLIVEIRA, et al. 2010).

The scope of care can be individual or collective, with different approaches but with the same principles, namely the guarantee of adequate working conditions. The care team individually guides food, encourages the proper use of personal protective equipment (PPE), guides physical safety and prevents damage resulting from mental and emotional overload. At the collective level, interventions

should take place in educational lectures and labor gymnastics (SILVA et al., 2011).

Workers' health and illness processes are directly affected by social, technical and organizational conditions that are determinants of occupational risk and living conditions. Therefore, in addition to having the perceptive ability to identify problems that the workday can cause, nurses must also be multidisciplinary and interdisciplinary in their work (MANTOVANI; LACERDA et al., 2009; OLIVEIRA-JUNIOR AR et al., 2014).

When a company sees a high number of requests for absenteeism and early retirement, the need for structural and administrative reforms has been suggested, "as this can be avoided through educational and awareness guidelines developed by occupational nurses, aimed at adapting the worker to their work environment" (SILVA; SECCO, et al. 2011).

According to Matos, Silva and Lima (2017), occupational diseases are diseases acquired or originated from the special conditions in which professionals perform their functions, consumed by work, overloaded by various activities, resulting in physical and mental suffering. They are subdivided into:

- Occupational or technical illnesses: the work itself causes the illness;
- Occupational or intermediate illnesses: work is not the specific cause of the illness, but in many cases it complicates the illness.

According to Junior (2016), occupational disease or occupational disease is understood as a disease that is caused or induced by the performance of work inherent to an activity and remains unchanged in the relationship as articulated by the Ministry of Labor and Social Security. Unlike occupational illnesses, work-related illnesses are not related to the functions performed by the worker, but rather to the worker's obligation to work. As an example of occupational diseases, we can cite: cancer that affects workers in nickel mines and refineries, people exposed to asbestos or close to radioactive substances, workers who suffer from lung diseases due to regular exposure to large amounts of substances dust, mist, steam or harmful gases, extreme deafness caused by noisy places, etc. (JÚNIOR, 2016).

Occupational diseases can also be caused by exposure to chemical agents, which are compounds or products that can enter the body through the respiratory tract, or by the nature of the exposure activity, which may come in contact with the skin or be absorbed by the body through ingestion. (SOUZA et al., 2021).

Frequent occupational diseases and the role of the occupational health nurse

- Exposure to toxic substances

Over time, humans acquired the knowledge that chemical agents can cause physical harm or death. Therefore, these substances cannot be considered harmless and must be used in accordance with safety principles (BELLUSCI, 2010). One of the most numerous groups of occupational diseases is the risk of exposure to chemicals.

The toxic effects of these elements can lead workers to a reversible or irreversible state. The penetration of these agents occurs systemically in the body: ingestion, inhalation or absorption, it occurs through the skin or mucous membranes and reaches the blood and lymph for distribution throughout the body. Therefore, three phases are considered: the exposure phase (absorption of the substance), the toxicokinetic phase (transport throughout the body) and the toxicokinetic phase (changes at the molecular level) (BELLUSCI, 2010). Therefore, routine activities and/or training must be carried out by occupational nurses to understand the risks of contamination of chemical products to exposed workers, in order to guide the handling and continued use of PPE to prevent possible damage to the health of workers.

Environmental and biological monitoring is necessary to provide data for implementing corrective actions together with environmental professionals, safety technicians and occupational health teams. There is a need to clarify the relationship between exposure, its effects and changes in health status (BELLUSCI, 2010).

- Occupational diseases of the respiratory system

The International Labor Organization (ILO) classifies respiratory diseases into five categories: pneumoconiosis, lung disease caused by heavy metals or plant dust, occupational asthma and allergic alveolitis (BELLUSCI, 2010). According to Lima (2009), to harm the worker's respiratory system, the material must be inhaled and reach the bronchi, bronchioles and alveoli (lower respiratory tract) in irremovable quantities. Regular performance of professional nurses, concomitant with CIPA lectures and guidance on such occupational diseases, contamination and prevention methods, always attentive to signs and symptoms, collection of anamnesis and referral to the medical professional.

The risk of developing clinical symptoms depends on the concentration, the size of the particles inhaled and the duration of exposure. When deposited in the lungs, they promote a variety of responses (BELLUSCI, 2010). "Acute exposure to irritating gases, vapors and smoke



results in damage at the alveolar level with pulmonary edema” (LIMA, 2009).

Occupational care teams play an extremely important role in collecting data that indicate exposure sites and identified cases so that they can provide early diagnosis and appropriate treatment. The entire team must investigate the atmospheric conditions to verify the presence of substances that invade the respiratory system (BELLUSCI, 2010).

Occupational nurses should always focus on prevention, education and daily actions, together with workers, to demonstrate the risk and severity they experience in order to avoid such exposures, as conscious and aware workers will be caregivers of their own health. workplace, avoiding damages and risks to your health. First, the prevention process has to do with controlling the concentration levels of respirable dust in the work environment. Many employees are aware of the risks they face, but some still ignore the importance of wearing masks. Professional nurses should develop professional learning actions focused on preventing health risks (CURADO, 2010).

#### Occupational psychological disorders

Work contributes to changes in mental health caused by a number of specific factors, such as exposure to toxic substances in the complex organization of work. “Mental disorders have multiple etiologies in which a diverse set of factors interact in a complex way” (JACQUES, 2007).

Occupational stress is the disruptive process of excessive mobilization of an individual's adaptive energy to meet the demands of their occupational environment that are beyond the person's current physical or mental capabilities, that is, the stress may only be temporary, with reduced stress. or successful adaptation to new professional requirements and return to normality. However, with intense persistence and constant repetition, and an absolutely outdated capacity for adaptation, the condition can evolve into occupational neurosis. By definition, a state of persistent personality disorganization, with consequent installation of pathology, related to a defined professional or organizational situation (JACQUES, 2007).

However, professional nurses should focus on services that significantly stress workers and, with the support of CIPA and other collaborators, seek ways to create a welcoming and pleasant environment through lectures, consultations with professional psychologists, etc. Take precautionary measures so that everyone engages in the same activities or actions in order to earn or even contribute to a high level of respect, such as solidarity among colleagues and/or addressing family issues that are

often brought up in your workplace , impairing their performance in their daily functions. Therefore, the occupational health nurse must have a comprehensive and especially sharp look, always focusing on preventive measures to avoid such occupational health problems (OLIVEIRA-JUNIOR AR et al., 2014).

#### Occupational nurse's actions

The assignment of professional nurses can be carried out individually or collectively, with different methods but with the same principle, namely the guarantee of adequate working conditions. The care team individually guides food, encourages the proper use of personal protective equipment (PPE), guides physical safety and prevents damage resulting from mental and emotional overload. The intervention of the occupational health nurse, a comprehensive analysis, should be done through educational lectures and labor gymnastics (SOUZA et al., 2021).

The prevention process is primarily concerned with monitoring the concentration levels of inhalable dust in the workplace. Many employees are aware of the risks they face, yet many ignore the importance of wearing masks. Professional nurses need to develop professional learning actions aimed at preventing health risks (CURADO, 2010).

Nurses need to develop strategies to reduce the risk of accidents at work, which must be institutionalized and used in conjunction with the strengthening of the Internal Commission for Accident Prevention (CIPA) and all other organizational structures responsible for education and supervision. , etc. Aspects (SOUZA et al. 2021).

Professional nurses have the ability to document institution-related risks and plan actions to provide a high quality of life for employees of any company, including hospitals. Continuing education actions need to be more incorporated, as the nurse is a permanent health educator and plays an important role in the prevention and management of health problems (SILVA; VALENTE, 2011).

Improving working conditions to maintain the health of caregivers is also important for the health and well-being of patients, as the quality of patient care increases with good working conditions (DUARTE; MAURO, 2010).

There is a need to build data sets that provide quick and direct information about workers' health to ensure better performance of care teams and achieve the assistance provided. Records must accurately describe the nature and distribution of the disease in the geographic area associated with the work. These records allow actions to

control diseases and accidents at work and facilitate the practice of preventive strategies (SILVERA, 2009).

Nursing requires basic tools to accommodate the functioning of services, and records enable nurses to generate knowledge and information for analysis and interpretation (SILVEIRA, 2006). It is important to collect and archive information to generate a library of elements, which are defined as “collections of organized and structured data, interrelated and stored/stored in an operating system designed to serve various applications” (SILVEIRA, 2006; OLIVEIRA- JUNIOR AR et al., 2014).

It is noticed that the role of nurses in workers' health is extremely important, as they are responsible for contributing to the satisfaction of human needs at work, thus promoting the health and well-being of all professionals. In this way, the guidelines formed by Occupational Nurses in organizations collaborate for the practice of nursing in Occupational Health, with repercussions on society (SOUZA et al., 2021).

It is also the responsibility of nursing to provide care in an agile way to guarantee the diagnostic processes. Be accurate, ensure continuity of delegated care and always keep your knowledge and that of the entire team up to date, thus providing professional improvement (OLIVEIRA E TRINDADE, 2010).

### III. FINAL CONSIDERATIONS

The ideas presented in this study lead to the conclusion that the work of a multidisciplinary team within companies is very important in promoting the health and well-being of workers, as it has the technical knowledge and can act in the prevention of accidents and occupational diseases. The objectives of this study were achieved because the need for greater technical competence of nurses, quality control and individualized care for workers was evident through the definition of occupational diseases and accidents at work, resulting in positive results throughout the health process and need further research on the subject, because only then will it be possible to learn more about the role of the worker as an active professional.

As a strong point of the elaboration of this work, there is a high degree of agreement among the authors about the relevance of this field for the work of nurses in the perspective of prevention. On the other hand, as a disadvantage, few authors and articles focus on emergency actions, teach how to prepare for the implementation of risk maps and the sectoral epidemiology of companies that are difficult to identify.

Expanded learning is possible in the nurse's role as a multifunctional professional. Build knowledge on a

growing area of the market that still needs more space and greater recognition in the nursing category

### ACKNOWLEDGEMENTS

Thanking colleagues for their performance in the construction of the work and the advisor for their patience and tips

### REFERENCES

- [1] AZEVEDO, M. V. Atenção à saúde do trabalhador. FACINTER. Curitiba. 2010.
- [2] BARBOSA DN & MEJIA DM. O papel da fisioterapia na qualidade de vida do trabalhador. 2018. BIOCURSOS. Disponível: [https://portalbiocursos.com.br/ohs/data/docs/183/6-O\\_Papel\\_da\\_Fisioterapia\\_na\\_Qualidade\\_de\\_Vida\\_do\\_Trabalhador.pdf](https://portalbiocursos.com.br/ohs/data/docs/183/6-O_Papel_da_Fisioterapia_na_Qualidade_de_Vida_do_Trabalhador.pdf)
- [3] BARBOSA, L. O.; RAMOS, W. A importância da prevenção de acidentes no setor de construção civil: um estudo de caso em Uberlândia, Minas Gerais, Brasil. Universidade Feevale. Uberlândia-MG, 2012.
- [4] BAÚ, L.M; KLEIN A.A. O reconhecimento da especialidade em fisioterapia do trabalho pelo COFFITO e Ministério do Trabalho/CBO: uma conquista para a fisioterapia e a saúde do trabalhador. Rev. Brasil. Fisiot. Ano 2002, v. 13, n. 2, p. 5 – 6.
- [5] CAETANO, V.C.; CRUZ, D.T.; SILVA, G.A.; LEITE, I.C.G. O lugar ocupado pela assistência fisioterapêutica: representações sociais de trabalhadores com DORT. Rev. Fisioter. mov. Ano 2012, v.25, n.4.
- [6] CASTILHO, Kárita Fernanda; OLIVEIRA, Débora Luiza Teles; BRASILEIRO, Marislei Espíndula. Riscos ocupacionais no Brasil no período de 2005 a 2009: Uma revisão. Rev. Eletr de Enfer. Centro de Estudos de Enfermagem e Nutrição. Goiás, n. 1, v.1, p.1-17, jan-jul. 2010.
- [7] CURADO, Fabíola. Avaliação de sintomas respiratórios e de índices espirométricos em trabalhadores de pedreiras/marmorarias. 2010. 84 f. Dissertação (Mestrado em ciências ambientais e saúde) –Pontifícia Universidade Católica de Goiás, Goiânia, 2010.
- [8] DIAS, J. A. et al. O papel do enfermeiro do trabalho frente às doenças ocupacionais na visão dos discentes de enfermagem. 2018. Revista de Ciências da Saúde Nova Esperança. V. 16.
- [9] DUARTE, N. S.; MAURO, M. Y. C. Análise dos fatores de riscos ocupacionais do trabalho de enfermagem sob a ótica da enfermagem. Revista Brasileira de Saúde Ocupacional, São Paulo, v. 35, n. 121, 2010.
- [10] HOUAISS, A. Instituto Antônio Houaiss. Dicionário. Versão Monusuário 3.0. Editora Objetiva Ltda. Jun. 2009.
- [11] JACQUES, Maria da Graça. O nexos causal em saúde/doença mental no trabalho: uma demanda para a

- psicologia. Rev. Psicol Soc. Belo Horizonte, v.19, n.1, p. 112-119, 2007.
- [12] JUNIOR, W. R. Doença ocupacional: conceito, características e direitos do trabalhador. 2016. Disponível em: <<https://saberalei.jusbrasil.com.br/artigos/378215786/doenca-ocupacional-conceito-caracteristicas-e-direitos-do-trabalhador>>. Acesso em: 19 jul. 2021.
- [13] LIMA, Elisângela Maria de. Doenças respiratórias associadas à atividade de mineração no município de Parelhas, região do Seridó Norte-riograndense. 2009. 126 f. Dissertação (Mestrado em desenvolvimento e meio ambiente/prodema) – Universidade Federal do Rio Grande do Norte – UFRGN. Natal, 2009. Disponível em: <<http://www.dominiopublico.gov.br/download/texto/cp115988.pdf>>. Acesso em: 17 abr. 2012
- [14] MANTOVANI; Maria de Fátima, LACERDA; Maria Ribeiro; ULBRICH, Elis; BANDEIRA, Janaína Marielen; GAIO, Daniela Maria. Panorama da produção do conhecimento em enfermagem na saúde do trabalhador: impacto e perspectivas. Rev. Bras Enferm. Brasília, v.62, n.5, p.784-788, set-out. 2009.
- [15] MATOS, D. A. R.; SILVA, S. O. P.; LIMA, C. B. Enfermagem do trabalho: abordando competências e habilidades para a atuação do enfermeiro. Revista Temas em Saúde, João Pessoa, V 17, n 3, 2017.
- [16] OLIVEIRA, Millena; TRINDADE, Marcela Ferreira. Atendimento de urgência e emergência na rede de atenção básica de saúde: análise do papel do enfermeiro e o processo de acolhimento. Rev. Hórus. São Paulo, v.4, n.2, p. 160-171, out-dez. 2010.
- [17] OLIVEIRA-JUNIOR AR et al. A atuação do enfermeiro na saúde do trabalhador. Um enfoque na prevenção. www.repositorio. São Paulo, 2014. Disponível: [www.bahiana.edu.br/jspui/bitstream/bahiana/516/1/Artigo%20Enfermagem%20do%20Trabalho%202014.pdf](http://www.bahiana.edu.br/jspui/bitstream/bahiana/516/1/Artigo%20Enfermagem%20do%20Trabalho%202014.pdf)
- [18] PINTO, A.L.T., WINDT, M.C.V.S., CÉSPEDES, L. Segurança e Medicina do Trabalho. – 5. ed. – São Paulo: Saraiva, 2010.
- [19] RIBEIRO, G. B. Contribuições das ações ergonômicas para a gestão organizacional: um estudo de caso em uma empresa da construção civil. Dissertação (Mestrado profissional em Administração) -Universidade Potiguar, Natal, RN, 2011.
- [20] SILVA, C. G. Ações do enfermeiro do trabalho na prevenção de doenças laborais: revisão da literatura. Revista Científica Multidisciplinar Núcleo do Conhecimento. Ed. 08, Vol. 08, 2018. SILVA, L. A.; SECCO, I. A. O.; DALRI, R. C. M. B. Enfermagem do trabalho e ergonomia: prevenção de agravos à saúde. Rev. enferm. UERJ. Rio de Janeiro, v.19, n, 2, 2011. SILVA, L. S., VALENTE, G. S. C. Riscos Químicos Hospitalares e Gerenciamento dos Agravos à Saúde do Trabalhador de Enfermagem. 2006. Disponível em: <<http://www.seer.unirio.br/>>. Acesso em: 5 jun. 2021. SILVA, S. L. As interações do enfermeiro do trabalho com a saúde do trabalhador em âmbito de prática e assistência de enfermagem, 2005. Tese de Doutorado. UFRJ: Rio de Janeiro.
- [21] SILVA, Luiz Almeida da; SECCO, Iara Aparecida de Oliveira; DALRI, Rita de Cássia de Marchi Barcellos. Enfermagem do trabalho e ergonomia: prevenção de agravos à saúde. Rev. enferm. UERJ. Rio de Janeiro, v.19, n, 2, p.317-323, abr-jun. 2011.
- [22] SILVEIRA, D.T. Consulta-Ação: educação e reflexão nas intervenções de enfermagem no processo trabalho- saúde-adoecimento. 1997. 132 f. Dissertação (Mestrado Expandido em Assistência de Enfermagem) – Universidade Federal de Santa Catarina e Universidade Federal do Rio Grande do Sul – UFSC/UFRGS, Porto Alegre, 1997. Disponível em: <<http://www.lume.ufrgs.br/bitstream/handle/10183/13296/000158266.pdf?sequence=1>>
- [23] SILVEIRA, Denise Tolfo e MARIN, Heimar de Fátima. Conjunto de dados mínimos de enfermagem: construindo um modelo em saúde ocupacional. Rev. Acta Paul Enferm. São Paulo, vol.19, n.2, p. 218-27, abr-jun. 2006. Disponível em: <<http://www.scielo.br/pdf/ape/v19n2/a15v19n2.pdf>>
- [24] Sociedade de medicina e cirurgia de Campinas -SMCC. Médico do trabalho da SMCC explica a importância do profissional na saúde do trabalhador. Campinas, 2019. Disponível: <https://smcc.org.br/noticias/medico-do-trabalho-da-smcc-explica-a-importancia-no-profissional-na-saude-do-trabalhador/>
- [25] SOUZA TA et al. Enfermagem do trabalho: o papel do enfermeiro na prevenção de acidentes e doenças ocupacionais. Brazilian Journal of Development, Curitiba, v.7, n.8, p.84281-84291 aug.2021
- [26] ZAPPAROLI A, MARZIALE M. Risco ocupacional em unidades de suporte básico e avançado de vida em emergências. Rev Bras Enferm 2006 fev/mar; 59(1): 41-6.

## Ethnogastronomy: A brief exploratory review

Monica Helena Panetta<sup>1</sup>, Jorge Luiz Schirmer de Mattos<sup>2</sup>, Wagner Lins Lira<sup>3</sup>

<sup>1</sup>Doctoral student, Postgraduate Program in Agroecology and Territorial Development, Rural Federal University of Pernambuco (UFRPE) Campus Recife - PE, Brazil

Email: [monica.panetta@ufrpe.br](mailto:monica.panetta@ufrpe.br)

<sup>2</sup>Teacher, Program in Agroecology and Territorial Development, Rural Federal University of Pernambuco (UFRPE) Campus Recife - PE, Brazil.

Email : [jorge.mattos@ufrpe.br](mailto:jorge.mattos@ufrpe.br)

<sup>3</sup>Teacher, Program in Agroecology and Territorial Development, Rural Federal University of Pernambuco (UFRPE) Campus Recife - PE, Brazil.

Email : [wagner.lira@ufrpe.br](mailto:wagner.lira@ufrpe.br)

Received: 09 Aug 2022,

Received in revised form: 03 Sep 2022,

Accepted: 07 Sep 2022,

Available online: 12 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**—Agrifood systems, Ancient cuisine; Eating habits; Food cultures; Traditional peoples.

**Abstract**— *The increase in the interest in gastronomy indicates research possibilities that consider food as a central theme, exploring cultures and traditions. In this sense, symbolic aspects, tastes, habits, rules, taboos and rituals point out that eating is more widespread than just the nutritional interest. Ethnoscience studies the human population's knowledge, encompassing several fields like ethnogastronomy. This field interests itself in ethnographic investigations in order to document and value the knowledge, wisdom and eating habits of the traditional peoples and, likewise, to positively appreciate their know-how, integrating with the traditions, protecting their culture and cooperating with the preservation of the environment. In these terms, bibliographical research was performed on Scielo, Google Scholar and Brazilian Digital Library for Theses and Dissertations, platforms looking for the following items: "ethnogastronomy", "traditional peoples" and "food culture". Eight works were selected that show the act of eating and more complex and broad factors like the cultivation, harvesting, cooking, presentation and serving of the food. It is essential the power of tradition ahead of the preparation of "caiçaras recipes" and that Campesinos protect the important bicultural patrimony, with knowledge of practices of agroecological basis and gastronomic culture. However, we observed that few were the works found, indicating a shortfall of research in these areas, besides showing the necessity of bigger studies, registers and valorisation of traditional eating habits, as well as its social relevance both in terms of feeding sovereignty and the preservation of the environment.*

### I. INTRODUCTION

The current interest in gastronomy and culinary became notorious because of several TV programs and news on the media and internet. Those elevate the search for courses in many levels, increasing the quantity of publications in congresses and scholarly journals, having as central theme

food and the act of cooking and eating (Barbosa, 2019; Canesqui, 2005). According to the dictionary New Concise Larousse Gastronomique the term gastronomy is recent: "the entry gastronomy comes from ancient Greek, *gastros* — stomach + *nomia* — knowledge/law" (Hamlyn, 2011, p. 545, our translation). It started to be used in France in 1801 with the publishing of *La Gastronomie ou l'Homme*

des champs à table by J. Berchoux, translation to English: “Gastronomy or the Villager at the table”, however, only in 1835 the French Academy made the word “gastronomie official”.

Gastronomy is conceived as a cultural phenomenon encompassing since the aesthetical factor of cooking, its various cooking rituals, to serving and eating: the very act of how to behave at the table, the satisfaction felt by being fed, a priori, without many biological and/or nutritional worries, but the gratification of tasting and smelling. So, the set of feelings associated with the aesthetic of dish’ presentation — with its colours and forms — are prioritised, and influence the social and individual acceptance of the food and the food’s perception (Poulain, 2004). Hence, the anthropologist Roberto Damatta (1986) works to differentiate nourishment from food — taking into consideration brazilian context — when he affirms that eating goes beyond the physiological and nutritional functions, for, in his opinion, food possesses a complex and broad cultural meaning “[...] (food) is also a manner, a style and a way of feeding, that includes oneself in social relations” (p. 36-37, our translation).

Studies on feeding bring different focuses that, oftentimes, are complementary. The cultural approach, in turn, interests itself in the symbolical aspects, like: “tastes, habits, culinary traditions, representations, practical identities, preferences, distastes, rituals and taboos, when eating is not only a nutritional act” (Braga, 2004, p. 40, our translation).

From this point of view: “cultures are the specific manners or patterns that guide the social coexistence and survival for an approximately prolonged time and societies are groups of individuals of the same species that have an organised coexistence” (Mintz, 2001, p. 12, our translation).

Eating habits are passed on orally, usually, in an affectionate manner and are learned early providing long, sentimental relationships. Thus, it is correct to affirm that an adult person can completely change their eating habits, but their first feelings, learnings and their way of being and existing socially will remain in their memory (Brandão, 2015; Mintz, 2001).

So, it can be affirmed that food culture is composed by eating habits in which traditions and new habits coexist in dialectics, once that it also refers to identity expressions that give meaning to choices and eating habits (Braga, 2004; Mintz, 2001). Anthropology, as a science, intends to study human behaviour, always showing deep interest in food so it can try to understand what, where, when, how often and how we feel about it. Also, it searches to understand what behaviours express social identities and

show the cultures in which the subjects are inserted (Mintz, 2001).

Studies about “food systems” exist in the first place, not only to supplement biological needs but also to express food cultures (Gonçalves, 2004). Every time, they require even more transdisciplinary and transcultural approaches, for they must allow other fields of knowledge and culture to work together. These are the cases of the epistemic approximations between History, Geography, Economics, Nutrition, Anthropology, Sociology, Arts, Agroecology, Chemistry, Biology, Gastronomy and every other discipline that cooperate — direct or indirectly — to the analysis of all necessary sequences for the food to be prepared, arrive at the table and be eaten (Tempass, 2010).

Furthermore, Ethnoscience seeks to study: “the knowledge of human populations about the natural processes, trying to discover the underlying logic to the human knowledge of the natural world, taxonomies and totalizers classifications” - Original quotation: “os saberes das populações humanas sobre os processos naturais, tentando descobrir a lógica subjacente ao conhecimento humano do mundo natural, as taxonomias e as classificações totalizadoras” (Diegues et al., 2000, p.36, our translation). These efforts have been undertaken in the first decades of the current century, broadening the dialogic horizon between empirical knowledge and scientific ones.

Ethnoscience permeates several fields that adopt the “ethno” prefix in their studies’ initiative, for the meaning for “ethno” is: “general term ‘ethno-X, where X denotes a discipline or specialty that belongs to the methodological classification of knowledge inside the Academia” - Original quotation: “termo genérico ‘etno-X’, onde X denomina uma disciplina ou especialidade pertencente à classificação metodológica do conhecimento dentro da Academia” (D’Olive Campos, 1995, p. 12, our translation). In this sense, the efforts of Ethnoecology, Ethnobotany, and Ethnogastronomy, among others, invest themselves in ethnographic points of view with the goal of studying, documenting and positively valuing the wisdom, knowledge and practices of traditional peoples and communities.

Specially Ethnogastronomy — emerging science in Brazil — tends to study the eating habits of the traditional peoples and rural communities, valuing their know-how and justifying the maintenance of agrobiodiversity and natural resources (Bittencourt et al., 2016; Gonçalves & Gonçalves Junior, 2011).

In the fields, Ethnogastronomy has a significant influence on cultivation choices, mainly in subsistence agriculture, as described by Nazarea-Sandoval. She used

this term in 1991 for finding it the most adequate when referring to the knowledge of what is considered edible and the classification of consumption of the food by the traditional peoples. Because of that, agricultural interventions work better when this ethnic knowledge is taken into consideration (Nazarea-Sandoval, 1991).

When talking about traditional peoples and communities it is meant the indigenous peoples, quilombolas, the caboclos, the riverside people, artisanal fishermen and the Campesino peoples (Couto, 2007; Lima, 2009; Oliveira-Monteiro, Scachetti & Nagib, 2017; Souza, Bernadini & Santos, 2020). In the Decree no. 6.040 on the 7th of February 2007, the traditional peoples are constitutionally defined as:

“Culturally diverse groups that recognise themselves as such, have their own ways of social organisation, that inhabit and use natural territories and resources as a condition to cultural, social, religious, ancestral and economic reproduction, and utilise knowledge, innovations and practices created and passed on by tradition” (Brasil, 2007, p. 01, our translation).

Also, the traditional peoples are the ones that protect natural areas, knowing the necessity to strengthen a less predatory relationship between society and nature. Thus, the studies based on ethnosciences value their know-how, work alongside traditions, protect the cultures of these peoples and, cooperate with environment preservation as well (Ávila et al., 2018).

The positive recognition of traditional peoples and local communities becomes important — above all — in front of the protection of biodiversity, as Souza et al. (2019) say. To them, cultural traditions “oftentimes are based on rituals, the beliefs and the menu are based on the culinary of religious festivities and ceremonies” (p. 165, our translation). Aside from the cultivation and harvest practices with an agroecological base, they also feature processes that guarantee the preservation of agricultural diversity and better environmental sustainability in the production for self-consumption, which, when directed to the local business, generate income for the families.

The observation of traditional peoples’ eating habits represents the valorisation of traditions developed orally through generations, although it can be understood that some cultures — for many reasons — modified themselves or were reframed throughout history (Wieczorkowki et al., 2018). Thus, the need to get to know the food, dishes and acts of preparation and eating rises, so the importance of food cultures long forgotten can be reinforced. However, it

is also necessary to stimulate the preservation of the sustainable cycle within the traditional communities — for they can lead us to food sovereignty (Wieczorkowki et al., 2018; Gonçalves & Gonçalves Junior, 2011).

Moreover, it is still convenient to point out that “family farming”, composed of small and medium producers, — coming not only from local communities but also from some traditional peoples — has been effectively contributing to environmental preservation through agricultural techniques supported by agroecological systems. They are capable of keeping agrobiodiversity, when, for instance, they preserve natural resources, exchange creole seeds and stimulate other sustainable and economic manifestations that generate work and income (Lopes & Lopes, 2011).

While science, Agroecology guides transition processes to sustainable agricultural styles, bringing benefits to human beings and the environment through dialogue between several knowledge and experience fields. This science favours the responsible handling of agroecosystems (Caporal, 2009) in the search for more sustainable societies. However, sustainable development cannot disregard the cultural and social spheres that take into account the need of respecting local cultures in which values and traditions “must be analysed, comprehended and utilised as a starting point in the processes of rural development” (Caporal & Costabeber, 2002, p. 78, our translation).

In other words — starting from the agroecological model — the empirical and scientific knowledge of the communities — in theoretical and practical connection — are focused on the sustainable handling of food cultures, and strengthening traditional knowledge; this contributes directly to the preservation of agrobiodiversity from the maintenance of natural resources and the invigoration of environmental preservation that will continue to exist over the time for future generations (Altieri, 2004; Caporal, 2009; Lopes & Lopes, 2011; Córdoba et al., 2018).

According to Azevedo (2017), the studies on food as a social phenomenon and from a multidisciplinary perspective, because of its complexity, appear more frequently in the 2000s. From those, researches on food, society and culture are highlighted, which predict that the contemporary researchers of the theme need to navigate in different fields of knowledge, and, as Silva et al. (2010) say, they need to get closer to concepts and methods capable of understanding the complexity of the realities and struggles of living in society.

In this sense, the present article has a goal to describe and discuss the scientific Brazilian productions that refer to the field of ethnogastronomy. Thus, to comprehend the

conceptions brought by them on the terms of ethnogastronomy, traditional peoples, indigenous and food culture. Also, this work brings elements that compose these studies in Brazil for the past 20 years (from 2001 to 2021), a period that encompasses the beginning of graduation Gastronomy courses in the country, expanding the visibility and interest in the studies of food as a social phenomenon, transdisciplinary and transcultural as well.

## II. METHODOLOGY

In this article, the intention was to analyse researches that focused on the ancestral food of traditional peoples in Brazil. Thus, to set the scene about the scientific production of ethnogastronomy and analyse the “state of the art” within context, an exploratory search was chosen consulting the criteria of narrative review, in which the literature analysis and the interpretation are carried out following the researchers’ interest criteria (Broone, 2006; Botelho, Cunha & Macedo, 2011).

The research of articles focused on publications presented on the database with the term “ethnogastronomy” in the title, keywords and works’ abstracts. This way, it was able to direct the research to articles that had this discussion in their analysis. However, the results were scarce. As a strategy to increase the number of works the following terms were added: “villagers” OR “indigenous” OR “traditional peoples” AND “food culture” were searched in the title, keywords and works’ abstracts. Hence, aiming to identify discussions that relate food culture to the traditional peoples.

In the beginning, the searches on the database Scientific Electronic Library Online (SciELO) were prioritised, for it is on this website that is gathered the biggest quantity of research made in Brazil and South America. As the results were minor, the searches were extended to the database of the Biblioteca Digital Brasileira de Teses e Dissertações (BDTD), and, finally, to end the possibilities of finding something else, the research was extended to Google Scholar.

Other elements included in the works were the publishing dates, between 2001 and 2021. Like this, the first works were selected consisting of three types of research that presented the word “ethnogastronomy” in the title. The first one was the extended summary of Gonçalves and Gonçalves Junior (2011) and the second and third were two summaries of Bittencourt et al. (2016) and Freitas and Nery (2018). Other three works were found with the term “food culture” in the title and/or keywords, and these were two dissertations — Pereira (2015) and Ungarelli (2009) — and a thesis from Maciel

(2010). Finally, to extend the discussion, two texts with the term “traditional peoples” in the keywords were selected, from Ávila et al. (2018) and from Silva and Lucas (2019).

It’s important to point out that the searches followed this way, for, in the beginning, only three texts were found with the word ethnogastronomy, so, to a bigger reflection, the investigations were extended with the keywords “traditional peoples” and “food culture”. This decision resulted in the selection of five more texts about food that revealed the act of eating and more broad and complex factors like cultivating, harvesting, cooking, presenting and serving the food.

## III. RESULTS AND DISCUSSIONS

From the searches previously mentioned above, eight works were selected (Figure 1) — from those, only three mentioned the term ethnogastronomy in the title. They are: Gonçalves and Gonçalves Junior (2011), Bittencourt et al. (2016) and Freitas and Nery (2018); these works were developed in São Paulo, Minas Gerais and Rio Grande do Sul respectively.

Apart from that, many other fields of scientific knowledge have been collaborating on studies about traditional practices (Couto, 2007). A few examples were found in the Educational field (Gonçalves & Gonçalves Junior, 2011), in Ethnobiology and Ethnoecology (Bittencourt et al., 2016), besides Tourism as well (Freitas & Nery, 2018), revealing that the transdisciplinary and transcultural approach needs to be engaged by ethnogastronomy.

Figure 1. Identification of selected works

|   | Author             | Title                                                                                                             | Year | Type of Academic Genre    |
|---|--------------------|-------------------------------------------------------------------------------------------------------------------|------|---------------------------|
| 1 | Ávila et al.       | The Importance of Ethnoscience in the preservation and maintenance of socio-biodiversity.                         | 2018 | Extended summary - annals |
| 2 | Bittencourt et al. | Ethnogastronomy, agroecology and villagers’ resistance on the Cachoeira da Fumaça campsite, east of Minas Gerais. | 2016 | Summary - annals          |
|   | Freitas            | Ethno-gastronomic                                                                                                 | 2018 | Summary                   |

|   |                              |                                                                                                                                        |      |                           |
|---|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|------|---------------------------|
| 3 | & Nery                       | events in the municipality of Nova Petrópolis - RS.                                                                                    |      | - annals                  |
| 4 | Gonçalves & Gonçalves Junior | Caiçara ethnogastronomy: the food culture of Praia Mansa's community in Ilhabela.                                                      | 2011 | Extended summary - annals |
| 5 | Maciel                       | Roots, plants and culture: the indigenous farmsteads in the eating habits of the Paresi people, Tangará da Serra, Mato Grosso, Brasil. | 2010 | Doctoral Thesis           |
| 6 | Pereira                      | Villagers' family farming and food culture: practices and eating habits in the rural families from Simonetti line - Ivorá/RS.          | 2015 | Master Thesis             |
| 7 | Silva & Lucas                | The riverside people and the Belo Monte hydroelectric: the deterritorialization and influences in the cultivation of food plants.      | 2019 | Article - journal         |
| 8 | Ungarelli                    | The Kalunga quilombola community from Engenho II: culture, food production and knowledge ecology.                                      | 2009 | Master's Dissertation     |

Source: The authors.

The knowledge research on the eating habits of traditional peoples had a distinct focus in these studies. Gonçalves and Gonçalves Junior (2011). 0 tried to comprehend the food culture and the educational processes gathered by the Caiçaras from the Praia Mansa community and surroundings (Praia de Castelhanos and Praia Vermelha), in Ilhabela-SP (Gonçalves & Gonçalves Junior, 2011). Bittencourt et al. (2016) recorded preparation methods, consumption and commercialisation of food produced by a couple of villagers from the

Cachoeira da Fumaça campsite, in Carrancas-MG. And, Freitas and Nery (2018) devoted themselves to observing the germanic and Azorean gastronomic traditions in events from Nova Petrópolis-RS; a city that has strong Portuguese and german influence (Freitas & Nery, 2018).

It is valid to point out that the Caiçaras, according to Diegues et al. (2000), tend to be peoples from indigenous, Portuguese descent, and, in fewer cases, from enslaved African descent. They live in cities and villages along the coasts of the states: Rio de Janeiro, São Paulo, Paraná and the north of Santa Catarina.

The research methods from these investigations undertake qualitative nature, and the field examinations were fundamental to the observation of what is — or isn't — spoken and explicit. This, the qualitative approach: "require special care on the researcher's account, for they must not escape the cultural precepts from their own cultural origin" - Original quotation: "requer cuidado especial por parte do pesquisador, que não pode escapar dos ditames culturais de sua própria origem cultural" (Viertler, 2002, p. 12, our translation). Following this logic, Gonçalves and Gonçalves Junior (2011) — for data collection and analysis — decided to insert themselves into the Caiçara community for a few days, observing people's behaviour, besides recording their speech and memories.

However, in the other two works, immersion and interactions with the communities investigated were not performed. Bittencourt et al. (2016) catalogued the data based on an interview made with a single couple from the campsite, whereas Freitas and Nery limited their research to bibliographical and mediatic consultations. Gonçalves and Gonçalves Junior (2011) visited the community and interacted with the Caiçara people for three days, searching to analyse their knowledge about purse-seine fishing (ethnoichthyology), the preparation of fish-based dishes (ethnogastronomy) and the usage of medicinal herbs and plants (ethnobotany), this way, seizing the opportunity of using transdisciplinarity and transculturality.

The authors also registered and disclosed information about the caiçara food, identified as well as "identity food", like the fresh fish, coconuts with a bigger fat content, the artisanal manioc flour and the "bush coriander", that is, in fact, the most used spice in the preparation of fish-based recipes (Gonçalves & Gonçalves Junior, 2011). Thus, they catalogued the power of tradition before the preparation of "caiçara recipes", like the marine blue fish and its *pirão*, baked fish in the banana leaf, the ginger and tangerine leaf *caipirinha*, and white roasted coconut candy as well.

In this manner, Gonçalves and Gonçalves Junior (2011) define ethnogastronomy as "the study of a



people/community's own characteristics developed with an intention related to educational processes of tradition and resistance" (p. 7430, our translation). To Bittencourt et al. (2016), ethnogastronomy would be a science in which the study "intends to value and register local eating traditions, showing its importance to the feeding sovereignty of many peoples and cultures" (p. 31, our translation). For this reason, they verified that the population from the campsite *Cachoeira da Fumaça* — located in Governador Valadares-MG — protects the "important bicultural patrimony with the knowledge of practices of agroecology base and gastronomic culture" (Bittencourt et al. 2016, p.31, our translation).

Both articles, with the term "traditional peoples" on the keywords, were selected from their relation with ethnogastronomy, once they approach agroecology systems practices since the cultivation process until harvesting and preparing the food, reverberating roundly in the conservation of the environment. Ávila et al. (2018), presented a work in the Agroecology field bringing precisely the focus to the importance of ethnosciences as a tool to value the local knowledge of the people in Southern Brazil. They corroborated with the conservation of socio-biodiversity, understanding that agriculture of agroecological basis represents, above all, practices that maintain the territories' sovereignty. Besides, it also is a technical action of great relevance to the maintenance of lives on Planet Earth.

Following this perspective, the article of Silva and Lucas (2019) was found; it covers the environmental field and evaluated vegetal food resources that collaborate with the maintenance of feeding cultures and practices of 20 riverside communities affected by the installation of the Hydroelectric power station in Belo Monte — located in the municipality of Altamira in the state of Pará. Silva and Lucas (2019) investigated the riverside people's ethnobotany knowledge to comprehend the challenges in keeping traditions even with the changes made in the local ecosystem.

This way, they managed to make an inventory of the total of 143 species, being the biggest percentage in the category of usage in food products (61%) — many of these also are in the medicinal category. The riverside people reorganised all these species in a new location after being deterritorialized because of the power station; the authors first gathered information about these species, then analysed the cultivation system and usage of the plants by category.

The farmsteads, which represent 21% of food plants: cassava, corn and pumpkin are common. They are made cooked or roasted, in cakes, sweets or in porridges. In the

farmyard, it is found 67% of food plants, herbs that serve as flavouring agents to fish, like scallions, parsley, Pará's chicory and fruits — the most found ones are lemons, bananas, oranges, mangos, cashews and guava. They are consumed "in natura", in juices or sweets, and the riverside people also toast the cashew nut (Silva & Lucas, 2019).

Besides farmsteads and farmyards, another system is the regions of "Ciliar forest" and woods more distant from the margins that correspond to 12% of the food plants, representing part of the family farmyard. There are collected açai, babaçu coconut and Brazil nut (more known in Brazil as "Pará nut"). The açai is harvested and prepared in large groups, its juice is extracted and consumed with manioc flour; with the babaçu coconut milk is produced, oil and also coal; and, the Brazil nut is consumed "in natura" and sold in street markets (Silva & Lucas, 2019).

Finally, Silva and Lucas (2019) conclude that, after the mandatory deterritorialization, there was a decrease of 45% in the supply of plants utilised by the riverside people. That indicates that the loss of the territory was prejudicial to this community; even so, they managed to reconstruct in their new space a diverse environment with organised vegetal species in farmyards — with bigger diversity in cultivation that promotes food safety —, farmsteads — with indispensable food to the traditional economy and nourishment — and forests, — with traditionally native products consumed by the communities.

Indeed, the results found corroborate with the perception of the relevance of food plants to the riverside Xingu communities, reinforcing the necessity of research in which food systems of the traditional peoples are valued and respected, especially in communities affected by big projects — hydro electrics, roads or mining — for memories, identities, knowledge and eating habits of traditional peoples are threatened by extinction (Silva & Lucas, 2019).

The three post-graduate productions selected with the term "food culture" intended to understand some relations between the cultures and eating habits of village peoples (Pereira, 2015), indigenous peoples (Maciel, 2010) and quilombola communities (Ungarelli, 2009). It is important to highlight that the three chosen types of research include — in their descriptive, theoretical and methodological concerns — the practices of farmsteads' management, the preparation and consumption of food.

Therefore, Pereira (2015), when investigated the sociological and anthropological contributions, that is, in what ways the habits and eating practices that characterise

the local food culture gets passed on amongst rural families of Italian immigrants descent, concluded that the villagers in his analysis remain with their traditional habits and eating practices. In this way, the food system in question guarantees both security and feeding sovereignty, besides, the know-how of artisanal food products in this specific territory has been guaranteeing stability and income to the local villagers.

In Maciel's (2010) indigenous observations the main interest was to describe and deeply interpret the traditional agricultural practices of the Paresi ethnicity in the cultivation and harvesting of food plants. It has been detected that contact with the non-indigenous society affects and alters the habits of the indigenous, especially concerning food. In this context, her research points out that the subject of environmental conservation needs to be stimulated so it can be known that the traditional farmsteads go much further than just the nutritional function. In the indigenous territories, they must exist, effectively: "to keep strong the bonds of friendship, resistance, and magic, since is through them that the spirits of the "abê" (grandmother), "atyó" (grandfather) and "azé" (great parents) return incarnated in the participants, coexisting with their beloved ones" (Maciel, 2010, p. 164, our translation).

Finally, Ungarelli's work (2009). Her research has as central theme the relationship with land and the cultivation of food in the Kalunga culture; she concludes that the food production in the quilombola farmsteads — through agricultural practices in an agriecological system — see the cultivation and harvesting with respect to the agrobiodiversity. This conception showed itself as relevant to the local sustainability; the community's custom in producing their own food reverberates in healthy eating, since it strengthens the health and the "identity palate".

Moreover, it was verified that — from the selected studies to the present article — the analyses about the popular and traditional knowledge including habits and eating practices have different emphases. Although, they do bring the urgency of a positive valorisation of non hegemonic cultures when making an analytical description of the food, just like its usage and preparation as well, stimulating the rising of recipes and habits that stay in collective memory. Because of that, they are passed on orally through generations, corroborating with the maintenance of the environment and guaranteeing sustainability in biodiversity.

#### IV. CONCLUSION

In this work, the researches were made taking into account what Azevedo (2017) declared: the studies about

food, produced from the 2000s, focus on the act of cooking and eating, questions that sociology and anthropology cover. Still, few relevant works were found to this first discussion.

Gonçalves and Gonçalves Junior's research seemed to be the one that approximates most of what is expected from a work that focuses on ethnogastronomy. With an ethnographic point of view, they studied the caiçara community on their daily activities, observed and registered their choices and processes of cultivation, fishing, harvesting and combining different types of food, besides, of course, the presentation and manner of consumption. Also, they highlighted that the preservation of eating habits is a resistance form of communities, thus, these questions go through several fields of knowledge, showing that ethnogastronomy studies are transdisciplinary and transcultural.

Bittencourt et al. (2016) reinforce that ethnogastronomy, as a science, worries about the valorisation and registration of food traditions, and that the preservation of traditional peoples and local communities' know-how is important to food security and sovereignty. Hence, Ávila et al. (2018) point out that the valorisation of this knowledge corroborates with the conservation of socio-biodiversity, and that practices and agriculture of agroecology represent, above all, practices that maintain territorial sovereignty. In the same perspective, Silva and Lucas (2019), reinforce the necessity of research on the food systems of traditional peoples, concluding that the relevance of food plants to the Xingu riverside community gathers memories, identities, knowledge and eating habits of traditional peoples threatened by extinction.

Therefore, the three post-graduation works of Pereira (2015), Maciel (2010) and Ungarelli (2009) augment the importance of resuming the agricultural and eating traditions, contributing to the preservation of food systems of villagers, indigenous peoples and quilombolas. Thus, walking to a healthier diet and environment conservation, besides guaranteeing food security and sovereignty to these people.

It is important to remark that ethnogastronomy as a science is still in construction, and that is, perhaps, why researches with this approach are few, and, sometimes implicitly expressed or without the necessary depth. That is, it is still needed to learn concepts and methods capable of studying, analysing, understanding, valuing and sharing the knowledge of traditional peoples, specifically about the processes of eating, which this act involves cultivating, harvesting, preparing, combining, presenting and serving, always worrying about enhancing senses of satisfaction.

In the end, although it is true that the research on Ethnogastronomy is still emerging and are not systematised, the importance of resuming the knowledge of traditional peoples cannot be denied. For, the theme goes through transdisciplinarity and requires ethnographic methods for registration and the know-how valorisation of the eating habits of traditional peoples. These peoples corroborate with the protection of the environment, once their eating habits are sustainable and based on agroecology practices that lead to agriculture in total balance with nature.

## REFERENCES

- [1] Altieri, M.(2004). *Agroecologia: a dinâmica produtiva da agricultura sustentável*. 5. ed. Porto Alegre: Editora da UFRGS, p.120.
- [2] Ávila, S.; Hohn, D.; Rosa, M.; Lovatto, P. (2017). A importância da Etnociência na conservação e manutenção da sociobiodiversidade. In: CONGRESSO LATINO-AMERICANO, 11. CONGRESSO BRASILEIRO, 10. SEMINÁRIO DO DISTRITO FEDERAL E ENTORNO, 5. Brasília, DF. Anais eletrônicos... Brasília, DF: *Cadernos de Agroecologia*, v. 13, n. 1, 2018. p.s/n. Disponível em: <http://cadernos.aba-agroecologia.org.br/index.php/cadernos/article/view/858/421> > Acesso em: 23 mar. 2022.
- [3] Azevedo, E. (2017). Alimentação, sociedade e cultura: temas contemporâneos. *Sociologias*, Porto Alegre, v.19, n. 44, p. 276-307. Disponível em: <https://bitly.com/cvcGEO>> Acesso em: 15 abr. 2022.
- [4] Barbosa, I. (2019). Entre o fogão e a ciência: a comida como objeto de estudo na construção da cultura. *Inter-legere*, v.2, n. 25, p. 1-20: Disponível em: < <https://periodicos.ufrn.br/interlegere/article/view/17308>> Acesso em: 15 maio 22
- [5] Braga, V. (2004). Cultura alimentar: contribuições da antropologia da alimentação. *Revista Saúde*, Piracicaba, v.6, n.13, p. 37-44. Disponível em: < <https://bitly.com/ZWPsoO>> Acesso em 02 mai. 2022.
- [6] Brandão, C. R.(2015). *A comunidade tradicional*. NUPAUB. Disponível em: <<https://bitly.com/FOKwdi>> Acesso em: 10 mai. 2022.
- [7] Brasil. (2007). *Casa Civil. Decreto n. 6.040 de 7 de fevereiro de 2007*. Dispõe sobre a política nacional de desenvolvimento sustentável dos povos e comunidades tradicionais. Brasília, DF, 2007. Disponível em: < [http://www.planalto.gov.br/ccivil\\_03/ato2007-2010/2007/decreto/d6040.htm](http://www.planalto.gov.br/ccivil_03/ato2007-2010/2007/decreto/d6040.htm)> Acesso em: 01 abr. 2022.
- [8] Bittencourt, Diego F.; Rosa, R.R.G.; Moura, G.G.M. (2016). Etnogastronomia, agroecologia e resistência camponesa no acampamento Cachoeira da Fumaça, leste de Minas Gerais. In: SIMPÓSIO BRASILEIRO DE ETNOBIOLOGIA E ETNOECOLOGIA, 11 e FESTIVAL DE SEMENTES CRIOLAS DA BAHIA, 1, 2016. Feira de Santana, Bahia. Anais eletrônicos... Feira de Santana, Bahia: Z Arte Editora, p.31. Disponível em: < <http://ethnoscientia.com/index.php/CEE/issue/viewFile/7/11> > Acesso em: 23 mai. 2022.
- [9] Canesqui, Ana M. (2005). Comentários sobre os estudos antropológicos da alimentação. In: \_\_\_\_\_; GARCIA, R.W.D. (Org.) *Antropologia e nutrição: um diálogo possível*. Rio de Janeiro: Editora FIOCRUZ. I, 23-48. Disponível em: < <http://books.scielo.org/id/v6rkd/pdf/canesqui-9788575413876-02.pdf> > Acesso em: 15 mai. 2022.
- [10] Caporal, F. R. (2009). *Agroecologia: uma nova ciência para apoiar a transição a agriculturas mais sustentáveis*. Brasília: p. 30. Disponível em: < [http://www.cpatsa.embrapa.br:8080/public\\_eletronica/downloads/OPB2442.pdf](http://www.cpatsa.embrapa.br:8080/public_eletronica/downloads/OPB2442.pdf) > . Acesso em: 10 mai. 2022.
- [11] Caporal, F. R.; Costabeber, J. (2002). Análise multidimensional da sustentabilidade: uma proposta metodológica a partir da agroecologia. *Agroecologia e Desenvolvimento Rural Sustentável*, Porto Alegre, v.3, n.3, p. 70-85. Disponível em: < [http://taquari.emater.tcche.br/docs/agroeco/revista/ano3\\_n3/revista11\\_artigo3.pdf](http://taquari.emater.tcche.br/docs/agroeco/revista/ano3_n3/revista11_artigo3.pdf) > Acesso em: 13 abr. 2022.
- [12] Córdula, E.B.L.; Nascimento, G.C.C.; Lucena, R.P.F. (2018). Comunidade, meio ambiente e etnociência: saberes locais na conservação dos recursos naturais. *Revista Brasileira de Educação Ambiental*, São Paulo, v.13, n.2, p.85-103. Disponível em:< <https://periodicos.unifesp.br/index.php/revbea/article/view/2551> > Acesso em: 05 maio 2022.
- [13] Couto, H. H. (2007). *Ecolinguística: Estudo das relações entre língua e meio ambiente*. Brasília: Thesaurus, p.462.
- [14] Damatta, R. (1986). *O que faz o brasil, Brasil?* Rio de Janeiro: Rocco, p. 128.
- [15] Diegues, A. C. (2000). [Org]. *Saberes tradicionais e biodiversidade no Brasil*. Brasília: MMA; São Paulo: USP, p.211. Disponível em: <<https://bitly.com/iEaXJ>> Acesso em:10 mai. 2022.
- [16] D'Olne Campos, M. (1995). *Discussão teórico-metodológica: aspectos Etnocientíficos. Relatório técnico-científico do projeto temático FAPESP: Homem, Saber e Natureza*, v.1, Campinas, Aldebarã: Observatório a Olho Nu -UNICAMP, p. III-3.1 - III-3.10. Disponível em: < <https://www.sulear.com.br/texto04.pdf> > Acesso em: 14 abr. 2022.
- [17] Freitas, E.; Nery, C.C. (2018). Evento Enogastronômicos no município de Nova Petrópolis - RS. In: SEMINÁRIO DE ATUAÇÃO PROFISSIONAL EM EVENTOS, 3, 2018. Porto Alegre, RS. *Anais eletrônicos...* Rio Grande do Sul, p. 23-26. Disponível em: < <https://memoriasape.furg.br/images/anais/ANAIS.pdf>> Acesso em: 25 maio 2022.
- [18] Gonçalves, T.F.C.; Gonçalves Junior, L. (2011). Etnogastronomia caiçara: a cultura alimentar da comunidade de Praia Mansa – Ilhabela. In: CONGRESSO NACIONAL DE EDUCAÇÃO, 10 e SEMINÁRIO INTERNACIONAL DE REPRESENTAÇÕES SOCIAIS, SUBJETIVIDADE E EDUCAÇÃO, 1, 2011. Curitiba, PR. *Anais eletrônicos...* Curitiba, Paraná. p. 7428-7439. Disponível em:

- [https://educere.bruc.com.br/CD2011/pdf/6091\\_3358.pdf](https://educere.bruc.com.br/CD2011/pdf/6091_3358.pdf)  
Acesso em: 10 abr. 2022.
- [19] Gonçalves, J.R.S. (2004). A fome e o paladar: a antropologia nativa de Luis da Câmara Cascudo. *Estudos Históricos*, n.33, p.40-55. Disponível em: <<http://bibliotecadigital.fgv.br/ojs/index.php/reh/article/view/2210>> Acesso em: 12 abr. 2022.
- [20] Hamlyn, P. (2011). *New Concise Larousse Gastronomique: The Culinary Classic Revised and Updated*. Reino Unido: Hamlyn, p. 1440.
- [21] Lima, D. M. (2009). A construção histórica do termo caboclo: Sobre estruturas e representações sociais no meio rural amazônico. *Novos Cadernos NAEA*, [S.l.], v. 2, n. 2. ISSN 2179-7536. Disponível em: <<https://periodicos.ufpa.br/index.php/ncn/article/view/107>>. Acesso em: 18 jun. 2022.
- [22] Lopes, P.R.; Lopes, K.C.S.A. (2011). Sistemas de produção de base agroecológica: a busca por um desenvolvimento rural sustentável. *Revista Espaço de Diálogo e Desconexão*. Araraquara, v.4, n.1, p.s/n. Disponível em: <<https://periodicos.fclar.unesp.br/redd/article/view/5047>> Acesso em: 29 mar. 2022.
- [23] Maciel, M.A. (2010). *Raiz, planta e cultura: as roças indígenas nos hábitos alimentares do povo Paresi, Tangará da Serra, Mato Grosso, Brasil*. Tese (Doutorado em Agronomia) - Universidade Estadual Paulista, Botucatu, São Paulo. Disponível em: <https://bitly.com/kZJDYh>> Acesso em: 12 abr. 2022.
- [24] Mintz, S.W. (2001). Comida e antropologia: uma breve revisão. *Revista Brasileira de Ciências Sociais*, v.16, n.47. Disponível em: <<https://bitly.com/TEKLYK>> Acesso em: 10 mar. 2022.
- [25] Nazarea-Sandoval, V. D. (1991). Ethnobotany and ethnogastronomy: On indigenous typology and use of biological resources. *Agriculture and Human Values*. Switzerland AG, v. 8, n. 1-2, p. 121-131. Disponível em: <<https://link.springer.com/article/10.1007/BF01579665>> Acesso em: 30 maio 2022.
- [26] Oliveira-Monteiro, N. R.; Scachetti, R. E.; Nagib, V. (2017). Identidades de pescadores caiçaras: heroísmo e precariedade em populações tradicionais? *Desenvolvimento e Meio Ambiente*, v. 41, p. 124-139. Disponível em: <https://revistas.ufpr.br/made/article/view/48341> Acesso em: 19 jun. 2022.
- [27] Pereira, A.B.A.S. (2015). *Agricultura familiar camponesa e cultura alimentar: hábitos e práticas alimentares das famílias rurais da linha Simonetti – Ivorá/RS*. Dissertação (Mestrado em Extensão Rural) – Universidade Federal de Santa Maria, Rio Grande do Sul, 2015. Disponível em: <<https://bitly.com/AdjMXf>> Acesso em: 20 abr. 2022.
- [28] Poulain, J.P. (2004). *Sociologias da Alimentação: os comedores e o espaço social alimentar*. Florianópolis: UFSC, [Trad.] Proença, R.P.C.; Rial, C.S.; Conte, J. p.223-242.
- [29] Silva, G.; Lucas, F. C. A. (2019). Ribeirinhos e a hidrelétrica Belo Monte: a desterritorialização e influências no cultivo de plantas alimentícias. *Ambiente & Sociedade*, n. s/n, v. 22, São Paulo. Disponível em: <<https://www.scielo.br/i/asoc/a/9pzFzjncWVrNrKjx4QtTm8x/?format=pdf&lang=pt>> Acesso em: 10 jul. 2022.
- [30] Silva, J.K.; Prado, S.D.; Carvalho, M.C.V.S.; Ornelas, T.F.S.; Oliveira, P.F.de. (2010). Alimentação e cultura como campo científico no Brasil. *Physis Revista de Saúde Coletiva*, Rio de Janeiro, v.20, n. 2, p. 413-442. Disponível em: <[https://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0103-73312010000200005](https://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-73312010000200005)> Acesso em: 10 mar. 2022.
- [31] Souza, Maria de; Bernardi, Luci dos Santos; SANTOS, Jorge Alejandro. (2020). Sobre “ser caboclo”: as vozes de caboclos do Oeste catarinense. *Revista do Instituto de Estudos Brasileiros*, Brasil, n. 77, p. 88-107. Disponível em: <<https://www.scielo.br/j/rieb/a/7d5hvjsHDLPNC6ndSMrN8Cj/?lang=pt>> Acesso em: 10 jul. 2022.
- [32] Souza, V.M.; Santos Júnior, A.F.; Benevides, C.M.J. (2019). Agrobiodiversidade e Plantas Alimentícias não convencionais (PANCS): inter-relações com povos tradicionais e comunidades locais. *Cadernos de ciências sociais aplicadas*, Vitória da conquista, Bahia, v.16, n.28, p.163-178. Disponível em: <<https://periodicos2.uesb.br/index.php/ccsa/article/view/5852>> Acesso em: 23 out. 2020.
- [33] Tempass, M.C. (2010). *Quanto mais doce, melhor: um estudo antropológico das práticas alimentares da doce sociedade Mbyá-Guarani*. Tese (Doutorado em Antropologia Social) - Universidade Federal do Rio Grande do Sul, Porto Alegre. Disponível em: <<https://bitly.com/WIuStS>> Acesso em: 11 abr 2022.
- [34] Ungarelli, D.B. (2009). *A comunidade quilombola Kalunga do Engenho II: cultura, produção de alimentos e ecologia de saberes*. Dissertação (Mestrado em Desenvolvimento Sustentável) – Universidade de Brasília, Distrito Federal. Disponível em: <[https://repositorio.unb.br/bitstream/10482/4187/1/2009\\_DaniellaBuchmannUngarelli.pdf](https://repositorio.unb.br/bitstream/10482/4187/1/2009_DaniellaBuchmannUngarelli.pdf)> Acesso em: 10 abr 2022.
- [35] Veltri, A.L.A. (2017). *Estudo de etnociências nas boas práticas agrícolas de plantas medicinais, aromáticas e condimentares do município de Botucatu, SP*. Dissertação (Mestrado em Agronomia) – Universidade Estadual Paulista, Botucatu, São Paulo. Disponível em: <[https://repositorio.unesp.br/bitstream/handle/11449/150062/veltri\\_ala\\_me\\_bot.pdf?sequence=4&isAllowed=y](https://repositorio.unesp.br/bitstream/handle/11449/150062/veltri_ala_me_bot.pdf?sequence=4&isAllowed=y)> Acesso em: 08 abr. 2022.
- [36] Viertler, R.B. (2002). Métodos antropológicos como ferramenta para estudos em etnobiologia e etnoecologia. In: AMOROZO, M. C. M.; MING, L. C.; SILVA, S. P. (Ed.). *Métodos de coleta e análise de dados em etnobiologia, etnoecologia e disciplinas correlatas*. Rio Claro: Unesp, p. 11-29.
- [37] Wiczorkowki, J.R.S.; Pesovento, A.; Téchio, K.H. (2018). Etnociência: um breve levantamento da produção acadêmica de discentes indígenas do curso de educação intercultural. *Revista Ciências & Ideias*, v. 9, n.3, p.153-168. Disponível em: <<https://revistascientificas.ifrj.edu.br/revista/index.php/reci/article/view/948/620>> Acesso em: 09 mar. 2022.

# What I as a Patient/Family need to know about Bariatric and Metabolic Surgery: A Booklet for Lay People

## O Que eu, Como Paciente/Familiar, Preciso Saber Sobre Cirurgia Bariátrica e Metabólica: Uma Cartilha Para Leigos

Clayton Alencar Moreira<sup>1</sup>, Silvestre Savino Neto<sup>2</sup>, Silvia Ferreira Nunes<sup>3</sup>

<sup>1</sup>Médico (a). Mestrando (a) em Gestão em Serviços de Saúde na Amazônia da Fundação Santa Casa do Pará. ( FSCMPA). Fundação Santa Casa do Pará (FSCMPA). Belém, Pará – Brasil.

<sup>2</sup>Doutor em Ciências Biológicas pela Universidade Federal do Pará. Professor e orientador do Programa de Pós-Graduação em Gestão e Saúde na Amazônia da Fundação Santa Casa de Misericórdia do Pará (FSCMPA). Fundação Santa Casa do Pará (FSCMPA). Belém, Pará – Brasil.

<sup>3</sup>Doutora em Ciências - Desenvolvimento Social e Ambiental (NAEA / UFPA), Professora do Programa de Pós-Graduação em Gestão e Saúde na Amazônia da Fundação Santa Casa de Misericórdia do Pará (FSCMPA) e professora do Programa de Pós-Graduação em Gestão Pública na Universidade Federal do Pará (NAEA/ UFPA). Fundação Santa Casa do Pará (FSCMPA). Belém, Pará – Brasil.

Received: 12 Aug 2022,

Received in revised form: 04 Sep 2022,

Accepted: 09 Sep 2022,

Available online: 14 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords— Obesity; Bariatric surgery; Metabolic syndrome; Quality of life; Comorbidities.**

**Palavras-chaves— Obesidade; Cirurgia Bariátrica; Síndrome Metabólica; Qualidade de Vida; Comorbidades.**

**Abstract— Introduction:** obesity and its comorbidities have an increasing prevalence each year, with a surgical treatment established for many years. **Objective:** to transform the preoperative, trans and postoperative aspects of bariatric and metabolic surgery in obese patients into accessible, clear and assertive information. **Methods:** This is an excerpt from a descriptive, observational and cross-sectional master's dissertation carried out in a hospital in the state of Pará. The information was collected through the institution's medical records, in addition to interviews with obese patients and close family members who presented the indications for bariatric and metabolic surgery. The study complied with the Research Standards involving Human Beings of the Ministry of Health and the National Health Council. **Results and discussion:** after analyzing the exclusion criteria, 98 patients and family members were included, who responded adequately to the questionnaire. Most were young adults, female, brown, with higher education and married. Soon after, an educational booklet was prepared for patients and their families. The research focused on selecting random bariatric surgery patients, being strategic in the information construction process. **Conclusion:** The tool as a booklet has very simple and intelligible didactics and can reach a very large percentage of patients, becoming of great value in the future of bariatric surgery, demystifying many topics that are still obscure for the vast majority of patients and their families.

**Resumo— Introdução:** a obesidade e suas comorbidades tem uma prevalência crescente a cada ano, com um tratamento cirúrgico estabelecido já há muitos anos. **Objetivo:** transformar em informações

*acessíveis, claras e assertivas o pré-operatório, trans e pós-operatório da cirurgia bariátrica e metabólica em pacientes obesos. Métodos: Trata-se de um recorte da dissertação de mestrado do tipo descritivo, observacional e transversal realizado em um hospital no estado do Pará. As informações foram coletadas através de prontuários da instituição, além da realização de entrevistas com pacientes obesos e familiares mais próximos que apresentaram as indicações para cirurgia bariátrica e metabólica. O estudo respeitou as Normas de Pesquisa envolvendo Seres Humanos do Ministério da Saúde e do Conselho Nacional de Saúde. Resultados e discussão: após análise dos critérios exclusão foram inclusos 98 pacientes e familiares, que responderam adequadamente ao questionário. A maioria eram adultos jovens, do sexo feminino, pardo, com ensino superior completo e casados. Logo após foi elaborado uma cartilha educativa para os pacientes e seus familiares. A pesquisa focou em selecionar pacientes aleatórios de cirurgia bariátrica, sendo estratégico no processo da construção de informação Conclusão: A ferramenta como cartilha tem didática muito simples e inteligível podendo alcançar um percentual de pacientes muito grande se tornando de grande valia no futuro da cirurgia bariátrica, desmistificando muito temas ainda obscuro para grande maioria dos pacientes e seus familiares.*

## I. INTRODUÇÃO

A OMS (organização mundial de saúde) reconhece que neste século a obesidade tem uma prevalência igual ou superior à da desnutrição, e se não for feito um esforço coletivo da sociedade como um todo, cerca de 50% da população será obesa até 2025<sup>1</sup>. Hipócrates já estava bem ciente da obesidade como doença e suas consequências. O famoso conhecido retórico Eliano Claudius (235d.c), mostra detalhadamente a história de Dionísio, ditador de Heráclea Póntica, que devia ser muito obeso e tinha apneia do sono. Mas desde desta época o tratamento era muito errático e com foco deslocado do necessário. Santo Agostinho, no século V e o papa Gregório I, no século VII, colocaram a gula como pecado capital. No século XV, Bosch (1450 – 1516) pintou os “sete pecados capitais” e relacionou a gula com a obesidade<sup>2</sup>.

O mundo evolui e as doenças seguem o fluxo, a obesidade vem se tornando problema de saúde pública, há muito tempo, os países ricos tem mais obesidade e a medicina vai tentando resolver, o surgimento da cirurgia bariátrica, em 1950 com dr. Krenen e Liner que fizeram as primeiras derivações intestinais foram logo abandonadas devido a muita desnutrição, no Brasil Dr.Salomão Chaib fez as primeiras em 1960, mas foi a partir de 1966 com observação do dr. Edward Mason(morto em 2020 aos 100 anos de idade) da universidade de Iowa nos Estados Unidos, tomou forma e rumo certo, ele observava que pacientes que sofriam uma gastrectomia por câncer gástrico ou trauma, emagreciam e dificilmente voltava a engordar, então ele planejou uma cirurgia de

reduzir o estômago mas sem retirar da cavidade(sem a gastrectomia) e teve enorme sucesso, vindo outros gigantes da cirurgia como dr. Rafael Capela e Dr. Mal Fobi deram um salto na cirurgia bariátrica com colocação de anel e outras evoluções, dr. Alan Wittgrove( Atlanta-Estados Unidos)fez a primeira bariátrica por vídeo-laparoscopia iniciando uma era de cirurgia minimamente invasiva<sup>3</sup>. O termo bariátrico deriva do prefixo grego “bari”, que significa peso, e do sufixo “iátrou” que significa os que praticam a medicina<sup>4</sup>.

A obesidade mórbida, como doença grave que leva a inúmeras comorbidades, tem que ser reconhecida como tratável, como quando bem indicada, cirúrgica, de causa multifatorial e de base genética. As sociedades médicas já estão bem-organizadas, mas divulgar ao leigo toda a gama de conhecimento que envolve a cirurgia bariátrica e metabólica, precisa ganhar mais importância, mais pesquisas, mais informações, de maneira mais acessível e mais inteligível com certeza que o mundo digital oferece inúmeros de dados, mas ainda faltava algo<sup>5</sup>.

Temos que salientar a evolução da cirurgia vídeo laparoscópica, da anestesiologia, da cirurgia robótica, como fator que promoveu o aumento do número de cirurgias bariátricas, não há como deixar de ressaltar o aumento progressivo da doença obesidade mórbida<sup>6,7</sup>.

O sucesso de qualquer tratamento perpassa inicialmente pelo nível de conhecimento que o interessado tem sobre o assunto e suas consequências, para além do paciente destaca-se importância do conhecimento daqueles que o acompanham no seu cotidiano onde são

estabelecidas as principais relações para o sucesso do tratamento, defende-se, nesse contexto, a necessidade de maior acesso a conteúdo e informação sobre a cirurgia bariátrica e metabólica, o preparo, importância, indicação, e recuperação de tal intervenção no tratamento da obesidade<sup>8</sup>.

Após 22 anos trabalhando com cirurgia bariátrica, observamos que os pacientes careciam de informação mais fácil de entender, em uma linguagem menos científica, claro que com internet existem milhões de dados sobre a bariátrica, mas havia a necessidade da ‘tradução ‘desses dados. Tínhamos palestras mensais da equipe (psicóloga, nutricionista, anesthesiologista, cirurgião plástico...), mas com a pandemia ficamos impedidos, entretanto continuou a necessidade de informar os pacientes, criamos então um canal no Instagram e no youtube, mas ainda não se alcançava os pacientes em grande número, então surgiu a oportunidade do mestrado em se fazer um produto acessível.

O objetivo geral do tratamento da obesidade mórbida, deve associar a equipe multiprofissional, dando a devida importância e valor ao nutricionista e psicólogo principalmente, para o paciente ter uma maior adesão ao tratamento, e claro com melhores resultados<sup>9</sup>, traçando uma estratégia assertiva de mudança comportamental, trazendo para junto da equipe e paciente, o familiar que convive com o este, podendo agregar conhecimento sobre o paciente, a cerca do ambiente familiar e todo o entorno da situação, facilitando o entendimento da complexidade(do contexto: paciente-familiar-equipe) de se tratar o paciente obeso mórbido, não somente operando o estômago e intestino, mas dando condições para ele aceitar as mudanças e não ter impacto negativo no resultado, se forem tomados esses cuidados, os desejos de saúde plena serão alcançados com certeza, sendo mais humanizados e melhores<sup>10</sup>.

Diante de tantas evidências científicas a respeito da obesidade e da síndrome metabólica e do destaque do tratamento efetivo das mesmas e do impacto de tal intervenção na qualidade de vida dos pacientes, é imensurável a relevância da discussão deste assunto e a necessidade de uma ferramenta que possa atingir a população leiga a respeito destes tópicos, de maneira educativa e objetiva, sendo assim, vê-se uma Cartilha Informativa sobre a Cirurgia Bariátrica um excelente e acessível produto para alcançar e instruir a população<sup>11</sup>.

A inserção de novas tecnologias no contexto da educação em saúde vem complementar e implementar as ações empenhadas e já conhecidas, mas muitas ainda pouco divulgadas. A utilização de maneira mais simplificada e traduzida para leigos, vem somar a um trabalho dinâmico

não mais passivo, com objetivo mais amplo. Pluralidade, dinamicidade e criatividade associados a flexibilidade, com muita sensibilidade vai gerar um conteúdo de acesso geral<sup>12</sup>.

Fator que justifica a elaboração de uma cartilha online destinada ao público leigo em Cirurgia Bariátrica e Metabólica para que possam se informar sobre o assunto. Assim o problema de pesquisa que se apresenta neste trabalho considera o que os pacientes precisam conhecer sobre a Cirurgia Bariátrica e Metabólica, busca-se transformar essas necessidades em informações assertivas para esse público e para a sociedade.

A criação dessa cartilha para leigos tem o intuito de divulgar, informar, desmistificar a cirurgia bariátrica e metabólica, oferecendo um acesso livre, com linguagem direta sem a roupagem científica tradicional. Após aplicado questionário aos pacientes, feito o roteiro da cartilha e consultado profissional de design para construir a cartilha, foi submetida a validação com profissionais de cirurgia bariátrica e pacientes já operados.

## II. MÉTODOS

Trata-se de um recorte da dissertação de mestrado do tipo descritivo, observacional e transversal, que pretende compreender as dúvidas dos pacientes em acompanhamento clínico e cirúrgico sob atendimento do Dr. Clayton Alencar Moreira, no Hospital do Coração, assim como do público em geral, a partir da análise das informações contidas e colhidas por meio de questionário fornecido aos envolvidos no projeto de pesquisa.

A pesquisa será realizada no Hospital do Coração, localizado em Belém/Pa. Os participantes envolvidos no referido projeto serão os pacientes e seus familiares atendidos pelo Dr. Clayton Alencar Moreira no referido Hospital e dispostos a participar da pesquisa.

Serão inclusos no presente estudo pacientes obesos e até dois familiares mais próximos como pai, mãe ou cônjuge, que apresentem as indicações para cirurgia bariátrica e metabólica e tenha o desejo de operar podendo ou não já estarem em pré ou mesmo no pós-operatório de Cirurgia Bariátrica e Metabólica, em conhecer sobre o tema da pesquisa e contribuir com a mesma, sem discriminar sexo, idade ou raça e que tenham aceitado os termos do Termo de Consentimento Livre e Esclarecido (TCLE) apresentados aos mesmos por via *Google Forms*. Serão excluídos do estudo, aquelas pessoas que não foram operadas pelo dr. Clayton ou não se incluem como familiares.

O estudo será realizado dentro dos preceitos éticos, respeitando as Normas de Pesquisa envolvendo

Seres Humanos (Rs. 466/2012) do Ministério da Saúde (MS) e do Conselho Nacional de Saúde (CNS), assim como as Res, CNS/MS 510/2016 e Res. CNS/MS 580/2018. Sendo submetido à apreciação do Comitê de Ética e Pesquisa da Fundação Santa Casa de Misericórdia do Pará, conforme CAAE 48054921.2.0000.5171 e parecer aprovado de número 4.817.409. Tendo o pesquisador comprometendo-se a manter a confidencialidade sobre os dados coletados, o rigor ético, bem como a privacidade dos seus conteúdos coletados e utilizados durante a pesquisa

As informações obtidas serão usadas unicamente para suprir os objetivos dessa pesquisa. O pesquisador se compromete em expor os resultados obtidos sem quaisquer restrições. Os participantes da pesquisa serão estudados segundo os preceitos da Declaração de Helsinki V e do Código de Nuremberg. Caso o responsável do questionário coletado venha a integrar a casuística deste estudo e deseje acesso à pesquisa para que tenham esclarecidas as intenções deste trabalho, bem como a destinação dos dados através dele obtidos, será apresentado um Termo de Consentimento Livre e Esclarecido – TCLE, assim como se ele for entrevistado.

Os dados manuseados serão guardados pelos pesquisadores, por um prazo mínimo de cinco anos e os resultados informados ao Sistema Único de Saúde (SUS) e à comunidade científica, através da publicação dos resultados apresentados em forma de comunicação científica do Curso de Mestrado Profissional Gestão e Serviços em Saúde da Fundação Santa Casa de Misericórdia do Pará.

As informações usadas por esse projeto serão obtidas por meio de prontuários eletrônicos e físicos armazenados no Hospital do Coração, após o pesquisador ter assinado Termo de Compromisso de Utilização de Dados (TCUD), com o fim de obter contato com os pacientes. Ademais informações não contidas nos prontuários serão obtidas por meio de entrevistas com pacientes do Dr. Clayton Alencar e público em geral, por meio da aplicação de questionário digital, via *Google Forms*, após eles terem assinado o TCLE, disponíveis no link: <https://forms.gle/tRY14xrmBqzFNjVF8>, sendo também possível fazer Download em PDF pelo <https://drive.google.com/file/d/1vXY9IZyLihdyNxom8g8Sevqja947na/view?usp=sharing>. Os dados coletados serão armazenados em planilha eletrônica do software Excel.

A base de dados, análises gráficas e tabelas foram organizados e construídos a partir das ferramentas do programa Microsoft Word e Excel 2016. Nesta etapa do trabalho utilizou-se especialmente da estatística descritiva para estabelecer mínimo, máximo e média, bem como, frequência e percentagem.

O presente projeto tem como intuito gerar uma cartilha física e digital (e-book, QR CODE E APLICATIVO) que pretende orientar os pacientes e seus familiares e público leigo em geral, sobre as repercussões clínicas da cirurgia bariátrica e metabólica.

- ✓ Viabilidade de implantação e implementação no serviço; intersectorialidade

O trabalho será viabilizado com recursos próprios do pesquisador. Os setores privados envolvidos como o Hospital do Coração não arcarão com despesas, apenas oferecerão os locais para consultas e aplicação dos questionários. Serão beneficiados os pacientes como um todo e a sociedade científica, sendo este projeto Tese de Mestrado do Curso de mestrado Profissional Gestão e Serviços em Saúde da Fundação Santa Casa de Misericórdia do Pará, viabilizando mais dados para consultas e pesquisas disponibilizadas no trabalho, assim como esclarecimentos das patologias, Obesidade e Síndrome Metabólica.

### III. RESULTADOS

#### 3.1 CARACTERÍSTICAS SOCIODEMOGRÁFICAS E CLÍNICAS DOS PARTICIPANTES

Foram incluídos no estudo 98 pacientes e familiares, que responderam adequadamente ao questionário. A maioria (74,5%) era do sexo feminino, adultos jovens (60% tinham de 20 a 39 anos). A idade média foi de 37,2 anos, variando de 21 a 67 anos. A maioria se declarou branca (41,8) ou pardo (49%). Quase 60% tinham ensino superior completo e 33,7% tinham pós-graduação. Mais da metade (54,1%) eram casados e apenas 4% eram de outros estados. As profissões foram bem diversificadas, sendo estudantes, administradores, professores e médicos os mais frequentes (**Error! Reference source not found.**).

*Tabela 1 - Características sociodemográficas dos pacientes obesos e familiares próximos, atendidos na Clínica Unigestro e no Hospital do Coração, de janeiro de 2010 a julho de 2021, Belém - Pará.*

| Variável        | Frequência | Percentagem |
|-----------------|------------|-------------|
| <b>Sexo</b>     |            |             |
| Feminino        | 73         | 74,5        |
| Masculino       | 24         | 24,5        |
| Outro           | 1          | 1,0         |
| <b>Idade</b>    |            |             |
| De 20 a 39 anos | 58         | 59,2        |
| De 40 a 59 anos | 37         | 37,8        |



|                         |    |      |
|-------------------------|----|------|
| De 60 a 67 anos         | 2  | 2,0  |
| <b>Etnia</b>            |    |      |
| Pardo                   | 48 | 49,0 |
| Branco                  | 41 | 41,8 |
| Negro                   | 6  | 6,1  |
| Outros                  | 3  | 3,1  |
| <b>Escolaridade</b>     |    |      |
| EM Completo             | 9  | 9,2  |
| ES completo/incompleto  | 56 | 57,1 |
| Pós-Graduação           | 33 | 33,7 |
| <b>Estado onde mora</b> |    |      |
| Pará                    | 93 | 94,9 |
| Tocantins               | 2  | 2,0  |
| Amapá                   | 1  | 1,0  |
| Goiás                   | 1  | 1,0  |
| Suriname                | 1  | 1,0  |
| <b>Estado civil</b>     |    |      |
| Casado                  | 53 | 54,1 |
| Solteiro                | 32 | 32,7 |

|                  |    |      |
|------------------|----|------|
| Divorciado       | 7  | 7,1  |
| Outro            | 6  | 6,1  |
| <b>Profissão</b> |    |      |
| Estudante        | 14 | 14,3 |
| Professor        | 10 | 10,2 |
| Administrador    | 8  | 8,2  |
| Médico           | 7  | 7,1  |
| Enfermeiro       | 6  | 6,1  |
| Advogado         | 5  | 5,1  |
| Empresário       | 5  | 5,1  |
| Outros           | 43 | 43,9 |

As percentagens são relativas ao total de participantes (n=98).

Considerando todos os entrevistados, 45% tinham IMC de 30 ou mais (o máximo encontrado foi 49,3) e 35,7% tinham IMC de 25 a 29,9 (Fig.1). As proporções de respondentes com IMC abaixo de 25 foram similares entre os entrevistados já submetidos à cirurgia bariátrica e os que não realizaram a cirurgia (aproximadamente 20%, em ambos os casos). Ao contrário, 53,5% dos entrevistados que não haviam feito cirurgia tinham IMC de 30 ou mais.



Fig.1 - IMC dos pacientes obesos e familiares próximos, atendidos na Clínica Unigastro e no Hospital do Coração, de janeiro de 2010 a julho de 2021, Belém - Pará.

As percentagens são relativas ao total de respondentes em cada grupo (sofreu cirurgia bariátrica ou não) ou ao total (Geral).

### 3.2 CONHECIMENTOS RELACIONADOS À CIRURGIA BARIÁTRICA

O nível de conhecimento relacionados à cirurgia bariátrica. Quando perguntados sobre os tipos de cirurgia bariátrica realizáveis, a proporção dos que não sabiam era bem maior entre os que não tinham feito a cirurgia (30,2%) comparativamente aos que fizeram (5,5%) (Fig.2).



Fig.2 - Respostas sobre os tipos de cirurgia bariátrica que podem ser feitas.

As percentagens são relativas ao total de respondentes em cada grupo (sofreu cirurgia bariátrica ou não) ou ao total (Geral).

Considerando o nível de conhecimento sobre técnicas cirúrgicas bariátricas mais conhecidas, a proporção de entrevistados que não sabiam quais técnicas de cirurgias existentes foi de 34,9% entre os que não haviam feito a cirurgia e 1,8% entre os que já realizaram o procedimento (

).

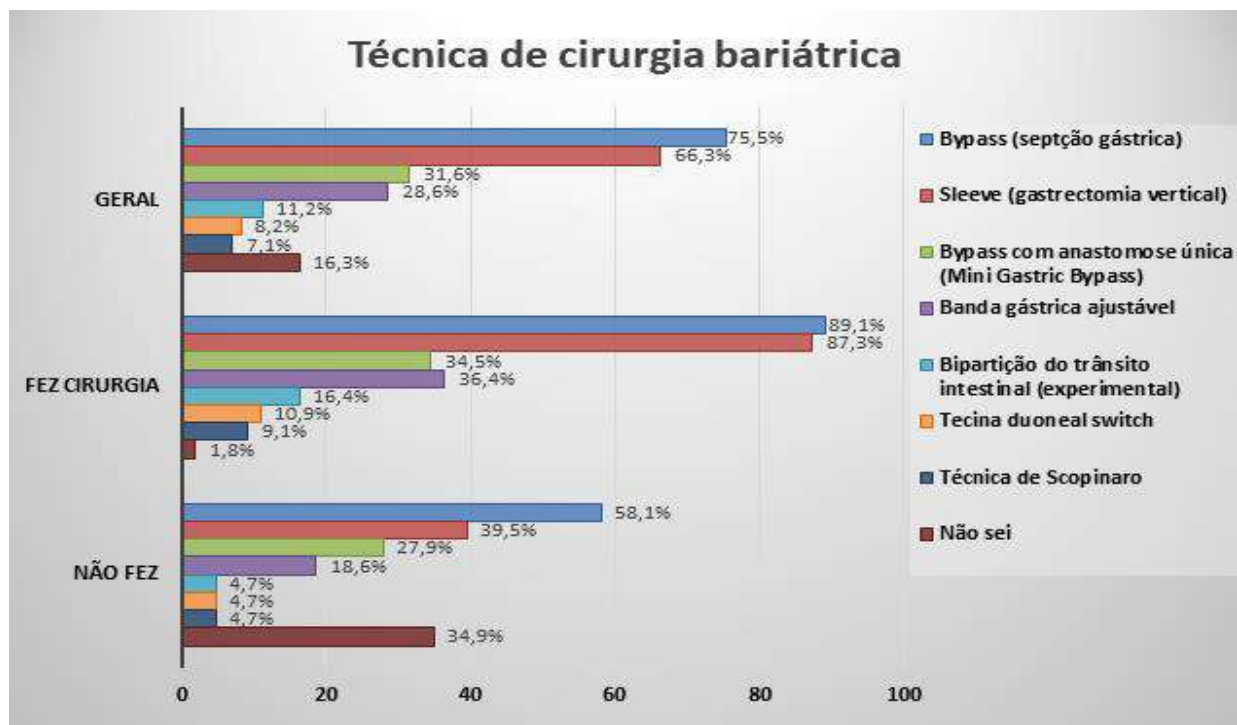


Fig.3 - Quais técnicas de cirurgia bariátrica você conhece?

As percentagens são relativas ao total de respondentes em cada grupo (sofreu cirurgia bariátrica ou não) ou ao total (Geral).

A respeito do conhecimento de IMC apresentado na figura 4, observou-se que a proporção dos que não sabiam o que era IMC foi levemente maior no grupo não submetido à cirurgia em comparação aos já operados (11,6% e 7,3%, respectivamente) (Fig.4).



Fig.4 - Sabe o que é IMC (Índice de Massa Corpórea)?

As percentagens são relativas ao total de respondentes em cada grupo (sofreu cirurgia bariátrica ou não) ou ao total (Geral).

De forma geral os grupos apresentam informação sobre as comorbidades relacionadas a obesidade, assim destacam-se as respostas mais frequentes que foram HAS (83,7%), Diabetes Mellitus II (82,7%) e gordura no fígado (80,6%). Gordura no fígado foi mais citada no grupo que já fez cirurgia (Fig.5).

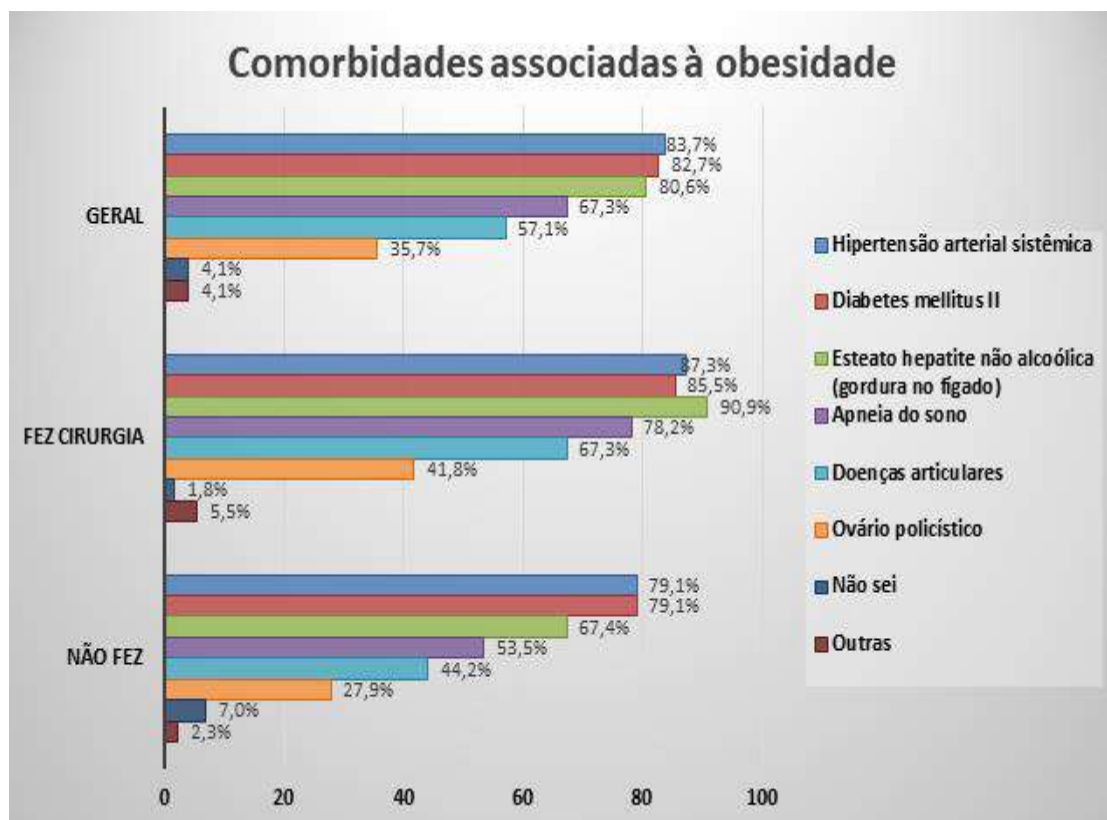


Fig.5 - Quais as comorbidades relacionadas à obesidade?

As percentagens são relativas ao total de respondentes em cada grupo (sofreu cirurgia bariátrica ou não) ou ao total (Geral).

O nível de informação sobre as indicações para cirurgia bariátrica entre quem já realizou a cirurgia, apenas 1,8% não conheciam as indicações para a cirurgia bariátrica, enquanto esta percentagem foi de 27,9% entre os não-operados (Fig.6).



Fig.6 - Sabe quais são as indicações para cirurgia bariátrica?

As percentagens são relativas ao total de respondentes em cada grupo (sofreu cirurgia bariátrica ou não) ou ao total (Geral).

Ao serem indagados a citar as indicações para a cirurgia, mais da metade dos que já realizaram o procedimento responderam como critério: IMC > 35 + três comorbidades (67,3%), IMC > 40 (61,8%) e falha no tratamento clínico após 2 anos (54,5%), enquanto entre os que não realizaram o procedimento estas frequências foram de 44,2% nos três casos (Fig.7).

A OMS classifica uma situação de obesidade quando o IMC (peso em kg dividido pelo quadrado da altura em metro), encontra-se acima de 30kg/m<sup>2</sup>. Quanto a gravidade, a OMS propõe a seguinte classificação: obesidade grau I, quando o IMC está entre 30 e 34,9 kg/m<sup>2</sup>, obesidade grau II, quando o IMC está entre 35 e 39,9 kg/m<sup>2</sup> e obesidade grau III, quando o IMC ultrapassa 40kg/m<sup>2</sup> 22.

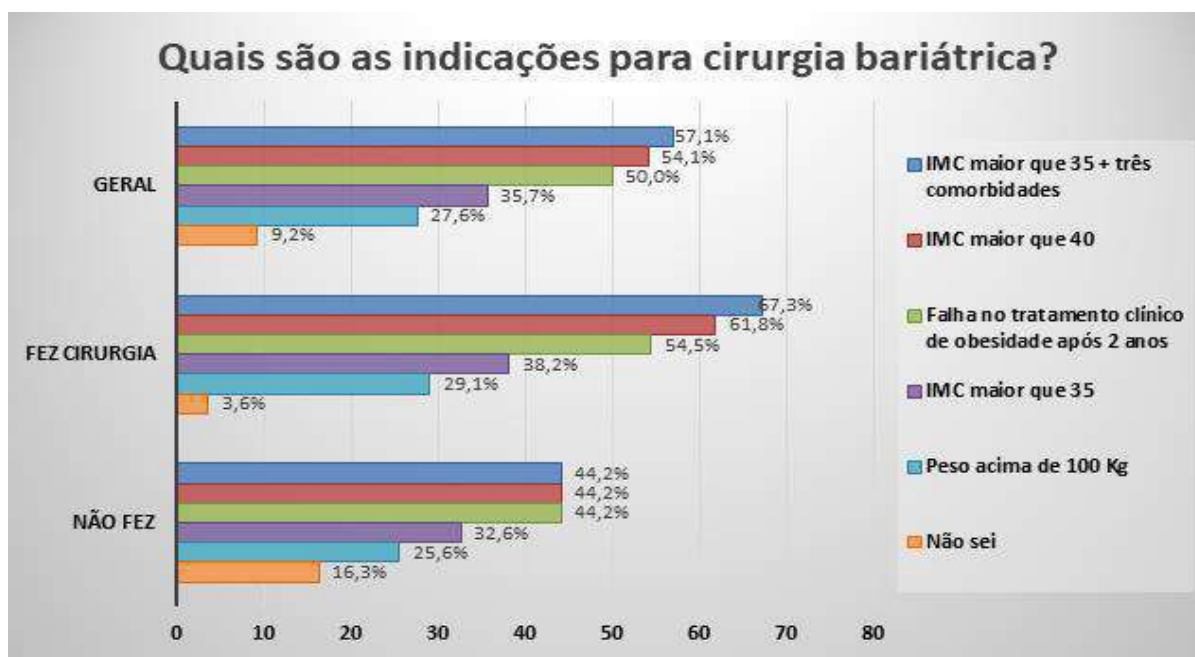


Fig.7 - Quais as indicações para cirurgia bariátrica?

As percentagens são relativas ao total de respondentes em cada grupo (sofreu cirurgia bariátrica ou não) ou ao total (Geral).

Questionados sobre as possíveis complicações, 34,9% dos não operados não souberam responder, enquanto 7,3% dos operados não souberam. 87,3% dos operados citaram queda de cabelo e 54,5% citaram desnutrição (Figura 08)

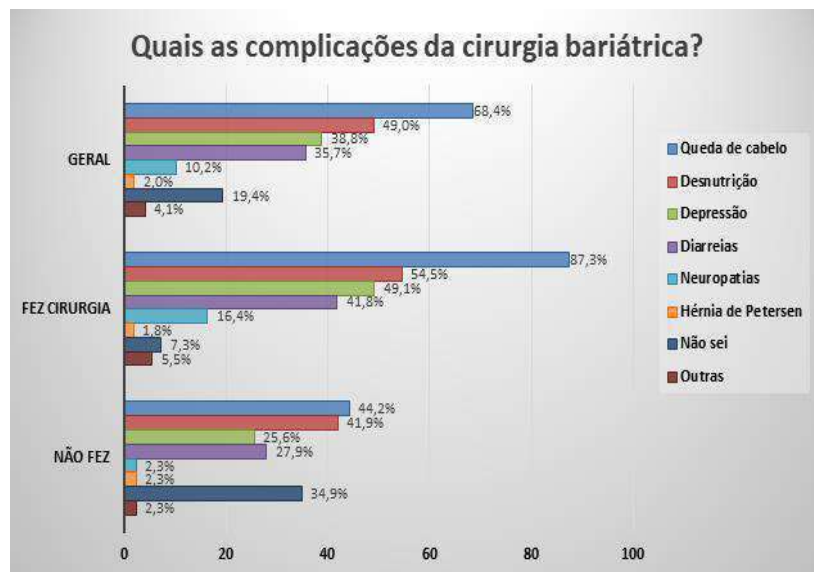


Fig.8 - Quais as possíveis complicações da cirurgia bariátrica?

As percentagens são relativas ao total de respondentes em cada grupo (sofreu cirurgia bariátrica ou não) ou ao total (Geral). Mais da metade (53,5%) dos não submetidos à cirurgia não souberam responder o tempo que a cirurgia existe, e as respostas foram divididas nos dois grupos (Figura 09).



Fig.9 - Há quantos anos existe a cirurgia bariátrica?

As percentagens são relativas ao total de respondentes em cada grupo (sofreu cirurgia bariátrica ou não) ou ao total (Geral).

Sobre as mudanças alimentares após a cirurgia, no grupo já operado a percentagem de pessoas que marcou “restrição de intervalos entre as alimentações” foi quase o dobro (9,1%) em relação aos não operados (4,7%), e a incerteza neste último grupo também foi maior (9,3%) (Figura 10).

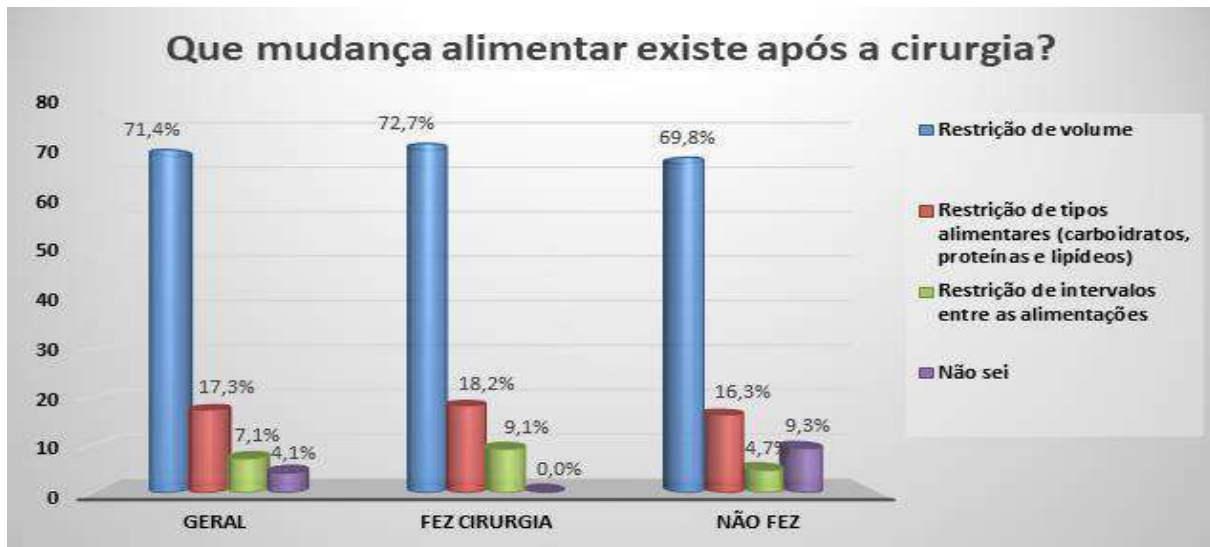


Fig.10- Qual mudança alimentar acha que existe após a cirurgia bariátrica?

As percentagens são relativas ao total de respondentes em cada grupo (sofreu cirurgia bariátrica ou não) ou ao total (Geral).

Em relação à necessidade de cirurgia plástica após a bariátrica, a incerteza novamente foi maior no grupo de não operados (20,9% não souberam responder). A certeza foi maior no grupo que já fez a cirurgia (80%) em relação aos que não fizeram (62,8%) (Figura 11).



Fig.11 - Acha que a cirurgia plástica é necessária após a cirurgia?

As percentagens são relativas ao total de respondentes em cada grupo (sofreu cirurgia bariátrica ou não) ou ao total (Geral).

Em relação aos cuidados necessários ao longo prazo após a cirurgia, 92,7% dos operados afirmaram saber, enquanto 46,5% dos não operados não sabiam quais os cuidados (Figura 12).



Fig.12 - Como devem ser os cuidados a longo prazo depois da cirurgia bariátrica?

As percentagens são relativas ao total de respondentes em cada grupo (sofreu cirurgia bariátrica ou não) ou ao total (Geral). Sobre a importância da reposição de vitaminas após a cirurgia, a certeza no grupo de não operados foi menor (79,1%) em relação aos operados (100%) (Figura 13).



Fig.13- Sabe da importância da reposição de vitaminas após a cirurgia bariátrica?

As percentagens são relativas ao total de respondentes em cada grupo (sofreu cirurgia bariátrica ou não) ou ao total (Geral). Sobre a necessidade de acompanhamento a longo prazo do paciente após a cirurgia, as respostas foram similares entre os dois grupos (próximos a 100%, Figura 14).



Fig.14 - Acha que o acompanhamento multiprofissional é necessário para um bom resultado da cirurgia bariátrica a longo prazo?

As percentagens são relativas ao total de respondentes em cada grupo (sofreu cirurgia bariátrica ou não) ou ao total (Geral).

Quando indagados a indicar os profissionais necessários no acompanhamento de longo prazo, os mais citados foram nutricionistas, educador físico e psicólogo, em ambos os grupos (Figura 15).

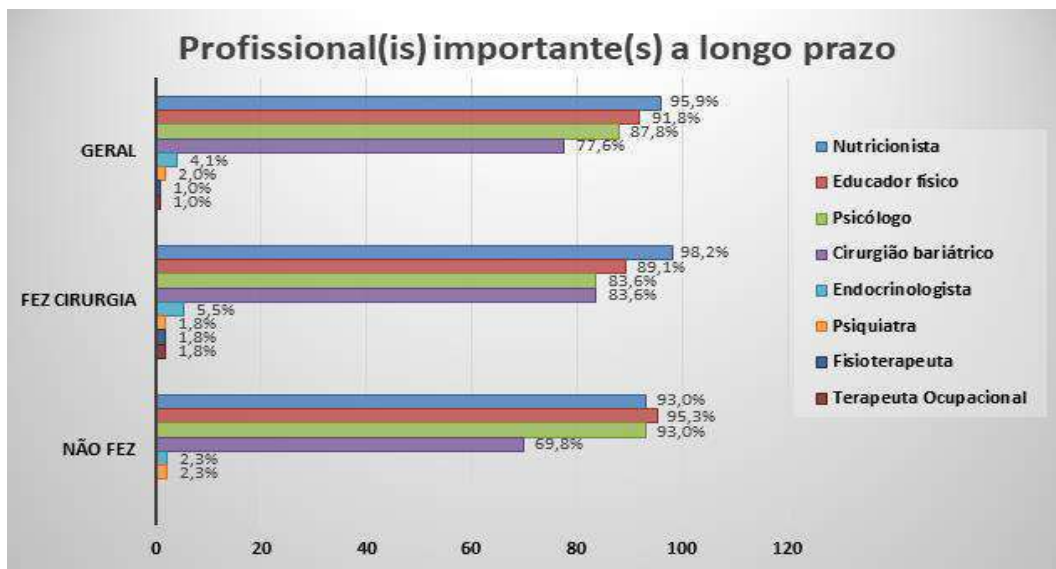


Fig.15 - Qual(is) profissional(is) acredita ser importante nos cuidados a longo prazo da cirurgia bariátrica?

As percentagens são relativas ao total de respondentes em cada grupo (sofreu cirurgia bariátrica ou não) ou ao total (Geral).

#### IV. DISCUSSÃO

Baseado nos resultados da pesquisa, denotava a imperiosa necessidade de informação, traduzida para uma linguagem mais acessível, mostrava um hiato de conhecimento, com mais facilidade de entendimento para

paciente leigo e seu familiar, e divulgar de maneira mais transparente e gratuita.

Inicialmente o levantamento apresenta que apesar do desenvolvimento de diversas técnicas cirúrgicas nos últimos 50 anos, do advento da cirurgia laparoscópica <sup>17</sup> e



ainda de novas técnicas e manobras serem responsáveis por várias mudanças nos paradigmas de tratamento estabelecidos<sup>20</sup>, observou-se que a proporção de entrevistados não conhece os tipos de técnicas de cirurgias existentes.

Os resultados também mostraram que existe uma grande necessidade de se explicar os tipos de procedimentos bariátricos (septação gástrica em y de Roux, Sleeve gastrectomia, duodenal Switch...), destacando as metodologias dos procedimentos especialmente porque a maioria das cirurgias hoje são por vídeo laparoscopia, podendo ser até robóticas inclusive e o tempo de internação.

Apresenta também a necessidade de expor os problemas físicos associados a obesidade, especialmente porque, considerando o grupo pesquisado, destaca-se massivamente a esteatose hepática e os problemas associados a hipertensão arterial; contudo ainda destaca-se a ortoeoartralgia, irregularidade menstrual, ovário policístico, dificuldade para engravidar, dislipidemias; e ainda, a falta de flexibilidade das articulações, a sobrecarga articular comprometendo os movimentos e limitando os sujeitos na execução de suas atividades físicas cotidianas; como também, suas reações incapacitantes, afastamento do trabalho, o custo do tratamento e as restrições para lazer e atividades físicas; e ainda o ônus emocional referentes preconceitos em relação à aparência corporal e relacionamentos afetivos.

Ressalta-se que o impacto positivo da cirurgia bariátrica e metabólica nas doenças cardiovasculares, reduzindo sobremaneira a hipertensão arterial e todas as suas consequências, como infarto agudo do miocárdio, os acidentes vasculares cerebrais<sup>12</sup>.

Lembrar também a redução dos quadros de diabetes mellitus tipo II, com redução de problemas renais, amputações, e lesões oculares, e melhor controle da glicemia com uso de menos medicações e até remissão na maioria dos casos.

Quanto aos procedimentos pós-operatórios, a necessidade de que um percentual pequeno, dentre os pesquisados, compreende que poucos necessitam ir para UTI e em sua grande maioria tem alta entre um a dois dias<sup>14</sup>.

Ainda no grupo estudado, um percentual entende que pode ocorrer queda de cabelo, desnutrição, depressão diarreias são as complicações mais presentes da cirurgia bariátrica. Dentro deste contexto o desconhecimento de suplementação nutricional adequada, pelo grupo que não fez cirurgia, bem como, uma concordância sobre a necessidade do acompanhamento sistemático

multiprofissional como nutricionistas, educador físico, psicólogo e o próprio cirurgião sempre<sup>4</sup>.

Estes resultados trazem um diagnóstico geral do quadro do conhecimento no assunto bariátrica para o paciente leigo e seus familiares, poderá ser utilizado como guia de referência e material de consulta.

## V. CONCLUSÃO

A pesquisa focou em selecionar pacientes aleatórios de cirurgia bariátrica, sendo estratégico no processo da construção de informação, porém não limitadas apenas a estes, mas estendidos também a seus familiares que acompanham durante realização de todo o protocolo de preparo e no pós-operatório e têm importância fundamental em todo o processo como apoio psicológico e muito mais.

Desta maneira, existem tratamentos diferentes para o controle e a redução do peso, para cada nível de obesidade, tais como dietas, exercícios físicos e terapia cognitiva comportamental, mas os resultados na perda e na manutenção do peso, em comparando com os resultados da cirurgia bariátrica, são muito pífios. Sendo assim o tratamento clínico da obesidade é muito insatisfatório para os pacientes com obesidade mórbida.

Assim com a verdadeira indicação e com necessidade de tratamento, se for bem motivado, tiver a plena e total consciência que a doença ameaça a sua vida, ele vai poder optar por esse tratamento cirúrgico, tendo um controle mais definido com o conhecimento de todo o escopo da cirurgia bariátrica com equipe multiprofissional.

Portanto, escolher pela bariátrica não é decisão fácil, são pacientes sofridos, muitos estão desesperançados, que precisam saber que vai fazer uma cirurgia de grande porte, com anestesia geral, que vai reduzir a capacidade gástrica e mudar o seu perfil hormonal, mas a expectativa de melhora da qualidade de vida, vai nortear essa decisão e assegurar um resultado mais seguro e feliz. A ferramenta como cartilha tem didática muito simples e inteligível podendo alcançar um percentual de pacientes muito grande se tornando de grande valia no futuro da cirurgia bariátrica, desmistificando muito temas ainda obscuro para grande maioria dos pacientes e seus familiares.

## REFERÊNCIAS

- [1] WORLD HEALTH ORGANIZATION. **World Obesity Federation. Obesity and overweight.** Fact Sheets. 16 fev. 2018. Disponível em: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>. Acesso em: 19 nov. 2020.

- [2] SANTOLIN, C. B. (2021). História da obesidade: a filmografia de Georges Méliès. *Motrivivência*, 33(64), 1-20.
- [3] SANTOLIN, C. B. (2021). História da obesidade no cinema mudo (1895-1927).
- [4] HINTZE, L. J., BEVILAQUA, C. A., PIMENTEL, E. B., & JUNIOR, N. N. (2011). Cirurgia bariátrica no Brasil. *Revista de Ciências Médicas*, 20(3/4), 87-98.
- [5] AMINIAN, Ali *et al.* Association of Metabolic Surgery With Major Adverse Cardiovascular Outcomes in Patients With Type 2 Diabetes and Obesity. *JAMA*. v. 322, n. 13, p. 1271–1282, set. 2019. DOI: <https://doi.org/10.1001/jama.2019.14231>. Disponível em: <https://jamanetwork.com/journals/jama/article-abstract/2749478>. Acesso em: 24 nov. 2019.
- [6] BARROS, L. M. Construção e validação de uma cartilha educativa sobre os cuidados no perioperatório da cirurgia bariátrica. 2015. 291 f. **Dissertação (Mestrado em Enfermagem)** - Universidade Federal do Ceará. Faculdade de Farmácia, Odontologia e Enfermagem, Fortaleza, 2015. Disponível: <http://www.repositorio.ufc.br/handle/riufc/10531>. Acesso em: 28 mar. 2021.
- [7] \_\_\_\_\_ Efetividade da cartilha "Cirurgia bariátrica: cuidados para uma vida saudável" no preparo pré-operatório: ensaio clínico randomizado pragmático. 2017. 240 f. **Tese (Doutorado em Enfermagem)** - Faculdade de Farmácia, Odontologia e Enfermagem, Universidade Federal do Ceará, Fortaleza, 2017. Disponível: <http://repositorio.ufc.br/handle/riufc/29201>. Acesso em: 28 mar. 2021.
- [8] BRASIL. MINISTÉRIO DA SAÚDE. Portaria nº 62, de 6 de janeiro de 2017. Altera as Portarias nº 424/GM/MS, de 19 de março de 2013, que redefine as diretrizes para a organização da prevenção e do tratamento do sobrepeso e obesidade como linha de cuidado prioritária na Rede de Atenção às Pessoas com Doenças Crônicas e nº 425/GM/MS, de 19 de março de 2013, que estabelece o regulamento técnico, normas e critérios para a Assistência de Alta Complexidade ao Indivíduo com Obesidade. **Diário Oficial da União**, Brasília, DF, 09 jan. 2017, ed. 6, s. 1, p. 31. Disponível em: <http://www.in.gov.br/web/dou/-/portaria-n-62-de-6-de-janeiro-de-2017-20576312>. Acesso em: 24 nov. 2019
- [9] BRASIL. MINISTÉRIO DA SAÚDE. Secretaria de Vigilância em Saúde. Departamento de Análise em Saúde e Vigilância de Doenças Não Transmissíveis. **Vigitel 2019: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2019** [Internet]. Brasília: Ministério da Saúde, 2020. Disponível em: [http://bvsmis.saude.gov.br/bvs/publicacoes/vigitel\\_brasil\\_2019\\_vigilancia\\_fatores\\_risco.pdf](http://bvsmis.saude.gov.br/bvs/publicacoes/vigitel_brasil_2019_vigilancia_fatores_risco.pdf). Acesso em: 28 mar. 2021.
- [10] CONSELHO FEDERAL DE MEDICINA. Resolução nº 2.131, de 12 de novembro de 2015. Altera o anexo da Resolução CFM nº 1.942/10, publicada no D.O.U. de 12 de fevereiro de 2010, Seção I, p. 72. **Diário Oficial da União**, Brasília, DF, 13 jan. 2016, ed. 8, s. 1, p. 66. Disponível em: [http://www.in.gov.br/web/guest/materia/-/asset\\_publisher/Kujrw0TZC2Mb/content/id/22175085/do1-2016-01-13-resolucao-n-2-131-de-12-de-novembro-de-2015-22174970](http://www.in.gov.br/web/guest/materia/-/asset_publisher/Kujrw0TZC2Mb/content/id/22175085/do1-2016-01-13-resolucao-n-2-131-de-12-de-novembro-de-2015-22174970). Acesso em: 24 nov. 2019.
- [11] SOUSA, V. E. C. Desenvolvimento e Validação de Software para Apoio ao Ensino Aprendizagem sobre Diagnósticos em Enfermagem. Tese de Doutorado. [recurso eletrônico]. Universidade Federal do Ceará, Fortaleza, 2015. Disponível em: [http://www.repositorio.ufc.br/bitstream/riufc/12557/1/2015\\_tese\\_vecousa.pdf](http://www.repositorio.ufc.br/bitstream/riufc/12557/1/2015_tese_vecousa.pdf). acesso em: 19 nov. 2020.
- [12] SOUSA, S. C. C. D. (2019). A influência da farmácia comunitária na promoção de estilos de vida saudáveis em crianças e adolescentes (Master's thesis).
- [13] CONSELHO FEDERAL DE MEDICINA. Resolução nº 2.172, de 22 de novembro de 2017. Reconhece a cirurgia metabólica para o tratamento de pacientes portadores de diabetes mellitus tipo 2, com IMC entre 30 kg/m<sup>2</sup> e 34,9 kg/m<sup>2</sup>, sem resposta ao tratamento clínico convencional, como técnica não experimental de alto risco e complexidade. **Diário Oficial da União**, Brasília, DF, 27 dez. 2017, ed. 247, s. 1, p. 40-206. Disponível em: [http://www.in.gov.br/materia/-/asset\\_publisher/Kujrw0TZC2Mb/content/id/1383576/do1-2017-12-27-resolucao-n-2-172-de-22-de-novembro-de-2017-1383572](http://www.in.gov.br/materia/-/asset_publisher/Kujrw0TZC2Mb/content/id/1383576/do1-2017-12-27-resolucao-n-2-172-de-22-de-novembro-de-2017-1383572). Acesso em: 24 nov. 2019.
- [14] Faria GR. A brief history of bariatric surgery. [Internet] Porto Biomedical Journal: 2(3): 90-92, 2017. Disponível em: [https://journals.lww.com/pbj/Fulltext/2017/05000/A\\_brief\\_history\\_of\\_bariatric\\_surgery.6.aspx](https://journals.lww.com/pbj/Fulltext/2017/05000/A_brief_history_of_bariatric_surgery.6.aspx). Acesso em: 28 mar.2021.
- [15] HERMAN, Mary E. *et al.* Insulin Therapy Increases Cardiovascular Risk in Type 2 Diabetes. **Prog Cardiovasc Dis. Ed. Elsevier**. v. 60, n. 3, p. 422-434. nov./dez. 2017. DOI: 10.1016/j.pcad.2017.09.001. Disponível em: <https://www.ncbi.nlm.nih.gov/pubmed/28958751>. Acesso em: 24 nov. 2019.
- [16] INTERNATIONAL DIABETES FEDERATION. **IDF Diabetes Atlas**. 9th ed. 2019. Disponível em: <https://www.diabetesatlas.org/>. Acesso em: 24 nov. 2019.
- [17] KURIAN, Marina; WOLFE, Bruce M.; IKMUDDIN, Sayeed. *Metabolic Syndrome and Diabetes. Medical and Surgical Management*. New York: Ed. Springer; 2016. E-book. ISBN 978-14-9393-220-7.
- [18] North American-based Obesity Canada; et al. **World Obesity Day**. Together we can create a healthier future [Online], 2021. Disponível em: <https://www.worldobesityday.org/>. Acesso em: 28 de mar. 2021.
- [19] PENALVA, Daniele Q. Fucciolo. Síndrome metabólica: diagnóstico e tratamento. **Rev Med**. São Paulo, v. 87, n. 4, p. 245-250. out./dez. 2008. DOI: <https://doi.org/10.11606/issn.1679-9836.v87i4p245-250>. Disponível em: <http://www.revistas.usp.br/revistadc/article/view/59086>. Acesso em: 24 nov. 2019.
- [20] SOUZA, Maíra Danielle Gomes de *et al.* PREVALÊNCIA DE OBESIDADE E SÍNDROME METABÓLICA EM FREQUENTADORES DE UM PARQUE. **ABCD, arq.**

- bras. cir. dig.** São Paulo, v. 28, supl. 1, p. 31-35, jul. 2015. DOI: <http://dx.doi.org/10.1590/S0102-6720201500S100010>. Disponível em: [http://www.scielo.br/pdf/abcd/v28s1/pt\\_0102-6720-abcd-28-s1-00031.pdf](http://www.scielo.br/pdf/abcd/v28s1/pt_0102-6720-abcd-28-s1-00031.pdf). Acesso em: 24 nov. 2019.
- [21] OWERS, CE et al. Perioperative Optimization of Patients Undergoing Bariatric Surgery. *Journal of Obesity*. v.2012, article id: 781546, p. 1-6, jul. 2015. DOI: 10.1155/2012/781546. Acesso em: 15 nov. 2021.
- [22] WORLD HEALTH ORGANIZATION. World Obesity Federation. Obesity and overweight. **Fact Sheets**. 16 fev. 2018. Disponível em: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>. Acesso em: 24 nov. 2019.
- [23] \_\_\_\_\_ Obesity and its roots. [Online]. Disponível em: <https://www.who.int/news-room/events/detail/2020/03/04/default-calendar/world-obesity-day>. 2020. Acesso em: 28 mar. 2021.
- [24] COELHO, L. (2022, June). IMC E OBESIDADE NO AMBIENTE UNIVERSITÁRIO. In *Anais Colóquio Estadual de Pesquisa Multidisciplinar (ISSN-2527-2500) & Congresso Nacional de Pesquisa Multidisciplinar*.

# Strategic Management and the use of Indicators by the Leaderships of a Public Hospital

## Gestão Estratégica e o uso de Indicadores Pelas Lideranças de um Hospital Público

Tatiana da Silva Mendes<sup>1</sup>, Creusa Barbosa dos Santos Trindade<sup>3</sup>, Silvia Ferreira Nunes<sup>4</sup>,  
Heliana Helena Moura Nunes<sup>5</sup>, Luciana Rodrigues Ferreira<sup>6</sup>, Eliane Moura da Silva<sup>7</sup>,  
Mariseth Carvalho de Andrade<sup>8</sup>, Edilson Ferreira Calandrini<sup>9</sup>, Fabiana Morbach da  
Silva<sup>10</sup>, Valeria Regina Cavalcante dos Santos<sup>2</sup>

<sup>1</sup>Assistente Social. Mestranda em Gestão em Serviços de Saúde na Amazônia da Fundação Santa Casa do Pará ( FSCMPA). Fundação Santa Casa do Pará (FSCMPA). Belém, Pará – Brasil.

<sup>2</sup>Farmacêutica. Doutora em Ciências - em Medicina Tropical (FIOCRUZ/RJ). Professora e coorientadora do Programa de Pós-Graduação em Gestão e Saúde na Amazônia da Fundação Santa Casa de Misericórdia do Pará (FSCMPA). Fundação Santa Casa do Pará (FSCMPA). Belém, Pará – Brasil.

<sup>3</sup>Pedagoga. Doutora em educação em ciências e matemática -UFMT/ UFPA. Professora e orientadora do Programa de Pós-Graduação em Gestão e Saúde na Amazônia da Fundação Santa Casa de Misericórdia do Pará (FSCMPA). Fundação Santa Casa do Pará (FSCMPA). Belém, Pará – Brasil.

<sup>4</sup>Doutora em Ciências - Desenvolvimento Social e Ambiental (NAEA / UFPA), Professora do Programa de Pós-Graduação em Gestão e Saúde na Amazônia da Fundação Santa Casa de Misericórdia do Pará (FSCMPA) e professora do Programa de Pós-Graduação em Gestão Pública na Universidade Federal do Pará (NAEA/ UFPA). Fundação Santa Casa do Pará (FSCMPA). Belém, Pará – Brasil.

<sup>5</sup>Enfermeira. Doutora em Enfermagem Universidade Federal do Rio de Janeiro. Professora. Adjunto III da Universidade do Estado do Pará. Fundação Santa Casa do Pará (FSCMPA). Belém, Pará – Brasil.

<sup>6</sup>Pós-Doutora no campo da Política Educacional com estudos sobre a Política de financiamento da Pós-Graduação, Pesquisa & Desenvolvimento no Brasil. Coordenadora do Programa de Pós-graduação em Gestão de Conhecimentos para o Desenvolvimento Socioambiental Escola Fazendária do Estado do Pará (EFAZ/SEFA) Belém, Pará – Brasil.

<sup>7</sup>Enfermeira. Mestre em Epidemiologia e Vigilância em Saúde. Coordenadora da estatística da Fundação Santa Casa do Pará (FSCMPA). Fundação Santa Casa do Pará (FSCMPA). Belém, Pará – Brasil.

<sup>8</sup>Mestre em Cirurgia e Pesquisa Experimental. Centro Universitário da Amazônia (UNIFAMAZ), Belém, Pará - Brasil

<sup>9</sup>Enfermeiro. Doutorando em enfermagem pela Universidade Estadual do Pará. Mestre em Enfermagem. Fundação Santa Casa do Pará (FSCMPA). Belém, Pará – Brasil.

<sup>10</sup>Graduanda em Enfermagem pela Universidade Estadual do Pará. Estagiária da Fundação Santa Casa do Pará. (FSCMPA). Belém, Pará – Brasil.

Received: 10 Aug 2022,

Received in revised form: 05 Sep 2022,

Accepted: 08 Sep 2022,

Available online: 14 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** Health management, indicators,

**Abstract—** Objective: to evaluate the impacts of the use of strategic indicators by the leaders of a public hospital. Method: This is an excerpt from the master's dissertation, entitled "strategic management and the use of indicators by the leaders of a public hospital: construction of a technological and sustainable instrument", presented in the Postgraduate Program in Management and Health in the Amazon of the Santa Casa de Misericórdia do Pará Foundation. Results: The study was systematized through statistical tools and analyzed from the inferences and categorizations of the questions based on the content analysis where it was applied to 70% of the leaders in the organization chart of a medium and

*strategic planning*

**Palavras-chave—** *Gestão em saúde, indicadores, planejamento estratégico*

*high complexity hospital in the metropolitan region of Belém, responsible for the sectors included in the institutional organization chart. Conclusion: the study helps us to know the profile of the institution's leaders and with that, we have subsidies for the institution to invest in the development of people, according to the results presented.*

**Resumo—** *Objetivo: avaliar os impactos do uso de indicadores estratégicos pelas lideranças de um hospital público. Método: Trata-se de um recorte da dissertação de mestrado, intitulada como “gestão estratégica e o uso de indicadores pelas lideranças de um hospital público: construção de um instrumento tecnológico e sustentável”, apresentada no Programa de Pós-graduação em Gestão e Saúde na Amazônia da Fundação Santa Casa de Misericórdia do Pará. Resultados: O estudo foi sistematizado por meio das ferramentas estatísticas e analisados a partir das inferências e categorizações dos questionamentos tomando como base a análise de conteúdo onde foi aplicado em 70% dos líderes constantes no organograma de um hospital de média e alta complexidade na região metropolitana de Belém, responsáveis pelos setores contemplados no organograma institucional. Conclusão: o estudo contribui para que possamos conhecer o perfil dos líderes da instituição e com isso tenhamos em mãos, subsídios para que a instituição invista no desenvolvimento das pessoas, de acordo com os resultados apresentados.*

## I. INTRODUÇÃO

A área da saúde busca cada vez mais inovações tecnológicas que impulsionam as instituições para a mudanças significativas no atendimento ao público e no tratamento das doenças. A transformação digital traz consigo, além de novas metodologias e ferramentas, a exigência por profissionais que busquem revolucionar a saúde com novos comportamentos e conhecimentos diante das mudanças e engajamento com as novas tecnologias<sup>3</sup>.

Além disso, o setor de saúde é considerado relevante para a inovação, sendo o maior responsável no mundo pelo desenvolvimento de pesquisa, isso permite com que o indivíduo seja beneficiado com atendimento mais seguro e de qualidade, pois “É reconhecido o papel da saúde como um fator essencial para as condições cidadania da população e como elemento estruturante do Estado de bem-estar social<sup>2</sup>”.

Atualmente, apesar de, haver uma constante mudança política, econômica e social que afetam as organizações e as pessoas, torna-se importante reforçar o desenvolvimento dos profissionais engajados nessas mudanças e também investimentos para que essas organizações avancem e se adaptem ao novo<sup>4</sup>, pois as organizações são importantes para o desenvolvimento socioeconômico de um país<sup>4 5</sup>. Apesar de todas essas transformações, torna-se necessário que as instituições continuem sendo mediadoras de conhecimento e oferecendo recursos de apoio ao processo de tomada de decisão, dentre elas, a utilização de ferramentas de

monitoramento e avaliação, como por exemplo, o uso de indicadores de gestão, que dão mais credibilidade e transparência ao trabalho do gestor<sup>6</sup>.

Na década de 1950 a Organização Mundial da Saúde (OMS) reuniu um comitê que pudesse propor um método capaz de definir e avaliar as condições de saúde de um indivíduo ou de uma população, diante disso, o Ministério da saúde desenvolveu os indicadores de saúde para facilitar a quantificação e a avaliação das informações produzidas com tal finalidade<sup>7</sup>.

No que tange sobre indicadores em saúde no Brasil, a Rede Interagencial de Informações para a Saúde (RIPSA), foi criada a partir da implementação pela Organização Pan-Americana da Saúde (OPAS) em 1995 da Iniciativa Regional de Dados Básicos em Saúde, com objetivo de difundir informações a respeito da situação e tendências na saúde nos países da América Latina<sup>8</sup>. No Brasil, através da RIPSA por meio de um grupo de trabalho com representantes do Ministério da saúde, OPAS e outras instituições de informação em saúde (IBGE, ABRASCO, IPEA, FMUSP), teve sua formalização em Portaria ministerial no ano de 1996<sup>9</sup>.

Torna-se relevante que qualquer gestão em saúde, estimule o uso de indicadores em todos os níveis, que aperfeiçoem seus resultados e favoreça o debate sobre eles e seu impacto na vida dos cidadãos<sup>10</sup>. Além disso, busca-se analisar o antes e o depois da intervenção para alcançar um panorama dos progressos da gestão<sup>11</sup>. O resultado fornecido pelos indicadores, permite fazer análise crítica

dos dados e posteriormente o desdobramento de planos de ação corretivos, preventivos ou de melhorias<sup>6 12</sup>. Além do mais, os indicadores são interpretações quantificáveis das características de produtos e processos, isto posto, emprega-se, no que tange, a melhoria da qualidade e performance de um produto, serviço ou ao final de um processo<sup>13</sup>.

Para mais torna-se importante fazer uma análise sobre o uso de indicadores pelos gestores e qual o grau de conhecimento destes sobre a interpretação correta desta ferramenta<sup>14</sup>. “um indicador é um estado de atenção que identifica ou desperta um alerta para assuntos específicos de resultados, dentro de uma organização de saúde<sup>15</sup>”. Esse projeto é importante para subsidiar a instituição sobre a tomada de decisão a partir do conhecimento efetivo e a utilização dos indicadores pelos gestores de saúde, pois eles são os principais responsáveis pelos processos de trabalho e pela condução de sua equipe<sup>16</sup>.

Segundo a Rede Interagencial de Informação para a Saúde – RIPSAs “Se gerados de forma regular e manejados em um sistema dinâmico, os indicadores são instrumentos valiosos para a gestão e avaliação da situação de saúde, em todos os níveis<sup>17</sup>”.

Os indicadores de gestão, interferem diretamente no planejamento da instituição, pois pensar na criação de um instrumento, me levou a refletir sobre a importância de algo que fomente o conhecimento dos indicadores de forma concreta e como eles influenciam na tomada de decisões para se trabalhar as não conformidades observadas, inserindo, se necessário, novas formas de monitorar e avaliar as ações a partir de resultados positivos ou negativos<sup>18</sup>. Um instrumento que produza mudanças e tenha impacto na qualidade dos serviços oferecidos à sociedade; no clima organizacional; na sustentabilidade econômica e financeira da organização e que possa interferir positivamente na cultura organizacional<sup>19</sup>.

É importante buscar informações sobre gestores que utilizam os indicadores para subsidiar a tomada de decisões a partir do conhecimento efetivo e a utilização destes, pois, são os principais responsáveis nas tomadas de decisões e na condução de sua equipe gerencial<sup>20</sup>.

Aliado a isto, a utilização de sistemas de monitoramento e avaliação em saúde é um passo importante para a garantia do acesso e transversalidade das informações por toda a instituição. O sistema de informação constitui um suporte para que as instituições possam atingir metas e objetivos, sendo considerado um instrumento de apoio para a gestão e avaliação da assistência ao paciente<sup>21</sup>. Diante desse contexto o objetivo do estudo é avaliar os impactos do uso de indicadores estratégicos pelas lideranças de um hospital público.

## II. MATERIAS E MÉTODOS

Trata-se de um recorte da dissertação de mestrado, intitulada como “gestão estratégica e o uso de indicadores pelas lideranças de um hospital público: construção de um instrumento tecnológico e sustentável”, apresentada no Programa de Pós-graduação em Gestão e Saúde na Amazônia da Fundação Santa Casa de Misericórdia do Pará.

A pesquisa seguiu os preceitos da resolução 466/2012 da Comissão Nacional de Ética em Pesquisa-CONEP/MS para a iniciação do estudo e também foi submetida para apreciação institucional para obtenção do aceite institucional.

O projeto foi submetido ao Comitê de Ética em Pesquisa (CEP) da instituição, foi aprovado após análise pelo parecer nº 5.161.218 e desenvolvido conforme delineado. A pesquisa foi iniciada após a decisão de aprovação ética e nela os gestores serão convidados a participar do projeto esclarecidos quanto ao projeto o qual participarão e após concordância, assinarão Termo de consentimento livre e esclarecido (TCLE);

Todos os dados institucionais foram resguardados com assinatura do Termo de compromisso de utilização de dados (TCUD) e não serão repassados dados para terceiros alheios à pesquisa.

Os riscos foram divididos em três segmentos, ou seja, para os entrevistados, para o entrevistador e para a instituição. No primeiro caso, quando os líderes deixar de participar desta pesquisa, quebra de sigilo dos dados coletados e exposição de identidade dos entrevistados. O risco para o entrevistador se resume no risco de contaminação, pois por estar em ambiente hospitalar, encontra-se mais exposto, mas esse tipo de risco, foi minimizados por meio do uso de Equipamentos de Proteção Individual. Para a instituição, existe o risco de comprometimento da imagem e do sigilo das informações coletadas;

Foram tomadas medidas para minimização dos riscos, onde, além da assinatura do TCUD para o resguardo dos dados na instituição, para os entrevistados será utilizado TCLE, onde todos os participantes foram codificados e identificados apenas numericamente. Os dados e materiais resultantes desta pesquisa estão mantidos em arquivo físico ou digital, sob a guarda e responsabilidade da pesquisadora pelo período de 05 anos após o término da pesquisa e posteriormente descartados ou incinerados;

De acordo com a natureza das variáveis analisadas pelo teste estatístico Teste Qui-Quadra do de Aderência, foi adotado como 0,05 ou 5% o índice de

rejeição de hipótese de nulidade, e assinalada com asterisco ou valores significantes

O estudo foi aplicado em 70% dos líderes constantes no organograma de um hospital de média e alta complexidade na região metropolitana de Belém, responsáveis pelos setores contemplados no organograma institucional. Os gestores envolvidos no estudo, são aqueles que estão à frente de algum processo de trabalho, seja de assistência, apoio, ensino, financeiro ou gestão e que prestam conta de seus resultados por meio da apresentação de indicadores estratégicos ou de processos. Atualmente, o referido organograma é composto por 01 presidência, 08 assessorias, 05 diretorias, 30 gerências e 34 coordenações.

Trata-se de um estudo descritivo, exploratório e observacional, com delineamento transversal quantitativo, onde os dados foram analisados e interpretados, dando subsídios para a formatação do produto.

O estudo foi realizado em um hospital público de média e alta complexidade do Estado do Pará, em todos os setores que tiverem gestores que se enquadrem nos critérios de inclusão, ou seja, nomeados por meio de portaria publicada na Imprensa Oficial do Estado do Pará (IOEPA) e adotou para coleta de dados, o uso de entrevistas estruturadas por meio de questionário com perguntas dirigidas e abertas, para obtenção de resultados quantitativos e posteriormente utilizadas para se fazer o diagnóstico do problema. A pesquisa foi realizada por meio do questionário elaborado que foi enviado por meio do link: <http://forms.gle/UtwndbbZ8rcAECKX8>, contendo todas as informações referentes ao sigilo e ao seu preenchimento correto.

O questionário foi aplicado na fase inicial da pesquisa e com duração de 30 (trinta) dias e contou com a participação de 70% dos gestores de saúde de um hospital público de média e alta complexidade do Estado do Pará. Foram excluídos da pesquisa, profissionais que não atuam como gestores e também os gestores exonerados durante o período proposto para a pesquisa.

Os dados coletados foram tabulados em planilhas no programa específico (*excel*) e analisados estatisticamente por meio de teste estatístico “Teste Qui-Quadrado” e analisados a partir da análise de conteúdos de Bardin, que segundo Silva e Fossá “É uma técnica de análise das comunicações, que irá analisar o que foi dito nas entrevistas ou observado pelo pesquisador”. As categorias da pesquisa foram classificadas como: caracterização do locus da pesquisa, perfil dos participantes da pesquisa, percepção dos líderes sobre planejamento e indicadores e comportamento dos líderes em relação aos indicadores.

De acordo com a natureza das variáveis analisadas pelo teste estatístico Teste Qui-Quadrado de Aderência, foi

adotado como 0,05 ou 5% o índice de rejeição de hipóteses de nulidade, e assinalada com asterisco ou valores significantes.

“O diagnóstico situacional fundamenta o planejamento estratégico e permite desenvolver de ações de saúde mais focais efetivas em relação aos problemas encontrados<sup>22</sup>”. Com a finalidade de conhecer os problemas e as necessidades dos gestores, foi realizada a coleta de dados por meio de aplicação de questionário com perguntas abertas e fechadas, onde primeiramente foi realizado o levantamento do perfil deste líder como sexo, idade, escolaridade, formação, vínculo e tempo no cargo. Posteriormente foram abordados os seguintes questionamentos:

- a) Tempo no cargo de liderança?
- b) Fez algum curso na área de gestão?
- c) Fez algum curso sobre indicadores?
- d) Conhece o planejamento estratégico no método BSC?
- e) Utiliza indicador na sua atividade diária?
- f) Seu nível de compreensão sobre indicadores?

O questionário foi enviado, apresentado e aplicado aos gestores de saúde da instituição estudada conforme estabelecido pela Resolução CNS 580/18 que dispõe no seu Artigo 5º:

Os procedimentos da pesquisa não deverão interferir na rotina dos serviços de assistência à saúde, a não ser quando a finalidade do estudo o justificar, e for expressamente autorizado pelo dirigente da instituição.

Após sua devolução, foi realizado uma análise das respostas, onde foram estudadas todas as categorias de respostas pertinentes ao líder e sobre seu conhecimento e utilização dos indicadores nos seus processos de trabalho.

Ao término do estudo avaliação do produto, os resultados da pesquisa serão posteriormente divulgados para os participantes e à instituição onde os dados foram coletados.

### III. RESULTADOS DA PESQUISA

Os resultados da pesquisa foram sistematizados por meio das ferramentas estatísticas e analisados a partir das inferências e categorizações dos questionamentos tomando como base a análise de conteúdo.

Participaram do estudo 67 servidores com cargo de liderança. Os resultados (Tabela I) evidenciaram que nas informações sobre sexo e idade dos líderes, 02 critérios apresentaram proporções significantes (\* $p < 0.0001$ ), ou seja, os dados critérios que demonstram que (76,2%) são

do sexo feminino e onde a média de idade de (45.4) anos.

Tabela 1- Líderes por sexo e faixa etária em uma instituição de saúde em 2022

| Variáveis                      | Frequência                 | % (N = 63) | p-valor             |
|--------------------------------|----------------------------|------------|---------------------|
| <b>Sexo</b>                    |                            |            | <b>&lt; 0.0001*</b> |
| Feminino*                      | 48                         | 76,2%      |                     |
| Masculino                      | 15                         | 23,8%      |                     |
| <b>Faixa etária (anos)</b>     |                            |            | <b>0.0021*</b>      |
| < 30                           | 3                          | 4,8%       |                     |
| 30 a 39                        | 10                         | 15,9%      |                     |
| 40 a 49*                       | 34                         | 54,0%      |                     |
| 50 a 59                        | 13                         | 20,6%      |                     |
| > = 60                         | 3                          | 4,8%       |                     |
| <b>Mínimo / Média / Máximo</b> | <b>25 / 45.4 / 63 anos</b> |            |                     |

Fonte: Protocolo aplicado

\*Teste Qui-Quadrado Aderência

Ainda sobre o perfil dos líderes, pode-se verificar que significativamente (\*p < 0.0001), (58,7%) disseram ter curso de especialização em alguma área e a maioria (42,2%) possui formação na área de enfermagem ( Tabela 2).

Tabela 2- Líderes por escolaridade e formação em uma instituição de saúde em 2022

| Variáveis             | Frequência | % (N = 63) | p-valor             |
|-----------------------|------------|------------|---------------------|
| <b>Escolaridade</b>   |            |            | <b>&lt; 0.0001*</b> |
| Ensino Médio          | 1          | 1,6%       |                     |
| Ensino Superior       | 7          | 11,1%      |                     |
| Especialização*       | 37         | 58,7%      |                     |
| Mestrado              | 15         | 23,8%      |                     |
| Doutorado             | 3          | 4,8%       |                     |
| <b>Formação</b>       |            |            | <b>&lt; 0.0001*</b> |
| Enfermagem*           | 27         | 42,9%      |                     |
| Medicina              | 6          | 9,5%       |                     |
| Farmácia              | 5          | 7,9%       |                     |
| Nutrição              | 4          | 6,3%       |                     |
| Administração         | 3          | 4,8%       |                     |
| Economia              | 2          | 3,2%       |                     |
| Ciência da Computação | 2          | 3,2%       |                     |
| Pedagogia             | 2          | 3,2%       |                     |
| Outras                | 12         | 19,0%      |                     |

Fonte: Protocolo aplicado

\*Teste G aderência

Em relação ao vínculo com a instituição, (49,2%) informaram que são concursados, ou seja, são ocupantes de cargos estáveis no Estado( Tabela 3).



Tabela 3- Líderes por vínculo e tempo no cargo de liderança em uma instituição de saúde em 2022

| Variáveis                                 | Frequência                     | % (N = 63) | p-valor             |
|-------------------------------------------|--------------------------------|------------|---------------------|
| <b>Vínculo com a instituição</b>          |                                |            | <b>0.0268*</b>      |
| Concursado*                               | 31                             | 49,2%      |                     |
| Contratado                                | 17                             | 27,0%      |                     |
| Cedido                                    | 8                              | 12,7%      |                     |
| Somente DAS                               | 7                              | 11,1%      |                     |
| <b>Tempo no cargo de liderança (anos)</b> |                                |            | <b>&lt; 0.0001*</b> |
| Abaixo de 01                              | 7                              | 11,1%      |                     |
| 01 a 05*                                  | 37                             | 58,7%      |                     |
| 06 a 10                                   | 11                             | 17,5%      |                     |
| Acima de 10                               | 8                              | 12,7%      |                     |
| <b>Moda / Mediana</b>                     | <b>02 anos / 03 anos</b>       |            |                     |
| <b>Mínimo / Média / Máximo</b>            | <b>&lt; 01 / 4.8 / 27 anos</b> |            |                     |

Fonte: Protocolo aplicado

\*Teste Qui-Quadrado Aderência

Houve proporção significante (\*p < 0.0001) de gestores que possuíam curso na área de gestão (73,0%), fez algum curso de indicadores (73,0%), conhecem planejamento estratégico pelo método BSC (76,2%), que utilizam indicador em sua atividade diária (96,8%) e nível de compreensão excelente sobre indicadores (62,0%) (Tabela 4).

Tabela 4- Servidores por variáveis diversas em uma instituição de saúde em 2022

| Variáveis                                        | Frequência | % (N = 63) | p-valor              |
|--------------------------------------------------|------------|------------|----------------------|
| Fez algum curso na área de gestão                | 46         | 73,0%      | <b>0.0004*</b>       |
| Fez algum curso sobre indicadores                | 46         | 73,0%      | <b>0.0004*</b>       |
| Conhece o planejamento estratégico no método BSC | 48         | 76,2%      | <b>&lt; 0.0001*</b>  |
| Utiliza indicador na sua atividade diária        | 61         | 96,8%      | <b>&lt; 0.0001*</b>  |
| Nível de compreensão sobre indicadores           |            |            | <b>&lt; 0.0001**</b> |
| Regular (4 a 6)                                  | 4          | 6,3%       |                      |
| Bom (7 a 8)                                      | 20         | 31,7%      |                      |
| Excelente (9 a 10)*                              | 39         | 62,0%      |                      |

\* Fonte: Protocolo aplicado

\*Teste Qui-Quadrado Aderência; \*\*Teste G Aderência

#### IV. DISCUSSÃO

Observou-se na instituição, um número significativo de gestores do sexo feminino (Tabela I), o que demonstra que a instituição oferece oportunidades para as profissionais do sexo feminino assumirem cargos de liderança em todas as

áreas, seja da assistência, apoio ou gestão.

As mulheres estão cada vez mais assumindo papéis de maior relevância na gestão dos serviços de saúde<sup>23</sup>. Desde a Revolução Industrial, as mulheres vem ocupando espaços antes exclusivos apenas de homem a II segunda Guerra

trouxe novas oportunidades de trabalho para a mulheres, porém, mesmo demonstrado que esse contingente vem crescendo exponencialmente, os homens ainda são na sua grande maioria os que ocupam cargo de gestão em todos os mercados de trabalho<sup>24</sup>. A mesma autora afirma que “há uma tendência clara (embora lenta) de maior participação da mulher nos espaços de poder das organizações de trabalho”.

O papel da mulher ao assumir funções de liderança, contribuiu para mudanças significativas na gestão das organizações, visto possuir atributos diferenciados e que cada vez mais abrem espaços para que possam mostrar seus talentos e vocação<sup>25</sup>.

A faixa etária mais significativa entre os líderes (Tabela I) ficou entre 40 e 49 anos, ou seja, adultos que já se qualificaram em alguma área de formação e que possuem experiências na área da saúde. Tal fato se diferencia da tendência nas grandes organizações privadas, pois a exigência é de profissionais jovens, cujos treinamentos são voltados para o engajamento desse profissional à identidade da empresa<sup>24 25</sup>, porém, <sup>16-18</sup> de acordo com a idade do profissional, é notório afirmar que seu tempo de experiência no mercado de trabalho, contribui para que muitos realizem suas atividades de forma mais segura, eficiente e menos dispendiosa, visto que o acúmulo de experiência permite que esses profissionais façam a diferença frente aos desafios que lhe são imputados.

Há evidência que profissionais considerados mais maduros, demonstram mais comprometimento no seu local de trabalho e por conseguinte também demonstram mais engajamento e relação interpessoal<sup>2 8</sup>.

Em relação ao perfil que aborda a escolaridade de gestores na instituição (Tabela II), verificou-se gestores com formações variadas que vai desde o ensino médio até o doutorado, porém, a proporção significativa é de gestores com especialização, tal fato, demonstra que a instituição possui profissionais capacitados em sua área de atuação. Nos últimos anos, tem crescido a oferta dos mais variados cursos de especialização, seja presencial ou à distância, o que facilita o acesso desses profissionais a esses cursos<sup>7</sup>. “A pós-graduação vislumbra a possibilidade de aprimoramento pessoal e consequente aplicabilidade em práticas profissionais, para o bem de uma sociedade<sup>2-4 10</sup>”.

O setor saúde passa por significativas mudanças e isso exige que os profissionais sejam cada vez mais capacitados e desenvolvidos em suas áreas de conhecimento<sup>13</sup>. A instituição deve possibilitar aos seus profissionais, cursos e ferramentas que possam contribuir para sua atuação profissional junto a sua equipe, na tomadas de decisões da instituição e na melhoria dos resultados para a sociedade.

A instituição é gerida por profissionais das mais diversas áreas que vão desde as áreas fim da saúde a áreas da educação, engenharia, tecnologia da informação, economia, estatística e etc. Porém, a proporção significativa de gestores são da área da enfermagem (Tabela II), ou seja, um número bastante expressivo em relação aos outros profissionais. “pode-se inferir que as habilidades em gestão são essenciais e podem ser desenvolvidas e agregadas ao cuidado por meio de práticas de liderança”<sup>21</sup>. Os gestores de enfermagem estão inseridos nas mais diversas áreas da instituição, atuam desde a área de gestão, apoio e majoritariamente na área da assistência. Atualmente a instituição conta com 418 enfermeiros entre concursados e temporários, a maioria são desenvolvidos em sua formação, dentro e fora da instituição. Em relação a isso, a mesma autora afirma que “a liderança tem poucas chances de avançar na enfermagem se não for incentivada por meio de atitudes inovadoras, investimentos coletivos e união de todos da equipe”.

A instituição possui servidores com os mais diversos vínculos (Tabela II), porém, houve proporção significativa de gestores concursados na instituição, o que demonstra que quase metade deles são servidores efetivos. Existe uma composição diversificada de cargos setor público em relação às formas de contratação, tal fato vai de encontro ao artigo 37, inciso II da Constituição de 1988 que garante:

A investidura em cargo ou emprego público depende de aprovação prévia em concurso público de provas ou de provas e títulos, de acordo com a natureza e a complexidade do cargo ou emprego, na forma prevista em lei, ressalvadas as nomeações para cargo em comissão declarado em lei de livre nomeação e exoneração.

Houve proporção significativa com o tempo de cargo de liderança (Tabela III), faz toda a diferença o tempo de permanência dos servidores em suas funções de liderança, esse fato, influencia diretamente na qualidade dos serviços e na continuidade do que foi planejado durante o percurso da gestão<sup>21</sup>. Segundo os mesmos autores, é importante um tempo acentuado na gestão, pois isso contribui para que haja a garantia de uma memória sobre os processos de trabalho e a instituição.

“A permanência do trabalhador no emprego é de suma importância para o mercado de trabalho”, ou seja, a experiência adquirida deste trabalhador melhora exponencialmente os seus resultados<sup>1</sup>. Quanto mais tempo o trabalhador passa no cargo ou função, menos custos a empresa terá com o desenvolvimento da sua força de trabalho, caso seja renovada.

Os resultados deste trabalho evidenciaram variáveis que demonstram a responsabilidade dos líderes em relação a indicadores e sua utilização e sobre planejamento

estratégico (Tabela IV). Tal fato, fortalece a gestão, pois utilizar os indicadores como estratégia de medição e planejamento, possibilita o acesso a informações seguras e a tomada de decisão factíveis, porém, a maioria dos gestores concordam entre si que existe uma dificuldade em definir e acompanhar os indicadores<sup>5 6</sup>.

Com os resultados obtidos, é possível afirmar que mais da metade dos líderes consideram seu nível de compreensão sobre indicadores como “excelente”, o que está relacionado de forma positiva ao planejamento estratégico em sua aplicabilidade. Isso demonstra o resultado do esforço da instituição, que periodicamente oferece capacitação aos seus líderes em várias áreas, por meio de cursos e treinamentos com profissionais com *expertise* em vários assuntos.

Segundo Maués e Mendes ‘Os avanços tecnológicos, a globalização do conhecimento e as transformações sociais colocam a educação como uma ferramenta permanente de aprimoramento pessoal e garantia da valorização humana frente às novas demandas que se apresentam’, de acordo com os mesmos autores, o trabalho deixou de ser apenas meramente técnico, tornando-se cada vez mais especializado, motivando as instituições na busca por aprimorar seus métodos de capacitação e desenvolvimento profissional.

Os indicadores são importantes para avaliar e monitorar de forma sistêmica os fatores que compõe todos os processos de trabalho da instituição, desde as atividades desempenhadas até os atendimentos realizados<sup>6 8</sup>. De outro modo, o mesmo autor, percebeu que os indicadores são ferramentas que possibilitam também a racionalização dos recursos materiais e financeiros.

Ao fazer a opção pelos indicadores, é necessário verificar aspectos específicos da instituições, ou seja, os indicadores devem estar voltados para missão institucional, principais processos finalísticos e de apoio, seu público alvo e sua estrutura organizacional<sup>20</sup>. Ademais, o resultado dos indicadores, demonstram a melhor forma de intervir nas não conformidades e também identifica as carências do serviço avaliado.

## V. CONCLUSÃO

A transformação precisa estar interligada com uma gestão madura e que invista não somente no seu parque tecnológico, mas também nas pessoas envolvidas no processo de mudança, pois uma instituição que reconhece que seu potencial está em pessoas qualificadas e valorizadas, possivelmente consegue engajá-las de forma mais satisfatória em todas as frentes de trabalho. Assim, espera-se que os resultados deste estudo contribuam para que para que possamos conhecer o perfil dos líderes da

instituição e com isso tenhamos em mãos, subsídios para que a instituição invista no desenvolvimento das pessoa, de acordo com os resultados apresentados.

É importante pensar na melhoria dos serviços oferecidos e no desenvolvimento do gestor, para que haja cada vez mais comprometimento na avaliação e monitoramento de seus resultados e com isso a melhoria contínua de seus processos. Que possamos pensar cada vez mais em melhorar os nossos serviços de saúde, contribuindo assim com um SUS de qualidade e excelência. Somos sabedores das mudanças pelo qual o setor saúde passa e podemos vislumbrar um futuro que certamente se apresentará de forma diferente da realidade que vivemos hoje, por isso, precisamos estar conectados uns aos outros por uma corrente que ultrapassa qualquer tecnologia

## REFERÊNCIAS

- [1] Santos Nabeto, A. M. (2020). A Transformação Digital no Sector da Saúde (Doctoral dissertation). Disponível : <https://comum.rcaap.pt/handle/10400.26/33074>
- [2] Almeida, H. O. C., & de Oliveira Góis, R. M. (2020). Avaliação da satisfação do paciente: indicadores assistenciais de qualidade. Revista de Administração em Saúde, 20(81). Disponível em: <https://cqh.org.br/ojs-2.4.8/index.php/ras/article/view/244> > Acesso em: 02 jun.2021
- [3] Nogueira, A. L. G., Munari, D. B., Sousa, E. T., & Ribeiro, L. C. M. (2021). Planejamento de sucessão de lideranças em enfermagem: caminhos para sua elaboração. Revista da Escola de Enfermagem da USP, 55. Disponível em: < <https://www.scielo.br/j/reeusp/a/dRc5VJBjQycnLW4hkQVwFwm/> . Acesso em: 02 jun.2021
- [4] Mesquita, C., Santos, J. F., da Silva, A. F., & Silva, A. M. (2018). Novos modelos de planeamento e controlo de gestão nos hospitais públicos portugueses. Revista de Gestão em Sistemas de Saúde, 7(3), 239-256. Disponível em: <https://periodicos.uninove.br/revistargss/article/view/12807>.
- [5] Silveira, J. S. (2019). Os indicadores de infecção hospitalar e a educação permanente em saúde: uma análise da educação na redução dos indicadores de infecção primária relacionada ao cateter venoso central. Disponível em: <https://www.lume.ufrgs.br/handle/10183/201837> .
- [6] Da Silva Mendes, T., da Silva, E. M., da Silva, G. J. B., dos Santos, W. C. L. V., Calandrini, E. F., Crystina, L., ... & dos Santos, V. R. C. (2022). The use of Instruments that Facilitate understanding and Correct Analysis of Indicators in Hospital Management: An Integrative Literature Review. International Journal of Advanced Engineering Research and Science, 9, 2. Disponível em: [https://d1wqtxts1xzle7.cloudfront.net/81267868/IJAERS\\_05\\_february\\_2022-with-cover-page-v2.pdf?Expires=1658930106&Signature=EDICFcSm5CHD Gh~oZ4a4RyIRx6caPWLHfmrkrzgeywm3MxzkOaGIY23oF AB7SrEQQ~UI7qaGRFGPE38Yg4cQ~HEGJs9CjEuk8AZ CrRMmjCVAu6vQG7RS5oc-](https://d1wqtxts1xzle7.cloudfront.net/81267868/IJAERS_05_february_2022-with-cover-page-v2.pdf?Expires=1658930106&Signature=EDICFcSm5CHD Gh~oZ4a4RyIRx6caPWLHfmrkrzgeywm3MxzkOaGIY23oF AB7SrEQQ~UI7qaGRFGPE38Yg4cQ~HEGJs9CjEuk8AZ CrRMmjCVAu6vQG7RS5oc-)

- mlLAWxTJ7IyyaMPQfWPglQ3VNhcOK~oZIRhDmg9ImD  
wgdl0b7VWH4YqiOTA087OjEjabHa3IGyk~9KreqTGoH  
SzFa~5J57gNuPkk-tQJtmxnQbw5TFOdQKL5glnqz-  
PVf81AtUsRM8gq2bcfydgsioToTkMfhGTPD27zmJcFt1sPj  
VK3uiR4aqiFVznZBoSn6chb89YdTQ37HylZ9ghzuNc1h8  
XuA\_\_&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA
- [7] Braga, A. T., Pena, M. M., & Melleiro, M. M. (2018). Metrics of assistance indicators of certified hospitals. *J Nurs UFPE Line*, 12(3), 665-675. Disponível em: <https://periodicos.ufpe.br/revistas/revistaenfermagem/article/viewFile/230715/28016>
- [8] Bão, A. C. P., Amestoy, S. C., Moura, G. M. S. S. D., & Trindade, L. D. L. (2019). Indicadores de qualidade: ferramentas para o gerenciamento de boas práticas em saúde. *Revista Brasileira de Enfermagem*, 72, 360-366. Disponível: <https://www.scielo.br/j/reben/a/T89wNCjgBwCKCYS9whxjSsm/abstract/?lang=pt>
- [9] Paulino, L. V. C. W., Souza, M. C., & MAURO, P. S. G. (2018). ALINHAMENTO ESTRATÉGICO COM USO DE BALANCED SCORECARD COMO FERRAMENTA DE GESTÃO. *Revista Científica*, 1(1). Disponível: <https://revistas.unilago.edu.br/index.php/revista-cientifica/article/view/87>
- [10] Kaplan, R. S., & Norton, D. P. (2007). Balanced scorecard. In *Das summa summarum des management* (pp. 137-148). Gabler. Disponível em: [https://link.springer.com/chapter/10.1007/978-3-8349-9320-5\\_12?noAccess=true](https://link.springer.com/chapter/10.1007/978-3-8349-9320-5_12?noAccess=true)
- [11] Nunes, P. M. (2018). Proposta de um sistema de indicadores para monitoramento do sistema produtivo dos hospitais do estado de Santa Catarina. Disponível em: <https://repositorio.ufsc.br/handle/123456789/191095>.
- [12] Nunes, L. G. N., Barbosa, M. P. S., & Saraiva, R. A. (2020). Controle de qualidade em anestesia: proposta para avaliação através de indicadores. *Brazilian Journal of Anesthesiology*, 47(6), 528-537. Disponível em: <https://www.bjan-sba.org/article/5e498c030aec5119028b48dc/pdf/rba-47-6-528.pdf>.
- [13] Silva, C. P. C. D. (2018). Implementação e análise dos indicadores de qualidade do setor de ressonância magnética de um hospital de ensino. Disponível em: <https://repositorio.unesp.br/handle/11449/153423>
- [14] Maisonave, I. G. W. (2020). A gestão da informação em processos de integração de programas de promoção da saúde e de segurança e saúde no trabalho em um complexo hospitalar. Disponível em: <https://repositorio.ufcspa.edu.br/jspui/handle/123456789/1813>
- [15] De Oliveira, J. S., de Oliveira, J. A., Matias, E. C., de Lima, E. S., & de Carvalho, V. L. (2020). Planejamento estratégico situacional e saúde da população indígena: experiência na graduação em Fisioterapia. *Diversitas Journal*, 5(3), 1805-1817. Disponível em: [https://www.diversitasjournal.com.br/diversitas\\_journal/article/view/1138](https://www.diversitasjournal.com.br/diversitas_journal/article/view/1138)
- [16] França, L. G. (2020). A situação das mulheres na administração pública brasileira durante a pandemia do covid-19. *Revista de Ciências Jurídicas e Sociais-IURJ*, 1(1), 186-194. Disponível em: <https://revista.institutouniversitario.com.br/index.php/cjsiurj/article/view/15>
- [17] Silva, H. P. D., & Elias, F. T. S. (2019). Incorporação de tecnologias nos sistemas de saúde do Canadá e do Brasil: perspectivas para avanços nos processos de avaliação. *Cadernos de Saúde Pública*, 35. Disponível em: <https://www.scielo.br/j/csp/a/6swM97RtM3jwggWMQLYV L3S/abstract/?lang=pt>
- [18] Braga, E. S., Silva, D. L., & Silva, F. P. (2018). Gestão no Terceiro Setor: Uma análise dos indicadores de gestão, stakeholders e gestão de materiais à luz de uma instituição do terceiro setor situada em Rondonópolis-MT. *Revista Estudos e Pesquisas em Administração*, 2(3), 96-110. Disponível em: <https://periodicoscientificos.ufmt.br/ojs/index.php/repad/article/view/7669>
- [19] Pinto, W. L. H., de Moraes, C. S. B., Capparol, D. C. A., de Oliveira, J. C., de Mattos Ansanelli, S. L., & Dolfine, L. M. (2020). Gestão municipal de resíduos sólidos e proposta de indicadores de sustentabilidade. *Brazilian Applied Science Review*, 4(1), 70-111. Disponível em: <https://brazilianjournals.com/ojs/index.php/BASR/article/view/6162>
- [20] Da Silva, D., & Rosa, J. C. (2019). A gestão por competências e o processo de treinamento e desenvolvimento de pessoas (t&d): estudo de caso na empresa kl embalagens-São João Batista/SC. *Revista Visão: Gestão Organizacional*, 8(2), 79-100. Disponível em: <https://periodicos.uniarp.edu.br/index.php/visao/article/view/2021>
- [21] Meira, S. R. C., Oliveira, A. D. S. B., & Santos, C. O. (2021). A contribuição da auditoria para a qualidade da gestão dos serviços de saúde. *Brazilian Journal of Business*, 3(1), 1021-1033. Disponível em: <https://brazilianjournals.com/ojs/index.php/BJB/article/view/26310>
- [22] Nunes PM; Erdmann RH. Percepção dos gestores hospitalares de santa catarina sobre a utilização de indicadores. *Rev de administração hospitalar e inovação em saúde vol 15 n 4*, 2019. Disponível em: <https://revistas.face.ufmg.br/index.php/rahis/article/view/5082>
- [23] Albuquerque, A. C. D., Cesse, E. Â. P., Felisberto, E., Samico, I. C., & Frias, P. G. D. (2019). Avaliação de desempenho da regionalização da vigilância em saúde em seis Regiões de Saúde brasileiras. *Cadernos de Saúde Pública*, 35. Disponível em: <https://www.scielo.br/j/csp/a/pFVmfPCFTYY8FsJRRXKfkGs/?format=html&lang=pt>
- [24] Lopez, F., & Silva, T. (2020). O carrossel burocrático nos cargos de confiança: análise de sobrevivência dos cargos de direção e assessoramento superior do executivo federal brasileiro (1999-2017) (No. 2597). *Texto para Discussão*. Disponível em: <https://www.econstor.eu/bitstream/10419/240791/1/td-2597.pdf>.
- [25] De Oliveira, J. L. C., Maia, M. C. W., de Magalhães, A. M.

M., Moraes, R. M. R., Santarem, M. D., de Oliveira Aquino, T. L., & da Silva, S. D. C. (2020). Benchmarking de indicadores de qualidade e dimensionamento de pessoal de enfermagem entre unidades hospitalares. Revista Baiana de Enfermagem34 . Disponível em: <https://periodicos.ufba.br/index.php/enfermagem/article/view/37756> .

## Quilombolas Territories: Resistance and Recognition

Simone Francisca Ramos de Sousa, Renato Ramos de Almeida, Luana Pereira Rodrigues,  
Jose Henrique Santos Souza, Nilton de Almeida Araújo

Received: 03 Aug 2022,

Received in revised form: 01 Sep 2022,

Accepted: 06 Sep 2022,

Available online: 14 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article under  
the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Quilombo. Public policy. Culture.*

**Abstract**— *Quilombola communities have been fighting for access to land since the colonization of the Americas in slave-holding Brazil, and especially after the abolition of slavery and the establishment of the Republic. This right had been systematically denied them, or even considered by the elites. In this sense, from a theoretical perspective, the present work points out, with a bibliographic discussion character, some historical and political aspects of the resignification processes through which the quilombos pass.*

### I. INTRODUCTION

The trajectory of enslaved Africans and blacks brought to Brazil during the colonial and imperial period marks the resistance and revolt against this system that categorized him in the condition of captive and left him invisible to Brazilian society and legislation as a subject of rights. Brazilian slavery has a characteristic of its own, as it was the last country in America and the West to abolish slavery. And the slave system was institutionalized within the entire national territory, in which its continuity was based on economic interests subordinated to the foreign market, while countries like Peru and Colombia had the slave system regionalized (MOURA, 1993, p. 05).

Marked by the revolt, they used escape mechanisms, which led to the bush or even close to the cities, but far from the lords, where they formed quilombos, a space of freedom, away from the violence in their bodies, from the exploitation of their workforce, where they could live. for themselves. Gomes (2015) highlights that there were colonial quilombos, in addition to Palmares, considered the most famous and reference of ancient quilombos. This escape movement, as Carneiro (2001) puts it, was denied by the so-called official society that oppressed enslaved blacks, eliminating or stigmatizing their language, their religion, their lifestyles.

Throughout history, the term quilombo has gone through several interpretations, being seen as a shelter for runaway blacks, by conservative historiography, for rebelling against the slave system. Or as the union of runaway slaves to protest against the conditions of exploitation and ill-treatment and trade they were subjected to, described by Moura (1993).

Gomes (2015) explains that since the first decades of colonization in Brazil, the communities became known as mocambos and later as quilombos. The words mocambos and quilombos, according to the author, were terms used by the Portuguese administration to characterize both military tactics in pre-colonial Africa and those of resistance to slavery in Portuguese America (GOMES, 2015, p.11).

For Carneiro (2001), the quilombo reaffirmed the culture and lifestyle of Africans, its social organization was close to the dominant type of African states, being a way of expressing rebellion against the standards of living imposed by official society and of repairing the old values. Santos (2015) also states that in the colonial and imperial period the communities were called by the colonizers as Mocambos, Quilombos, Retiros, etc., and considered by the current legislation as criminal organizations.

Quilombos have always been on the margins of society. It occurred in the search for freedom, because they wanted

freedom at any cost. However, they were not totally isolated, as they posed a threat to trade, but they lived by a thread. Gomes (1996) states that the quilombolas chose geographically strategic locations where they could establish their trade relations, with middlemen, who dialogued and developed other practices such as robberies, guerrillas, as an economic tactic to guarantee their livelihood.

In Munanga's (1995) view, the conception of the quilombo is a reconstruction of the enslaved against the slavery structure that was implemented by a political composition where the oppressed were, who organized themselves to escape and occupied the unpopulated Brazilian territory, that is, the quilombos were in relatively isolated places, as many quilombola communities still live today, and they became fields of resistance and existence.

## II. RESIGNIFICATION OF QUILOMBOS

For a long time, the concept of quilombo was frozen (ALMEIDA, 2011), according to the description made by the Overseas Council of 1740, that “every dwelling of runaway blacks, more than five, partially depopulated, even if they do not have ranches raised and nor are pestles found in it” (CONSELHO ULTRAMARINO, 1740, apud ALMEIDA, 2011, p. 49). This definition influenced renowned scholars and lasted until the 1970s (SCHMITT; TURATTI; CARVALHO, 2002).

However, scholars such as Almeida (2011) criticized the term quilombo described by the Council, in which he listed five elements, such as escape; the minimum number of fugitives; geographic isolation, in places of difficult access and closer to a “wild” nature than to the so-called civilization; the dwelling; and self-consumption and the ability to reproduce. These highlighted elements reinforced concepts that persist both in academics and in the common sense of society.

Almeida (2011) states that there are instruments, such as the pestle, for example, for food processing, such as harvested rice representing both self-consumption and the ability to reproduce.

The author emphasizes from a research on conflicts that involved peasant families, who conceived the family units of work and consumption. And that the symbology of the pestle reveals the group's relationships with traders, who are in rural markets when in contradiction with the large monoculture (ALMEIDA, 2011, p. 60).

O'dwyer (2002) also explains that the expression quilombo was used by historians and other professionals, who seek new interpretations of the past. As Leite (2000) states that the quilombo establishes an important milestone

on the first steps of resistance to slavery in Brazil and its return takes place during the redemocratization of the country.

For the Brazilian State, the term quilombo is legally categorized, used from the Federal Constitution of 1988 (BRASIL, 1988), in order to definitively guarantee property to rural black communities that come from their own historical trajectory, from relations with such territory, which black ancestry based on the slavery period and its consequences.

The quilombos formed along the way gained the forests, rivers, natural resources existing in Brazilian territory, and acquired it through agreements and treaties by the colonizer, who always privileged slavery, which generated profit through the sale and purchase of slaves; commercial expansion, provided by the territorial occupation.

The organization of the quilombos was based on community work, respect for the land, which allowed the development of free and autonomous production, establishing networks of solidarity among themselves and with other groups. The basis of the economy was agriculture, and animal husbandry, characterized by diversified production, to guarantee the livelihood of everyone in the quilombo. Palmares was the pioneer quilombo that developed this organization that others copied, and expanded their way of organizing the society that was formed there.

The market has always determined the way in which society should be conducted. Large estates were established in Brazil, based on slave labor, monoculture and commercial expansion, which provided the enrichment of large landowners. The practice of dealing with the land established a relationship of respect and defense for it, but that did not guarantee him having rights over it, as happened with the colonizers.

The occupation of Brazilian soil, as highlighted by Ruy Cirne Lima (1990), transported the immeasurable ownership of the territory, both to the high echelon of the king and to the Church, in accordance with Portuguese laws. And the sesmaria system was the trunk that branched off with immovable property, giving rise to the first land regimes, ranging from the granting of sesmarias to the Land Law of 1850, where land becomes a commodity.

According to Arruti (2007), the Land Law (law no. that prevented their acquisition other than through purchase, that is, concentrating and legitimizing the lands. No Art. 3, § 1, of Law No. 601, of September 18, 1850, are “those that are in the private domain by any legitimate title, and have not been applied to national, provincial or municipal public use”.

What can be seen in this concentration of public, private and vacant land legitimized and excluded the right to access land, which became more distant for the quilombolas, as the processes of Discrimination and regularization began with the Republic and with the transfer of rights on the lands given over to the states of the Federation (ARRUTI, 2007, p.252).

According to Ilka Boaventura Leite (2000) the processes of expropriation of land gave even greater forces to inequalities, exercising and controlling the rules that define who has the right to appropriate it. The first Land Law of 1850 already excluded Africans and their Brazilian descendants, categorized as “freedmen”. And affected by racism, arbitrariness and violence against their skin color, blacks were expelled or removed from their places where they were chosen to live, even though the land was bought or inherited from the former masters, as noted in the will registered in the notary. For them, the appropriation of this space came to have a strong meaning of struggle.

In this context, the strong concentration of land by large landowners generates conflicts, violence, where rural populations are held hostage, as they see their territories invaded, exploited, more recently in the name of development that disrespects the identity, the territoriality of traditional peoples.

### III. TO REMAINING QUILOMBOS RECOGNIZED

The slave system and the post-abolition period contributed to making quilombola communities invisible for centuries, having to face racism, intolerance, discrimination and oppression. For this population it was an arduous process, all their rights were denied, including the right to exist. The quilombo had been adopted by the black movement, during the 20th century, as a symbol of resistance, life, culture, to fight for equality and for denied rights.

However, quilombola communities emerge decisively with the rise of the struggle of the Brazilian peasant movement for agrarian reform in the redemocratization process with the exhaustion of the Military Dictatorship, based on the term terra de preto (ARRUTI, 2001). The emergency to recover was part of the mobilization of the black movement, which integrated the debate on the recognition of rights. For that, it was necessary to break the concept of quilombo, which were still seen as mere spaces of escape, for a place of organization, of struggle, of the collective use of common areas and of the relationship with the land and with its identity, which is linked to the feeling of belonging.

In 1988, the Federal Constitution enters into force, as explained in articles 2158 and 2169, and through Art. 68, the remaining quilombo communities are recognized before the State: “To the remnants of the quilombo communities that are occupying their lands, the definitive ownership is recognized, and the State must issue them respective titles”.

Thus, the State had the obligation to comply with the provisions of the Constitution and meet the demand of these populations. In order to help understand what the CF/1988 instituted, the Brazilian Association of Anthropology (ABA) states that:

Contemporarily, therefore, the term quilombo does not refer to residues or archaeological remains of temporal occupation or biological evidence. Nor is it a question of groups and isolates or of a strictly homogeneous population. In the same way, they were not always constituted from insurrectionary or rebel movements, but, above all, they consist of groups that developed resistance practices in the maintenance and reproduction of their characteristic ways of life in a given place. (Document of the working group on rural black communities, meeting held on October 17/18, 1994 - ABA/Rio de Janeiro).

It is important to emphasize that this denomination made by the ABA on the term quilombo was to demystify what had been told and presented to Brazilian society for many centuries. However, the reality is different from what is still in the imagination of those who visit or idealize quilombola communities, thinking that the quilombo described in the literature remains the same. In quilombola communities, as in other territories of traditional peoples and communities, there is life, determined resistance in the place where they are subjects of rights.

Leite (2000) also argues that the notion of quilombo is a form of organization and struggle, of a space of belonging that spans several generations. And the quilombo of today means a right that must be recognized and not just a past to be remembered. It is a national political agenda that involves the State, politicians, researchers, activists and especially the quilombolas are the protagonists of this scenario. And in this sense, other nomenclatures were adopted for the term quilombo, such as “black lands, mocambos, black communities, quilombos”, among others (ALMEIDA, 2008)

The quilombola identity is particularly linked to the feeling of belonging, beyond the immediate family nucleus. Rather, there is a process in which identity ties are marked in the communities, beyond kinship and consanguinity, that



is, based on the experiences experienced and shared by the groups, in the solidarity of their social, productive practices, in the relationship with natural resources. . The affirmation of quilombola identity goes beyond the relationship with the land, but to recognize him as a citizen, “with rights and not just duties.” (LEITE, 2000). In the view of Barth (2000), ethnic groups are a form of social organization, in which actors aim to use ethnic identities to categorize themselves and others.

Quilombolas organize themselves as a community through collective actions, common struggles and representations that are fundamental and structural, making them a different group from what was defined by society. The unity and strength present among quilombola communities are constituted by a network of relationships and sharing that increasingly become mobilized and articulated groups. From this perspective, the struggle for the right to land is part of building unity and solidarity, which is related to the issue of territoriality.

It is important to emphasize that the bonds of affection that quilombola communities nurture in relation to the land go beyond economic production, but rather the continuity of the social and physical life of the families who live there. As Little (2002) defines territoriality as the collective effort of a social group that decides to occupy, control, enjoy and identify with a specific part of its biophysical environment, which becomes its territory. Almeida (2008) argues that:

Territoriality works as a factor of identification, defense and strength. Solidarity and mutual aid ties inform a set of rules established on a physical basis considered common, essential and inalienable, notwithstanding any succession provisions that may exist. In a generic way, these extensions are represented by their occupants and by those of neighboring areas under the current meaning of “common land” (ALMEIDA, 2008, p. 133-134).

Quilombola communities have a special and strong territorial relationship, as it is in the territory that identity is affirmed, where their history is being shared by several generations, without an individual, but a collective perspective. Identity and belonging are constituted in the territory as organizational strategies. In other words, it is not possible to separate the quilombola identity, experience and vision from the quilombola territory. That is why communities resist and defend their territories so determinedly.

Santos (2011) argues that the territory is the place where all the actions, passions, powers, strengths and weaknesses are, that is, where the history of men and women takes place

entirely from demonstrations of their reality. Where this land is salable, but the territory is ground, life. Therefore, once the quilombola territories are titled, as determined by Art. 24 of IN 57/2009, which:

[...] the title through the granting of collective and pro-individual title to the community, on behalf of its legally constituted association, without any financial burden, with mandatory insertion of a clause of inalienability, imprescriptibility and unseizability, duly registered in the Service Registry of the District where the areas are located.

Such determination provided for in Article 24 of the normative is to protect quilombola families by preventing them from transferring or engaging, remaining in their territories that are not just any territory, who have an interest in a defined and delimited place in generations, where the feeling of belonging, ancestry, culture is taken into account, and especially that rights are recognized.

#### IV. LEGISLATION AND THE QUILOMBOLAS TERRITORIES

The invisibility of the black population lasted for centuries, in which they were denied the right to be a citizen, being discriminated against and rejected, with their cheapest labor on the market. Thus, in order to have their rights recognized and visibility, the struggle for land was the determining point for the quilombola communities to guarantee their permanence in the thousands of territories spread throughout Brazil.

The promulgation of the Federal Constitution of 1988 (BRASIL, 1988), despite the insertion of Article 68 of the ADCT, was paralyzed for a long time, as they did not establish regulations to regulate the proposal to guarantee rights to access to land by quilombola communities. . In this wake, after the debates gained strength in the spaces of discussions throughout Brazil, legal and legislative norms were found to put this determination of the Magna Carta into practice.

It is important to highlight that a rupture that has been claimed for some time is underway both in academia and in the public debate, so that the remnants of quilombos are no longer represented as residues of a distant past and think of them as subjects of rights, which claim not only the regularization of territory, but the recognition of themselves as quilombola.

The State should seek reparation for the damage caused by slavery and republican negligence. One of its main results was the regulation of Decree 4,887/2003, a legal and administrative instrument that regularizes quilombo lands,

defining the responsibilities of the quilombolas. government agencies through the management committee<sup>11</sup>, with procedures for identification, recognition, delimitation, demarcation and titling of lands occupied by quilombolas.

In order to regulate the land tenure regularization policy that had been instituted to support the execution, Normative Instruction 57/2009 was published, which administratively guides the process of land tenure regularization of quilombola territories. With this standard, the steps for preparing the Technical Report became more comprehensive.

This action was the responsibility of the Palmares Cultural Foundation (FCP), which both issued the declaration of remaining quilombo community, and regularized the territories. However, this mission was transferred to INCRA, which assumed an important role, as it reformulated the legislation, with several internal instructions to carry out the action, until the consolidation of IN 57/2009.

Prior to the regulation mentioned above, Decree 3,239/2001 was regulated so that the administrative process of identifying the remnants of quilombo communities could be recognized, delimited, demarcated, titled and have real estate registration of the lands occupied by them, and FCP is responsible for , to start, follow up and complete the process. However, this decree took into account the recognition of properties that were already occupied by quilombos in 1888 or that were occupied by remnants of quilombo communities on October 5, 1988, leaving out all contemporary quilombos.

Currently, Fundação Cultural Palmares contributes to the general registration of quilombo remnants by issuing a certificate of self-declaration as a quilombola. It is an important action so that rural black communities can self-identify as quilombola. Other policies were also designed so that communities could exercise their rights, such as education, health, because before the decree, when it was carried out in isolation, each sector had its actions.

With the strengthening of the recognition of rights, through the promulgation of Convention No. 169 of the International Labor Organization - ILO, on Indigenous and Tribal Peoples, in part II - Lands, in articles 14 and 15, the recognition of property rights is established and tenure of traditionally occupied lands, and that their natural resources must be protected. Thus, people gained more strength to have their rights guaranteed, in their territories and in the protection of existing resources. However, the reality would be designed differently, as the attacks on their territories advanced daily, whether due to the absence and omission of the State, unilateral state projects or the pressure or land

grabbing of large private companies that interfere in the way of life of these populations.

The consolidation of rights was established in the National Policy for Sustainable Development of Traditional Peoples and Communities – PNPCT, through Decree 6040/2007, incorporating principles: I – recognition, appreciation and respect for the socio-environmental and cultural diversity of PCTs; II - give visibility to the PCTs; III – guarantee food and nutritional security, with regular and permanent access; IV – access in accessible language to information and knowledge of documents produced and used within the scope of the PNPCT; V – sustainable development as a promoter of improving the quality of life; VI - economic, socio-environmental and cultural plurality with interaction in different biomes and ecosystems, whether in rural or urban areas; VII – promote the decentralization and transversality of actions and the participation of civil society in the elaboration, monitoring and execution of the policy in all governmental instances; VIII – recognize and consolidate rights; IX – articulation with other public policies; X – make social control; XI – articulate and integrate the National of Food and Nutrition Security; XII - ensure training; XIII – eradicate all forms of discrimination in the fight against religious intolerance; XIV – preserve cultural rights. XIII – eradicate all forms of discrimination in the fight against religious intolerance; XIV – preserve cultural rights. XIII – eradicate all forms of discrimination in the fight against religious intolerance; XIV – preserve cultural rights.

All the principles mentioned above are fundamental in guaranteeing the rights of traditional peoples and communities. However, it is worth noting that within the scope of rural extension, principle IV is important for the development of extension actions, which often, with the eagerness to bring their proposals, forget to use an accessible language and are unaware of the policies aimed at these populations. . The extensionist practice must be based on the appreciation of the knowledge and actions of the communities, on the prior knowledge of the population that will be worked and seek to use participatory methodologies to guarantee participation and understand the realities experienced by the populations of the countryside, forests and waters.

In this land tenure regularization process, anthropologists play an important role, as they contribute to the elaboration of technical reports for the defense of quilombola territories. And with progress in these discussions, reflections and actions aimed at this population, there is within the anthropologists community a group that today makes up a network that dynamizes the quilombola service administratively, within the National Institute of Colonization and Agrarian Reform (INCRA). It

is important to emphasize that the construction of the anthropological report is an articulated work between anthropologists and quilombola communities that are the main subjects, that is, the protagonists, who hold their memories and desires of their life stories and their territory (ARRUTI, 1998).

With the regulation of legal norms for the regularization of quilombola territories, the numbers of quilombola communities have grown a lot, because before it was not known in the part of the state where the quilombolas were, nor how they lived. The communities are spread throughout the Brazilian territory.

There are states that have a greater concentration of quilombola communities, whether rural or urban, that suffer from not having their territories regularized, natural resources that they have are invaded, because they cannot practice their religiosity having their culture disrespected.

According to FCP data, up to 2002, before the publication of Decree 4,887/2003, 743 communities had already been identified and in 2020, 2,79812 quilombola communities are certified. This scenario of articulation and strength is also supported by its organization in states where there are state and municipal commissions that contribute to the survey of real demands and needs and are strengthened with the support of the National Coordination of Articulation of Rural Black Quilombola Communities (CONAQ).

In order to develop actions for quilombola communities, the federal government, through Decree 6,261/2007, instituted at that time a Quilombola Social Agenda within the Brazil Quilombola Program (PBQ). The Program was launched in 2004, with the aim of consolidating the State policy framework for quilombola areas, grouping actions aimed at communities in various areas, such as access to land, infrastructure and quality of life, productive inclusion and local development, rights and citizenship.

In this way, the State of Pernambuco also instituted the State Policy for Land Regularization and Sustainable Development of Quilombola Communities, through Decree No. identify, delimit, demarcate and title the areas of land occupied by quilombolas, in accordance with Law No. 12,235/200213.

At the state level, there is also the Pernambuco Quilombola Plan with the objective of consolidating existing policies with the state government policy, for the reduction of racial inequalities, with an emphasis on the quilombola population, whether in the rural or urban areas, through the preparation of proposals and the adoption of actions associated with universal policies to be implemented within the Triennium (2016/2019). The plan adds the same guidelines as the PBQ, but the actions still do

not reach all communities, especially with regard to access to land.

## V. FINAL CONSIDERATIONS

In the midst of advances and setbacks, quilombola communities have their rights guaranteed. However, effective reparation by the State is necessary, which provides access to public policies aimed at this population, and not reduce resources, as has been happening every year.

In practice, there are no integrated actions by the state and federal governments for the development of quilombola communities, especially with regard to land tenure regularization of quilombola territories, as well as for the development of these communities.

In this sense, the National Coordination for the Articulation of Black Rural Quilombola Communities (CONAQ) and the state and regional Coordinations are attentive to the negligence that occurs and fight an almost daily struggle against the State, so that they provide access to these policies. This lack of interest makes quilombola communities live in places that are invisible to public resources, but not to spoliation.

## REFERENCES

- [1] ARRUTI, José Maurício. Mocambo: antropologia e história do processo de formação quilombola. Bauru: Edusc, 2006.
- [2] ALMEIDA, Alfredo Wagner Berno de. Terras de preto, terras de santo, terras de índio- uso comum e conflito. In: Terras de Quilombo, Terras Indígenas, “Babaçuais Livres”, “Castanhais do Povo”, Faxinais e Fundos de Pasto: terras tradicionalmente ocupadas. 2.<sup>a</sup> ed, Manaus: PGSCA-UFAM, 2008.
- [3] ALMEIDA, Alfredo Wagner Berno de. Os quilombos e novas etnias. In: Quilombolas e novas etnias. Manaus: UEA Edições, 2011.
- [4] BARTH, Fredrik. O guru, o iniciador e outras variações antropológicas. LASK, Tomke (Org.). Rio de Janeiro: Contra Capa Livraria, 2000.
- [5] BRASIL, Senado Federal. Constituição da república federativa do Brasil. Brasília: Senado, 1988.
- [6] CARNEIRO, Edison. Singularidades dos Quilombos. IN: IN: MOURA, Clóvis (org) Os quilombos na dinâmica social do Brasil. LIDUFAL, Maceió, 2001, 378p.
- [7] GOMES, Flávio dos Santos. Mocambos e Quilombos: uma história do campesinato negro no Brasil. São Paulo: Ed. Claro Enigma, 2015.
- [8] GOMES, Flávio dos Santos. Quilombos do Rio de Janeiro no século XIX. IN: REIS, João José & GOMES, Flávio dos Santos. Liberdade por um fio: história dos quilombos no Brasil. São Paulo, Cia das Letras, 1996, 509p.
- [9] LEITE, Ilka Boaventura. Os Quilombos no Brasil: questões conceituais e normativas. In: Revista Etnográfica, Vol. VII (2), 2000.

- [10] LIMA, Ruy Cime. 1908: pequena história territorial brasileira: sesmarias e terras devolutas. 4. ed. São Paulo: Secretaria do Estado da Cultura, 1990.
- [11] LITTLE, P. E. Territórios sociais e povos tradicionais no Brasil: por uma antropologia da territorialidade. Brasília: UNB. Série Antropologia, n. 332, 2002.
- [12] MOURA, Clovis. Quilombos: resistência ao escravismo. São Paulo, 3ª. Ed. SP: Ática, 1993.
- [13] MUNANGA, Kabengele. "Origem e histórico do quilombo na África". Revista USP, v. 28, 1995-6.
- [14] O'Dwyer, Eliane Cantarino – 2002 – Introdução. Os quilombos e a prática profissional dos antropólogos. Quilombos: Identidade Étnica e Territorialidade. Rio de Janeiro. Editora da Fundação Getúlio Vargas/ Associação Brasileira de Antropologia (Co-editora), páginas 13-42.
- [15] SANTOS, Antonio Bispo dos. Colonização, Quilombos: modos e significações. Brasília: INCT, jun/2015.
- [16] SANTOS, Milton. O dinheiro e o território. In: SANTOS, Milton; BECKER, Bertha (orgs). Território, territórios: ensaios sobre o ordenamento territorial. 3ª ed. Rio de Janeiro: Ed. Lamparina, 2011.
- [17] SCHMITT, A.; TURATTI, M.C. M.; CARVALHO, M.C.P.de. A atualização do conceito de quilombo: identidade e território nas definições teóricas. Ambiente e Sociedade. Campinas, n.10, p.129-136, jan./jun. 2002.

## Main Public Tourism Policies in Brazil as a Tool for the Development of Tourism on the Amazon Frontier: A Review

Fabio Robson Casara Cavalcante<sup>1</sup>, Gilmara Ferreira de Lima<sup>2</sup>, Carlos Alberto Paraguassú-Chaves<sup>3</sup>, Ana Maria Morais da Fonseca Cavalcante<sup>4</sup>, Carla Dolezel Trindade<sup>5</sup>, Simão Aznar Filho<sup>6</sup>, Ruy Drummont Smith<sup>7</sup>, Simão Dolezel Aznar<sup>8</sup>, Fabrício Moraes de Almeida<sup>9</sup>, Lenita Rodrigues Moreira Dantas<sup>10</sup>

<sup>1</sup>PhD in Sciences: Socio-environmental development - NAEA / UFPA. Associate Professor, Federal University of Rondônia – UNIR.

<sup>2</sup>Graduated in Environmental Management – Federal University of Rondônia - UNIR (Brazil). Voluntary researcher at the Higher Institute of Health Sciences and the Environment of the Amazon – AICSA.

<sup>3</sup>PhD in Health Sciences -University of Brasília - UnB, Brazil; Post-Doctor in Health Sciences - UnB and Degli Studi D'Aquila University - Italy. Full Professor at the Rio de Janeiro Institute Faculty, Brazil

<sup>4</sup>Master in Agronomy from the Federal University of Pernambuco (UFPE), Brazil. Voluntary researcher at the Higher Institute of Health Sciences and the Environment of the Amazon – AICSA.

<sup>5</sup>PhD in Law - Universidad Nacional de Lomas de Zamora (Argentina). Post-doctorate - Universita deli Studi di Messina (Italy). Full Professor at the University Institute of Rio de Janeiro - IURJ, Brazil.

<sup>6</sup>PhD in Law - Universidad Nacional de Lomas de Zamora (Argentina). Post-doctorate - Universita deli Studi di Messina (Italy). Full Professor at the University Institute of Rio de Janeiro - IURJ, Brazil.

<sup>7</sup>Master in Legal Sciences from the Autonomous University of Lisbon. Adjunct Professor at the Faculty Instituto Rio de Janeiro, Brazil.

<sup>8</sup>Graduated in Law. Master of Law Student, Specialist in Law. Professor at the University Institute of Rio de Janeiro, Brazil.

<sup>9</sup>PhD in Physics (UFC), with post-doctorate in Scientific Regional Development (DCR/CNPq). Researcher of the Doctoral and Master Program in Regional Development and Environment (PGDRA/UNIR).

<sup>10</sup>Graduated in Law. Graduated in Geography. Specialist in Law. Voluntary researcher at the Higher Institute of Health Sciences and the Environment of the Amazon – AICSA.

Received: 07 Aug 2022,

Received in revised form: 01 Sep 2022,

Accepted: 07 Sep 2022,

Available online: 14 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** Public Tourism Policies,  
Tourism, Development, Amazon frontier

**Abstract—** This paper describes the main public policies for tourism in Brazil, highlighting them as instruments for tourism development in the Amazon frontier region. Public policies for the development of tourist activity, the goals and guidelines that guide the socio-spatial development of the activity, depend on the actions of government officials. In this sense, the development plan is fundamental in determining the priorities that will stimulate the growth of tourism in each region, that is, the tourism policy must work both in stimulating and directly controlling the development of tourism, as well as being concerned with the protection of the interests of society. This is a contextualization study based on a literature review. It was evident that public tourism policies can be elaborated, implemented and supervised at the municipal, state and federal levels, however, it is at this last level that the guidelines of public tourism policies in Brazil are concentrated, however, conditioning the creativity of companies to the background, strategies for the sector at the state and municipal levels, thus demonstrating the strong dependence of the sector on the action of the federal public power and, consequently, an obstacle to entrepreneurship

*and the very development of tourism at the local level. It can be inferred that despite the great potential that the Amazon region has, the tourism sector still faces numerous obstacles to its development in its entirety, among them we can highlight: low interest in the topic due to municipal economic fragility; by social disorganization; the lack of adequate infrastructure for leisure practices; by the lack of public investments that encourage the development of the tourism market; by the lack of information from society's actors regarding public policies; by the lack of strategic vision of the public power; due to the lack of a master plan in the municipality that establishes rules and that these are clear with regard to the development of tourist activity in the Amazon region.*

## I. INTRODUCTION

Tourism and its variants have been identified as one of the main economic activities in expansion in the world, especially with regard to the practices of ecotourism activities, a form of sustainable development. In this context, the Amazon, as the main biome on the planet and of paramount importance in terms of biodiversity, at first one could expect a significant advance in these activities in the region. However, what is observed is a reality quite different from this thought, even in regions where the public and/or private agencies themselves point to a vocation for the sector for certain municipalities, as is the case of the municipality of Guajará-Mirim, in Rondônia. The municipality of Guajará-Mirim, for example, has a territorial area of 24,855,724 km<sup>2</sup>, an estimated population of almost 50,000 inhabitants and is located on the border between Brazil and Bolivia and within the so-called Legal Amazon. This municipality counts with an area of 92.06% of its territorial extension as being legally protected areas, among them 41.57% being of Indigenous Lands and 50.49% of Conservation Units, a fact that led the municipality to be recognized by the central government of Brazil with the title of “Green City”, through the Environmental Institute of the Biosphere [1], however despite this situation, public tourism policies are incipient and almost unnoticeable.

The growth of the tourist segment largely depends on government initiatives, starting from the elaboration of public policies that will be linked to the local reality and will be the guiding principles for its action, in order to constitute an effective form of intervention by the public power in the regulation, planning and inspection [2]. A public tourism policy originates in the political environment, and brings together a series of interests on the part of local leaders, which make possible the development and progress of local infrastructure, encouraging and strengthening the development of tourist activity [3]. According to Fino; Matheus [4] only in 1966, while the world was experiencing the period known as the

“Tourist Boom” - when the tourist flow increased to the point of massification of the activity, is that the Brazilian government began to value the activity for economic benefits. Dias [5] highlights that the Brazilian government began to pay attention to tourism effectively in the 1960s, specifically in 1966, when it created the Brazilian Tourism Institute (EMBRATUR) and established guidelines for the elaboration of a national tourism policy. According to Sancho; Irving [7] emphasize that, in the historical perspective, until the 90's, tourism policies did not constitute a priority in national planning, receiving attention and investments only by sector. For Cruz [6] the emergence of tourism, at the end of the 20th century, as one of the most important wealth-generating activities in the world, aroused in Brazilian public administrations, and especially in the federal sphere, a sudden and deep interest in its development. However, tourism policies are still a field that have been gradually occupying space in the scope of planning and public management, unlike other policies such as those directed to health and education, which already have defined agendas and projects [8]. Salini [9] emphasizes that the behavior and practice of tourism must be guided through laws, programs, projects and actions - public policies -, which focus on valuing the subjects involved with tourism, in the context of sustainability. Public tourism policy is one of the policy areas responsible for developing guidelines, planning, promotion and control of tourist activity in a country, state, region or municipality [9].

To Barretto; Burgos; Freenkel [10] Most of the negative impacts attributed to tourism by geographers and anthropologists are due to the lack of policies to prevent the problems raised. In this sense, Cruz [11]; [12] highlights the importance of creating public policies for the development of tourist activity, as it is up to them to establish goals and guidelines that guide the socio-spatial development of the activity, both in terms of the public sphere and the private sector. For the author, in the absence of public policy, tourism is given in absentia, that is, at the mercy of initiatives and particular interests. It is

essential to establish objectives in the planning of public tourism policies, so that the historical, cultural and natural preservation of destinations can be ensured, create conditions for improvement in equipment and services and allow the well-being of natives and visitors. In this sense, the development plan is fundamental in determining the priorities that will stimulate the growth of tourism in each region [13]. Furthermore, for Solha [14] there is no doubt that tourism policy should work both in stimulating and directly controlling the development of tourism, as well as being concerned with protecting the interests of society. In Goeldner's understanding; Ritchie; McIntosh [15], tourism policy is a set of regulations, rules, guidelines, strategies and development and promotion objectives that provide a framework in which individual and collective decisions that directly affect tourism development and activities are adopted per day at a tourist destination. According to Cruz [16]; [11] tourism policy is a set of intentions, guidelines and strategies established and/or deliberate actions, within the scope of the public power, due to the general objective of achieving and/or continuing the full development of tourist activity in a given location. The author also highlights that a sectoral public policy - such as public tourism policies - does not have to be conceived, necessarily under this designation. Every guideline or strategy instituted by the public power with the exposed objective, will compose, with the set of measures established with the same purpose, the governmental policy in question. According to Beni [17] tourism policy is a set of conditioning factors and basic guidelines that express the paths to reach the global objectives for the country's tourism, determining the priorities of the executive, supplementary or assistance action of the State. For Beni [18], tourism policy must be driven by three conditions: cultural, economic and social, being the basis of public institutions, in their plans and programs, which will determine priorities; promote incentives and manage resources, formatting regulatory guidelines and support for the sector.

Hall [9]; [19] emphasizes that for the satisfactory development of public tourism policies it is essential to evaluate and monitor the actions, with this it is possible to: assess the degree of needs of government policies and interventions; to enable the testing of hypotheses regarding the functioning of the process, the nature of the results and the efficiency of the programs; specify about policy outcomes and impacts; measure the efficiency and cost-effectiveness of tourism policies and plans in terms of financial, human and capital resources. Furthermore, Vieira [2] highlights that municipalities potentially destined for tourism need the participation of public actors for the effective implementation of these policies; it is with

their support that the equipment and services available to the public will be able to be offered with quality; they are the ones who will formulate the basic guidelines for environmental protection, dissemination and promotion of cultural values and incentives for domestic and international tourism. It is incumbent upon the Public Power to disseminate and expand the understanding of the importance of the wealth of biological heritage resources and knowledge of the legislation and public policies aimed at its conservation. As much as a region has attractions, it will not be able to attract and expand the stay of visitors if it does not have adequate infrastructure and services [20].

The objective of this study was to describe the main public policies for tourism in Brazil, highlighting them as instruments for the development of the Amazon frontier region. As a methodological procedure, a bibliographic study was carried out through the literature review technique, where official documents, books, articles, theses and dissertations were analyzed that address the topics that concern public policies, public tourism policies, as well as as well as on tourism and its application in border regions and other subjects developed in this work. Bibliographic research is a method of studying and analyzing documents in the scientific domain [21]. According to Fonseca [22] any scientific work begins with a bibliographic research. For Koche [23] the objective of bibliographic research is to know and analyze the main existing theoretical contributions on a given subject or problem, making it an indispensable instrument for any research. According to Marconi; Lakatos [24] "bibliographic research is not a mere repetition of what has already been said or written about a certain subject, but it allows the examination of a theme under a new focus or approach, reaching innovative conclusions".

## II. THE MAIN PUBLIC TOURISM POLICIES DEVELOPED IN BRAZIL AND IN THE AMAZON REGION

For Dias [5], public policies are actions carried out by the government that aim at the common good and meeting the needs of society, oriented towards satisfying public interests. They can also be understood as governmental planning tools, by which norms, rules, strategies and goals are determined to achieve certain objectives outlined. For this author, although policy can be exercised by society as a whole, not being an exclusive action of the State, public policy is a set of exclusive actions of the State. In this sense, Barretto; Burgos; Freenkel [10] report that public policies are "state actions guided by the general interest of society". Perret [25] considers that public policies are the set of action devices, implemented as a result of the decisions of one or several public authorities, in order to

achieve an objective or to achieve a purpose linked to the general interest. And it is this general interest that must be maintained to ensure the development of communities. In Hall's view [9], public policy encompasses government action, inaction, decisions and non-decisions, since it implies a deliberate choice between alternatives. For a policy to be considered public, it must, at the very least, have gone through a process, even if only authorized or ratified by public bodies. These government actions must be aimed at meeting the needs of the whole of society. Hall [9] also emphasizes that public policy making is, above all, a political activity, and these are influenced by the economic, social and cultural characteristics of society, as well as the formal structures of governments and other aspects of the political system. Politics must be seen as a consequence of the political environment, values and ideologies, the distribution of power, institutional structures and decision-making processes.

Teixeira [26] conceptualizes public policies as guidelines, guiding principles of action by the public authorities; rules and procedures for relations between public power and society, mediations between actors in society and the State. In this case, policies are explicit, systematized or formulated in documents (laws, programs, lines of financing) that guide actions that normally involve investments of public resources. However, there is not always compatibility between the interventions and declarations of will and the actions developed. The “non-actions”, the omissions, as forms of manifestation of policies must also be considered, as they represent options and orientations of those who occupy positions. The author mentions the following types of public policies: Regarding the nature or degree of intervention: structural – they seek to interfere in structural relationships such as income, employment, property, etc.; conjunctural or emergency – aim to alleviate a temporary, immediate situation. Regarding the scope of possible benefits: universal – for all segmental citizens – for a segment of the population, characterized by a specific factor (age, physical condition, gender, etc.); fragmented – aimed at social groups within each segment. As for the impacts they can cause to beneficiaries, or their role in social relations: distributive aim to distribute individual benefits; they are often instrumentalized by clientelism; redistributive – they aim to redistribute resources among social groups: seeking some equity, they withdraw resources from one group to benefit others, which causes conflicts; regulatory – aim to define rules and procedures that regulate the behavior of actors to meet the general interests of society; would not aim at immediate benefits for any one group. The author Rua [27] shows that “although a public policy implies a political decision, not every political decision constitutes a

public policy”. Public policies, according to Dias; Matos [28] emerged as a way of managing collective problems and demands “through the use of methodologies that identify priorities, rationalizing the application of investments and using planning as a way of achieving predefined objectives and goals”. For Castro [29] “It is up to public policies to establish guidelines through the planning of strategies, identifying needs and problems in the most varied segments (...)”. Public policies are thought and idealized with a view to sequential stages, being understood by distinct phases that constitute the policy in its entirety. These range from problem identification; formulation of solutions; decision making; action implementation; and finally, the evaluation of the results [30]. Lopes; Amaral; Caldas [31] report that the Public Policy formulation process, also called Public Policy Cycle, has several stages (Table 1).

Public policies can be designed, implemented and supervised at the municipal, state and federal levels, with the State, at each of the three levels of government, being primarily responsible for ensuring the formulation and execution of public policies. The participation of civil society in the elaboration and management of public policies takes place mainly through municipal, state and national councils. In addition to the councils, civil society exercises social control over public policies through forums, movements and other organizations. It should be noted that civil society can participate in the execution of public policies, but the guidelines and criteria must be defined by the government. Thus, a general theory of public policy implies the search to synthesize theories built in the field of sociology, political science and economics. Public policies have repercussions on the economy and on societies, which is why any theory of public policy must also explain the interrelationships between State, politics, economy and society [32].

Table 1 - Illustration of public policy phases

|                     |                                                                     |
|---------------------|---------------------------------------------------------------------|
| <b>First phase</b>  | Agenda formation (priority selection)                               |
| <b>Second Phase</b> | Formulation of Policies (presentation of solutions or alternatives) |
| <b>Third Phase</b>  | Decision Making Process (Choice of Actions)                         |
| <b>Fourth Phase</b> | Implementation                                                      |
| <b>Fifth Phase</b>  | Evaluation                                                          |

Source: Adapted from [31].

Public policies for tourism are based on the National Tourism Policy. According to art. 4 of Law No. 11,771, of September 17, 2008, which provides for the National Tourism Policy and Article 2, item I, of Decree No.



7,381/2010, the National Tourism Policy is a set of laws and regulations, aimed at planning and ordering the sector, guidelines, goals and programs defined in the National Tourism Plan – PNT. By Art. 5 of Law No. 11,771, the objectives of the National Tourism Policy are: to democratize and provide access to tourism in the country to all population segments, contributing to the elevation of general well-being; reduce regional social and economic disparities, promoting social inclusion by increasing the supply of work and better income distribution; expanding tourist flows, permanence and average spending of national and foreign tourists in the country, through the promotion and support of the development of the Brazilian tourist product; to stimulate the creation, consolidation and dissemination of Brazilian tourist products and destinations, with a view to attracting national and foreign tourists, diversifying flows between Federation units and seeking to benefit, especially, regions with a lower level of economic and social development; provide support to strategic programs to attract and support the holding of business fairs and exhibitions, incentive trips, congresses and national and international events; promote, decentralize and regionalize tourism, encouraging States, the Federal District and Municipalities to plan, in their territories, tourist activities in a sustainable and safe way, including among themselves, with the involvement and effective participation of the receiving communities in the benefits arising from the activity economic; create and implement enterprises for cultural expression, tourist entertainment, entertainment and leisure activities and other attractions capable of retaining and prolonging the length of stay of tourists in the localities; to promote the practice of sustainable tourism in natural areas, promoting the activity as a vehicle for environmental education and interpretation and encouraging the adoption of conducts and practices of minimal impact compatible with the conservation of the natural environment; preserve the cultural identity of communities and traditional populations eventually affected by tourism; prevent and combat tourist activities related to abuses of a sexual nature and others that affect human dignity, respecting the powers of the various government agencies involved; to develop, organize and promote the different tourist segments; implement the inventory of the national tourist heritage, updating it regularly; provide the necessary resources for investments and use of the national tourist space in order to allow the expansion, diversification, modernization and safety of tourist equipment and services, adapting them to demand preferences, and also to environmental and socioeconomic characteristics existing regions; increase and diversify lines of financing for tourism enterprises and for the development of small and

micro-enterprises in the sector by banks and official development agencies; contribute to the achievement of a fair and equitable tax policy, at the federal, state, district and municipal levels, for the various entities that make up the tourism production chain; promote the integration of the private sector as a complementary agent of financing in infrastructure and public services necessary for tourism development; to promote the sector's competitiveness through the improvement of quality, efficiency and safety in the provision of services, the search for originality and increased productivity of public agents and private tourism entrepreneurs; establish standards and norms of quality, efficiency and safety in the provision of services by operators, enterprises and tourist facilities; to promote the training, improvement, qualification and qualification of human resources for the area of tourism, as well as the implementation of policies that enable professional placement in the job market; and implement the production, systematization and exchange of statistical data and information related to tourism activities and enterprises installed in the country, integrating universities and public and private research institutes in the analysis of these data, in the pursuit of improving quality and credibility of statistical reports on the Brazilian tourism sector. When dealing with conservation units, tourism will be developed in line with their creation objectives and with the provisions of the unit's management plan.

### **2.1. National Tourism Plan (PNT)**

In Art 2, item II, of Decree No. 7,381, of December 2, 2010, the National Tourism Plan - PNT is considered as: a set of guidelines, goals and programs that guide the activities of the Ministry of Tourism, in partnership with other sectors of public management in the three spheres of government and with the representations of civil society, private initiative and the third sector, related to tourism, under the terms of art. 6 of Law No. 11,771, of 2008. Article. 6 of Law No. 11,771, of 2008. Pursuant to art. 6 of Law No. 11,771, the National Tourism Plan - PNT is prepared by the Ministry of Tourism, after consultation with the interested public and private sectors, including the National Tourism Council, and approved by the President of the Republic, with the aim of promoting: credit for the sector, including financial agents, lines of financing and financial costing; the good image of the Brazilian tourist product in the national and international market; the arrival of foreign tourists and the movement of tourists in the domestic market; greater contribution of the exchange rate to the balance of payments; the incorporation of special demand segments into the national market, namely the elderly, young people and people with disabilities or reduced mobility, by encouraging discount programs and facilitating travel, accommodation and enjoyment of

tourist products in general and campaign promotion institutions; protection of the environment, biodiversity and cultural heritage of tourist interest; the mitigation of socio-environmental liabilities eventually caused by tourism; the stimulus to responsible tourism practiced in protected natural areas or not; guidance for the actions of the private sector, providing subsidies to economic agents to plan and execute their activities; and inform society and citizens about the economic and social importance of tourism. By the sole paragraph of the referred law, the PNT will have its goals and programs reviewed every 4 (four) years, in line with the pluriannual plan, or when necessary, observing the public interest, with the objective of ordering the actions of the public sector, guided by the effort of the State and the use of public resources for the development of tourism. The National Tourism Plans have been an advance in terms of the current way of seeing and thinking about tourism in different instances, whether local, regional or national. It is still an initiative of the national government in an attempt to establish goals, implement actions, placing the tourist activity as an important generator of employment and income for the population that is directly or indirectly linked with the activity, and therefore, as an important element of economic development for the country [33]. Next, the national tourism plans from the 2000s will be exposed, as well as the main programs and plans related to tourism.

**2.1.1 National Tourism Plan 2013-2016**

The National Tourism Plan 2013-2016 presents as a vision of the future, positioning Brazil as one of the three largest tourist economies in the world by the year 2022. Considering the diagnosis of the sector and having as a reference the guidelines that guided the preparation of this Plan, four major objectives were identified to be pursued within the defined horizon: Prepare Brazilian tourism for mega-events; Increase the generation of foreign exchange and the arrival of foreign tourists; Encourage Brazilians to travel around Brazil; and Improve the quality and increase the competitiveness of Brazilian tourism. The Plan's vision of the future is to position Brazil as one of the three largest tourist economies in the world, by 2022, prioritizing aspects such as the arrival of foreign tourists and their stay in the country for longer, since the external public mostly spends more money in Brazil. For each of the objectives presented, indicators are built, goals are set and actions are elaborated, defining the results expected to be achieved in 2016, summarizing the effort to be undertaken in the coming years by the Ministry of Tourism, in partnership with the actors of the National System of Tourism. The definition of strategic actions, proposed in the National Tourism Plan 2013-2016, reinforces the position presented in the evaluation of the Tourism Regionalization Program,

to prioritize actions in the regions and, thus, consolidate Decentralized Management from the expansion of participation, dialogue and social control. As a central strategy for achieving the objectives and targets set out in this document, as well as for guiding the various activities listed therein, two integrated paths for planning and implementing policies for Brazilian tourism were established: A Strategic Agenda for Brazilian Tourism; and The preparation of executive documents, called PNTs in Action.

Table 2 - Goals of the National Tourism Plan 2013-2016

|        |                                                                                  |
|--------|----------------------------------------------------------------------------------|
| Goal 1 | Increase the arrival of foreign tourists to the country to 7.9 million           |
| Goal 2 | Increase international tourism revenue to US\$10.8 billion by 2016               |
| Goal 3 | Increase to 250 million the number of domestic trips carried out by 2016         |
| Goal 4 | Raise to 70 points the average national tourism competitiveness index until 2016 |
| Goal 5 | Increase to 3.6 million formal occupations in the tourism sector by 2016         |

Source: Adapted based on the National Tourism Plan - 2013/2016

**2.1.2 National Tourism Municipalization Program (PNMT)**

The trajectory of the National Tourism Policy with a territorial focus began with the institutionalization of the National Tourism Municipalization Program – PNMT. For Brusadin [34], the PNMT was one of the main programs implemented in the National Tourism Policy. The PNMT was a program created by the federal government to stimulate national tourism development through the decentralization of public tourism policies and the strengthening of tourism planning in the municipalities. Despite having been created in 1992, the PNMT was only officially instituted in 1994, through Ordinance n° 130, of March 30, 1994, from the Ministry of Industry, Commerce and Tourism (MICT), starting its effective activities in the municipalities from 1995 onwards and persisting at the federal level until the end of 2001 [34]. The PNMT is defined as a federal program to promote the decentralized development of Tourism. The PNMT is coordinated by EMBRATUR with the purpose of implementing a new simplified and standardized management model for the tourist activity for states and municipalities in an integrated manner, seeking greater efficiency and effectiveness in the management of tourist activity, in a participatory manner. As a strategic and multifaceted program, the PNMT brought together several projects and initiatives from the PNT 1996/1999, focusing efforts on the implementation of guidelines and strategies for the sector at the national level [7].

According to the author [7], the program, whose structure involved the federal, state and municipal levels, focused on tourism management and planning at the local level. Municipalities were considered the main agents for conducting the tourism development process, based on the commitment to sustainability. Economic, social, cultural, political and environmental issues permeated all the objectives and actions of the PNMT, whose proposals and statements partially internalized the theme of social inclusion. The PNMT aimed at decentralizing planning activities to the municipalities, with a horizontalization of guidelines and actions for tourism policy in the country. Municipalities should build a municipal tourism policy aimed at their interests, based on the National Tourism Policy [5]. The PNMT contemplated the elaboration of inventories of the municipal tourist offer, creation of councils and municipal tourism funds and culminated with the formatting of a municipal tourism development plan, so that the municipality was "baptized", receiving the seal of tourist municipality, after the fulfillment of all the workshops and stages of the program [35]. Beni [36] highlights that the program was created with the main objective of improving the tourist product through the awareness of municipalities and their inhabitants about the economic benefits that tourism could bring, as well as the decentralization of planning activities. The PNMT intervention strategy included the preparation and holding of workshops in three phases, aimed at: (a) raising awareness of tourism as an economic activity, developed based on the pillars of sustainability; (b) organization of tourism actors (providers of tourism services, public, private and third sector), at the municipal level, up to their organization in a municipal council (representative and legitimate); and (c) construction of the municipal tourism development plan (alignment of tourist demand and supply), in a participatory and collective manner, by the municipal tourism councils.

The process of implementing the PNMT in the municipality went through a series of steps that can be summarized as follows: Completion of the Tourist Information Report - RINTUR (established by Normative Deliberation 417), training of Multipliers, community awareness, formation of the Municipal Tourism Council, creation of the Municipal Tourism Fund, preparation and implementation of the Municipal Tourism Development Plan. In the PNMT, an attempt was made to introduce a differentiated tourism planning methodology, with a participatory approach, formulated from the fusion of the Metaplan technique and the ZOPP method, both created in Germany in the 70s and 80s, respectively, by the Government Agency GTZ (German Society for Technical Cooperation). The Metaplan technique is based on

visualization with an emphasis on the moderator. The ZOPP method, Objective-Oriented Project Planning – incorporates Metaplan techniques, but is more focused on development and technical cooperation projects. The procedure is based on training through workshops, which take place in three phases with minimum intervals of 90 days, composed of working groups in which all participants, based on questions and guiding material, start building knowledge from from the individual reality [34]. The implementation of the PNMT in 1,081 Brazilian municipalities enabled the involvement and training of 27,483 people through 1,107 workshops at different levels [37]. According to the aforementioned authors, in eight years of effective operation (1995 - 2002), the program generated a significant change in the management of Brazilian tourism, especially when the involvement and participation of the various social agents is observed. The country has moved from a situation of extremely centralized and vertical public policies to a situation of involvement and participation of agents interested in the development of tourism in their municipalities.

Tretin; Fratucci [37] also emphasize that the PNMT awakened the municipalities to the possibilities that tourism development could mean for local economies, especially with regard to the possibilities of implementing an endogenous tourism development model, centered on local characteristics and potential. without, however, closing itself off to exogenous agents and projects. For the authors, the involvement of local social agents in the management processes of tourism development provided a new understanding of tourism itself, both for the population in general, as well as for local political representatives, who began to treat the sector with a more professional and less misrepresented. However, Sancho; Irving [7] emphasize that the position adopted by EMBRATUR during the implementation of the PNMT prevented the decentralization proposal from being effectively implemented. This is because the actions of the municipalities were conditioned to the regulations of this body, since to participate in the program, they should be identified as priorities for the development of tourism. In this direction, the actions of the municipalities were, many times, subordinated and conditioned to the rules at the federal and state levels. Thus, according to the aforementioned authors, the PNMT proposed, but failed to effectively implement, a truly decentralized management structure, especially from the point of view of democratizing the decision-making process among all government levels. Only at the local level, once the "rules of the game" were met, were municipalities able to acquire some autonomy to implement the tourist development process. The most consistent criticisms in relation to the

PNMT were directed at the implementation and design flaws of the project. The inexistence of a reliable mapping of the country's tourist potential led to the inclusion of numerous municipalities without tourist attractions in the program. This resulted in a paradox, in which the priority municipalities of the program were the majority of those enrolled, and therefore there was no priority. The design flaw of the project was that, by urging municipalities to develop planning actions very independently, the prospects for planning regional tourism were put at risk, intensifying the competition between isolated tourist destinations. On the other hand, Sancho; Irving [7] point out that it is also necessary to consider the advances made by the PNMT, up to that point, in tourism policies, especially considering the strategic approach to development for the sector. Through the PNMT, the PNT 1996/1999 contributed to a new perspective on the tourism management model in Brazil until that moment, as it incorporated into the work carried out government's vision and strategic planning. Topics such as 2004 and 2009? How the involvement of different segments and social actors behave in the the tourist development process, actions at the local level in Brazil? What is citizen education and the adoption of sustainability of foreign tourists assumptions in tourist practice, essential to think about country? How is the tourism from the perspective of social inclusion, offer of products and incorporated. The effects of the PNMT services for the international strengthened in the following decade, when inserted. What do the leaders basis for the creation of measures related to that public and private tourism policies and plans and brought significant benefits of Brazilian tourism to the municipalities that adopted its practice. Think this time, efforts were made by the Federal Government to stimulate, organize and boost the tourism sector through policies, programs and plans aimed at involving its various actors and bodies (investors, entrepreneurs, real estate speculators, municipal and state governments and others), as will be seen below. The sector came to be considered as one of the most important generators of socioeconomic development [38].

**2.1.3 Watercolor Plan (2020)**

The Aquarela Plan 2020 – International Tourism Marketing in Brazil, outlines the paths to be followed, the objectives to be achieved, and the essential actions for Brazilian tourism to advance with the great opportunities for global promotion and communication in the coming years. The objectives of international promotion are: Contribute to the success of the World Cup and the Olympic Games; Maximize results for Brazilian tourism; Optimize the country's worldwide exposure to make it better known. The work of diagnosis and preparation to build a tourism marketing strategy in the decade of the World Cup and the Olympics in Brazil fulfilled a series of steps. Since 2008, Embratur has been working with its team of professionals, carrying out studies, trips, meetings

and preparing to learn about the functioning and calendar of the World Cup. With the victory, in October 2009, of the bid to host the Rio 2016 Olympic Games, it incorporates yet another great challenge in preparing actions to promote Brazilian tourism internationally. When designing the new plan for this new stage, the path followed was the same, and demanded research, studies and involvement of the Brazilian public and private sectors. At the beginning of 2009, Embratur began to prepare the three fundamental steps to arrive at the design of the plan as shown in table 3, [39]; [40]; [41]; [42].

Table 3 - Phases for the design of the 2020 Watercolor Plan

| Diagnosis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Formulation of Marketing Strategy                                                                                                                                                    | Operational plan                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| What is the current situation, after the work carried out in 2004 and 2009? How do social actors behave in the the tourist development process, actions at the local level in Brazil? What is the sustainability of foreign tourists assumptions in tourist practice, essential to think about country? How is the tourism, offer of products and services for the international market? What do the leaders think about that public and private tourism policies and plans and brought significant benefits of Brazilian tourism to the municipalities that adopted its practice. Think this time, efforts were made by the Federal Government to stimulate, organize and boost the tourism sector through policies, programs and plans aimed at involving its various actors and bodies (investors, entrepreneurs, real estate speculators, municipal and state governments and others), as will be seen below. The sector came to be considered as one of the most important generators of socioeconomic development [38]. | What is the vision for 2020? What goals and targets will we pursue? What products will we offer, in which markets? What budget will we need to meet our goals and achieve our goals? | What tools, what products, what actions will be carried out in each country? What are the priority markets for international promotion? How to take into account the holding of the World Cup and the Olympics in Brazil? Which projects and agenda will be the most appropriate to take advantage of the great possibilities of communication about Brazil as a tourist destination in this period? |

Source: Adapted based on the 2020 Watercolor Plan

The strategic objectives of the Aquarela Plan 2020 were designed to meet the following objectives for international tourism in Brazil: Improve and have long-term results in the work of promoting international tourism in Brazil; Involve the public and private sectors of national tourism in a unified strategy from the country to the outside to better take advantage of the opportunities of the future; Promote Brazil as a global tourist destination in a professional manner, based on studies, research and results goals beyond 2014 and 2016; Take advantage of the main sporting events in the world to make Brazil better known in the world as a tourist destination. With these assumptions, the most important numerical targets for the period are: Increase international tourism by 113% from 2010 to 2020. Increase by 304% the inflow of foreign exchange with foreign expenditures in Brazil from 2010 to 2020; Increase by 500 thousand tourists in Brazil, in the year of the 2014 World Cup; and 380,000 in the year of the Rio 2016 Olympic Games over previous years; Maintain

sustained growth of at least 1 percentage point above the growth in South America.

**2.1.4 Color Plan**

In 2005, the Plano Cores do Brasil was launched, with the main objective of promoting tourism at the national level. In it, the analysis of the country's tourist products was considered, with a set of 111 tourist itineraries, represented in the data collection carried out in January 2005. Plano Cores used exactly the same evaluation methodology as Aquarela. In this context, the Plan, at first, sought to analyze the promotional actions of tourism in the country, its image and that of its products in the Brazilian trade; evaluate the Brazilian tourist centers through the Regionalization Program; define promotional strategies consistent with the objectives of the PNT 2003-2007; integrate into the international tourist brand; propose criteria aimed at promotional actions in promotion forums on a state scale and prepare an operational marketing plan from a commercial perspective. Furthermore, based on the Aquarela Plan 2003-2007, the segmentation of Brazilian tourism products was presented. In the elaboration of the Plano Cores do Brasil, it was identified that the lack of knowledge of the national market in relation to the Brazil product is almost as great as that of the international market. As seen earlier, the Brazil brand was created during the process of building the Plano Aquarela – International Tourism Marketing Plan for Brazil. The Cores do Brasil Plan, National Tourism Marketing Plan establishes 2 well-differentiated temporal phases: Year 2006. The year of launch of domestic tourism, to: Consolidate the internal organization of the Ministry of Tourism Marketing and its integration with the partners directly involved with the management of the tourism product Brazil; Sensitize the sectors involved; Capture new resources for the promotion; Structure current products into roadmaps and packages; Produce promotional materials; Change the image of the act of “traveling through Brazil”, implementing the new positioning of “Experience” traveling through your own country. Years 2007–2010. The years of consolidation of Plano Cores, to: Consolidate the new positioning of domestic tourism in the national tourist market; Increase the number of tourists, increase income and generate jobs, reaching the proposed goals and objectives.

**2.1.5 Tourism Regionalization Program**

In 2004, after the presentation of the National Tourism Plan (PNT) 2003/2007, the Ministry of Tourism launched the Regionalization Program – Roteiros do Brasil, an important policy for structuring tourism in Brazil, based on the guidelines contained in the PNT and which presented a new perspective on the development of

through decentralized management. The Tourism Regionalization Program reached 219 tourist regions in 3,203 municipalities [39]; [40]; [41]; [42]. The Tourism Regionalization Program grew under the integration of the social, economic, institutional, cultural and political sectors of the municipalities. It also articulates the relationship between the spheres of government, civil society, higher education institutions and the tourism sector agent, joining efforts in fulfilling the goals of the National Tourism Plan [43]. The Program is the result of the National Tourism Plan 2003-2007: Macroprogram 4 – Structuring and Diversification of the Tourist Offer, which had as its starting point the national debate with the representative segments of society, in order to promote sustainable tourism development in a regionalized way in Brazil. The premise of the Program, considered strategic for the achievement of the National Tourism Policy, focused on the purpose that its execution, in a decentralized and regionalized way, with a focus on coordinated and participatory planning, would have a positive impact on the socioeconomic results of the national territory. The regionalization process applied a new model of tourism development in Brazil, which was already strongly marked by the Tourism Municipalization Plan launched in 1994, seeking the integration of municipalities, strengthening the regions and creating Tourist Routes. Flexibility, articulation, mobilization, inter-institutional cooperation and “decision synergy” were also sought [39]; [40]; [41]; [42]; [44]. The operational guidelines of the “Regionalization Program” consist of nine modules: Awareness; Mobilization; Institutionalization of the Regional Governance Instance; Elaboration of the Strategic Plan for the Development of Regional Tourism; Implementation of the Strategic Plan for the Development of Regional Tourism; Program Tourist Information System; Tourist Routing; Marketing Promotion and Support; Program Monitoring and Evaluation System. The Tourism Regionalization Program – Roteiros do Brasil, according to its Political Guidelines, presents three strategies to achieve regionalization. (Table 4).

*Table 4 - Strategies of the Tourism Regionalization Program to achieve regionalization*

| <b>coordinated management</b>                                                                                                                                | <b>Integrated and participatory planning</b>                                                                                                                                                             | <b>Marketing promotion support</b>                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Coordinated management seeks to form partnerships with a view to sharing proposals, responsibilities and actions. It involves the three spheres of executive | Integrated and participatory planning means dreaming together, to think about the tourism we want in the short, medium and long term. Enabling the elaboration of Strategic Plans for the Development of | The promotion and commercialization characterized by establishment of relationships with market agents, by institutional and |

|                                                                                                       |                                                                                                                                                                                                                     |                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>but also the that promote the ation of the power with the ty, both in and in ent, including n.</p> | <p>Regional Tourism in a participatory manner means democratizing the spaces and mechanisms of political representation of civil society, allowing for changes, but also for the necessary structural advances.</p> | <p>action and interaction. The objective is to provide a suitable environment for the changes required to increase competitiveness, in a context to favor social inclusion.</p> | <p>tion. The provided in the parameters. Despite the existence of this structure, many states and municipalities still face difficulties to understand, apply, operationalize and continue within their political-territorial limits, the prescribed and applicable directives in their respective conjunctures. These obstacles, in large part, reveal the incapacity and institutional fragility for tourism management in many regions of the country, despite successive attempts to plan the integrated development of tourist activity [36]. With the launch of the National Tourism Plan 2007-2010 – An Inclusion Trip, in June 2007, the Tourism Regionalization Program gained more notoriety and consolidated itself as a structuring and transversal program. The new PNT is composed of eight macroprograms, including the Tourism Regionalization Macroprogram, which guides all other macroprograms, programs and actions of the Plan. In other words, the regionalization of tourism gains status within the PNT and establishes itself as an instrument that contributes to the achievement of all the goals established for Brazilian tourism by the year 2010. Now as a macro-program, its responsibility has increased and its objectives have been expanded, as follows: to promote the development and deconcentration of tourist activity; support the planning, structuring and development of tourist regions; increase and diversify quality tourist products, contemplating the cultural plurality and regional difference of the Country; enable the insertion of new destinations and tourist itineraries for commercialization; to encourage production associated with tourism, adding value to the tourist offer and enhancing the competitiveness of tourism products; enhance the benefits of the activity for local communities; Integrate and dynamize the productive arrangements of tourism; increase the tourist stay time in tourist destinations and itineraries; boost regional economies. The Tourism Regionalization Macroprogram is composed of four Programs, within the scope of the 2007-2010 PNT, as shown in Table 5.</p> |
|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

The operational guidelines of the “Regionalization Program” consist of nine modules: Awareness; Mobilization; Institutionalization of the Regional Governance Instance; Elaboration of the Strategic Plan for the Development of Regional Tourism; Implementation of the Strategic Plan for the Development of Regional Tourism; Program Tourist Information System; Tourist Routing; Marketing Promotion and Support; Program Monitoring and Evaluation System. According to the Operational Guidelines of the Tourism Regionalization Program – Roteiros do Brasil, the tourism regionalization process must: involve representatives from all levels – public authorities, entrepreneurs, civil society, educational institutions and the third sector – and open space for everyone contributes to the Program's actions in the region; respect the diversity of opinions in building consensus, promoting joint discussions and negotiations among participants; raise different visions of the same problem according to the interests, needs, expectations and fears of the groups involved; take into account local knowledge, skills, vocations, local culture and experiences, for their use and inclusion in the regionalization process; consider and respect ethnic, social, cultural, historical, economic and environmental inequalities and differences, among others, minimizing negative or prejudiced interference in the process [39]; [40]; [41]; [42].

The Tourism Regionalization Program – Roteiros do Brasil can be considered the hallmark of Brazilian tourism and, perhaps due to this policy, the sector has never been so structurally strengthened. Thinking about regional tourism planning means understanding the territory as a space and place of interaction between man and nature and using it as a tool to agglomerate destinations in a single geographic region with similar characteristics, forming clusters; zones; poles; circuits or tourist itineraries. The social organization of the municipalities itself undergoes changes, since regionalization intends to “think collectively” of the sector, adapting economic agents with new strategies, interacting with public authorities, the private sector and the community, inducing them to a global vision of planning and service delivery [44]. These characteristics allow us to conclude that the elaboration of any tourism plan in Brazil

Table 5 - Programs of the Tourism Regionalization Macroprogram: PNT 2007-2010

|                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Regionalization Planning and Management Program</b></p>                                                                                                                                                                                                                                                 |
| <p>it ranges from articulation, sensitization and mobilization activities, to the elaboration of strategic plans for tourist regions. It has effective action through the institutionalization of Regional Governance Instances, in the formation of networks and in the monitoring and evaluation of the</p> |

|                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| regionalization process.                                                                                                                                                                                                                                                                                                      |
| <b>Structuring Program for Tourism Segments</b>                                                                                                                                                                                                                                                                               |
| proposes the ordering and consolidation of each segment, the articulation and strengthening of its representative bodies and the standardization of conceptual reference, which together with the structuring of production associated with tourism configure the basis for the construction of tourist itineraries.          |
| <b>Program Structuring Production Associated with Tourism</b>                                                                                                                                                                                                                                                                 |
| aims to identify products associated with tourism, artisanal, industrial, commercial and services, as a way of expanding and diversifying the offer. It proposes ways to leverage opportunities and overcome challenges to incorporate these products and adapt them to the market and the tourism commercialization process. |
| <b>Support Program for Regional Tourism Development</b>                                                                                                                                                                                                                                                                       |
| integrates the Regional Tourism Development Programs – PRODETUR. It aims to ensure sustainable and integrated development, improve the quality of life of the local population, increase the sector's revenues and improve the capacity to manage the activity in areas of expansion and tourism potential.                   |

Source: Adapted from PNT

The Tourism Regionalization Program, structured by the National Tourism Plan 2013-2016, is qualified based on the propositions arising from the discussions held within the scope of the National Tourism System, the technical teams of the Ministry of Tourism, the evaluations arising from the governance bodies, the National Regionalization Network and, finally, the public consultation. The Program, in its revision, reflects the aspirations of society, recovers the determination of the State's action and makes possible the emergence of the diversities of the territories, transforming them into a powerful economy, capable of generating the state of well-being. The Program was established by Ordinance No. 105, of May 16, 2013, which according to Art. 1st aims to promote the convergence and articulation of the actions of the Ministry of Tourism and the set of sectoral and local public policies, focusing on the management, structuring and promotion of tourism in Brazil, in a regionalized and decentralized way. In its article 2, it presents the following specific objectives: to mobilize and articulate programs and actions within the

scope of the Ministry of Tourism, other public bodies and national and multilateral development agencies, for the territorial approach and decentralized management of tourism; establish criteria and parameters for the definition and categorization of tourist municipalities and regions, in order to generate indicators of processes, results and performance as tools to support technical and political decision-making; promote the integration and strengthening of collegiate bodies in states, regions and municipalities; encourage and support the formulation and management of state, regional and municipal tourist plans, with the protagonism of the production chain, adopting an integrative vision of spaces, agents, markets and public policies; provide means to qualify professionals and services, as well as increase associated production in tourist regions and municipalities; foster entrepreneurship in tourist states, regions and municipalities; to stimulate the capture and promotion of investments in the tourist area of states, regions and municipalities, training managers for these purposes; identify the infrastructure needs of states, regions and municipalities and articulate their prioritization with the sectorial areas; support the promotion and marketing of tourist products; transfer technical knowledge aimed at the efficiency and effectiveness of public tourism management in the country; define criteria, parameters and methods capable of stimulating and disseminating the best practices and initiatives in tourism in the country; and establish criteria for expanding the use of public selection notices, in choosing projects for the allocation of public budget resources. Article 3 The management model adopted by the Tourism Regionalization Program is based on the perspective of shared, decentralized, coordinated and integrated management, providing participation, democratization, consensus and agreements, involving the multiplicity and diversity of institutional entities, economic agents and society organized civilian. Article 4 The Areas of Action of the Tourism Regionalization Program are: decentralized management of tourism; market planning and positioning; professional qualification, services and associated production; entrepreneurship, attracting and promoting investments; tourist infrastructure; tourist information; marketing promotion and support; and monitoring.

To achieve the desired results in the tourism regionalization process, guidelines were defined that constitute the premises for its execution: Territorial approach, adopted as a reference for development. Integration and social participation, strengthening the protagonism of the tourism production chain at the regional level, in the set of municipalities, and in the processes of public policy management. Inclusion,

understanding the region as a plural and participatory space, which expands human and institutional capacities, facilitating political, economic, social and cultural relations. Decentralization, acting within the scope of the National Tourism System, adopting the methods and processes of Decentralized Management. Sustainability, comprising the sustainable development of tourist regions as a basis for the preservation of cultural identity, respecting political, economic, social and environmental specificities. Innovation, defined as the ability of the tourism production chain to understand that the structuring of tourist destinations depends on a new integrative vision of productive development and competitiveness, which: requires the formalization of services and qualification of people; causes the expansion of micro and small enterprises, associative and cooperative organizations; requires articulation in networks; demand investments in technologies; seeks to offer segmented products and services that add values to the socio-cultural and environmental heritage and that generate, as a result, the expansion of production capacity, occupation positions, dissemination and distribution of products and services, in addition to the circulation of income in the territory. Competitiveness, understood as the growing ability to generate business in economic activities related to the tourism sector, in a sustainable way, providing the tourist with a positive experience. The management model adopted by the Tourism Regionalization Program is based on the perspective of shared management, making evident the participation, democratization, consensus and agreements, involving multiplicity and diversity of institutional entities, economic agents and organized civil society.

## 2.2 TOURISM POLICIES IN THE AMAZON

It is important to highlight that studies and analyzes on public tourism policies aimed at the Amazon are few. Most of the published research has been carried out in the states of Amazonas and Pará. Therefore, the bibliographic research carried out in this work was reduced to a small number of authors who discuss the theme. Two of the main tourism policies for the region, according to Todesco [45], were: Amazon Tourism Plan (PTA) and Proecotur. Such policies were elaborated in different historical moments, however, they adopted the same strategies to reach their objectives, apparently, divergent, evidencing the contradictions referring to the planning and the development of this activity in the territory in question.

### 2.2.1 Amazon Tourism Plan (I PTA and II PTA)

The elaboration of public tourism policies began to take shape in the Amazon in the 1970s, with the elaboration of the I Plan for Tourism in the Amazon – PTA, in 1977 [46].

The I Amazon Tourism Plan (PTA), for the period from 1980 to 1985, was launched in 1977, resulting from an agreement signed between Sudam and Embratur. This agreement establishes that the contracted company should prepare the I PTA in two stages: 1. “planning for domestic and neighborhood tourism” and 2. “planning for major international tourism” [45]; [47]. The objectives that were intended to be achieved through the I PTA were: to contribute to an orderly territorial occupation of the Amazon; participate in the economic and social development of the region, through the generation of income and employment, with the lowest economic and social costs and ecologically defend and enhance the region's natural resources and its historical-cultural heritage [46]. For the first stage, the agencies envisaged “moderate financial investments”, focused on the creation of a support structure along the recently opened or under construction highways (Belém-Brasília, Transamazônica, Cuiabá-Santarém, Belém-São Luís, Manaus-Border with Venezuela and Guyana, Manaus-Humaitá-Porto Velho, Humaitá-Lábrea-Rio Branco, Rio Branco-Border with Peru, Macapá-Oiapoque and Perimetral Norte) and in the increase of reception infrastructure and complementary services [45]. For the second stage, the objective was to “capture a portion of North American tourism oriented towards the Caribbean” and Europeans, however, this public would not be “attracted by the urban poles of the Amazon ecumene”, it should be oriented towards the “great rivers of the area, for its beauty and natural characteristics”. The I PTA intended to direct investments “in areas that respond more quickly to demand and allow a rational redistribution of effects in other pre-selected areas”. The selection of “priority tourist centers and poles” was carried out through a hierarchy of the potential for tourist use of natural and cultural resources, urban and tourist infrastructure [45]. The areas defined as tourism hubs were: Manaus, Belém, Santarém and São Luís - arranged in a horizontal line and located on the banks of the Amazon River, with the exception of São Luís - Maranhão. And as tourist centers: the capitals of the states of Acre and Mato Grosso, and, at the time, the capitals of the federal territories of Rondônia, Roraima and Amapá, all located in the border region [45]; [46].

Aiming at the preservation of natural areas for the economic exploitation of tourism, the I PTA also proposes the delimitation of “Special Areas of Tourist Interest” in some states of the Legal Amazon, stimulated by the then recent Law No. provided for the creation of “Special Areas and Places of Tourist Interest” [45]. In 1992, the II PTA was published which, like the previous one, followed world trends. However, in this case, they advocated planning that was much more concerned with the



environment and society and pointed to the need to value and preserve the natural and cultural heritage of the Amazon region [47]. The II Plan for Tourism in the Amazon - PTA, prepared by the Superintendence for the Development of the Amazon (SUDAM), jointly with the Superintendence of the Manaus Free Zone - SUFRAMA and the Bank of the Amazon - BASA, was to be in force until 1995. Its objective was to constitute an instrument to coordinate the actions of the Federal Government, and of the private initiative, in the sense of overcoming the existing barriers for the realization of tourist activity in the Region. The II PTA aimed to deepen the priority lines of work and actions defined in the Tourism Program of the Amazon Development Plan [46]. According to Nóbrega [46] the document presents the following general guidelines: promote tourism development in an ecologically sustainable manner; revitalize the structural actions of public and private institutions that make up the regional tourist trade; minimize the use of natural and cultural resources in the production of inbound tourism; integrate regional tourist itineraries; reinvigorate the image of the Amazon as a destination for tourist currents. The II PTA presents four priority programs to consolidate the Amazon as a tourist product: a) Tourism Education Program; b) Study, Research and Planning Program; c) Marketing and Promotion Program; d) Tourism Infrastructure and Equipment Program.

The strategies that guided the II PTA were not only of an economic nature, unlike the objectives presented in the I PTA. SUDAM observes, in its position, the need to adapt to the global influence, relating tourism to environmental and social sustainability. It is in this circumstance “that tourism, especially ecotourism, is placed as an alternative for the development of the Amazon” [48]. Based on Normative Deliberation nº 303, of January 20, 1992, Embratur defined the priority poles for development and classified them as: consolidated, under development and potential in the sector. Under this orientation, in the II PTA, the following were defined: consolidated tourist centers such as Manaus and the Metropolitan Region of Belém; the poles that would be under development in the region, such as: Rio Branco and surroundings of Acre; Macapá and surroundings of Amapá; coast of Pará; West of Pará; South of Pará; Porto Velho and surroundings in Rondônia; Boa Vista and surroundings in Roraima; Cuiabá and surroundings of Mato Grosso; Araguaia Valley in Mato Grosso and Amazon Region in Mato Grosso. In addition to the potential poles, which would be in different regions of the Amazon [47].

### 2.2.2 PROECOTUR

The Program for the Development of Ecotourism in the Legal Amazon – Proecotur, was created with the objective of developing and proposing a policy and a program for the practice of Ecotourism [28]. It is a program co-financed by the Brazilian Government and the Inter-American Development Bank - BID and executed by the Ministry of the Environment - MMA, being managed by the bodies responsible for tourism at the State level. It is worth mentioning that its conception emerged from the ecological “wave” experienced in the 1990s, worldwide. In that decade, Brazil was the scene of great discussions regarding the ecological movement, heated by Rio – 92, enabling measures to be taken to minimize the impacts on the environment [46]; [49]. According to Cruz [12], this Program was mainly justified by the vastness of the forest, low density of the regional territory and lack of basic and tourist infrastructure, and also sought to offer tourist destinations in this region to an international tourist demand. Proecotur was launched in 2000, with the general objective of promoting the sustainable development of the Amazon region through ecotourism, establishing guidelines and means for the implementation of basic tourist infrastructure, in an area covered by nine states, which make up the Legal Amazon: Acre, Amapá, Amazonas, Maranhão, Mato Grosso, Pará, Rondônia, Roraima and Tocantins. The specific objectives of PROECOTUR are: to protect and develop the region's tourist attractions, through measures such as the creation of parks and reserves with specific management in ecotourism; create a stable environment for investments in ecotourism ventures, through the definition of policies and norms and the strengthening of state, regional and national environmental management and tourism development bodies; make ecotourism ventures operationally viable by conducting market studies, identifying, developing and adapting technologies for energy generation, effluent treatment, etc. to the Region, and making the results available to private investors; make ecotourism ventures financially viable through the expansion of specific credit lines for the segment; and improve/implement or expand the basic infrastructure necessary to make possible the increase in the tourist flow to the Legal Amazon. In order to achieve the aforementioned objectives, the MMA aimed to execute Proecotur in 6 years, divided into two phases, with Phase I called pre-investments (coordinated by the Ministry of Environment and Phase II of investments (coordinated by the Ministry of Tourism).

Proecotur has as a parameter the “Guidelines for a National Ecotourism Policy” and was subsidized by the “Ecotourism Strategies for the Legal Amazon” which aims to achieve the sustainable development of the Amazon

through the practice of ecotourism. It includes planning and investment actions in ecotourism centers, made up of a set of municipalities that concentrate many ecotourism attractions, selected in each of the states of the Legal Amazon [50]. The main goals of the Program: implement ecotourism centers in the Amazon; create around 30 thousand direct jobs and 100 thousand indirect jobs; implement around 10,000 new housing units – hotels / inns and lodges in the jungle; develop institutional and environmental activities; promote cooperation with private organizations; to promote changes in performance indices and improvement of professionalism and quality standards of existing and to be operated ecotourism products; conduct institutional strengthening actions for local environmental agencies; identify, generate and make available identified technologies; prioritize financing from Banco da Amazônia – BASA / FND (Green Tourism); stimulate the creation of the Investment Promotion Agency [46]. After its launch in 2000, the planning phase of the poles (Phase I), which should have been completed in 3 years, ended only in 2010, with the conclusion of the “Strategic Studies for the Development of Sustainable Tourism in the Legal Amazon” as a milestone. Brasileira” (study contracted by the MMA to Fundação Getúlio Vargas - FGV). According to the MMA, the main results of Proecotur in Phase I were: i) Mobilization and articulation of governmental and non-governmental actors through the Technical Group for the Coordination of Ecotourism for the Legal Amazon (GTC Amazônia), an advisory body of the Proecotur Coordination, which made possible the participation and integration of social actors in the Amazon, giving a participatory and decentralized character to the management of the Program. ii) Induction to the institutionalization of Tourism by supporting the structuring of state tourism agencies in the Legal Amazon, consolidating the insertion of the theme in the governance structures of the nine states in the region. iii) Local and regional ecotourism planning through the elaboration of Regional Strategies and Ecotourism Development Plans for the 15 poles of the Program. These documents define the guidelines for the implantation of the poles, based on the effective and potential tourist attractions and propose strategies for tourist commercialization. iv) Planning and implementation of projects to support ecotourism in Conservation Units, including infrastructure works, environmental zoning, plans for the creation and management of various categories of UCs (federal, state and municipal), studies and management plans of archaeological sites, management plans and tourist use strategies, speleological management plans, implementation of interpretive trails and tourist signs, among others. v) Implementation of small infrastructure

works with the objective of preserving natural attractions and improving tourist reception areas (mainly Tourist Service Centers - CAT and Tourist Fluvial Terminals - TFT). vi) Elaboration of 20 executive projects for several works to be implemented in Phase II. Among these, airport projects, road paving, tourist river terminals, environmental sanitation. Some infrastructure works, sanitation and paving of roads, landing strips and revitalization of borders and ports were also carried out. vii) Support for institutional strengthening through training actions involving more than four thousand people in awareness-raising workshops and training courses on the following topics: Quality in Service to Visitors, Planning and Management of Ecotourism Enterprises, Driving Visitors in Natural Environments, of Management Plans in Conservation Units and Strategic Planning Workshops for the Development of Ecotourism in Communities. Proecotur, as well as several federal and state programs had many difficulties to take off. Many gaps were left by most programs, Proecotur is no exception to the rule. The characteristics, the objectives, the essence, the obstacles are very important components for the understanding of several policies already implemented and in the management process. Perhaps the main obstacle encountered by public policy managers in governance bodies is the process of evaluating public policies [49].

### 2.2.3 FRONTUR

The Brazilian State defines the region of the Brazilian Border Strip geographically as it is 150 km wide along 15,719 km of the land border; this extension encompasses 11 units of the Federation and 588 municipalities, accounting for approximately 10 million inhabitants and bordering 10 countries in South America. According to the World Tourism Organization (WTO), “80% of international tourism is carried out between neighboring countries”. Therefore, when the Ministry of Tourism was created in 2003, a Department of International Relations was structured. Among the main areas of action of this department was to evaluate and disseminate best international practices in tourism, in addition to subsidizing the development of tourism policies, and identifying and carrying out actions that promote tourism at the borders [51]. In the reactivation of the Meetings Specialized in Tourism of Mercosul - RET, in 2003, a survey was carried out with the purpose of diagnosing what were the problems faced for the tourist integration of the continent and what were the main needs of the sector. Most of the issues cited were related to borders [52]. The integration of legislation, the standardization of immigration documents, buses and customs services were identified as the main demands of the tourist trade to improve the flow of tourists in Mercosur. In order to meet

these demands, the Border Concentration project was developed. This project gave rise to the International Seminar on Border Tourism (FRONTUR) as a tool for studies involving border regions. Frontur emerged in 2004 from a partnership between the Ministry of Tourism and the academic sector, aiming at debating proposals and solutions for the main obstacles to border flow in South America [51]; [53]. Frontur's main objective is to attract attention to tourism generated in a scenario of borders, bringing together all bodies and entities related to cross-border tourism to discuss and find solutions that facilitate the movement of the international flow of tourists. During the Frontur, the peculiarities and difficulties encountered by tourists at the border crossing are discussed together with the authorities responsible for borders, government tourism bodies, private initiative, universities and border communities to draw up plans with goals to find solutions to the problems identified [52]. The Seminar has already been held in several cities, such as: Santa Maria/ RS (2004); Foz do Iguacu/PR (2005); Boa Vista/RR (2006); Cuiabá/MT (2007); Campo Grande/MS (2008); Santa Maria/ RS (2009). In 2010, for the first time it was held outside Brazil, in Asunción/Paraguay (2010). Among the results obtained in these seminars are: aggregation of actors interested in the cause; formation of the Border Tourism Observatory – a network of researchers from South America and overseas, from Portugal and Spain; insertion of other national bodies for the debate, such as the Ministry of Justice, the Ministry of Foreign Affairs, the Ministry of National Integration, the National Land Transport Agency, among others; and foreigners, such as the National Secretariat of Tourism of Paraguay, the National Directorate of Migration of Paraguay, the National Institute of Tourism of Venezuela, etc. [52]. In 2011, the Ministry of Tourism (MTUR) through Ordinance No. 162 of August 26, 2011 creates the Frontier Tourism Program FRONTUR. With the following objectives: Art. 2º The objectives of FRONTUR are: I - to reduce regional disparities, increasing the offer of employment and income; II - strengthen South American tourism, especially with MERCOSUR countries, working on the implementation and improvements in integrated tourist itineraries; III - Assist in the preparation of border states for the mega-events of 2014 and 2016 IV - increase the flow of tourists from neighboring countries, improving information and attendance systems at the entrance gates; V - expand the cooperation of federal government agencies that work at the borders; VI - improve the collection mechanisms and statistical data processing systems at border gates. The Border Tourism Program – Frontur emerged with the proposal to boost the activities of the MTur in the border regions that encompass the states of

Acre, Amapá, Amazonas, Mato Grosso, Mato Grosso do Sul, Pará, Paraná, Rio Grande do Sul, Rondônia, Roraima and Santa Catarina. The activities carried out by Frontur will be developed in partnership with the tourism secretariats and agencies of the states, capitals and municipalities involved [54].

### III. FINAL CONSIDERATIONS

For the development of the tourism trade, it is necessary to have pre-established rules to be followed, rules that are present in public policies, prepared by the public sector in order to guide the actions of all actors in society, respecting the limits and characteristics corresponding to the locality. Public policies for tourism are based on the National Tourism Policy. The PNT is considered as a set of guidelines, goals and programs that guide the Ministry of Tourism's activities, in partnership with other sectors of public management in the three spheres of government and with representatives of civil society, the private sector and the third sector, related to the tourism. The Plan's vision of the future is to position Brazil as one of the three largest tourist economies in the world, by 2022, prioritizing aspects such as the arrival of foreign tourists and their stay longer in the country, given that the external public mostly leaves more foreign exchange in the territory. The National Tourism Municipalization Program (PNMT) was a program created by the federal government to stimulate national tourism development through the decentralization of public tourism policies and the strengthening of tourism planning in the municipalities. The program, whose structure involved the federal, state and municipal levels, focused on tourism management and planning at the local level. Municipalities were considered the main agents for conducting the tourism development process, based on the commitment to sustainability. Economic, social, cultural, political and environmental issues permeated all the objectives and actions of the PNMT, whose proposals and statements partially internalized the theme of social inclusion. The PNMT aimed at decentralizing planning activities to the municipalities, with a horizontalization of guidelines and actions for tourism policy in the country. Municipalities should build a municipal tourism policy aimed at their interests, based on the National Tourism Policy. The Aquarela Plan – International Tourism Marketing of Brazil, sets out the paths to be followed, the objectives to be achieved, and the essential actions for Brazilian tourism to advance with the great opportunities for promotion and global communication in the coming years.

The strategic objectives of the Aquarela Plan 2020 were designed to meet the following objectives for international

tourism in Brazil: improve and have long-term results in Brazil's international tourism promotion work; involve the public and private sectors of national tourism in a unified strategy from the country to the outside to better take advantage of the opportunities of the future; promote Brazil as a global tourist destination in a professional manner; take advantage of the great sporting events in the world to make Brazil better known around the world as a tourist destination. With the Plano Cores launched in 2005, Brazil's main objective was to promote tourism nationwide. In it, the analysis of the country's tourist products was considered, with a set of 111 tourist itineraries. In the elaboration of the Plano Cores do Brasil, it was identified that the lack of knowledge of the national market in relation to the Brazil product is almost as great as that of the international market. The Tourism Regionalization Program – Roteiros do Brasil, an important policy for structuring tourism in Brazil, presented a new perspective on the development of tourist activity through decentralized management. The Tourism Regionalization Program reached 219 tourist regions in 3,203 municipalities. The Tourism Regionalization Program grew under the integration of the social, economic, institutional, cultural and political sectors of the municipalities. The premise of the Program, considered strategic for the achievement of the National Tourism Policy, was centered on the purpose that its execution, in a decentralized and regionalized way, with a focus on coordinated and participatory planning, would have a positive impact on the socio-economic results of the territory.

The two main Public Tourism Policies aimed at the Amazon were the Amazon Tourism Plan (PTA) and Proecotur. These policies were elaborated in different historical moments, however, they adopted the same strategies to reach their objectives, apparently divergent, evidencing the contradictions regarding the planning and development of tourism in the Amazon.

The I Amazon Tourism Plan (PTA) is the result of an agreement signed between Sudam and Embratur. The objectives that were intended to be achieved through the I PTA were: to contribute to an orderly territorial occupation of the Amazon; participate in the economic and social development of the region, through the generation of income and employment, with the lowest economic and social costs and ecologically defend and enhance the region's natural resources and its historical-cultural heritage. The II Plan for Tourism in the Amazon - PTA, prepared by the Superintendence for the Development of the Amazon (SUDAM), jointly with the Superintendence of the Manaus Free Zone - SUFRAMA and the Bank of the Amazon - BASA, aimed to constitute an instrument to

coordinate the actions of the Federal Government, and of the private initiative, in the sense of overcoming the existing barriers for the accomplishment of the tourist activity in the Region. The document presents as general guidelines, to promote tourism development in an ecologically sustainable way, to revitalize the structural actions of public and private institutions that are part of the regional tourist trade, to minimize the use of natural and cultural resources in the production of receptive tourism, to integrate regional tourist itineraries and, reinvigorate the image of the Amazon as a destination for tourist currents. It also presents four priority programs to consolidate the Amazon as a tourist product: the Tourism Education Program; the Study, Research and Planning Program; the Marketing and Promotion Program; and, the Tourism Infrastructure and Equipment Program.

The Program for the Development of Ecotourism in the Legal Amazon – Proecotur, was created with the objective of developing and proposing a policy and program for the practice of Ecotourism. It is a program co-financed by the Brazilian Government and the Inter-American Development Bank - BID and executed by the Ministry of the Environment - MMA, being managed by the bodies responsible for tourism at the State level. The general objective of Proecotur was to promote the sustainable development of the Amazon Region through ecotourism, establishing guidelines and means for the implementation of basic tourist infrastructure, in an area covered by nine states, which make up the Legal Amazon: Acre, Amapá, Amazonas, Maranhão, Mato Grosso, Pará, Rondônia, Roraima and Tocantins. The Border Tourism Program – Frontur emerged with the proposal to boost the activities of the Ministry of Tourism in the border regions that encompass the states of Acre, Amapá, Amazonas, Mato Grosso, Mato Grosso do Sul, Pará, Paraná, Rio Grande do Sul, Rondônia, Roraima and Santa Catarina. The activities carried out by Frontur are developed in partnership with the tourism departments and agencies of the states, capitals and municipalities involved. Reduce regional disparities, increasing employment and income; strengthen South American tourism, especially with Mercosur countries, working on the implementation and improvements in integrated tourist itineraries; assist in preparing border states for mega-events; increase the flow of tourists from neighboring countries, improving information and attendance systems at the entrance gates; expand the cooperation of federal government agencies that work at the borders; to improve the collection mechanisms and statistical data processing systems at the border gates, are the objectives of Frontur.

When analyzing the issue of Trade in Tourism, it is clear to any viewer the disregard for the subject, with regard to

the exploitation of natural resources, in view of the enormous potential that Brazil has, especially in the Amazon region. Because according to what the National Tourism Plan itself points out, Brazil, considered the greatest power of natural resources on the planet, holder of a fifth of the Earth's species and 67 national parks open to visitors, at no time had a Tourism policy in protected areas. If used as a priority for government policy, tourism can be presented as a strategy for sustainable development, as it has the potential to collaborate with the protection and conservation of the environment. An expanding market such as tourism can be considered synonymous with the generation of opportunities, as it provides significant economic growth, and can even serve as the basis of the economy, with job creation, dissemination of culture, local valuation, income generation, among others. In this sense, public policies arise in order to manage this entire development process. However, it was found that, given the Brazilian scenario, the signaling of public policies is not always accompanied by structural changes in terms of performance improvement. Proof of this are programs that had their implementation frustrated in certain regions, as was the case of Proecotur. Thus, for its application to be successfully implemented, recognition and local empowerment are necessary, within a governance base that guarantees the functioning of the tourism system. For this, knowledge of public policies by stakeholders is an essential part. In this way, it can be inferred that despite the great potential available to the region, the tourism sector still faces numerous obstacles to its development in its entirety, among them we can highlight: low interest in the topic due to the economic fragility of the municipality; by social disorganization; the lack of adequate infrastructure for leisure practices; by the lack of public investments that encourage the development of the tourism market; by the lack of information from society's actors regarding public policies; by the lack of strategic vision of the public power; due to the lack of a master plan in the municipality that establishes rules and that these are clear with regard to the development of tourist activity in the region.

These are indications that reinforce the thesis of ignorance of public policies on the part of actors, directly and/or indirectly linked to the sector, which help to understand the challenge still to be overcome by the local social structure. As an example of the Amazon frontier region, Guajará-Mirim is open to multiple possibilities due to its incomparable stocks of biodiversity, as well as its socioeconomic history, such as the creation of the Madeira Mamoré Railroad, known worldwide, however it does not progress from the point of view of local valorization. It is noted that several policies were created, but not all of them

were able to achieve their goals. Therefore, the failures pointed out here sound like a warning signal to the local society. Overcoming them becomes the main objective. Knowledge about public policies is on the list of actions identified as strategic in search of a new milestone for the country's development, based on the consolidation of the tourism economic sector.

## REFERENCES

- [1] CAVALCANTE, F. R. C.; BATISTA, S. A.; GÓES, S. B.; FLORES, C. R.; FLORES, J. A. Processo de Desenvolvimento Regional e a Política Ambiental em Rondônia: O Turismo como vetor de desenvolvimento local de Guajará-Mirim. V Congresso Brasileiro de Gestão Ambiental Belo Horizonte/MG – 24 a 27/11/2014.
- [2] VIEIRA, A.R.M. Planejamento e políticas públicas de turismo: análise dos módulos operacionais do Programa de Regionalização do Turismo no Pólo São Luis – MA. Dissertação (mestrado) - Universidade de Brasília, Centro de Excelência em Turismo, Mestrado Profissional em Turismo, 2011.
- [3] CARVALHO, C. R. As políticas públicas de (re)ordenamento do turismo no Brasil e suas repercussões para a região nordeste: novas ações do governo estadual baiano. GeoAtos, Revista geografia em atos. Departamento de Geografia da FCT/UNESP, Presidente Prudente, n. 14, v.1, julho a dezembro de 2014, p. 48-63.
- [4] FINO, P.; MATHEUS, Z.M.. Políticas Públicas: O Turismo no Brasil Através da Análise do Novo Institucionalismo. VII Seminário da Associação Nacional Pesquisa e Pós-Graduação em Turismo 20 e 21 de setembro de 2010 – Universidade Anhembi Morumbi – UAM/ São Paulo/SP.
- [5] DIAS, R. Planejamento do turismo: política e desenvolvimento do turismo no Brasil. São Paulo: Atlas, 2003.
- [6] CRUZ, R. de C.A.. Planejamento governamental do turismo: convergências e contradições na produção do espaço. En publicação: América Latina: cidade, campo e turismo. Amalia Inés Geraiges de Lemos, Mónica Arroyo, María Laura Silveira. CLACSO, Consejo Latinoamericano de Ciencias Sociales, San Pablo. Diciembre 2006.
- [7] SANCHO, A.; IRVING, M. de A. Interpretando o Plano Nacional de Turismo 2003/2007 sob a ótica da inclusão social. Caderno Virtual de Turismo. vol. 10, n° 3, 2010.
- [8] MAIA, L. F. S. Políticas Públicas e Identidade Cultural: um binômio significativo na construção de uma intervenção no turismo local. In: BARBOSA, Andréia D. BRITO, Ronaldo C. et al (Org.) Turismo: cultura, lazer e possibilidades de intervenção. Natal/ RN: Gráfica do Banco do Nordeste, 2004.
- [9] HALL, C.M. Planejamento Turístico: políticas, processos e relacionamentos. Tradução de Edite Sciulli. São Paulo: Contexto, 2001.
- [10] BARRETTO, M.; BURGOS, R.; FREENKEL, D. Turismo, políticas públicas e relações internacionais. Campinas, SP: Papirus, 2003 (Coleção Turismo).
- [11] CRUZ, Rita de Cássia. Política de turismo e território. 2.ed.- São Paulo: Contexto, 2001.- (Coleção turismo).
- [12] CRUZ, R. de C. A. da. Hospitalidade turística e fenômeno urbano no Brasil: considerações finais. In: DIAS, C. (org.). Hospitalidade: Reflexões e Perspectivas. São Paulo: Manole, 2002, p. 39-56.
- [13] RUSCHMANN, D.V. de M. Turismo e planejamento

- sustentável: a proteção do meio ambiente. Campinas: Papirus, 1997.
- [14] SOLHA, K. T. Política de turismo: desenvolvimento e implementação. In: RUSCHMANN, D.; SOLHA, K. T. Planejamento turístico. Barueri, SP: Manole, 2006. p. 89-100.
- [15] GOELDNER, Charles; RITCHIE, J.R.Brent; MCINTOSH, Robert. W. Turismo: princípios, práticas e filosofia. 8.ed.PortoAlegre:Bookman,2002. GOMES, 2011.
- [16] CRUZ, R. de C.A. Política de Turismo e Território. São Paulo: Contexto, 2000.
- [17] BENI, M.C.. Análise Estrutural do Turismo. 8ª ed. São Paulo: SENAC, 2003.
- [18] BENI, M.C.. Análise Estrutural do Turismo. 7. ed. São Paulo: SENAC, 2002.
- [19] HALL, C. M. Planejamento do Turismo: política, processos e relacionamentos. 2. ed. São Paulo: Contexto, 2004.
- [20] BRASIL. Ministério do Turismo. **Programa de Regionalização do Turismo - Roteiros do Brasil: Ação Municipal para a Regionalização do Turismo**. Secretaria Nacional de Políticas de Turismo. Departamento de Estruturação, Articulação e Ordenamento Turístico. Coordenação Geral de Regionalização. – Brasília, 2007.
- [21] OLIVEIRA, M. M.. Como fazer pesquisa qualitativa. Petrópolis: Vozes, 2007.
- [22] FONSECA, J. J. S. Metodologia da pesquisa científica. Fortaleza: UEC, 2002. (Apostila).
- [23] KÖCHE, J. C. Fundamentos de metodologia científica: teoria da ciência e prática da pesquisa. 15. ed. Petrópolis, RJ: Vozes, 1997.
- [24] MARCONI, Marina de Andrade; LAKATOS, Eva Maria. Técnicas de Pesquisa: planejamento e execução de pesquisas, amostragens e técnicas de pesquisa, elaboração, análise e interpretação de dados. 6º Ed. São Paulo: Atlas, 2006.
- [25] PERRET, B. Levaluation des politiques publiques. Paris: La Documentation Française, 2007.
- [26] TEIXEIRA, E.C. O papel das políticas públicas no desenvolvimento local e na transformação da realidade. Salvador: AATR; 2002.
- [27] RUA, M. das G. Políticas Públicas. Florianópolis: Departamento de Ciências da Administração / UFSC, 2009. 130 p.
- [28] DIAS, R.; MATOS, F. Políticas Públicas: princípios, propósitos e processos. São Paulo: Atlas, 2012.
- [29] CASTRO, L.L.C. O Projeto Expedições para o Turismo e Ação em Santo Amaro do Maranhão – Contribuições para a Construção das Políticas Públicas Municipais de Turismo. São Luís, 2004. Trabalho de Conclusão de Curso (Graduação em Turismo), Universidade Federal do Maranhão.
- [30] SUBIRATS, Joan. Análisis de políticas públicas y eficacia de la Administración. Madrid: Ministerio para las Administraciones Públicas, 1994. SUDAM. I Plano de Turismo da Amazônia. v.1. Belém: SUDAM, 1978.
- [31] LOPES, B; AMARAL, J.N.; CALDAS, R. W. Políticas Públicas: conceitos e práticas. Belo Horizonte: Sebrae/MG, 2008. 48 p.
- [32] SOUZA, C. Políticas Públicas: uma revisão da literatura. Sociologias, Porto Alegre, ano 8, nº 16, jul/dez 2006, p. 20-45.
- [33] OLIVEIRA, E.J. de; LIMA, R. M. M. de. Por uma política pública de inclusão no turismo: análise dos planos nacionais de turismo 2003/2006 e 2007/2010. Anais...I Conferência Nacional de Políticas Públicas contra a Pobreza e a Desigualdade. Disponível em: . Acesso em: 5 mai. 2020.
- [34] BRUSADIN, Leandro Beneditini. Estudo da avaliação do Programa Nacional de Municipalização do Turismo – PNMT na gestão do presidente Fernando Henrique Cardoso. Revista Hospitalidade, São Paulo, ano 2, n. 2, p. 87-111, 2. sem. 2005.
- [35] NOIA, A.C; VIEIRA JÚNIOR, A.; KUSHANO, E.S. Avaliação do plano nacional de turismo: gestão do governo Lula, entre os anos de 2003 a 2007. CULTUR – Revista de Cultura e Turismo, ano 01, n. 01, out/2007 – Edição Especial.
- [36] BENI, M.C.. Política e Planejamento do Turismo no Brasil. São Paulo: Aleph, 2006.
- [37] TRENTIN, F.; FRATUCCI, A. C. Política Nacional de Turismo no Brasil: da Municipalização á Regionalização. Tourism & Management Studies, v. 1, p. 839- 48, 2011.
- [38] SOUZA, M. J. B. de; FERREIRA, E. Planos Nacionais de Turismo, Desenvolvimento Local e Sustentabilidade. In: Encontro Nacional da ANPAD, 35, 2011, Rio de Janeiro. Anais... Rio de Janeiro: ANPAD, 2011. 1 CDROM.
- [39] Ministério do Turismo. **Plano Nacional do Turismo: diretrizes, metas e programas 2003–2007. Brasília**.
- [40] BRASIL. **Relatório de desempenho e resultados do Proecotur– Fase I: contrato de empréstimo nº 1216/oc-br**. Brasília: MMA, 2009. (Relatório Técnico).
- [41] BRASIL.. EMBRATUR. MINISTÉRIO DO TURISMO. **Plano Aquarela: marketing turístico internacional do Brasil 2007-2010**. Brasília: EMBRATUR, 2007.
- [42] BRASIL. Ministério do Turismo. **Programa de Regionalização do Turismo - Roteiros do Brasil : Ação Municipal para a Regionalização do Turismo**. Secretaria Nacional de Políticas de Turismo. Departamento de Estruturação, Articulação e Ordenamento Turístico. Coordenação Geral de Regionalização. – Brasília, 2007.
- [43] GRIMM, I.J.; SAMPAIO, C.A.C.; GREUEL, M. C.; CERVEIRA FILHO, J.L. Políticas Públicas do Turismo e Sustentabilidade: a interrelação na Esfera Nacional, Estadual e Local. Revista Turismo Visão e Ação – Eletrônica, Vol. 15 - nº 1 - p. 95–111 / jan-abr 2013
- [44] ANJOS, F. A. dos; HENZ, A.P. Planejamento do Turismo no Brasil entre 2003 e 2007. Anais...IX Seminário da Associação Nacional Pesquisa e Pós-Graduação em Turismo, 30 de agosto e 01 setembro de 2012 – Universidade Anhembi Morumbi - São Paulo.
- [45] TODESCO, C. Estado e produção terceirizada de políticas públicas de turismo para a Amazônia Legal: uma análise fundada nas dimensões da vida política. 2013. 257 f.Tese (Doutorado em Geografia). Universidade de São Paulo. Faculdade de Filosofia, Letras e Ciências Humanas da Universidade de São Paulo, São Paulo, 2013.
- [46] NÓBREGA, W. R.M. Participação popular e as políticas públicas de turismo na Amazônia: o Proecotur no distrito de Mosqueiro, Belém – PA. Dissertação (Mestrado em Cultura & Turismo). Universidade Estadual de Santa Cruz–UESC; Universidade Federal da Bahia– UFBA, 2006. 157fl.
- [47] FARIAS, K. S. da S. Principais políticas de fomento do turismo na Amazônia: análise dos primeiros planos de turismo da Amazônia (PTA I e II) e do PROECOTUR. Revista de Turismo Contemporâneo – RTC, Natal, v. 2, n. 2, p. 183-205, jul./dez. 2014.
- [48] NASCIMENTO, V. L. Q. (2009). Políticas Públicas de ecoturismo e participação: a trajetória do PROECOTUR no Poló Belém/Costa Atlântica. Dissertação (Mestrado). Universidade Federal do Pará. Núcleo de Altos Estudos Amazônicos. Programa de Pósgraduação em Desenvolvimento Sustentável do Trópico Úmido.
- [49] NÓBREGA, W. R. M. Turismo e políticas públicas na Amazônia brasileira: instâncias de governança e desenvolvimento nos municípios de Santarém e Belterra,

- oeste do estado do Pará. 2012. Tese (Doutorado em Ciências do Desenvolvimento Socioambiental). Universidade Federal do Pará, Belém, PA, Brasil, 2012.
- [50] FONSECA, J.M.A.A; RODRIGUES, W. Avaliação da eficácia do PROECOTUR no Pólo Turístico do Jalapão (TO). Revista Brasileira de Ecoturismo, São Paulo, v.8, n.5, nov – 2015/jan - 2016, pp.652-666.
- [51] RIBAS, M.D.; SILVA, A.P. da. Turismo e relações internacionais: uma breve abordagem de teoria e história. Anais...IV Encontro Semintur Júnior. Universidade de Caxias do Sul. 2013. RIBEIRO, Roseli. Governo Cria o Programa Turismo de Fronteiras. Observatório Eco. Direito Ambiental, 2011. Disponível em: Acesso em: 11 mai. 2020.
- [52] BRASIL. Ministério da Integração Nacional. Grupo de Trabalho Interfederativo de Integração Fronteiriça. **Bases para uma proposta de desenvolvimento e integração da faixa de fronteira**. Brasília: Ministério da Integração Nacional, 2010.
- [53] LEOTI, A.; NOGUEIRA, C.R.D.; JASPER, J.R. SEGOVIA, R. da C. Turismo de Fronteira: o Caso das Cidades-Gêmeas do RS. Intellector. Ano X, v. XI, nº 21, Julho/Dezembro2014. Rio de Janeiro. LOBATO, F. Descentralização das Políticas Públicas de Turismo: estudo da municipalização no Estado do Maranhão. Dissertação (Mestrado). USP/ECA, 2001.
- [54] RIBEIRO, Roseli. **Governo Cria o Programa Turismo de Fronteiras**. Observatório Eco. Direito Ambiental, 2011.

## The inclusion and evolution of *isms* and *dades* in higher education Institutions

A. Pereira Júnior<sup>1,\*</sup>, A. O. Ferreira<sup>2</sup>, R. G. B. S. Gatinho<sup>3</sup>, A. N. Pontes<sup>4</sup>, N. E. S. Beltrão<sup>5</sup>, G. P. Morales<sup>6</sup>

<sup>1</sup>Department of Environmental Engineering, State of Para University, Brazil.

Email: [antonio.junior@uepa.br](mailto:antonio.junior@uepa.br)

<sup>2</sup>Department of Foreign Trade, State of Para University, Brazil

Email: [aline.ferreira@uepa.br](mailto:aline.ferreira@uepa.br)

<sup>3</sup>Department of Foreign Trade, State of Para University, Brazil

Email: [rosegbs@gmail.com](mailto:rosegbs@gmail.com)

<sup>4</sup>Center for Natural Sciences and Technology, State of Para University, Brazil.

Email: [altempontes@hotmail.com](mailto:altempontes@hotmail.com)

<sup>5</sup>Center for Natural Sciences and Technology, State of Para University, Brazil.

Email: [normaelybeltrao@gmail.com](mailto:normaelybeltrao@gmail.com)

<sup>6</sup>Department of Environmental Engineering, State University of Para

Email: [gundymorales@gmail.com](mailto:gundymorales@gmail.com)

\*Corresponding Author

Received: 11 Aug 2022,

Received in revised form: 04 Sep 2022,

Accepted: 10 Sep 2022,

Available online: 14 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Human behaviorism, Human devaluation, Invisibility, Racial and Sexual Superiority.*

**Abstract**— *The objective of this research was to analyze the evolutionary form, at an international and national level, of ageism, feminism, racism, sexism, diversity, equity, sexuality, and transsexuality on the campuses of higher education institutions. The data obtained and analyzed indicated that, in the international context, ageism is constantly adapting and studying (n = 7.0; 30.0% when compared to the national context (n = 5.0; 20.0%); As for studies on racism, there is an inversion in terms of quantity: international (n = 6.0; 30.0%), national (n = 11.0; 44.0%). Equity has been studied more in the international context (n = 7.0; 63.5%). Studies on sexuality are less effective at the international level (n = 1.0; 9.2%) when compared to the national level (n = 4.0; 80.0%). Therefore, mitigating the discriminatory processes, already included in the daily life of universities, for these two suffixes, involves changing human behavior, the acceptability of differences between living beings, and the elaboration of institutional policies that are not guided by federal legislation. or state, but the search for a more effective, lasting, and evolutionary inclusive objective. 0% when compared to the national context (n = 5.0; 20.0%); As for studies on racism, there is an inversion in terms of quantity: international (n = 6.0; 30.0%), national (n = 11.0; 44.0%). Equity has been studied more in the international context (n = 7.0; 63.5%). Studies on sexuality are less effective at the international level (n = 1.0; 9.2%) when compared to the national level (n = 4.0; 80.0%).*



## I. INTRODUCTION

The “Lord time” gives rise to new human behaviors (Ex.: ageism; diversity) that are often bizarre and Antique against individuals and, in most cases, generate phobias. Currently, this behavior is labeled in three pillars: diversity, equity<sup>1</sup> and inclusion (DEI). The use of these pillars aims to mitigate the emotional, work, knowledge, friendship, fraternity, welcoming impacts that these behaviors cause to their target audience. The acronym DEI is used in current policies that integrate communities in terms of age, race, creed, ethnicity, ability, disability, gender, religion, culture, and sexual orientation [1]. To better understand these pillars, two aspects should be noted: 1. discrimination, which has been discussed since 1870 and reached its peak in 1915 [2]. So much so that, in the 20th century, it originated the 2. Eugenics movement<sup>2</sup> and, currently, this action reaches 18 different groups, among them: sex, gender identity; breed; age; ethnicity and socioeconomic status. In the background, it is necessary to understand the inclusion process.

In this case, attention should be paid to the social character<sup>3</sup> and the right to higher education. But both are associated with accessibility to movable spaces, security, transport, academic materials, already determined by Law No. 13,146 [3]. There is also inclusion in higher education, whose inclusive foundation begins with basic education, and culminates in that. Because until then, students or students, teachers, and administrative staff, should already be aware of the differences that this included has [4].

For prejudice regarding the age group, the terms applied are ageism<sup>4</sup> or etarism. The latter term was created in 1969 by the American physicist, gerontologist, and psychiatrist Robert Neil Butler (1927-2010), who describes it as a type of subjective and implicit experience, such as a gap between generations, where young people express prejudice towards the elderly. and, therefore, he called it age idealism. All this takes away from the individual the real satisfaction of aging, since, in the popular saying, it leads to diseases and deficiencies and to uselessness and death [5]. In the university context, “elderly people” have the same academic demands on themselves that are imposed on “younger people” with the same degree of quantitative and qualitative assessment. However, the first one still has “extra loads of work,”

especially female ones, such as taking care of the home [6].

Regarding feminism<sup>5</sup>, the historical context places it as a modern movement, whose genesis occurred from the Enlightenment ideas disseminated by the French Revolution (1789-1799), as well as the American Revolution (1775-1781). The focus was on obtaining social, political, educational, maternal, and labor rights [7]. All this to try to eradicate the processes of oppression to which they were subjected, as well as the discrimination imposed on them, especially their accession to university courses and, when they arrived there, they hardly held research coordination positions [8].

As for racism, it is one of the forms of applied discrimination whose basis is the race to which the individual belongs. As a result, racial prejudice is added to it, when the social group to which it belongs is brought to light and, finally, racial discrimination, which involves unconventional and unsocial treatments to the components of the fully identified social group, that is identified, there is an expression of “power” of an individual over another [11].

This term was inserted in the university context since the period (1930 to 1945) in which Getúlio Dorneles Vargas (1882-1954) allowed the establishment of higher education institutions, without social inclusion for those who went there in search of knowledge. , and this continued, in Brazilian territory, until the establishment of quotas for people declared to be black and/or brown [12].

Another “ism” identified in the daily life of the university context is sexism, whose origin is North American: sexism [13], that is, a type of discrimination based on the individual's sex, the most interesting thing is that it was created as a counterpoint to the term racism in 1960.

Nine years later (1969), the first term was used during the “Freedom for Girls – Now” march in the United States [14]. In the university context, despite attending the same academic space, and often the chairs, the female sex still keeps the “fragility”, and that is supposed to be evidence of a superiority of the other sex, in this case, the male over the female [15].

In the context of diversity in higher education, this concept must be human, social, religiosity, gender, ethno-racial, gender, sexual, age, among others. This statement is a proven fact because the entire historical context of the formation and development of humanity is linked to the diversity of events, the diversity of cultures that, in the

<sup>1</sup>Derived from Latin, where: *aequus* – equal, fair, even; *aequitas* = equality, symmetric/semitaria.

<sup>2</sup>It has its origins in the United States and during World War II, Hitler used it to create a “better” generation than the one existing at the time. [9]

<sup>3</sup>It must ensure that people at risk of poverty and cultural socio-economic exclusion participate in these activities [10].

<sup>4</sup>Nowadays, actions and what is thought daily are discriminatory and generate stereotypes for groups of people aged 50 or over.

<sup>5</sup>Term created by French sociologist Charles Fourier (1771-1837), in 1837.

construction of today's society, was raised on a time scale constituted by Geological Eras. However, the construction of a critical view developed against pre-existing communities because they had individuals "different" from the current context [16]. This multidimensional analysis must be based on the relationship between different beings, which must be taught, as a discipline, or coupled to one of them, such as Environmental Education, because in the environment there are different individuals cohabiting in it, and not only in disciplines such as biology, geography, among others [17].

Regarding equity, it is observed that it involves a sense of justice, a value for impartial conduct that allows a guarantee of rights regarding access to education and quality employment with adequate remuneration and housing [18]. As for inclusion, whether in society or in higher education, in Brazil, it is regulated by four legal documents: 1. Circular Article No. 277 [19]; 2. Decree No. 3,298 [20]; 3. Ordinance No. 3,284 [21], and 4. Law No. 13,146 [22]. However, it is clearly noted in these legal documents, an "individual identity": students with specific educational needs, that is, disability or ableism [23]. The alignment of this content is horizontal when three of the 17 goals contained in the Sustainable Development Goals (SDGs) are observed: number four (quality education), eight (decent work and economic growth) and 10 (reduction of inequalities), in addition to support from the human rights agenda [24].

In the context of integrative policies, nowadays, it is necessary to observe the sub-goals of goal four of the SDG:4.3 (Ensure access for people at all levels, including university), and 4.4 (By 2030, the elimination of gender phobia in education), are also outstanding in their content [25]. In relation to the expression "throughout life", it is observed that in undergraduate and graduate courses there are increased "elderly" people with full mental and intellectual capacity in search of knowledge, and a defined objective: to become more useful to the society of which they are a part. However, this is not yet the object of studies and literary research, especially in Brazilian universities [26].

The term sexuality, in the European Union, is composed of emotional, social, and physical aspects, both in childhood and adolescence. To better enhance this, sex education programs are designed and implemented in schools for these two age groups. The approach (involves the cognitive and emotional aspects) includes gender equality, human rights, their well-being, and security. For the youngest, the approach includes sexually transmitted diseases and juvenile pregnancy [27]. In Brazil, there are already undergraduate courses that have included the discussion of sexuality as a mandatory or optional subject,

in view of the obligation expressed in Resolution No. 02, Article 3, § 2 [28], which establishes the National Curriculum Guidelines [29]. The approach includes gender, diversity, and difference: intersex. However, they are not yet included in curricular menus, but discussions have already started for the definitive insertion of sexuality [30].

As for transsexuality, which involves transvestites, transsexuals, and transgender people, in Brazil, the HEI's Campi does not include them in a sociable way because the bodies "show deregulation regarding gender (male/female)" especially in the northeast region [31]. In the European context, article 21 guarantees the right to non-discrimination, including those motivated by sex [32]. In southeastern Italy, there are already groups for the defense of trans people (Univesitrans) in universities, and this is a favorable factor for the inclusion of this group in the Italian university context [33].

All these arguments involving discrimination against people in the university context became the problem to be researched and justified such action. The relevance of this research is based on racial, sexual and age discrimination and prejudice that are practiced by university society, and this has damage to the mental and physical health of these individuals. In addition, it is important to know the legislation that underlies the process of "inclusion" with a disability (ableism) and the socialization that other university students present to them.

Therefore, the primary objective was to conduct an analysis of the academic literary context, regarding the occurrences and actions that higher education institutions (HEIs) present to mitigate discrimination and prejudice against groups of individuals who seek improvements in their knowledge and quality of life. In order to better organize this research, it was elaborated from the international context, North America, Europe, Central America, entering South America, arriving in Brazil, to analyze, in the five Brazilian regions, these problems and the solutions previously used by HEIs.

## II. MATERIAL AND METHODS

The applied method has a mixed, cross-sectional approach and an analytical nature, organized in two stages: 1. Quantitative, with collection of past data from the selection of academic literature involved with the topic. 2. Qualitative, as an integrative literature review was used, with the search for data that indicated the current conditions of studies and actions used to mitigate isms and data in HEI's from the Word Wide Web (WWW). The

basis for choices one and two was the synthesis described [34].

These researchers stated that the use of a scale was allowed with or without a unit, in relation to the qualitative, thus exposing that the person responsible for the research must use past tense data, however, he must be careful with the product he seeks, that is, the literatures already published. The literature selection process was based on the search for selective descriptors in English, Portuguese, and Spanish, in three sections: title, abstract/summary, and key words (Table 1).

Table 1. Seven selective descriptors used for the selection of literatures

|       |   | English            | Portuguese                      | Spanish                                     |
|-------|---|--------------------|---------------------------------|---------------------------------------------|
| isms  | 1 | Ageism or etarism. | Ageismo ou etarismo ou idadismo | Ageismo, idadismo, discriminación por edad. |
|       | 2 | Feminism.          | Feminismo.                      |                                             |
|       | 3 | Racism             | Racismo.                        | Racismo.                                    |
|       | 4 | Sexism             | Sexismo.                        | Sexismo.                                    |
| dades | 5 | Diversity.         | Diversidade.                    | Diversidad.                                 |
|       | 6 | Equity             | Equidade.                       | Equidad.                                    |
|       | 7 | Sexuality.         | Sexualidade.                    | Sexualidad.                                 |
|       | 8 | Transexuality      | Transexualidade                 | Transexualidad                              |

Elaboration: authors (2022).

The selected literatures were scientific articles, course conclusion works, dissertations and theses. These choices are justified in view of the selection having occurred from the verification of approval by specialists in the areas of the subjects contained therein. In order to improve this selection, regarding the form of consultation (query) and to reduce the time spent searching for information (overhead) on these topics, the recommendations made by [35].

Therefore, Boolean strings were used: and, or, more, and not (Ex.: ageism and racism; sexism or Sexuality; Sexuality and Transexuality more racism; racism in the University not city; age and discrimination). The Higher Education Institutions involved in this research were, preferably, those of a federal nature, due to a greater number of students, professors, and administrative staff, since the occurrence of the discriminatory process regarding the researched isms and data may occur in one of these groups in all of them. they.

### III. RESULTS

#### 3.1 Isms and dades

The data obtained and analyzed indicated that studies on isms and ties, at international and national levels, did not show similarities. This was noticeable when analyzing data on ageism at an international level, and it was found that it was more studied and discussed in the academic environment. Feminism, racism, and sexism were studied with the same intensity. In the national context, specifically in the Brazilian territory, racism, followed by studies on sexuality and diversity (Table 2).

Table 2. Quantitative of terms analyzed, at international and national levels.

| -----International----- |             |               |             |             |                      |
|-------------------------|-------------|---------------|-------------|-------------|----------------------|
|                         | <i>fi</i>   | <i>fr (%)</i> | <b>Min.</b> | <b>Max.</b> | $\bar{x} \pm \sigma$ |
| 1                       | 7.0         | 30.0          | 1.0         | 2.0         | 1.2±0.4              |
| 2                       | 3.0         | 15.0          | 1.0         | 1.0         | 1.0±0.0              |
| 3                       | 6.0         | 30.0          | 1.0         | 1.0         | 1.0±0,0              |
| 4                       | 5.0         | 25.0          | 1.0         | 1.0         | 1.0±0.0              |
| <b>S.T.</b>             | <b>21.0</b> | <b>100</b>    | <b>4.0</b>  | <b>5.0</b>  | --                   |
| 5                       | 3.0         | 27.3          | 0.0         | 1.0         | 0.4±0.5              |
| 6                       | 7.0         | 63.5          | 1.0         | 1.0         | 1.0±0.0              |
| 7                       | 1.0         | 9.2           | 0           | 1           | 0.1±0.4              |
| 8                       | -           | --            | --          | --          | --                   |
| <b>S.T.</b>             | <b>11.0</b> | <b>100</b>    | <b>1.0</b>  | <b>3.0</b>  | --                   |
| <b>T.</b>               | <b>36.0</b> | <b>100</b>    | <b>5.0</b>  | <b>8.0</b>  | --                   |
| -----National-----      |             |               |             |             |                      |
|                         | <i>fi</i>   | <i>fr (%)</i> | <b>Min.</b> | <b>Max.</b> | $\bar{x} \pm \sigma$ |
| 1                       | 5.0         | 20.0          | 0.0         | 1.0         | 0.4±0.5              |
| 2                       | 4.0         | 16.0          | 0.0         | 1.0         | 0.4±0.5              |
| 3                       | 11.0        | 44.0          | 1.0         | 1.0         | 1.0±0.0              |
| 4                       | 5.0         | 20.0          | 0.0         | 1.0         | 0.4±0.5              |
| <b>S.T.</b>             | <b>25.0</b> | <b>100</b>    | <b>1.0</b>  | <b>4.0</b>  | --                   |
| 5                       | 1.0         | 20.0          | 0.0         | 1.0         | 0.2±0.5              |
| 6                       | --          | --            | --          | --          | --                   |
| 7                       | 4.0         | 80.0          | 1.0         | 1.0         | 1.0±0.0              |
| 8                       | --          | --            | --          | --          | --                   |
| <b>S.T.</b>             | <b>5.0</b>  | <b>100</b>    | <b>1.0</b>  | <b>1.0</b>  | --                   |
| <b>T.</b>               | <b>30.0</b> | <b>100</b>    | <b>2.0</b>  | <b>2.0</b>  | --                   |

Subtitles: *fi* = absolute frequency; *fr (%)* relative frequency; *min.* Minimum value; *Max.* Maximum value;

$\bar{x} \pm \sigma$  values for mean and standard deviation. S.T. Subtotal; T. Total; 1. Ageism; 2. Feminism; 3. Racism; 4 Sexism; 5. Diversity; Equity; Sexuality; Transsexuality. Elaborated from data obtained by the Authors (2022).

In Table 1, the two analyzed contexts, international and national, studies [28; 29] on transsexuality are non-existent as a subject of isolated research, but associated with gender, which was not the object of this research.

4.2 Institutional tools

Among the HEIs, four types of discrimination are already being monitored with seven institutional tools, whose elaborations are conducted by research centers or groups and some by the establishment of Resolutions (Table 3).

Table 3. Values for absolute and relative (%), as the institutional tools applied frequency for monitoring by the HEIs for occurrences of Earthquakes and Dades.

| Applications | A   | B   | C     | D     | E    | F     |
|--------------|-----|-----|-------|-------|------|-------|
| 1            | --  | --  | 1,0   | 1,0   | 4,0  | --    |
|              | --  | --  | 16,7% | 16,7% | 66,7 | --    |
| 2            | 1,0 | 1,0 | 1,0   | --    | --   | 1,0   |
|              | 25% | 25% | 25%   | --    | --   | 25%   |
| 3            | --  | --  | 40    | --    | --   | 3,0   |
|              | --  | --  | 90.9% | --    | --   | 6.8%  |
| LGBTQIA+     | --  | --  | 2,0   | --    | --   | 3,0   |
|              | --  | --  | 28.5% | --    | --   | 42.8% |

Subtitles: A. Committees; B. Research Groups; C. Study center; D. IDP - Institutional Development Plan; E. Programs and Policies; F. extension projects. Elaborated from data collected by the authors (2022).

In table 2, sexism, sexuality and transsexuality were added to the LGBTQIA+ data, because in the analyzed literature and in the actions taken by the HEIs, the instructional content for monitoring these actions was inserted in specific sections of guides or books. Regarding the guides, two of them were identified: 1. Safe home educational guide. Risks and health care of the domiciled elderly [36]; 2. Guiding guide for the creation of

state/municipal councils for the rights of the lesbian, gay, bisexual, transvestite and transsexual – LGBT population [37]. For the books, the following were published: 1. Human rights of women and LGBTQI people [38].

IV. DISCUSSIONS

4.1 The international context

4.1.1. Ageism or Etarism

In the American continent, in North America, more precisely in the region of the subcontinent, is the United States of America (USA). The problem of ageism only began to be analyzed after intense focus on sexism and racism. However, in the last ten years, scholars on discrimination have increased interest in understanding the aging of individuals and the treatment of them by North American society, especially in the workplace [39]. On sexism and racism, mitigation of these impacts is already active at William Paterson University<sup>6</sup>because it offers a specific course for these topics (<https://www.wpunj.edu/racegender/course-outlines>). In the Asian subcontinent, India is located, where discrimination against the elderly, or ageism, presents a high degree of discrimination against this age group, in the social context because they have become real burdens that have no contribution to offer to society [40]. However, one of the state universities in India developed and implemented a course entitled “elderly care,” from 2018 to 2019, as a way of combating and verifying the best mechanism so that the elderly is not so rejected in this society [41].

In the South American continent, in Central America, the Republic of Cuba is located, where the average longevity reaches 78 years, regardless of sex. Due to lack of socialization with the younger ones, the so-called “third age (tercera edad)”, gathers in circles called “grandparents circles (circle of abuelos) and in them, they carry out university studies from the so-called Chair of the Elders (Cathedra del Adult Mayor - CUAM), whose objective is to establish a link between: old age and the environment, life, as knowledge and with employment. Therefore, it is about continuing education [42]. One of the solutions for age discrimination was the foundation of the University of the Elderly (La Universidad de Personas Mayores) as a path to the well-being of older people, since in that country, the Cathedra del Adult Mayor has existed for almost 19 years. , which does not eliminate isolation and non-existence with other age groups below 60 years old [43].

<sup>6</sup>Racism/Sexism in the US AACSB, 150 and WS 150. See at: Racism

#### 4.1.2 Feminism

In Western Europe, France is located, where the right to education, whether for people, evolved from the history of the struggles of feminists such as Christine de Pizan, who used the pen as a tool to generate support for family members. It also runs through Marie de Gournay Le Jars (1565-1645)<sup>7</sup> and Poulain de La Barre (1647-1725)<sup>8</sup>, whose struggle turned the concept of equal rights into a principle. Finally, the Marquis de Condorcet (1743-1794) and Olympe de Gouges (1748-1793) went further and universalized the concept of equal rights [44]. In the so-called Netherlands such as the Netherlands, transnational meetings take place with the aim of reflecting on the role of feminists, as well as promoting an analysis of the existing archives on this topic, where histories of loss of kinship and intimacy were identified. [45].

In the eastern portion of the Eurasian continent, in eastern Europe, Russia is located, where feminism showed that the offers from society, for women, were linked to two conditions: submission and stay-at-home spouses. The core of everything was the Enlightenment, because from the nihilistic works (Ex.: Chernyshevski), they (women) took on the belief that with a higher education degree, they would achieve social and economic independence. Since then, Russian higher education has had a female presence in its history [48].

At the University of St. Petersburg, there was a discussion about institutionalization for the study of gender, which involved both feminists and non-feminists. This has been going on since the late 1980s, with analysis of social movements, with Elena Zdravomyslova<sup>9</sup>. Since then, academic exchanges allowed an expansion of the feminist movement at this university, when the discussion gained an international context regarding gender and the daily life of sexism and feminism [49].

In Germany, the HEIs under female command are exceedingly small when compared to the opposite sex, so much so that, in 2020, this represented 22.9% in the public ones, while in the private ones, it is even lower: 20.8% [50].

In East Asia, female oppression is so strong that if women are part of feminist movements such as the movement called "Dalit<sup>10</sup>" in Tokyo, Japan, they are discriminated against. The participants of this movement

are considered inferior beings to certain sectors of society, then judged as "superior," and who, for them, offer a life without any dignity and subservience. All these acts were the subject of a complaint at the Asian Court of the Women's Human Rights Council, especially when associated with war crimes and trafficking in women. However, there has still not been a reduction in Dalit female discrimination [51].

At the Tokyo School of Engineering, from the approach entitled "from women, by women and for women" to mitigate this type of prejudice, as well as eliminate social losses and opportunities women are entitled to. In this HEI, the number of female professors is greater than the number of male professors, which determines an evolution in terms of female participation and capacity in any area of academic performance, including in leadership positions in engineering courses [52].

In India, the digital platform called Feminism in India (FII) coordinates the elaboration of the list for the "social justice collectives (SSJCs)" that, on the campuses, are concerned with the well-being based on the rights of women, irrespective of their origins, as they implement complaint committees against sexual harassment in the internal areas of universities [53]. To lessen female discrimination, Indian feminists Annie Besant, Isabella Thoburn, and Dorothy de La Ei have implemented all-female campuses, as females suffer discrimination and harassment from students and teachers at all levels of education. Therefore, the establishment of these Campi was a response to the right to an education without discrimination that emerged in the 19th century [54].

#### 4.1.3 Racism and sexism

In North American universities, there is an internationalized practice of social and cultural racism, reported by African students, and these actions contribute to a non-intercultural enrichment, since these students do not receive the respect and dignity they deserve within the Campus. This elevates exclusion to discrimination and iniquity of the individual subjected to racism [55]. In French universities, the so-called white supremacy is already under discussion, which still persists linked to the post-colonial time and which discredits those who fight so that the view on racism is no longer factual and dividing between individuals, but to bring France to the level of an egalitarian society [56]. In relation to this discussion, in Indian universities, there is a report from Indiana University Bloomington, where the discussion of topics such as racism generates difficulties in classroom management, as teaching on topics such as "race" has already begun to arise spontaneously and, at that moment,

<sup>7</sup>Author of the article entitled *Égalité des hommes et des femmes*, in the 17th century [46]

<sup>8</sup>Author of the thesis *de l'égalité des deux sexes*, in 1673 [47] (Mattos, 2019).

<sup>9</sup>Professor at the Department of Social Sciences at the University of Saint Petersburg – Russia.

<sup>10</sup>In India, they are oppressed by castes and by men considered Dalit. They suffer more violence than other female groups and, in general, in India, abuses suffered by these women are not investigated.

the management of the class becomes a challenge because the teacher must deal with facts and reports that can be used as “techniques/measures” not yet structured by him, which shows an evolutionary process. about the discussion on this topic and microaggressions [57].

As for sexism, in the United States, it is already in practice, albeit slowly, the rise of disadvantaged gender groups with ascension to higher education. This is the result of a collective effort made by HEIs in that country to compensate for discrimination especially linked to sexism, that is, directed against women, that is, sexism is no longer as bad as it used to be [58]. In higher education institutions in the European Union, between 2016 and 2019, the growth in the presence of women in leadership positions on Campi was weak ( $n = 2.0\%$ ). So, male dominance is still elevated, and the binary system weakened. Therefore, the solution is to combat the cultural process against the female gender and the subordination framework that is prevalent in HEIs until today [59].

#### 4.1.4 Diversity and equity

The best perspective on this concept was shown in 2020, when the UK Publishing Association report on “Workforce Diversity” was published. It states that, in the United Kingdom: Women occupy the majority ( $\pm 55\%$ ) of management and executive positions; of this total, there are black women (3%), Asians (6%), mixed ethnicities (3%) and other ethnic groups (1%). In addition to LGBT<sup>11</sup>(11%), trans (0.6%), disabled (8%) and people with health problems (46%). This diversity was also evident in that same year, when a publication at an International Congress of Medicine about an Ebola outbreak during a conflict in Congo was analyzed, but, without the inference of any black Congolese researcher, what was labeled a “narrative investigation from helicopters or parachutes [60]. Another measurable aspect regarding the application of diversity may be due to publications on this topic. In 2019, USA and Canada were the most prolific ( $n = 176. 1.2\%$ ), Ukraine and Ireland ( $n = 31; 0.60\%$ ), Oceania ( $n = 198; 0.67\%$ ); Europe ( $n = 164; 0.14\%$ ). As can be seen, the effective application of diversity in higher education still has a low frequency [61].

For the context of equity, the disparity regarding this action was reviewed between 2018 and 2019, when the Global Voice for Workplace Equity and Research by Diversity in Publishing revealed that the authors are, in most cases, of white ethnicity (81 %), heterosexual (79%), and non-disabled (88%). As can be seen, there is no data on the presence of blacks in this context. Another case of equity is associated with job maintenance. In this case, the

male gender, when they reach the “third age” are more likely to continue occupying positions, especially those of managers, when compared to females [60]. In Australian higher education, equity has become a challenge in terms of triennial funding, whether for females or blacks, as there are no formalized public policies regarding equity at this level of education, which widens the gap in terms of access and permanence of equal rights for all [62].

#### 5.1.5 Sexuality and transsexuality

The first term, in the European Union, was part of a document by 24 member countries of the European Union, which produced a single document entitled Policies for Sexuality Education in the European Union: Citizens Rights and constitutional affairs. There, sex education has the purpose of providing information that young people must provide so that they can make firm determinations about sexuality and how to enjoy it without future constraints (Ex.: emotional), as well as the negative points if the use is inappropriate [63]. On the Asian continent, transsexuality is being accepted and included in universities for women, such as Ochanomu University. Two others, Tsuda University and Japan Women's University, in Tokyo, have already started to modify the qualification for access to them, and adapt the reception of transsexuals [64].

## 4. 2. LATIN AMERICA

### 4.2.1 Ageism or Etarism

In the Chilean university context, it has challenges within medical courses, where students do not choose the “geriatrics” specialty, because they have a negative legacy about old age, that is, the formation of antipathy is not generated in the university course, but in the family, but the student himself has no idea that aging will come to him [65]. In Venezuela, spaces for the elderly, or still Adults Mayores, tend to allocate them to universities located close to asylums, or even university dormitories for them. Another “solution” found in this country was the creation of “virtual campuses,” as a “social inclusion” for these elderly people [66]. In this context, the University on the Internet (UNIR) has a distance learning program in the areas of Social Sciences, Humanities, Architecture and Engineering.

### 4.2.2 Feminism

Feminism in Colombia is still a reason for clashes in academia, such as at Universidad Externato. It is treated as a synonym of patriarchy, a case of machismo, a homophobia [67]. Sexual harassment (sexual harassment) is one of the struggles associated with feminism in Colombian universities, especially at the Universidad Nacional de Colombia, although the discourse on gender

<sup>11</sup>Lesbians, gays, transvestites and trans

within the campuses of these HEIs is still a new, however, prevalent subject [68]. At the Universidad Central de Ecuador, feminist and gender theory gave rise to key ideas that allowed the formation of the so-called “social collectives,” where these themes, in addition to sex, are discussed. However, this university does not support or monitor cases of vulnerability and violation of the rights of university women. Therefore, there is a non-functionality regarding the equality of rights of all university students who study there [69]. All these facts still occur in higher education in Ecuador, although the Constitution of that country contains a declaration regarding the need for interculturality, whose legal support comes from the Organic Law on Higher Education [70].

#### 4.2.3 Racism and sexism

In Bolivia, racism is considered a crime since Law n. 045 [71] prohibits discrimination of this kind, but this has not stopped racist violence. In Chile, the Universidad de Chile, following the approval by the University Senate of Decree No. and tell stories of their ancestors [72]. But, in this country, there are reports about the social silence, denial and disbelief that racism committed against indigenous people who do not reach higher education, the jobs they occupy are the lowest possible, which configures a supremacy of social classes. tallest [73]. In Colombia, black students offer stories of racism as they are experienced in the daily life of the academic context. The manifestation of this racial discrimination is manifested with the use of euphemism whose objective is to generate a connotation of inferiority and subordination of blacks, all of this in a very pejorative way. So, there is a contradiction in the role of HEIs in the context of social inclusion and an increase in racial discrimination [74].

In Ecuador, although there have been advances in terms of accessibility for indigenous and Afro-descendants and other ethnic groups since the publication of legal documents such as the Declaration of Interculturality contained in the core of the Ecuadorian Constitution, the HEIs in that country still do not meet this type of inclusion, and this leaves the quality of life and professional life of these peoples on the path of ignorance, poverty and domination by another living being, then judged “superior” [75]. In Paraguay, in order to promote a truly inclusive education, in 2018 that country prepared guidelines contained in the “Lineamientos para una sistema educativo em el Paraguay” [76]. In this country, racism is already a landmark in its own statutes, since, of the eight higher education institutions in that country, Paraguayan nationality is required for access to their teaching staff, that is, xenophobia [77].

In relation to Peru, racism is evident in HEIs, as seen in Arequipa, Huancaya, Lime and Trujillo. What drew attention was that discrimination was more active in private universities (n = +10%) when compared to public ones. Not only between students, but also between teacher-students, especially in the indigenous context [78]. In Uruguay, however, reports about racism are similar, especially about indigenous, and African peoples who have become “invisible” to academic eyes, and the manifestations of behaviorism do not involve physical force, but a contempt and daily intolerance in the academic context [79].

Racism is also present in Venezuela, especially against indigenous peoples, which comes from elementary school, that is, anti-race behavior is already supported at this level of education, in addition to what is practiced in the three levels of education in that country against afro descendants [80].

As for sexism, the female sex has one of the cruelest forms of prejudice and discrimination and, in general, this ends up reaping countless victims. The legislative document for the protection of women, called Comisión Interamericana de Mujeres, exists since 1928, which was only signed at the Convención de Belem do Pará, in 1994. In Argentina, the entry of a woman into higher education took place in 1885. However, the time was not a factor in the quantitative inclusion of women in HEIs in that country. But her role in domestic and family work was not changed [81].

In Bolivia, cases of sexual harassment at the Universidad Católica Boliviana are conducted by groups of former students (Los Amantes) and teachers, including a priest who, when denounced about the practice of sexual harassment with a student, was transferred to another Campus to continue teaching. He used films about Christianity (Cristianismo a través del cine) which is a mandatory subject at this HEI and, from then on, he practiced acts of this nature [82].

In Chile, sexism has been a reason for violence in universities since 2018, when claims against sexual harassment began at the Universidad Austral. One of these movements takes place at the Universidad de Playa Ancha and Universidad de Chile, where the gender relationship that since that period has fought for a non-sexist education, and for the end of this patriarchy that sustains and oppresses Chilean university students to this day [83;84].

In Colombia, in four universities in the city of Manizales, department of Caldas (Universidad Nacional, Universidad de Caldas, Universidad de Manizales and Universidad Autónoma), for undergraduate students,

ambivalent sexism: the hostile<sup>12</sup> is current (n = 48.3%), and the benevolent<sup>13</sup> (n = 46.5%), and in addition to all this, violence against sexism (n = 23.7%), and the report that actions already exist (undersigned; informal academic activities on the theme; protection of victims of this violence) to curb this behavior on Campuses, from the perspective of women, has not yet had the desired effect [85].

In Ecuador, in 2014, the Organic Penal Code began to define that gender violence is a physical, psychological, and sexual phenomenon [86]. In Paraguay, student reports in 2017 identified the absence of actions or protocols to protect them from sexual harassment. Another factor about sexism in Paraguay is linked to the occupation of management positions in HEIs. In three of them (San Ignacio de Loyola, Americana, and Del Norte), the current occupation varies between 78% and 37%, but there is still a prevalence of males for the dean position ([87].

In Peru, sexism occurs in the form of sexual harassment (sexual harassment), although since 2003 there have been regulations against this type of behavior in academia, but this regulation has not been implemented. But the harassment has not stopped, and currently, any stereotype that leads to it: hostile, intimidating environment, verbal humiliation, or other acts that affect their daily lives. To this end, actions such as prevention, training and information gathering in the university context, since 2019, are practiced so that there is a mitigation of sexual harassment in universities [74].

#### 5.2.4 Diversity and equity

The Andean region of Latin America, which includes Bolivia, Ecuador, and Colombia, has a growing number of projects for higher education that address this theme, especially the so-called "intercultural education," whose concepts and principles were introduced by UNESCO in 1970 [88]. In the latter country, the universities of Cacia, Guajira, Amazonia and Pontificia Universidad Bolivariana have intercultural programs that have established links with Afro-Colombian communities and, from there, are expanding the links of diversity with other universities.

However, in other Latin American countries such as Argentina, Chile and Peru, diversity in the academic field is still scarce [89]. Regarding equity, in Argentina, gender equity, female and male, is expanding in the academic context, especially with regard to female participation, between 2000-2010 (> 60%), in quantitative terms, among the two sexes, regarding the exercise of teaching and

research and the contribution to science and technology. To do this, it was proposed to analyze 10 items and, among them: b) peace and self-esteem; c) realization of one's own abilities and potential; g) sense of purpose in life; h) good social relationships [90].

#### 4.2.5 Sexuality and transsexuality

The first term, according to Michel Foucault<sup>14</sup> (1926-1984), for those who hold power in contemporary society, it is something indispensable, that is, sexuality is not capable of provoking fear of power, but it is used as a strategy for exercising it. Since the Victorian Era, repression and intolerance of sexual transgression were active, as the female sex should only play the reproductive role [92].

In the university context, it has been offered, as a discipline, in Pedagogy degree courses, where the context of the discussion is subject to frequent surveillance on the central theme and gender [30]. Transsexuality and intersexuality are behaviors that transcend the normality of biological sexual practice, that is, male and female. This social group, in the university context, is a minority (n = 0.1%) in Brazilian federal universities and, when subjected to prejudice, they leave the HEI, and when they remain, they can reach the doctorate.

## V. BRAZILIAN NATIONAL CONTEXT

### 5.1 Ageism or Etarism

*"You are too old for this"*

*"An old man's place is at home"*

*"You are already 68 years old, four years from now, 72, what will you do?"*

These phrases make up the daily life of elderly people who, in Brazil, are supported by a defined legislation: Law n.º 10,741 [93]). In it, the individual is considered "elderly" when his age is equal to/above 60 years. The aging process is not linked to the gene that defines sex, nor the amount of melanin produced by melanocytes, nor the Matter language, much less to titles, figures, knowledge, literacy that the individual has, but to the human aspect that he represents. . In this context, Law No. 8,842 [94] chapter II, section I, article 3, item II, states that aging is linked to society as a whole, and that everyone should be aware of and inform about it. In item IV, and in this the Law is clear, any elderly person cannot be discriminated against. This term, ageism, is derived from the English language ageism [79] and which is also called "age

<sup>12</sup>Competitive view of women controlling men with the use of sexuality, as well as feminist ideology [91].

<sup>13</sup>It is manifested by a state of protection, admiration, and maintenance of the quality of the genre [91]

<sup>14</sup>French philosopher, teacher, psychologist, and writer.



prejudice” because age tends to be denied because this procedure creates or induces the creation of stereotypes in society against the elderly, especially when this prejudice has its genesis within the family, from which it also springs up, racism and sexism [95].

In the Midwest region, the Federal University of Mato Grosso (UFMT) does not routinely report ageism [96]. At the Federal University of Mato Grosso do Sul (UFMS), the “Open University for the Elderly” was founded, with the legal support of Law n. 5.215 [97] to exercise control over the forms of discrimination the elderly is subjected to. In the Federal District (DF), in 2020, there were already 346,000 elderly people, with a forecast for 565,000 by 2025, so the academic profile of this age group in the DF will still undergo further changes, especially regarding the extension projects that currently only occurs at the Centro Universitário do DF, and only with the process of digital inclusion [98].

In Northeast Brazil, at the University of Alagoas (UFAL), ageism was directed to the job market. Students over 50 of the Economics, Administration and Accounting courses already see that the job market for them will become more difficult as they advance in the aging process, even with a higher education degree [99]. A proof of ageism in higher education occurred in the social service course at Centro Universitário CESMAC, where a 65-year-old student complained about her invisibility in group work, during their training, as she was not chosen for any [100].

In the context of the North Region, in the state of Pará, the University for the “Third Age,” both sexes participate in subjects in different areas of graduation as “listeners,” in the continuing education program [101]. In relation to ageism, the Federal University of Tocantins (UFT), implemented the “University of Maturity” with the course of Social Political Educator for Human Aging, as an extension course [102].

For students of Speech-Language Pathology and Audiology courses and professionals at the Federal University of the State of Pará (UFPA), ageism or ageism is mitigated through permanent education in the same scientific area, they present vastly different degrees of knowledge about ageism, since academic ignorance on aging may introduce future discriminatory barriers regarding care on emergency shifts or even within the family [103]. In the Southeast Region, at the Fluminense Federal University (UFF), the Extension Program (PROEX) launched in 2021 an electronic magazine called “Best Age at the University” ([http://www.proex.uff.br/emtvidade/saude/.](http://www.proex.uff.br/emtvidade/saude/)), where the theme “aging” is discussed. In the South Region, the

Federal University of Paraná (UFPR) maintains in its active staff, professors who, like the others, are subjected to a process of cognition, affectivity and instrumentalization.

What sets it apart from other professors is the age factor: 50 years or older, however, active in classrooms, although this work sector encompasses aging processes such as: biological, chronological, social, and psychological processes [104]. At the Federal University of Rio Grande do Sul (UFRGS), it has an Open University for Elderly People (UNUPI). In it, the focus is on continuing education for these people. At the Federal University of Santa Catarina (UFSC), the insertion of the elderly in the university context took place through the Center for Studies of the Third Age (NETI), in 1982, to develop research actions, teaching and extension with this social group and, in this way, avoid exclusion and provide inclusion [105].

#### 5.1.1.Feminism

The historic landmark of feminism is inserted in English territory, in the 19th century, when there was a struggle for rights, starting with the right to vote, these women, due to the type of struggle they waged, were labeled “suffragettes”, most of them arrested on several occasions and, to give more emphasis to the struggle, now double (vote and freedom) started a hunger strike.

At the national level, there was a similarity regarding the object of the struggle in relation to London (the vote), led by Bertha Lutz, a biologist and scientist with training abroad who, after completing the course, returned to Brazil [106]. In the university context, the struggle of feminism reaped precious fruits in 1879, in the 19th century, when Decree n.º 7,247 was promulgated [107] that allowed women to enter the higher level of the educational process [108].

At UFBA, she studies the development of feminism in Brazil in the critical sense of androcentrism, at the Nucleus of Interdisciplinary Studies on Women (NEIM) then linked to the master's degree [8]. Another feminist group is located at the Federal University of Goiás, called “Grupo de Estudos Práticas Identitários, a ser-tão” research group that discusses the rights and reports on the history of women in the sertão, and the Takinahakÿ Nucleus, whose objective is the formation indigenous superior ([109].

#### 5.1.2 Racism and sexism

*“All are equal before the law,” article 5 of the Constitution of the Federative Republic of Brazil, 1988.*

Racism in Brazilian universities, due to white elitism, is present not only in terms of access, but in the selection process for professors and researchers in higher education institutions. White elitism is still prevalent, especially in regions where the colonization process was conducted with European predominance [12]. It is enough to check in the academic memory of each individual who has already graduated, the number of black professors during graduation taught subjects to him [110].

Therefore, black women in the university context endure isolation and socio-academic marginalization, in addition to hearing racist expressions on a daily basis, or through intragroup looks and comments, which causes hurt and can emotional imbalance [111]. It is still predominant because the advancement of women in the academic context is surrounded by actions, whether sociocultural or not, that hold back the growth of the academic career, which denotes two predominant discriminations within the university: race and gender [112].

But not only black women in HEI's are in the process of discrimination, at the Federal University of Acre (UFAC), a professor of the medicine course, prepared for the "saudade class" from the incorporation of a character entitled "negão WhatsApp," that was in 2017. Netizens labeled him a "racist," and he responded to an administrative process [113]. As for sexism, another proof of gender discrimination is installed in the school management sectors, as leadership in this aspect is still dominated by males in the Federal District [114].

In the Northeast region, in the state of Maranhão, the Federal University of Maranhão (UFMA), sexism is based on the level of education; the more religious tend to be more discriminatory; the political side, left or right, influence can elevate discrimination to sexism that, the higher, the greater the rejection of sex [115]. There is also a report of racism that occurred at the Federal University of Ceará, Social Sciences course, of a student who, after trying to enter the Campus, was attacked by security guards after being asked to identify himself. However, according to the report, this did not happen with other students who passed by [116].

#### 5.1.3 Diversity and equity

In Brazilian universities, the quota system has guided the application of diversity to the black community" which also includes browns, however, there is still no application of "diversity" to the economically under-sufficient, those with other types of ableism that are not the physical, or even for a broader group: LGBTQIA+<sup>15</sup>. Therefore, the

<sup>15</sup>Lesbians, transvestites, trans, queers, pansexuals, agenders, non-binary and intersex people.

actions of the first term must be the driver of the second because this will allow a socio-economic, cultural, and social development of these individuals ([117;118]

Regarding equity, in Brazil, there is still no effectiveness since basic education, which makes it difficult to ascend to higher education and, when this occurs, there is no effective permanence of this inclusion until the conclusion and subsequent continuity to postgraduate studies, and this can be proven by the content of Law No. 9,394 [119]. But some institutions are already elaborating and discussing policies that allow effective actions related to the two terms in question, as in the Federal University of São Carlos [120].

#### 5.1.4 Sexuality and transsexuality

The first term identifies a field that is in the space managed by power and regarding the identification of the genitalia, so there is an assumption of dominion over the body. It is clear that the female sex has always been characterized as "inferior," so in the annals of male and female development, the second has always been poorly and has never been represented [121].

This theme is discussed in dissertations and theses from Brazilian universities, sexuality for the formation of the male dancer, from the modes applied to ballet and in this way, breaking the barriers so that his sexuality does not make him give up on dance [122]. The second, in a university located in the northeast region, this topic is addressed in the training of health professionals based on the point of view of students and professors on how to act during outpatient/hospital medical care with a trans person.

This doubt is linked to the lack of knowledge of the terms: transsexuality<sup>16</sup>and transsexualism<sup>17</sup>, and this can increase the degree of transphobia [123]. Transsexuality has different biases, as there are heterosexual transsexual groups, gay transsexual groups, another group involves the bisexual transsexual, therefore, the nomenclatural and behavioral conflict within social movements [124].

At the Federal University of ABC<sup>18</sup>, adopted the quota system for transsexuals, similar to that adopted by the Universidade do Estado da Bahia and Universidade Federal do Sul da Bahia [125]. With this, transsexuality has already entered the academic space, but more studies are needed to verify the acceptability by faculty and students when the invisibility of this group.

<sup>16</sup>The individual is born with male/female genitalia, but cannot psychologically fit in with this fact, that is, as male, he perceives himself as female, if female, he perceives himself as male [15].

<sup>17</sup>A pathology in terms of identity disorder, in the face of non-conformity between sex and gender [126].

<sup>18</sup>Greater ABC, involves seven municipalities in São Paulo: Santo André, São Bernardo do Campo, São Caetano do Sul, Diadema, Mauá, Ribeirão Pires and Rio Grande da Serra.

## VI. CONCLUSION

The four isms studied in academic publications, at an international level, still lack a solution that really includes the individual in the academic context. In both Europe and Asia, ageism is still discriminatory and not inclusive in universities. Feminism, in the face of continuous struggles, shows a slight improvement because, in some North American and Latin American universities, there are already service centers, and academic studies that have shown the insertion of women in positions not previously held, such as rectors. In relation to racism, there is much to work on, as cases of severe institutional racial discrimination have been identified. One of them is linked to the staff of professors and researchers of black color, in the face of a high number of whites who still call themselves the ruling class.

In relation to *dades*, like diversity, it is only defined in countless ways, however, in practice, there is no growth in it, nor the advancement of equity, even with a range of legislation on these two topics, both at the generalized population and academic levels. where, in the latter, the advance is quite slow.

In Brazil, legislation has advanced, as in Europe, but legislation is not always obeyed and supervised, and this results, in Europe, Asia and Latin America, in a context of redundancy and an increase in the gap between the Laws and the academic reality. The data contained herein can be used for comparisons in research and evaluations regarding the evolution/involution of isms and ties in higher education institutions, whether in the international or national context.

## REFERENCES

- [1] Rosecrance, D.(2021). Diversity, equity, and inclusion. (DEI). Retrieved from <https://www.techtarget.com/searchhrsoftware/definition/diversity-equity-and-inclusion-DEI>.
- [2] Cope. (2021). Committee on Publication Ethics. Discussion documents: Diversity and inclusivity. Retrieved from <https://publicationethics.org/files/diversity-and-inclusivity-cope-discussion-document.pdf>.
- [3] Brazil. (2015). Lei n. 13.146, de 6 de julho de 2015. Institui a Lei Brasileira de Inclusão de Pessoa com deficiência (Estatuto da Pessoa com Deficiência). Retrieved from [http://www.planalto.gov.br/ccivil\\_03/ato2015-2018/2015/lei/13146.htm](http://www.planalto.gov.br/ccivil_03/ato2015-2018/2015/lei/13146.htm).
- [4] Sá, A. C. M., & Della Déa, V. H. S. (2020). Acessibilidade e inclusão no ensino superior: reflexões e ações em universidades brasileiras. Goiânia: Cograf, UFG.
- [5] Butler, R. N. (1969). Ageism: another form of bigotry. *The Gerontologist* (E-ISSN:1758-5341), 9(4),243-246. [https://dx.doi.org/10.1093/geront/9.4\\_Part\\_1.243](https://dx.doi.org/10.1093/geront/9.4_Part_1.243)
- [6] Dutra, L R. (2020). Discriminação no ambiente acadêmico: uma revisão de literatura. 2020. Retrieved from <https://wp.ufpel.edu.br/psicologia/files/2021/03/Lourdes-Rodrigues-Dutra-TCC-2020.pdf>.
- [7] Oliveira, L. P. R., & Cassab, L. A. (2014). O movimento feminista: algumas considerações bibliográficas. *Simpósio de Gênero e Políticas Públicas*. 3. Retrieved from [http://www.uel.br/eventos/gpp/pages/arquivos/GT10\\_Laís%20Paula%20Rodrigues%20de%20Oliveira%20e%20Latif%20Cassab.pdf](http://www.uel.br/eventos/gpp/pages/arquivos/GT10_Laís%20Paula%20Rodrigues%20de%20Oliveira%20e%20Latif%20Cassab.pdf)
- [8] Sardenberg, C. M. B. (2020). História E Memória Do Feminismo Acadêmico No Brasil: O Núcleo De Estudos Interdisciplinares Sobre A Mulher-Neim/Ufba (1983-2020). *Revista Feminismos*, 8(3), 82-121. Retrieved from <https://periodicos.ufba.br/index.php/feminismos/issue/view/2187>
- [9] Lagn-Stanton, P.; Jackson, S. (2017). Eugenia: como movimento para criar seres humanos “melhores” nos EUA influenciou Hitler. Retrieved from <https://www.bbc.com/portuguese/internacional-39625619>
- [10] Marcelino, K.; Gonçalves, M.; Hemerski, B.; Moraes, M. (2022). Projetos de extensão e políticas de inclusão social nas universidades federais brasileiras. *Linhas Críticas* (E-ISSN:1981-0432), 28, e41341. <https://dx.doi.org/10.26512/Ic28202241341>
- [11] Almeida, S. L (2017). Racismo. *Enciclopédia Jurídica da Pontífice Universidade Católica*. Retrieved from [https://enciclopediajuridica.pucsp.br/pdfs/racismo\\_58ec7621\\_92828.pdf](https://enciclopediajuridica.pucsp.br/pdfs/racismo_58ec7621_92828.pdf)
- [12] Bastos, A. A., & Schwarzkopf, A. J. L. (2022). Implementação da política afirmativa para a população negra em três universidades públicas do sul do Brasil: uma longa caminhada. *Práxis educativa* (E-ISSN:1809-4309), 17, e.19406. <https://dx.doi.org/10.55212/PraxEduc.v.17.19406.046>
- [13] Kerner, I. (2012). Tudo isso é interseccional? Sobre a relação entre racismo e sexismo. *Novos Estudos* (ISSN:1980-5403(O), 93, 45-58. <https://dx.doi.org/10.1590/S0101-33002012000200005>
- [14] Ssoc. Southern Student Organizing Committee. (1996). Freedom from Movement Girls – Now. Retrieved from <https://repository.duke.edu/dc/wlmpc/wlmms01027>
- [15] Nascimento, A. P. B. (2022). Transexualidade: uma reflexão sobre as transformações dos papéis sociais, a respeito do que é ser homem e do que é ser mulher. Retrieved from <https://mncp.org.br/2022/01/27/transexualidade-um-reflexao-sobre-as-transformacoes-dos-papeis-sociais-a-respeito-do-que-e-ser-homem-e-do-que-e-ser-mulher/>
- [16] Sousa, M. P., Silva, L. Q., Fossati, P., & Jung, H. S. (2021). Universidade e inclusão: um estudo de caso sobre o acolhimento ao aluno. *Revista Educação, artes e Inclusão* (ISSN:1984-3178(O), 17,p. 1-23. <https://dx.doi.org/10.5965/19843178172021e0011>
- [17] Alcântara, R. L. S. (2015). Formação para a diversidade? Desafios da formação de professores em Grajaú – MA.

2015. [Doctoral, Universidade Federal do Maranhão]. Retrieved from <https://tede.ucfma.br/jspui/handle/tede/750>
- [18] Fleury, H. J. (2021) O psicodrama confirma missão política da diversidade, equidade e inclusão. *Revista Brasileira de Psicodrama* (ISSN:0104-5393(O), 29(3), 159-162. [https://dx.doi.org/15329/2318-0998.00509\\_PT](https://dx.doi.org/15329/2318-0998.00509_PT)
- [19] Brazil. (1996). Aviso Circular nº 277, de 08 de maio. Retrieved from <http://portal.mec.gov.br/seesp/arquivos/pdf/aviso277.pdf>.
- [20] Brazil (1999). Decreto n.º 3.298, de 20 de dezembro Retrieved from <https://legislacao.presidencia.gov.br/atos/?tipo=DEC&numero=3298&ano=1999&ato=a55k3Zq5keNpWTe7a>
- [21] Brazil. (2003). Portaria n.º 3.284, de 7 de novembro de 2003. Dispõe sobre requisitos de acessibilidade de pessoas portadoras de deficiências, para instruir os processos de autorização e de reconhecimento de cursos, e de credenciamento de instituições. <http://portal.mec.gov.br/arquivos/pdf/portaria3284.pdf>.
- [22] Brazil (2015). Law n.º 13.146, de 6 de julho de 2015. Retrieved from [L13146 \(planalto.gov.br\)](https://www.planalto.gov.br)
- [23] Poker, R. B., Valentim, F. O. D., & Garcia, I. A. (2018) Inclusão no ensino superior: a percepção de docentes de uma instituição pública do interior do estado de São Paulo. *Psicologia Escolar e Educacional* (ISSN:2176-3539(O), 127-134. <https://dx.doi.org/10.1590/2175-3539/2018/010>
- [24] Tjdf. (2022). Tribunal de Justiça do Distrito Federal e dos Territórios. Diagnóstico organizacional de equidade e inclusão da diversidade. Retrieved from [https://www.tjdf.tjus.br/institucional/governanca/integridade-e-etica/programa-pro-equidade-e-diversidade/relatorio\\_diversidade.pdf](https://www.tjdf.tjus.br/institucional/governanca/integridade-e-etica/programa-pro-equidade-e-diversidade/relatorio_diversidade.pdf)
- [25] Nubr. Nações Unidas Brasil. (2022). Como as Nações Unidas apoiam os Objetivos do Desenvolvimento Sustentável no Brasil. 2022. Retrieved from <https://brasil.un.org/pt-br/sdgs>.
- [26] Batista, W. F. G.; Regato, D., & Hanashiro, D. M. M. (2018). Etarismo no serviço público: percepção dos servidores administrativos de universidades brasileiras. Chapter 1. In: *Nuevas forma de organización y trabajo: Latinoamérica frente a los actuales desafíos económicos, sociales, y medioambientales*. Retrieved from [https://www.researchgate.net/publication/331340709\\_Etarismo\\_no\\_servico\\_publico\\_Percepcoes\\_de\\_servidores\\_administrativos\\_de\\_universidades\\_estaduais\\_brasileiras](https://www.researchgate.net/publication/331340709_Etarismo_no_servico_publico_Percepcoes_de_servidores_administrativos_de_universidades_estaduais_brasileiras)
- [27] Picken, N., Brown, E. R., & Hoorens, S. (2021). European Platform for Investigation in Children. Sexuality education across the European Union: an overview. Luxembourg: European Union. Retrieved from <https://www.rand.org/randeurope/research/projects/european-platform-investing-in-children.html>
- [28] Brazil (2015) Resolution n. 2, de 1 de julho. Retrieved from [rcp002\\_15 \(mec.gov.br\)](http://portal.mec.gov.br/rcp002_15).
- [29] Silva, A. A., Araújo, J. F., & Jesus, A. R. (2021). Gênero e sexualidade nos currículos de pedagogia do Paraná. *Revista Forum Identidades* (ISSN:1982-3916(O), 33(1),113-128. <https://dx.doi.org/10.47250/forident.v.33n1.p113-128>.
- [30] Rizza, J. L. (2015). A sexualidade no cenário do ensino superior: um estudo sobre as disciplinas nos cursos de graduação das universidades brasileiras. [Doctorate, Universidade Federal do Rio Grande]. Retrieved from <http://repositorio.furg.br/handle/1/6008>
- [31] Cardoso, H. M.; Dias, A. F. (2020). Saberes trans\* em universidades nordestinas. *Revista on line de Política e Gestão Educacional*(E-ISSN:1519-9029), 24(3), 1689-1712. <https://dx.doi.org/10.22633/rpge.v24iesp3.14208>
- [32] Eufra. European Union Agency for Fundamental Rights. Being trans in the EU. Comparative analysis of the EU LGBT survey data. Retrieved from [https://fra.europa.eu/sites/default/files/fra-2015-being-trans-eu-comparative-summary\\_en.pdf](https://fra.europa.eu/sites/default/files/fra-2015-being-trans-eu-comparative-summary_en.pdf)
- [33] Russo, T., Addabbo, T., Muzzioli, S., & De Baetes, B. (2021). The development to the LGBT+ university inclusion index and its application to Italian universities. *International Workshop on Fuzzy Logic and Applications*. 13. Italia. Retrieved from <http://ceur-ws.org/Vol-3074/paper10.pdf>
- [34] Pereira, A. S., Shitsuka, D. M., Parreira, F. J., & Shitsuka, R. Metodologia da pesquisa científica. Santa Maria: UAB/NET/UFSM, 2018. Retrieved from [https://www.ufsm.br/app/uploads/sites/358/2019/02/Metodologia-da-Pesquisa-Cientifica\\_final.pdf](https://www.ufsm.br/app/uploads/sites/358/2019/02/Metodologia-da-Pesquisa-Cientifica_final.pdf)
- [35] Dantas, S. (2022). Introdução à recuperação de informação. Recife: Universidade Salgado de Oliveira. Retrieved from <https://www.cin.ufpe.br>
- [36] Bezerra. D. S. (2021). Guia educativo casa segura. Riscos e cuidados à saúde do idoso domiciliado. Retrieved from <https://arquivos.ufrr.br/index.php/s/jOmsa82WRgkh9b1>
- [37] Brazil. (2013). Guia orientador para a criação de conselhos estaduais/municipais de direitos da população de lésbicas, gays, bissexuais, travestis e transexuais – LGBT. Retrieved from <https://prceu.usp.br/repositorio/guia-orientador-para-a-criacao-de-conselhos-estaduais-municipais-de-direitos-da-populacao-de-lesbicas-gays-bissexuais-travestis-e-transexuais-lgbt/>.
- [38] Carvalho, M. E. P., Rabay, G., Brabo, T. S. A. M., Felix, J., & Dias, A. F (Eds). (2017). *Direitos humanos das mulheres e das pessoas LGBTQI. Inclusão da perspectiva da diversidade sexual e de gênero na educação e na formação de docentes*. Retrieved from <http://www.editora.ufpb.br/sistema/press5/index.php/UFPB/catalog/view/149/58/581-1>.
- [39] North, M. S. (2022). Chinese versus United States workplace ageism as GATE-ism: generation, age, tenure, experience. *Frontiers in Psychology* (ISSN:1664-1078(O), 13. <https://dx.doi.org/10.3389/fpsyg.2022.817160>
- [40] Maurya, P., Sharma, P. & Muhammad, T. (2022). Prevalence and correlates of perceived age-related discrimination among older adults in India. *BMC Public Health* (ISSN:1471-2458(O), 22:561. <https://dx.doi.org/10.1186/s12889-022-13002-5>
- [41] Ertem, M. Y., & Yildirim, J. G. (2020). Undergraduate students' attitudes towards ageism and influencing factors of ageism. *Erdelyi Issues Research Journal* (ISSN:1308-5816(O), 13(2),98-106. <https://dx.doi.org/10.46414/yasad.803533>

- [42] Orozco, S. E. G, Chávez, D. A. C, & Bretaña, R. M. G. (2021). Formación continua y calidad de vida de los adultos mayores. *Educación Médica Superior* (ISSN:1561-2902(O),4 (35). Retrieved from <http://www.ems.sld.cu/index.php/ems/article/view/3163#:~:text=La%20formación%20continua%20influye%20de,una%20vida%20digna%20y%20saludable>.
- [43] Perez, T. J. M., Reyes, I. A. R., & Argón, C. M. G. (2020). La Universidad de Personas Adultas Mayores ¿factos de bienestar y participación ciudadana? *Revista Conrado* (ISSN:1990-8644(O), 17(79), 206-213. Retrieved from <https://conrado.ucf.edu.cu/index.php/conrado/article/view/1715>
- [44] Ferraro, A. R. (2021). The woman question, equality, and the right education: France, 1399 to 1793. *Educação & Realidade* (ISSN:2175-6236(O), 46(3). <https://dx.doi.org/10.1590/2175-6236113918>
- [45] Frank, C. (2019). Sister outsider and Audre Lorde in the Netherlands: on transnational queer feminisms and archival methodological practices. *Feminist Review* (ISSN:1466-4380(O), (121), 9-13. <https://dx.doi.org/10.1177/0141778918818753>
- [46] Blaud, C. F. (2021). Marie de Gournay e Simone de Beauvoir: notas sobre memória e histórias. *Cadernos de Ética e Filosofia Política* (ISSN:1517-0128(O), v. 39, n° 2, p. 203-213, 2021. <https://dx.doi.org/10.11606/issn.1517-0128.v39i2p203-213>
- [47] Mattos, E. I. (2019). O discurso feminista no cartesianismo de Poulain de La Barre. *Griot. Revista de filosofia* (ISSN:2187-1036(O), 19(3), 338-349. <https://dx.doi.org/10.31977/grirfi.v19i3.1304>
- [48] Nazarov, M. (2018). Exploring the feminist wave for higher education in nineteenth century Russia. [Master Dissertação, Macquarie University, NSW, Australia]. Retrieved from [https://figshare.mq.edu.au/articles/thesis/Exploring\\_the\\_feminist\\_wave\\_of\\_higher\\_education\\_in\\_nineteenth\\_century\\_Russia/19443776/1](https://figshare.mq.edu.au/articles/thesis/Exploring_the_feminist_wave_of_higher_education_in_nineteenth_century_Russia/19443776/1)
- [49] Temkina, A., & Zdravosmyslova, E. (2014). Gender's crooked path: feminism confronts Russian patriarchy. *Current Sociology* (issn:1466-4380(O), 62(2),253-270. <https://dx.doi.org/10.1177/0011392113515566>
- [50] Müller, U. (2021). Lack of diversity: more than three-quarters of Germany's university heads are male. Retrieved from <https://www.che.de/en/2021/geringe-diversitaet-mehr-als-drei-viertel-der-deutschen-hochschulleitungen-sind-maennlich/>
- [51] Mehta, P. (2019). Dalit feminism in Tokyo: analogy and affiliation in transnational Dalit activism. *Feminist Review* (ISSN:1466-4380(O), (121),24-36. <https://dx.doi.org/10.1177/01417778911118318>
- [52] UTOHYO (2022). Committee for the gender equality. School of Engineering. The University Tokio. Retrieved from <http://www.t.u-tokyo.ac.jp/en/soe/diversity/gender>.
- [53] Pasricha, J. (2020). The crowdsourced list of social justice collectives across Indian Campuses. Retrieved from <https://feminisminindia.com/fii-feminist-resource-centre-india/crowdsourced-list-social-justice-collectives-indian-campuses/>
- [54] Pandey, S. (2020). *As faculdades feministas na índia ainda são relevantes?* Retrieved from [As faculdades feministas na Índia ainda são relevantes? \(feminisminindia.com\)](https://feminisminindia.com).
- [55] Sawarel, W. (2022). US International HE 'reinforces racism' study finds. *University World News: the global window on higher Education*. Retrieved from <https://www.universityworldnews.com/post.php?story=2022010810042948>
- [56] Colak, Z., & Toguslu, E. (2021). France's attack on academics in an attempt to silence debate on race. *European Center for Populism Studies*. Retrieved from <https://www.populismstudies.org/frances-attack-on-academics-is-an-attempt-to-silence-debate-on-race/>
- [57] Souza, T. (2018). Responding to microaggressions in the classroom: taking ACTION. *Faculty Focus*. Retrieved from <https://www.facultyfocus.com/articles/effective-classroom-management/responding-to-microaggressions-in-the-classroom/>
- [58] Levchak, C. C. (2013). An examination of racist and sexist microaggressions on College Campuses. [Doctorate Thesis. University of Iowa]. Retrieved from <https://iro.uiowa.edu/esploro/outputs/doctoral/An-examination-of-racist-and-sexist/99837762202771>
- [59] Rosa, R., & Clavero, S. (2020). Gender equality in higher education and research. *Journal of gender studies* (ISSN: 10465-3869(O), 31(1),1-7. <https://dx.doi.org/10.1080/09589236.2022.2007446>
- [60] COPE. (2021). Committee on Publication Ethics. *Discussion documents: Diversity and inclusivity*. Retrieved from. <https://publicationethics.org/files/diversity-and-inclusivity-cope-discussion-document.pdf>
- [61] Pineda, P.; Misha, S. (2022). The semantics of diversity in higher education: differences between the Global North and Global South. *Higher Education Online*. Retrieved from <https://link.springer.com/content/pdf/10.1007/s10734-022-00870-4.pdf>.
- [62] Atherton, G (Ed). (2012), *Perspectives in the challenges to access and Equity in Higher Education across the world in the context of COVID*. Londres: University of West London. Retrieved from <https://www.iesalc.unesco.org/wp-content/uploads/2021/09/DRAFT-WAHED-24th-Sep-2021-2.pdf>
- [63] Beaumont, K.; Maguire, M. (2013). Policy department C: citizens rights and constitutional affairs. Brussels: European Union, 2013. Retrieved from [https://op.europa.eu/en/web/who-is-who/organization/-/organization/EP\\_SG/EP\\_DPPE02C60](https://op.europa.eu/en/web/who-is-who/organization/-/organization/EP_SG/EP_DPPE02C60)
- [64] Kyodo.(2018). Women's university in Tokyo to accept transgender students. Retrieved from <https://english.kyodonews.net/news/2018/07/eb31197f3fb1-womens-university-in-tokyo-to-accept-transgender-students.html>.
- [65] Chepo M. (2018). Envejecimiento inserto en los currículos de carreras de la salud: desafíos y propuestas. *Revista Médica de Chile* (ISSN(P)0034-9897), (146), 1224-1226. <https://dx.doi.org/10.4067/S0034-988720180011001224>
- [66] Fuerte, K. (2020). ¿Cómo afecta la brecha digital a los adultos mayores? Instituto para el futuro de la educación.

- Retrieved from <https://observatorio.tec.mx/edu-news?tag=educacion+para+adultos+mayores>.
- [67] Parejo, S. Y. P. (2020). Feminismo en las universidades de Colombia. Conexión Externado. Sociedad Interameirca de Prensa. Feminismo en las universidades de Colombia. Retrieved from <https://conexion.uexternado.edu.co/feminismo-en-las-universidades-de-colombia/>
- [68] Peñarada, M. L. R. (2019). Fraternidad y Luchas Feministas Contra el Acoso Sexual em la Universidad Nacional de Colombia. NÓMADA (ISSN(P)0121-7550), (51), 2019. <https://dx.doi.org/10.30278/nomadas.n54a3>
- [69] Mecias, J. M. J. (2019). Movimientos estudiantiles de mujeres en la Universidad Central del Ecuador: estudio ligado a su creación, luchas, experiencias y abordajes teóricos feministas. [Universidad Central del Ecuador, Quito]. Retrieved from <http://www.dspace.uce.edu.ec/handle/25000/19093>
- [70] Ecuador. (2010). Lei Orgânica da Educação Superior (LOES). Suplemento del Registro Oficial n.º 298. Retrieved from [https://oig.cepal.org/sites/default/files/2010\\_leyeducacionsuperior\\_ecu.pdf](https://oig.cepal.org/sites/default/files/2010_leyeducacionsuperior_ecu.pdf).
- [71] Bolívia. (2010). Lei n.º 045, de 8 de octubre de 2010. Ley contra el racismo y toda discriminación. Retrieved from <https://www.acnur.org/fileadmin/Documentos/BDL/2014/9502.pdf>.
- [72] Guixé, F. B. (2020). Universidad de Chile decreta primera política universitaria en el país sobre Pueblos Indígenas. Santiago: Universidad de Chile. Retrieved from <https://www.uchile.cl/noticias/169456/racismo-y-educacion-superior-latinoamericana>
- [73] Curriao, M. M. (2020). Racismo estructural y el rol de la educación superior Latinoamericana. Santiago: Universidad de Chile. Retrieved from <https://www.uchile.cl/noticias/169456/racismo-y-32> educación-superior-latinoamericana.
- [74] Ramírez, O. A. Q. (2014). El racismo cotidiano en la universidad colombiana desde la experiencia vivida por los estudiantes negros en Bogotá. Universitas Humanísticas (ISSN:1020-4807(O), (77),71-94. <https://dx.doi.org/10.11144/Javariana.UH77.reue>
- [75] Anagonó, M. S. C., & Castro, L. A. T. (2021). Racismo y universidades en el Ecuador. Universidades, (87),35-50.
- [75] Ramírez, B. (2021). Universidades frente al hostigamiento sexual. Retrieved from <https://elperuano.pe/noticia/117602-universidades-frente-al-hostigamiento-sexual>
- [76] Paraguai. (2018). Lineamientos para um sistema educativo inclusivo em el Paraguay. Assunção: Texonbotet Ha Tembikuaa; USAID; SRAKI. Retrieved from [https://pdf.usaid.gov/pdf\\_docs/PA00TNPB.pdf](https://pdf.usaid.gov/pdf_docs/PA00TNPB.pdf)
- [77] Ríos, G. C. (2022). Discriminación a extranjeros en universidades públicas de Paraguay: ¿Hasta cuándo? Retrieved from <https://cienciasdelsur.com/2022/05/11/discriminacion-extranjeros-en-universidades-publicas-de-paraguay/>.
- [78] Kogan, L. & Galarza, F. (2014). ¿Discriminas o te discriminan? Un análisis de las percepciones de universitarios de cuatro ciudades del Perú. Lima: Universidad del Pacifico. Retrieved from <https://repositorio.up.edu.pe/bitstream/handle/11354/1682/DT96.pdf?sequence=1>
- [79] Helal, D. H., & Viana, L. O. (2021). Ageísmo: uma revisão integrativa em língua portuguesa. Conhecimento y Diversidade (ISSN:2237-8049(O), 13(29), 171-191. <https://dx.doi.org/10.18316/rcd.v13i29.8115>
- [80] Bonilla, L. L. B. (2009). Huellas del racismo antiindígena en textos escolares venezolanos de finales de los años ochenta. Núcleo (ISSN:0798-9784(O), (26),11-35. Retrieved from [http://saber.ucv.ve/ojs/index.php/rev\\_n](http://saber.ucv.ve/ojs/index.php/rev_n)
- [81] Morón, N. G. (2018). Discriminación de género en el sistema universitario argentino. Revista Estudos Feministas (ISSN:1806-9584(O), 26(2), e51339. <https://dx.doi.org/10.1590/1806-9584-2018v26n251339>
- [82] Fabreger, D. (2021). Violencia machista y patriarcal. Tarija: salen a la luz más casos de acoso en la Universidad Católica Boliviana. Retrieved from <https://www.laizquierdadiario.com.bo/Tarija-salen-a-la-luz-mas-casos-de-acoso-en-la-Universidad-Catolica-Boliviana>
- [83] Alfaro-Álvarez, J., & Pedraza T. A. (2019). Estudiantes universitarias chilenas: discursos y prácticas contra la violencia sexista. Nómadas (ISSN:0121-7550(O), (51), 31-47. <https://dx.doi.org/10.30578/nomadas.n51a2>
- [84] Neculqueo, V. S. (2020). Género en la institucionalidad de educación superior: respuesta de la Universidad de Chile contra el acoso sexual. 2020. [Dissertation, Universidad de Chile]. Retrieved from <https://repositorio.uchile.cl/bitstream/handle/2250/181489/Te-sis%20final%20Vania%20Andrea%20Silva%20Neculqueo.pdf?sequence=1>
- [85] Cardona, J. Ac., Guerra, L. P. C., Cañon, S. C., Castrillón, J. J. C., García, A. K. G., Mendoza, D. F. H., & Valencia, L. K. V. (2015). Sexismo y concepciones de la violencia de género contra la mujer en cuatro universidades de la ciudad de Manizales (Colombia). Archivos de Medicina (E-ISSN:2339-3874), 15(2), 200-219. <https://dx.doi.org/10.30554/archmed.15.1.1004.2015>
- [86] Ibañez, D. B. (2017). La violencia de género en Ecuador: un estudio sobre los universitarios. Estudos Feministas (ISSN:1806-9584(O), 25(3), 1313-1327. <https://dx.doi.org/10.1590/1806-9584.2017v25n3p1313>
- [87] Cardozo, S. (2020). Relación entre el género y los cargos directivos en tres universidades de la ciudad de Asunción – Paraguay. Revista Científica en Ciencias Sociales (ISSN:2708-0412(O), 2(2),18-34. <https://dx.doi.org/10.53732/rccsociole20.02.2020.18>
- [88] Unesco. (2014). Organização das Nações Unidas para a Educação, Ciência e Cultura. Directrices de la UNESCO sobre la educación intercultural. Paris: UNESCO. Retrieved from [https://unesdoc.unesco.org/ark:/48223/pf0000147878\\_spa](https://unesdoc.unesco.org/ark:/48223/pf0000147878_spa)
- [89] Perusset, M. (2022). Interculturalidad y educación: diversidad de sentidos, contextos y realidades en las tierras altas de América Latina. Espacios en Blanco (E-ISSN:2313-9927), 1(32),13-150. <https://dx.doi.org/10.37177/UNICEN/EB32-320>

- [90] Perona, E., Molina A, E., Cuttica, M., & Escudero, C. (2012). Equidad de género em la ciencia y la educación superior en Argentina: ¿Un signo de desarrollo? *Oikonomos* (ISSN:1853-5690(O), 1,175-192. Retrieved from <https://core.ac.uk/download/pdf/228415284.pdf>
- [91] Belo, R. P., Gouveia, V. V., Raymundo, J. S., & Marques, C. M. C. (2005). Correlatos Valorativos Do Sexismo Ambivalente. *Psicologia, Reflexão E Crítica* (ISSN: 0102-7972(O), 18(1), 7-15. <https://dx.doi.org/10.1590/S0102-7972005000100003>
- [92] Carvalho, G. P., & Oliveira, A. S. Q. (2017). Discurso, poder e sexualidade em Foucault. *Revista Dialectus* (E-ISSN:2317-2010), 11,100-115. <https://dx.doi.org/10.30611/2017n11id31003>
- [93] Brazil. (2003) Law n. 10.741. Retrieved from <https://www.gov.br/cidadania/pt-br/acao-a-informacao/legislacao/antigos/lei-no-10-741-de-01-de-outubro-de-2003>
- [94] Brazil. (1994). Law n.º 8.842 Retrieved from [http://www.planalto.gov.br/ccivil\\_03/leis/18842.htm#:~:text=Dispõe%20sobre%20a%20política%20nacional,Idoso%20e%20dá%20outras%20providências.&text=Art.,e%20participação%20efetiva%20na%20sociedade](http://www.planalto.gov.br/ccivil_03/leis/18842.htm#:~:text=Dispõe%20sobre%20a%20política%20nacional,Idoso%20e%20dá%20outras%20providências.&text=Art.,e%20participação%20efetiva%20na%20sociedade)
- [95] Goldani, A. M. (2010). Desafios do “preconceito etário” no Brazil. *Educação & Sociedade* (ISSN:1678-4626(O), 31(111), 411-434. <https://dx.doi.org/10.1590/SO101-73302010000200007>
- [96] Rozendo, A. S. (2016). Ageísmo: um estudo com grupos da terceira idade. *Revista Kairós Gerontologia* (ISSN:2176-901X (O), 19(3),79-89. <https://dx.doi.org/10.23925/2176-901X.2016c19i13p79-89>
- [97] MS. (2018). Law n.º 5. 215 Retrieved from <http://aacpdappls.net.ms.gov.br/appls/legislacao/secoge/govaf/1b758e65922af3e904256b220050342a/b3a0eedb74b80a06042582ad0043777d?OpenDocument>
- [98] Bezerra, P. A. (2021). História de vida de pessoas idosas no Distrito Federal: um olhar sobre o isolamento social na perspectiva teórica do ageísmo. {Doctoral dissertation, Brazilian University}. UNB Repository. Retrieved from <https://repositorio.unb.br/handle/10482/41762>
- [99] Neves, A. I.; Barbosa, M. A. C.(2021). Empregabilidade de pessoas acima de 50 anos: um estudo com alunos de uma universidade federal. Retrieved from <https://doity.com.br/anais/31enangrad/trabalho/162149>
- [100] Cesmac. (2022). Centro de Estudos Superiores de Maceió. Conteúdo sobre ENEM, Ensino Superior e Carreira. Retrieved from <https://ead.cesmac.edu.br/blog/tag/vida-na-universidade>
- [101] Pereira, I. C. S., & Farias, A. M. B. (2016). A educação permanente em áreas de graduação na UFPA: ferramentas de empoderamento da pessoa idosa. Retrieved from [https://cbeu.ufop.br/anais\\_files/b6a36224de20f6453afec084a020dcb2.pdf](https://cbeu.ufop.br/anais_files/b6a36224de20f6453afec084a020dcb2.pdf).
- [102] Pereira, H. (2021). 15 anos de UMA: projeto que atende cerca de 400 idoso no Tocantins. Palmas: UFT, 2021. Retrieved from <https://ww2.uft.edu.br/index.php/ultimas-noticias/28920-15-anos-de-uma-projeto-atende-cerca-de-400-idosos-no-tocantins>
- [103] Garcia, A. C. O.; Santos, T. M. M. (2021). Ageísmo: considerações a partir do conhecimento entre estudantes de graduação e fonoaudiólogos. *Revista Society and Development* (ISSN: 2525-3409 (O), 10(8), e38410816793. <https://dx.doi.org/10.33448/rsd-v10i8.16793>
- [104] Kai, F. B. (2019). A idade silenciosa nas organizações: o processo de envelhecer no trabalho docente e a cultura organizacional das instituições de ensino superior. [Dissertation, Universidade Federal de Sant Catarina]. Retrieved from <https://acervodigital.ufpr.br/handle/1884/59927>
- [105] Machado, C. C. A. C. (2017). O empoderamento de idosos na escolarização da EJA do Núcleo de Estudos da Terceira Idade/UFSC. [Dissertation, Universidade Federal de Santa Catarina]. Retrieved from <https://repositorio.ufsc.br/handle/123456789/186408>
- [106] Pinto, C. R. J. (2010). Feminismo, história e poder. *Revista Sociologia Política*, 18(36),15-23.
- [107] Brasil. (1879). Decree n.º 7.247. Retrieved from <https://www2.camara.leg.br/legin/fed/decret/1824-1899/decreto-7247-19-abril-1879-547933-publicacaooriginal-62862-pe.html#:~:text=Reforma%20o%20ensino%20primario%20e.superior%20em%20todo%20o%20Imperio>
- [108] Saraiva, V. M. (2019). Coletivos feministas universitários e violência de gênero no Centro-Oeste e Distrito Federal. [Dissertation, Vale dos Sinos, University].
- [109] Oliveira, E. A. (2015). Produção de conhecimento feministas em universidades brasileiras. [Dissertation, Universidade Federal de Goiás]. Retrieved from <https://repositorio.bc.ufg.br/tede/handle/tede/6477>
- [110] Mateus, F.(2010). Racismo no mundo acadêmico: um tema para se discutir na universidade. Retrieved from <https://www.unicamp.br/unicamp/ju/noticias/2019/11/19/racismo-no-mundo-academico-um-tema-para-se-discutir-na-universidade>
- [111] Valério, A. C. O., Bezerra, W. B., Santos, V. S., Leite Júnior, J. D., Farias, M. N., & Santos, S.M. B. (2021). Racismo e participação social na universidade: experiência de estudantes negras em cursos de saúde. *Cadernos Brasileiros de Terapia Ocupacional* (ISSN: 2526-8910 (O), (29), e3007. <https://dx.doi.org/10.1590/2526-8910.ctoAO2278>
- [112] Pereira, R. S., Marigot, X. R., Ciriaco, C., & Paceliuka, K. (2008). Mulheres brancas e negras na Universidade Federal de Mato Grosso. *Jornada Internacional de Políticas Públicas*. São Luiz, Maranhão, Brazil. Retrieved from [https://silo.tips/queue/mulheres-brancas-e-negras-na-universidade-federal-de-mato-grosso-a-profissao-fal?&queue\\_id=-1&v=1658048431&u=MjgwNDoxNGM6NTk4Yjo4MGUwOmMlOWM6Y2NkNTozYjlkOmU2ZmM=](https://silo.tips/queue/mulheres-brancas-e-negras-na-universidade-federal-de-mato-grosso-a-profissao-fal?&queue_id=-1&v=1658048431&u=MjgwNDoxNGM6NTk4Yjo4MGUwOmMlOWM6Y2NkNTozYjlkOmU2ZmM=)
- [113] Geledés. (2017). UFAC abre processo administrativo contra professor que se fantasiou de “negão do WhatsApp”. Retrieved from <https://www.geledes.org.br/ufac-abre-processo-administrativo-contra-professor-que-se-fantasiou-de-negao-do-whatsapp/>

- [114] Freitas, O. C. R. A (2017). feminização da educação e ocupação dos espaços de poder na escola: a força do discurso sexista e a atuação da mulher na gestão escolar. Retrieved from [https://old.iesb.br/Cms\\_Data/Contents/Portal/Media/arquivos/A-feminiza-o-da-educa-o-e-ocupa-o-dos-espa-os-de-poder-na-escola-a-for-a-do-discurso-sexista-e-a-atua-o-da-mulher-na-gest-o-escolar\\_13-Mundo-de-Mulheres-2.pdf](https://old.iesb.br/Cms_Data/Contents/Portal/Media/arquivos/A-feminiza-o-da-educa-o-e-ocupa-o-dos-espa-os-de-poder-na-escola-a-for-a-do-discurso-sexista-e-a-atua-o-da-mulher-na-gest-o-escolar_13-Mundo-de-Mulheres-2.pdf).
- [115] Nascimento, B. B.(2017). *O sexismo no ensino superior no Maranhão*. [Dissertation, Universidade Federal do Maranhão].
- [116] Vieira, A.(2019). Estudante relata caso de racismo e abordagem violenta de seguranças da UFC. Retrieved from. <https://www.opovo.com.br/noticias/fortaleza/2019/06/19/estudante-relata-caso-de-racismo-e-abordagem-violenta-de-seguranças-da-ufc.html>
- [117] Iensue, G. (2021). Diversidade, equidade e ações afirmativas para os negros na educação superior brasileira. Revista de Direito (ISSN:2527-0389(O), 13(01),1-31. <https://dx.doi.org/10.32361/2021139111175>
- [118] Montagnoli, R. L. Vizzotto, L. (2021) (Não vamos falar sobre diversidade: o silenciamento na formação de docentes no século XXI. Revista Comunnitas (ISSN:2526-5970(O) , 5(9), 297-311. Retrieved from <https://periodicos.ufac.br/index.php/COMMUNITAS/articloe/view/4674>
- [119] Brazil. (1996). Lei n.º 9.394. Retrieved from [http://www.planalto.gov.br/ccivil\\_03/leis/L9394compilado.htm](http://www.planalto.gov.br/ccivil_03/leis/L9394compilado.htm)
- [120] Ufscar (2016). Universidade de São Carlos. Políticas de ações afirmativas, diversidade e equidade da Universidade Federal de São Carlos. São Carlos, São Paulo.
- [121] Silva, A, A., Araújo, J. F., & Jesus, A. R. (2021). Gênero e sexualidade nos currículos de pedagogia do Paraná. Revista Forum Identidades (ISSN: 1982-3916 (O), 33(1), 113-128, 2021. <https://dx.doi.org/10.47250/foridnet.v33n1.p113-128>
- [122] Souza, M. T. O, & Capraco, A. M. (2021). Intersecções entre balé, gênero e sexualidade na produção acadêmica no Brasil: revisão de teses e dissertações. Licere (ISSN: 1981-3171 (O), 24(3),356-378. <https://dx.doi.org/10.35699/2447-6218.2021.36330>
- [123] Dornelas, R., Granzotti, R. B. G., Anjos, J. H. G., Souza, R. P. F. & Silva, K. (2021). Gênero, 22(1),1-12. Retrieved from <https://periodicos.uff.br/revistagenero/article/view/49957>
- [124] Vieira Júnior, L. A. M. (2021). A experiência trans: uma disputa semântica nas mídias digitais. Insurgência (ISSN:2447-66814(O), 7(2), 78-103. <https://dx.doi.org/10.26512/indurgncia.v8i1.38575>
- [125] Gomes, B., Faheina, C., Ker, J.(2019). No ensino superior, o espelho da exclusão de pessoas trans. Retrieved from <https://arte.estadao.com.br/focas/capitu/materia/no-ensino-superior-o-espelho-da-exclusao-de-pessoas-trans>
- [126] Aran, A. (2006). A transexualidade e a gramática normativa do sistema sexo-gênero. Agora (ISSN: 1809-4414), 9(1),49-63. <https://de.doi.org/10.1590/S1516-1498206000100004>



# Antioxidant, anti-inflammatory and antimicrobial activities promoted by hydroalcoholic extract of *Laguncularia racemosa* (L) c.f. leaves Gaert

Jhonatta Alexandre Brito Dias<sup>1\*</sup>, Antonio Carlos Vital Júnior<sup>2</sup>, Fábio Miguel Santos Costa<sup>3</sup>, Priscilla Yevellin Barros de Melo Lima<sup>4</sup>, Helimarcos Nunes Pereira<sup>1</sup>, Iranildo José da Cruz Filho<sup>1</sup>, Cristiane Moutinho Lagos de Melo<sup>1</sup>, Teresinha Gonçalves da Silva<sup>1</sup>, Ivone Antônia de Souza<sup>1</sup>

<sup>1</sup>Department of Antibiotics, Center for Biosciences, Universidade Federal de Pernambuco, UFPE, Recife, Pernambuco, Brazil.

<sup>2</sup>Department of Microbiology and Parasitology, Center of Biosciences, Federal University of Rio Grande do Norte, UFRN, Natal, Rio Grande do Norte, Brazil.

<sup>3</sup>Department of Analytical Chemistry, Faculty of Pharmacy of the University of Porto, Porto, Portugal.

<sup>4</sup>Maurício de Nassau University Center - UNINASSAU, Campina Grande, Paraíba, Brazil.

\*Correspondence: Jhonatta Alexandre Brito Dias (jhontta@hotmail.com)

Received: 05 Aug 2022,

Received in revised form: 02 Sep 2022,

Accepted: 08 Sep 2022,

Available online: 14 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Combretaceae*, *Hydroalcoholic extract*, *biological activities*, *antimicrobials*

**Abstract**— This study aimed to evaluate the antioxidant, anti-inflammatory, antimicrobial and toxicity potential of the hydroalcoholic extract of the leaves of *L. racemosa* (EHALr) a mangrove plant. The results showed that the extract was able to promote moderate antioxidant activity. In acute toxicity assays, EHA-Lr showed low toxicity, with no significant changes in animal and organ weights and in biochemical and hematological parameters. In the evaluation of anti-inflammatory activity, the 200 mg/kg dose of EHA-Lr was most effective in reducing leukocyte migration in the paw edema model and in the LPS-induced acute lung inflammation model the 50 mg/kg dose was most effective in reducing plantar volume. The antimicrobial potential of the hydroalcoholic extract was observed against *Staphylococcus aureus*, *Micrococcus luteus*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Serratia marcescens*, *Escherichia coli* and *Enterococcus faecalis* strains, proving to be effective. However, the extract was most active against the *Micrococcus luteus* strain (0.93mg/mL). The hydroalcoholic extract of *L. racemosa* leaves showed anti-inflammatory and antimicrobial activities, with low toxicity, which makes it a strong promise to be applied or combined in clinical therapy.

## I. INTRODUCTION

Medicinal plants have been used to combat different diseases since the earliest records of human civilization. According to the World Health Organization (WHO), approximately 80% of the population in developing countries face difficulties in acquiring synthetic

medicines and use traditional medicines, especially those of plant origin, to meet their basic health needs (SULTANA et al. 2015).

Through the development of research in the field of natural products, several biological activities have been systematically and widely studied using botanical material

as the main raw material, such as antimicrobial, anti-inflammatory, antioxidant, gastroprotective, anxiolytic and, more recently, antineoplastic (RTIBI et al. 2015; AL-ANSARI et al. 2019; SHARMA et al. 2017; GONULALAN et al. 2019; SIEW et al. 2019). In this intention, several botanical families have been studied seeking the determination of medicinal properties or aiming at the prospection of bioactive compounds. In Brazil, plants from practically all ecosystems are studied, from the Amazon, Atlantic Forest and Caatinga to the Mangrove, which is still little explored (LIPORACCI, 2014; BARTZ et al. 2015).

Four species occur in Brazilian mangroves (*Rhizophora mangle* L. - Rhizophoraceae, *Avicennia schaueriana* Stapf & Leechm. ex Moldenke and *Avicennia germinans* (L.) Stearn - Acanthaceae, and *Laguncularia racemosa* (L.) C. F. Gaertn. - Combretaceae). The latter is popularly known as mangrove. It is of global range, with greater presence in North and South America, and overall, plays great importance for the ecosystem where it inhabits (SILVA, 2012; NETO et al. 2015). In this sense, *Laguncularia racemosa* (L.) C. F. Gaertn has been the target of several studies involving its interaction in the mangrove ecosystem, in terms of pollution monitoring and in interaction studies with some microorganisms, however, pharmacological and phytochemical studies with this species are scarce (DE FREITAS GUEDES et al. 2018; REINERT et al. 2016; SODRÉ et al. 2013).

Some pharmacological studies indicate that *L. racemosa* has potential molluscicidal activity (MENDES et al. 2018), antioxidant activity (XUE et al, 2008) and inhibition of PLA2 and other pathways of the inflammation cascade (PINHO et al, 2014). And a phytochemical study revealed in this plant the presence of some compounds, such as tannins and flavonoids, with possible antioxidant activity and protein kinase inhibitors (PINHO, 2014). The literature shows that other species representing the Combretaceae family showed antimicrobial, antioxidant and anticancer activities, a fact that reveals a huge potential for further investigation of *L. racemosa*, considering that chemotaxonomic factors determine that species of the same family may possess similarities in phytochemical constitution and, consequently, biological activities (RAJABPOUR et al, 2019; SANTOS et al. 2018 SIMÕES et al. 2017; KATERERE et al. 2012).

In view of these possible biological activities and facing the high cost, therapeutic limitations and side effects evidenced with the drugs currently employed for the treatment of pathologies. The present study proposes an evaluation of the antioxidant, toxicity, anti-inflammatory and antimicrobial activities of the hydroalcoholic extract of *L. racemosa*.

## II. MATERIAL AND METHODS

### Reagents

Ethanol 100% (Vetec), methanol (Merck) heparin sodium 5.000 IU/mL (Cristalia), Evans blue (Sigma), HEMSTAB EDTA 15 g/dL (Labtest), ketamine hydrochloride (Vetbrands), xylazine hydrochloride (Vetbrands); Griess reagent (Sigma), iodized alcohol, 70% alcohol, 9% saline, PBS (Phosphate Buffered Saline), carragenina e LPS (lipopolissacarídeo bacteriano) indometacina, NaCl Mueller-Hinton (HIMEDIA®) resazurina dexametasona Broth Heart Infusion (HIMEDIA®), Folin-Ciocalteu (Merck) carbonato de sódio (Merck), ácido ascórbico (Merck), 2,2-Diphenyl-1-picrylhydrazyl (DPPH) (Merck), 2,2'-azino-bis(3-etilbenzotiazolona-6-ácido sulfônico) (ABTS) (Merck), butylated hydroxytoluene (Merck), cloreto de alumínio (Merck), acetato de sódio (Merck).

### Collecting plant material and obtaining extract from the leaves *Laguncularia racemosa*

The leaves of the species *L. racemosa* were collected in the mangrove of Tamandaré (8° 44' 54" South, 35° 6' 14" West), southern coast of the State of Pernambuco, identified and deposited in the Herbarium UFP- Geraldo Mariz, located in the center of Biocências of the Federal University of Pernambuco, with the accession number *Laguncularia racemosa* (Combretaceae); Soares, C. (01) UFP 83.203. Then, the plant material was dried in an oven (Tecnal, TE-393/1) at 45 °C for 48 hours, then ground in a knife mill (FRITSCH- Pulverisette 14) and sieved in a 80 mesh particle size range according to the methodology proposed by Melo et al. (2022).

To obtain the hydroalcoholic extract, 50 g of the plant material was used for 500 mL of ethanol/water solution 70% (v/v), in which it was macerated at room temperature for 48 hours, kept in amber glasses, under the shelter of sunlight and with occasional agitation. After that, this extractive material was filtered, concentrated in a rotary evaporator, under reduced pressure, at a temperature of 40-50°C and then lyophilized to obtain the hydroalcoholic extract of *Laguncularia racemosa* dry leaves. The yield of the extract was determined by Equation 1.

$$\text{Yield (\%)} = \left( \frac{\text{Mass of the extract obtained (g)}}{\text{Mass of leaves (g)}} \right) * 100\% \quad (1)$$

### Partial characterization of the hydroalcoholic extract by UV/Visible spectroscopy

#### Determination of total phenolic content

Total phenolic content was determined according to Nerys et al. (2022) and Royani et al. (2022) with modifications.

For this, 1 mL of extract at the concentration of 1000 µg/mL was added to 1 mL of Folin-Ciocalteu reagent (1/10 v/v) and allowed to react for 1 minute. Subsequently, 2 mL of sodium carbonate (2% w/v) was added to the system (extract + reagent), homogenized in vortex and incubated for 2 hours in the absence of light under ambient conditions (25°C). The samples were analyzed at a wavelength of 765 nm in a UV-vis spectrophotometer (Hewlett-Packard, model 8453).

The equipment blank was formed under the same conditions as the sample, using distilled water instead of the extract. After incubation, the total phenolic content of the extract was calculated using a curve prepared with standard gallic acid at different concentrations (3.12 -500 µg/mL). The total phenolic content was expressed as mg GAE (gallic acid equivalent) per g extract. The tests were performed in triplicate.

#### Determination of total flavonoid content

The assay for determination of total flavonoid content was performed according to the methodology proposed by Nerys et al. (2022) and Royani et al. (2022) with few modifications. The extract was diluted in 70% ethanol at a concentration of 1000 µg/mL. In a 10 mL volumetric flask, 1.0 mL of the extract solution, 1.0 mL of the 2% ethanol-aluminum chloride reagent was added and the volume was made up with ethanol. The absorbances were determined after 30 min at 425 nm in a spectrophotometer (Hewlett-Packard, model 8453). The equipment blank was formed under the same conditions as the sample, using water instead of the extract. After incubation, the total flavonoid content present in the extract was calculated using a curve with the quercetin standard at different concentrations (3.12 -500 µg/mL). The total flavonoid content was expressed as mg QE (quercetin equivalent) per g extract. The tests were performed in triplicate.

#### Determination of total flavonols content

The content of total flavonols in the hydroalcoholic extract was previously determined by Nerys et al. (2022) with modifications. The extract was diluted in 70% ethanol at a concentration of 1000 µg/mL. The assay consisted of 2 mL of extract, 2 mL of AlCl<sub>3</sub> (2%)/ethanol, and 3 mL of sodium acetate (50 g/L). The mixture was stirred and incubated for 2.5 h at 20°C. After this period, the absorbances were determined at 440 nm in a spectrophotometer (Hewlett-Packard, model 8453). The equipment blank was formed in the same proportions as the sample, using water instead of the extract. After incubation, the total flavonol content present in the extract was calculated using a quercetin curve at different concentrations (3.12 -500 µg/mL). The total flavonol content was expressed as mg QE (quercetin equivalent) per g extract. The tests were performed in triplicate.

#### Determination of total tannin content

**The total tannin content in the hydroalcoholic extract was previously determined by Nerys et al. (2022) and Maobe et al. (2022) with modifications.** The extract was diluted in 70% ethanol at a concentration of 1000 µg/mL. The assay consisted of 2 mL extract, 3 mL distilled water, 0.5 mL Folin-ciocalteu reagent. The system was reacted for 3 min. After this period, 1.5 mL of 17% sodium carbonate (Na<sub>2</sub>CO<sub>3</sub>) and 3 mL of distilled water were added, totaling 10 mL. The samples were homogenized and incubated in the dark for 2 hours. After this period, the absorbance of the samples was determined by a UV/Vis spectrophotometer (Hewlett-Packard, model 8453) at a wavelength of 725 nm. The equipment blank was formed in the same proportions as the sample, using water instead of the extract. After incubation, the total tannin content present in the extract was calculated using a curve using standard tannic acid prepared with standard quercetin at different concentrations (3.12 -500 µg/mL). The tannin content was expressed as mg TAE (tannic acid equivalent) per g extract. The tests were performed in triplicate.

#### In vitro antioxidant activity

The DPPH free radical scavenging activity was determined by the method described by Ita et al. (2022) and Nerys et al. (2022) with minor modifications. For the DPPH assay, 0.70 mL of sample or standard (ascorbic acid or BHT) extract with varying concentrations (0 to 1000 µg/mL) were added to the same volume of DPPH methanolic solution (100 µM). The mixtures were shaken vigorously and left to incubate for 20 minutes in the dark at room temperature. A decrease in absorbance was measured at 515 nm against a methanol blank without DPPH using a Hewlett-Packard spectrophotometer, model 8453. The absorbance measured for the control solution was in the range of 0.75 ± 0.01. The percentage of DPPH discoloration inhibition was calculated using Equation 2.

$$[\text{DPPH}](\%) = \left( \frac{\text{ABS control} - \text{ABS sample}}{\text{ABS control}} \right) \times 100 \quad (2)$$

Control ABS: is the absorbance of the control; sample ABS: absorbance of the samples at different concentrations.

#### ABTS method

ABTS radical scavenging activity was determined according to the method described by Ita et al. (2022) and Nerys et al. (2022) with some modifications. The ABTS + stock solution was produced by reacting the aqueous ABTS solution (7 mM) with 2.45 mM potassium persulfate aqueous solution in equal amounts and allowed to react for 12-16 h at room temperature in the dark. Then, 1 mL of ABTS + solution was mixed with 0.50 mL of the extract at

different concentrations (0 to 1000 µg/mL). The mixture was then incubated at room temperature for exactly 10 min in the dark. The control was prepared by mixing 1 mL of ABTS+solution with 0.50 mL of double-distilled water. The absorbance measured for the control solution was in the range of  $0.38 \pm 0.04$ . The percent elimination activity results were calculated as % inhibition using Equation 2. The experimental standards were ascorbic acid and BHT at the same concentrations as the extract. All experiments were performed in triplicate.

#### Determination of EC<sub>50</sub>

The amount of antioxidant required to decrease the initial concentration of DPPH or ABTS by 50%, called EC<sub>50</sub>, was determined from a non-linear fit, obtained graphically by plotting the concentration of the samples against the antioxidant capacity. Where, the higher the consumption of DPPH or ABTS by a sample, the lower its EC<sub>50</sub> and the higher its antioxidant activity.

#### Experimental animals

For the biological activity studies, 40 adult male Swiss albino mice (*Mus musculus*) weighing between 25 and 35g - from the bioterium of the Antibiotics Department of the Federal University of Pernambuco - were used. In addition, 48 albino *Mus musculus* mice of the Balb/c strain were used (6 to 8 weeks old), which were bred and maintained in the Keizo Asami Laboratory of Immunopathology (LIKA), also located in the Federal University of Pernambuco.

The animals were housed in polyethylene cages with stainless steel bars. They had free access to water and balanced feed (Labina/Presence), and were kept in an environment with a temperature of  $22 \pm 2^\circ\text{C}$  and controlled light providing a 12-hour light-dark cycle. All animals were submitted to fasting, with the withdrawal of the feed about 4 hours before the beginning of the experiment. However, during the experiment, the animals had free access to drinking water. The animals were kept according to the international guidelines of the Council for Experimental Laboratory Animals Council for Experimental Laboratory Animals (ICLAS).

#### Ethical Procedures

All experiments were performed according to the standards established by the Brazilian Society of Animal Science (SBCAL) and the standards established by the National Institute of Health Guide for the Care and Use of Laboratory Animals. This work was approved by the Ethics Committee on the Use of Animals of the Federal University of Pernambuco (CEUA-UFPE), under protocol number 23076.030374/2018-85. In addition, it is in accordance with current regulations in Brazil, especially Law 9.605 - art. 32

and decree 3.179 - art. 17, of 21/09/1999, which deals with the issue of animal use for scientific purposes.

#### Acute Toxicity Evaluation

The methodology recommended by the Organization for Economic Cooperation and Development Guideline 423 (OECD, 2001) was used for acute toxicology evaluation. Female mice (60 days old) were randomly assigned to two groups of three animals. A single dose was administered orally to the groups of test animals. The control group (n=3) received the vehicle water, the treated group (n=3) received the crude hydroalcoholic extract (EHA-Lr) at a dose of 2,000mg/kg.

The animals were observed for the first two hours and then every 24 hours daily for 14 days after administration of the extract. The evaluation was performed by the hypocratic screening method, in addition, weight, water and feed consumption were evaluated daily. On the 14th day, the animals were anesthetized with ketamine and xylazine (2:1; v/v) intraperitoneally to collect blood by cardiac puncture and perform hematological and biochemical tests. The liver, kidneys, spleen, brain, ovaries, lung, heart, and stomach were collected for micro and macroscopic analysis as well as to determine the relative weight of the organs.

Afterwards the whole experiment was repeated under the same initial conditions to confirm the results obtained. The results were analyzed and all parameters were evaluated in the same way and expressed as means between the groups. The relative weight of the organs was determined by Equation 3.

$$\text{Relative weight (\%)} = \left( \frac{\text{Organ weight (g)}}{\text{Animal weight (g)}} \right) * 100 \quad (3)$$

#### Anti-inflammatory activity

For the evaluation of the anti-inflammatory activity of the hydroalcoholic extract, the carrageenan-induced paw edema technique (Carrageenan-induced paw edema test) and LPS (bacterial lipopolysaccharide) described by Winter et al. (1962), Henriques et al, (1987) Hamad et al. (2019), Siraj et al. (2021) with modifications. Thus, the animals were divided into 5 groups containing one (n=8) animal per group, the groups generally received the substances orally, the groups treated with hydroalcoholic extract (EHA-Lr) at doses of 50, 100 and 200mg/kg. one. The standard used was indomethacin (non-steroidal anti-inflammatory drug) at a dose of 10 mg/kg. The negative control group received only water. One hour after treatment, inflammation was induced by an intra-plantar (i.pl.) injection of 50 µL of carrageenan (1%) in the right hind leg. The other leg of the animal was also analyzed for volume and compared to the paws that received the carrageenan. The paw volumes were measured

before induction by the flogging agent and after induction at 0.5, 1, 2, 3, 4, 5, and 6 hours after carrageenan. The volume of edema, in milliliters (mL), was recorded using a plethysmometer (Ugo Basile, Italy). The animal's hind paw was submerged up to the tibio-tarsal junction in the reading chamber of the device. The volume of fluid displacement was digitally recorded and corresponded to the volume of the paw. The results were expressed as the difference in volume (mL) between the foot that received carrageenan and the contralateral paw that did not receive carrageenan.

### LPS-induced acute lung inflammation

Forty-eight female Balb/c mice were divided into six groups of (n=8) animals: control group with saline solution (NaCl 0.9%); LPS group; LPS + dexamethasone group (0.5 mg/kg); LPS + hydroalcoholic extract of *L. racemosa* groups (50, 100 and 200 mg/kg). The animals received saline, dexamethasone or the extract, by gavage, and after 1 hour were challenged with 25  $\mu$ L of lipopolysaccharide (LPS 1 mg/mL saline) by intranasal instillation. Twenty-four hours after LPS challenge, the animals were euthanized by anesthetic overdose (ketamine 300mg/kg + xylazine 30mg/kg) and bronchoalveolar lavage was collected for leukocyte migration analysis. Following the protocols described by Lee et al. (2016), Daram et al. (2021) and Talwar et al. (2021) respectively.

### Bacterial strains and inoculum preparation

The strains tested included the species *Staphylococcus aureus* (UFPEDA 02), *Micrococcus luteus* (UFPEDA 100), *Bacillus subtilis* (UFPEDA 86), *Pseudomonas aeruginosa* (UFPEDA 416), *Serratia marcescens* (UFPEDA 352), *Escherichia coli* (UFPEDA 224) and *Enterococcus faecalis* (UFPEDA 138) from the microorganism collection of the Antibiotic Department of the Federal University of Pernambuco. To prepare the inoculum, the bacteria were cultured in Broth Heart Infusion (HIMEDIA®) plus 5% defibrinated sheep blood (Sigma) at 35°C for 24-48 hours. After incubation, the obtained colonies were suspended in sterile 0.9% NaCl solution and adjusted according to McFarland 0.5, corresponding to a concentration of 1.5 x 10<sup>8</sup> colony forming units CFU/mL (Stoppa et al. 2009).

### In vitro antimicrobial activity

The antibacterial activity of the hydroalcoholic extract of *L. racemosa* was quantitatively evaluated by the broth microdilution technique (CLSI, 2021). All samples were tested in triplicate and Erythromycin was used as an evaluation parameter, as a positive control and dimethylsulfoxide (DMSO) 5%, as a negative control. In the technique used, 100  $\mu$ L of Mueller-Hinton broth (HIMEDIA®) was pipetted into each well of the microtiter plate. Then, 100  $\mu$ L of the stock solution of the hydroalcoholic extract was added to the first well, with

subsequent homogenization, followed by serial dilutions to obtain the 8 final concentrations for the hydroalcoholic extract (0.23 to 30 mg/mL). Then, the plates were incubated for 24 hours to determine the Minimum Inhibitory Concentration (MIC). After incubation, the plates were read, using the bacterial growth developer resazurin (0.01 mg/mL) was added to all wells, followed by incubation for 1 hour and subsequent reading of the plates (Cortinhas et al. 2013). The minimum inhibitory concentrations were considered those capable of inhibiting the growth of the microorganism in 90% of the bacterial isolates. The experiments were performed in triplicate. The standard drug used was streptomycin, under the same conditions as the hydroalcoholic extract of *L. racemosa*.

### Statistical analysis

The carrageenan-induced paw edema experiments were statistically evaluated statistically evaluated by two-way analysis of variance (ANOVA) followed by Bonferroni test with 95% confidence interval, using Graph Pad prism 5.0 software. Values of "p" less than 0.05 (p<0.05) were considered as indicative of significance. The others experiments were statistically evaluated by one-way analysis of variance (ANOVA), followed by the Newman-Keuls test with a 99% confidence interval, using Graph Pad Prism 7.0 software. P-values less than 0.01 (p<0.01) were considered indicative of significance as indicative of significance. In parallel, the antimicrobial activity (MIC) data obtained were plotted using Microsoft Excel® version 2010.

## III. RESULTS AND DISCUSSION

### Yield of obtaining the hydroalcoholic extract and partial characterization by UV/Visible spectroscopy

The yield of the hydroalcoholic extract obtained from the leaves of *L. racemosa* was 12.7% a value close to that obtained by Soares (2018) who evaluating the same extract obtained a yield of 10.47%. Knowing the constituents of the hydroalcoholic extract of *L. racemosa* is an important step for possible applications. In table 1 presents the total contents of phenols, flavonoids, flavonols, and tannins respectively.

Table 1. Content of phenolics, flavonoids, flavonols and tannic acid determined by UV/Vis spectroscopy present in the hydroalcoholic extract.

| Constituents                              | Hydroalcoholic Extract |
|-------------------------------------------|------------------------|
| Total Phenolic Content (mg EGA/g extract) | 445,4 ± 0,1            |
| Total Flavonoid Content (mg EQ/g extract) | 247,2 ± 0,9            |
| Total Flavonols content (mg EQ/g extract) | 155,7 ± 1,9            |
| Tannin content (mg ETA/g extract)         | 34,7 ± 0,8             |

Average ± standard deviation. EAG: gallic acid equivalent. EQ: quercetin equivalent. ETA: tannic acid equivalent.

Few works are reported in the literature performing the characterization of the hydroalcoholic extract of *L. racemosa*. Among these are those performed by Soares

(2018) who verified the presence of total phenols, tannins, flavonoids and coumarins and quantitatively presented total phenols and tannins content of  $128.24 \pm 2.6$  and  $113 \pm 0.43$  mg EAT/g, respectively, of flavonoids  $85.75 \pm 7.19$  mg ER/g and coumarins  $226.36 \pm 8.7$  mgEC/g. In addition, Rodrigues et al. (2015), Mendes et al. (2018) and Costa et al. (2021) identified different phenolic compounds present in *L. racemosa* extract.

#### In vitro antioxidant activity

Extracts of different plants are described in the literature as good antioxidant agents. In many cases this activity is directly related to the presence phenolic constituents present (Wang et al. 2021; Xu et al. 2021). Phenolic compounds act as radical scavengers and sometimes as metal chelators, acting at both the initiation and propagation stages of the oxidative process Wang et al. (2021). Figure 1 shows the antioxidant activity curves promoted by hydroalcoholic extract of *L. racemosa* at different concentrations for DPPH (A) and ABTS (B) assays respectively.

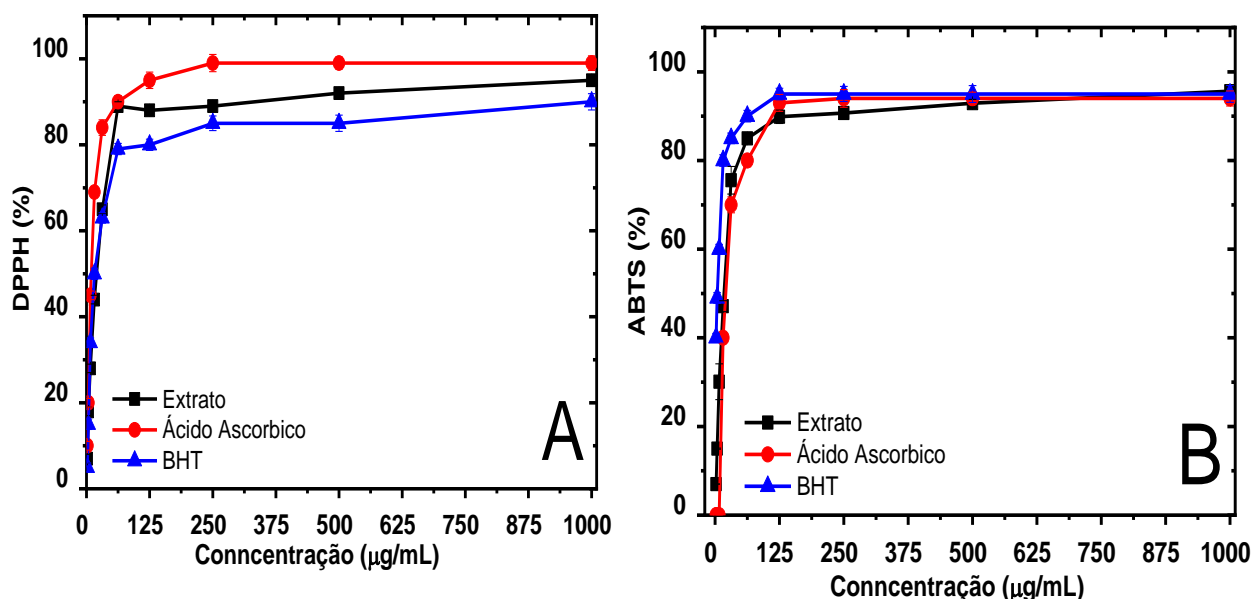


Fig.1. Antioxidant activity promoted by hydroalcoholic extract of *L. racemosa* by in vitro DPPH (A) and ABTS (B) methods at different concentrations compared to ascorbic acid and butylated hydroxytoluene (BHT) standards, respectively.

The results presented in Figure 1 show that the extract promotes increased antioxidant activity with increasing concentration for both activity assays. Similar profile were obtained by Ahmed et al. (2014), Kaneria et al. (2018) and Bui et al. (2021) evaluating different extracts of plants belonging to the Combretaceae family. Through the

obtained curves it was possible to determine the EC50 values (concentration capable of capturing radicals by 50%) for the extract for each of the assays. Table 2 shows the EC50 values for the extract and for the standards ascorbic acid and butylated hydroxytoluene (BHT).

Table 2. EC50 results for *L. racemosa* hydroalcoholic extract and for ascorbic acid and butylated hydroxytoluene (BHT) standards against DPPH and ABTS assays

| Samples                        | DPPH                     | ABTS EC <sub>50</sub> (µg/mL) |
|--------------------------------|--------------------------|-------------------------------|
|                                | EC <sub>50</sub> (µg/mL) |                               |
| <i>L. racemosa</i> extract     | 41,90 ± 3,15             | 21,78 ± 0,5                   |
| Ascorbic Acid                  | 18,97± 0,4               | 5,24 ± 0,1                    |
| Butylated Hydroxytoluene (BHT) | 7,75 ± 0,1               | 13,37± 0,01                   |

Average ± Standard Deviation

The results presented in Table 2 show that the hydroalcoholic extract presented lower results when compared to the evaluated standards. This fact indicates that the extract presents moderate antioxidant activity in vitro. Moreover, it showed better results for the ABTS radical scavenging assays when compared to the DPPH assay.

This better result may be related to the versatility of the ABTS radical scavenging method when compared to the DPPH radical scavenging assay, since the latter shows better results when the molecules evaluated are polar, while the ABTS assay evaluates polar and apolar compounds at the same time (Floegel et al. 2011; Schaich et al. 2015). Similar data to those expressed in Table 2 were found by Ibrahim and collaborators (2022), of which their DPPH showed IC 50 of 50.3 µg/ml for mangrove ethyl acetate extract (MEE).

Similar results were obtained by Ahmed et al. (2014) obtained mean EC 50 values of the extracts for DPPH and ABTS antioxidant assays ranging from 0.21 - 12 µg/mL (*Combretum padoides*), 0.25 - 16 µg/mL (*Combretum vendae*), 0.33-9.41 µg/mL (*Combretum woodii*) and 4, 97-85 µg/mL (*Combretum bracteosum*), respectively, while the mean EC 50 values for the positive controls ascorbic acid and trolox were 1.28 - 1.51 and 1.02-1.19 µg/mL, respectively. All crude extracts inhibited lipid peroxidation of linoleic acid by more than 80% at the concentration of 64 µg/mL.

Awotunde et al. (2017) evaluating the Hydroethanol and Saponin fractions from Terminalia schimperiana root found that the polar hydroethanol fraction showed potent DPPH

antioxidant activity with EC50 value of 19.36± 0, 436 µg/mL and ABTS elimination activity with EC50 value of 0.9420 ± 0.011 µg/mL, while the Saponin fraction has moderate DPPH elimination activity with EC50 of 59.33 ± 0.417 µg/mL and moderate ABTS elimination activity with EC50 value of 2.273 ± 0 µg/mL.

Sousa et al. (2021) performing different antioxidant assays, found that the intermediate fraction of the stem bark (28.5 ± 0.60 µg/mL) and the ethyl acetate fraction of the leaves (40 ± 0, 56 µg/mL) showed higher % inhibition of DPPH free radical activity, while the intermediate stem bark fraction (27.5 ± 0.9 µg/mL) and the hydromethanol fraction of the leaves (81 ± 1.4 µg/mL) demonstrated inhibition of the ABTS free radical. These results show that the hydroalcoholic extract of *L. racemosa* can be used as a promising antioxidant agent.

#### Acute Toxicity Evaluation

The results of the toxicity assays showed that the hydroalcoholic extract of *L. racemosa* was not able to promote signs of toxicity and mortality within a period of 14 days after administration of the extract. The lethal dose, 50% (LD50) of this extract was estimated to be above 2000 mg/kg. Furthermore, the results indicated no statistically significant differences between control and extract treated mice in the amount of food, weight, water consumed and the relative weight of different organs (lung, ovary, brain, heart, kidney, liver, spleen and stomach) as presented in Table 3.

Table 3. Ponderal evolution, water and feed consumption, and relative weight of the organs of mice in the control group and the group treated with hydroalcoholic extract of *L. racemosa* leaves at a dose of 2,000 mg/kg.

| Parameters                           | Control        | EHA-L.r        |
|--------------------------------------|----------------|----------------|
| Initial weight (g)                   | 25,1 ± 1,58    | 24,7 ± 1,81    |
| Final weight (g)                     | 36,0 ± 1,08    | 34,4 ± 2,67    |
| Water consumption per animal (mL)    | 10,67 ± 0,95   | 11,20* ± 0,74* |
| Feed consumption per animal (g)      | 5,69 ± 0,41    | 6,49* ± 0,18*  |
| <b>Relative weight of organs (%)</b> | <b>Control</b> | <b>EHA-L.r</b> |
| Lung                                 | 9,70 ± 0,46    | 9,04 ± 0,37    |
| Ovary                                | 0,04 ± 0,01    | 0,03 ± 0,01    |
| Brain                                | 4,17 ± 0,46    | 4,09 ± 0,33    |
| Heart                                | 1,82 ± 0,26    | 1,58 ± 0,42    |
| Kidney                               | 6,00 ± 0,64    | 6,27 ± 0,69    |
| Liver                                | 56,00 ± 0,64   | 53,15 ± 5,86   |
| Spleen                               | 6,27 ± 0,69    | 7,30 ± 0,85    |
| Stomach                              | 10,27 ± 0,69   | 10,01 ± 0,47   |

Mean ± Standard Deviation; \*p<0.05. Significant after two-way analysis of variance (ANOVA) followed by Bonferroni test with 95% confidence interval when compared to the control group.

In addition to weight, water consumption, food consumption, and relative organ weight, the effects of the hydroalcoholic extract of *L. racemosa* on biochemical and hematological parameters were analyzed. These results are presented in Table 4.

Table 4. Biochemical and hematological parameters of the control and treated groups with hydroalcoholic extract of *Laguncularia racemosa* in acute toxicity at a dose of 2,000 mg/kg.

| Biochemical parameters          | Control        | EHA-L.r        |
|---------------------------------|----------------|----------------|
| ng/dL                           | : 9,73         | : 7,33         |
| ine (mg/dL)                     | 0,03           | : 0,06         |
| J/L)                            | ± 63,3         | ± 24,6         |
| l/L)                            | : 9,50         | : 23,6         |
| e Phosphatase (U/L)             | ± 36,7         | ± 30,1         |
| Total (g/dL)                    | : 1,12         | : 0,52         |
| n (g/dL)                        | : 0,26         | : 0,21         |
| ε (mg/dL)                       | ± 10,8         | : 9,29         |
| <b>Hematological Parameters</b> | <b>Control</b> | <b>EHA-L.r</b> |
| RBC (mm <sup>3</sup> )          | : 0,33         | : 0,41         |
| Hemoglobin (g/dL-1)             | ± 0,03         | : 0,05         |
| Hematocrit (%)                  | ,31            | ,46            |
| MCV (fL)                        | : 0,05         | : 0,07         |



|                           |          |          |
|---------------------------|----------|----------|
| MCHC (pg)                 | ± 0,07   | ± 0,01   |
| MCHC (%)                  | ± 0,32   | ± 0,28   |
| Platelets (mm3)           | 3 ± 0,26 | 3 ± 0,21 |
| Total Leukocytes (mm3)    | : 0,48   | : 0,29   |
| Segmented neutrophils (%) | 40       | 45       |
| Eosinophils (%)           | 01       | 04       |
| Lymphocytes (%)           | 57       | 50       |
| Monocytes (%)             | 02       | 01       |

Mean ± Standard Deviation; \*p<0.05. Significant after two-way analysis of variance (ANOVA) followed by Bonferroni test with 95% confidence interval when compared to the control group.

Biochemical and hematological parameters remained in the normal range, with no statistically significant difference between the mice in the EHA-Lr treated and untreated groups (Table 3). Non-significant levels of toxicity of other hydroalcoholic extracts obtained by different species of the Combretaceae family in animal models have been described in the literature.

Kpemissi et al. (2020) evaluating the toxicity of the hydroalcoholic extract of *Combretum micranthum* found that during the acute toxicity assay, no mortality or adverse effects were observed at the dose of 5,000 mg/kg. Daram et al. (2021) evaluating the ethanolic extract of *Terminalia catappa*, found that during the 14-day observation period, no adverse symptoms were found without any mortality for the maximum dose administered during the study (4,000 mg/kg). Similar results were obtained by Vilegas et al. (2018) who evaluating the hydroethanolic extract of *Terminalia argentea* Mart. Leaves found that the doses of 1000 and 2000 mg/kg did not alter the weight gain of mice over the 14-day period nor did it alter the relative weight of the organs analyzed. No macroscopic changes were observed in the organs analyzed.

Jayesh et al. (2017), demonstrated low toxicity for *Terminalia bellirica* (Gaertn.) extract. Meanwhile, a review on the toxicity of *Terminalia sericea* Burch. ex DC. evidenced that some compounds and extracts of this plant had moderate toxicity (Mongalo et al. 2016).

Moreover, the cited studies show that the evaluated extracts were not able to promote changes in biochemical and hematological parameters of different animals. These findings thus reinforce the importance of pharmacological research on representatives of this family.

#### Carrageenan-induced paw edema test

The results of the carrageenin-induced paw edema test were presented in Figure 2. The animals that received the intraplantar injection of carrageenan demonstrated the

induction of edema, which was evidenced by the increase in volume of the paws that received the stimulus being analyzed at different time intervals. The group of animals pre-treated only with the vehicle (water) showed extremely significant edema when compared to indomethacin and to all doses of the extract EHA-Lr at all corresponding times. The extract EHA-Lr in all doses tested proved to be efficient in reducing the edema provoked by carrageenan at all observed times.

In this mouse model of paw edema, the extract EHA-Lr significantly reduced edema volume and showed superior inhibition compared to indomethacin. The paw edema induced by carrageenan in rats is associated with the synthesis of mediators involved in the inflammatory process (Farça et al. 2001; Hamad et al. 2019; Sharma et al. 2020). Among these we can highlight some of the most relevant ones such as: histamine, serotonin, bradykinin, nitric oxide and prostaglandins, whose release is closely related to the chemotaxis process of cells in particular leukocytes to the inflammatory sites (Farça et al. 2001; Hajare et al. 2001).

Although the carrageenan-induced paw edema model is more resistant in mice, this logistic agent is also capable of inducing edema formation. Studies have shown that albumin in mice demonstrates extravasation for more than 24 hours after its stimulation (Henriques et al. 1987; Farça et al. 2001; Hajare et al. 2001; Hamad et al. 2019; Siraj et al. 2021). The paw edema performed in mice can be described through two very distinct phases characterized as follows: the 1st phase corresponding to (0 - 24 hours) after the inflammatory stimulus, and the 2nd phase (after 24 hours). In the initial period corresponding to the 1st phase a predominance of neutrophils occurs, they in turn have the ability to release inflammatory agents such as histamine, bradykinin, serotonin, and prostaglandins (Henriques et al. 1987; Farça et al. 2001; Hajare et al. 2001; Hamad et al. 2019; Siraj et al. 2021).

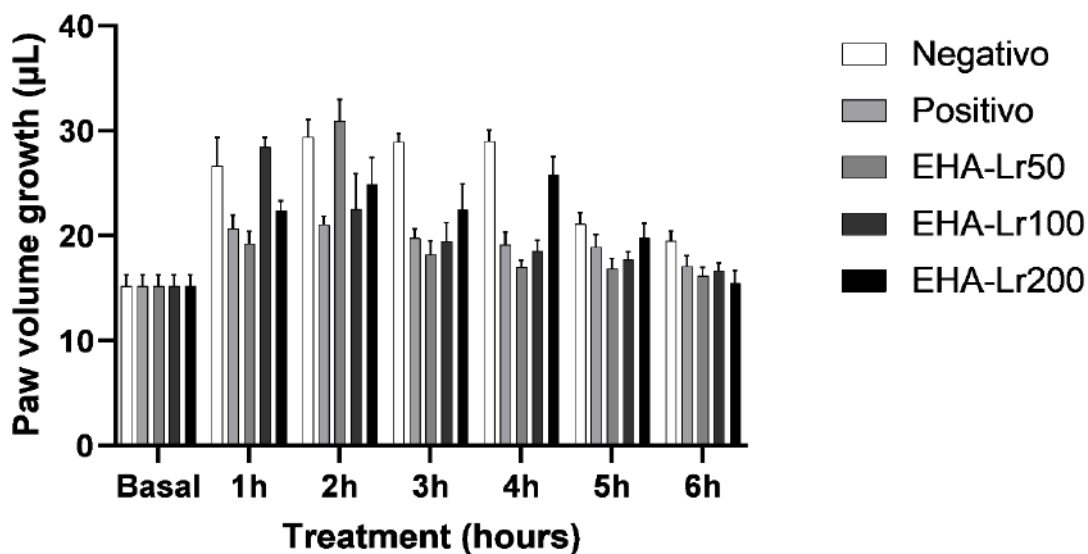


Fig.2.Effect of EHA-Lr extract (50, 100 and 200mg/kg, v.o) and indomethacin (10mg/kg, v.o) on paw edema formation in mice. Mean ± Standard Deviation; \*p<0.05. Significant after two-way analysis of variance (ANOVA) followed by Bonferroni test with 95% confidence interval when compared to the control group.

The mechanism by which the inhibition of edema formation occurs is directly linked to the synthesis of PGs, and is compatible with the action generated by drugs classified as nonsteroidal anti-inflammatory drugs (NSAIDs), where the cyclooxygenases pathway is involved.

Hydroalcoholic extracts of different species belonging to Combretaceae family. Sharma et al. (2020) found that using the ethanolic extract of the stem bark of Anogeissus latifolia prevented paw volume increase in both in vivo models with percentage of inhibition of 44.40 and 46.21, respectively at 5 hours. To this end, Hamad and colleagues (2019) found that the ethanolic extract of Combretum aculeatum Vent at a concentration of 400 mg/kg decreased paw edema (only 32 ± 1.9% increase in

paw weight after 4 hours) compared to indomethacin (28.6 ± 2.5%). Similar results to the current study (Figure 2), were obtained by Siraj et al. (2021) evaluating the anti-inflammatory effect of Terminalia myriocarpa ethanolic extract in paw edema trials found that doses of 250 and 500 mg/kg were able to reduce edema and showed promising results when compared to carrageenan. These results show that the extracts obtained from different species belonging to the Combretaceae family are able to reduce paw edema in different animals.

**LPS-induced acute lung inflammation**

Figure 3 presents the results of the effect of EHA-Lr extract (50, 100 and 200mg/kg, v.o) and dexamethasone (0.5mg/kg, v.o) on leukocyte migration in acute lung inflammation.

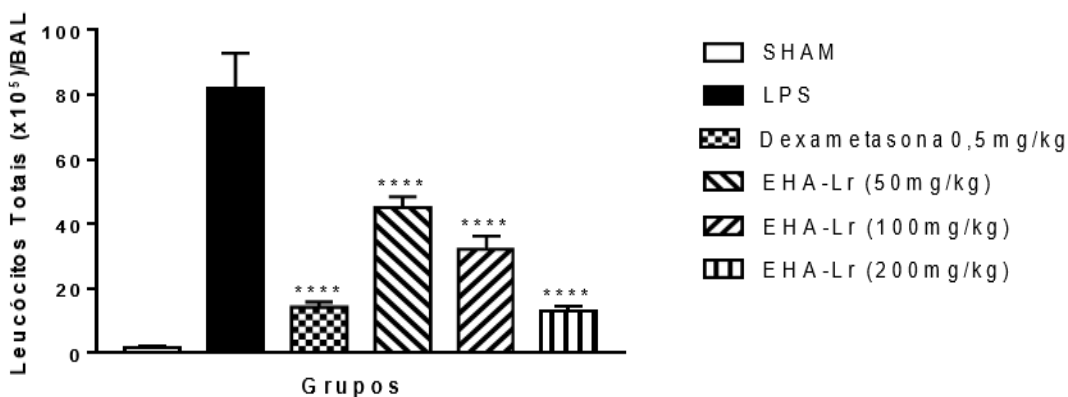


Fig.3. Effect of EHA-Lr extract (50, 100 and 200mg/kg, v.o) and dexamethasone (0.5mg/kg, v.o) on leukocyte migration in acute lung inflammation.

EHA-Lr extract has been shown to significantly reduce the migration of polymorphic nucleated leukocytes in the

brochoalveolar lavage of animals subjected to LPS-induced acute lung inflammation. According to Liang et al. (2018) LPS is the main activator of inflammatory cells, being further responsible for the induction of neutrophils and active participation in the production and release of inflammatory cytokines, stating that the reduction of these inflammatory cytokines exerts proven therapeutic effects.

The reduction in the amount of leukocytes in the inflammatory brochoalveolar exudate when compared to the values found in the vehicle group and the group that received the reference drug (dexamethasone 0.5mg/kg, v.o.). It was also observed that the reduction of leukocyte migration in the brochoalveolar lavage in the model of acute lung inflammation was closely related to the dose used of EHA-Lr extract because the higher the dose used the greater was the reduction in the number of cells observed.

For Gao et al. (2020), pleurisy is associated with pleural inflammation and oxidative stress. The injury produced in the lungs and the inflammatory induction by carrageenan increases the levels of inflammatory cell exudates, protein leakage, and the pro-inflammatory mediators themselves. Similar results to those presented in figure 3 were obtained by Moreira et al. (2020), who found that treatment with *T. argentea* extract was able to reduce total protein production after stimulation with LPS, especially when the 300 mg/kg concentration was used, when compared to the other concentrations (5 and 60 mg/kg) or vehicle. Furthermore, according to the reduction of total proteins in the pleurisy process ascertained, the plant extract at the highest concentration (300 mg/kg), reduced the number of neutrophils and mononuclear cells at the same site. To a lesser extent, a reduction in the number of neutrophils was observed in mice treated with 5 and 60 mg/kg of the plant extract, when compared to those that received vehicle alone.

Other studies using the same pleurisy model, such as that of Silva-Balin et al. (2018), also demonstrated anti-inflammatory activity at 300 mg/kg, however, the authors used an ethanolic extract obtained from the fruit of *Bromelia balansae*. According to Shorkry and colleagues (2022), the induction of acute inflammation in vivo by LPS provides significant data for evaluating the pharmacological activity

of extracts. The same highlights that Ivy ethanolic extract at 200mg/kg especially decreased LPS-induced pro-inflammatory mediators and oxidative stress. Thus, corroborating with the findings of this study (Figure 3), considering that the EHA-Lr extract at 200mg/kg reduced the number of neutrophils as much as its treatment with dexamethasone.

In another study, Daram et al. (2021) evaluating the ethanolic extract of *Terminalia catappa* found that at the concentration of 500 mg/kg it was able to promote the decrease in total leukocyte count, lymphocyte count and myeloperoxidase enzyme activity. To this end, the granulocyte count was increased in almost all three treatments and the percentage data of total leukocyte, granulocyte, and MPO activity. Thus, the anti-inflammatory potential without causing acute toxicity of extracts from medicinal plants, such as those reported in this study, may contribute to new pharmaceutical applications.

Thus, murine models provide suitable frameworks for studying the anti-inflammatory activity of medicinal plants, mainly by counting cell migration during a stimulation of an inflammation-inducing agent. In this context, Talwar et al. (2021) found that the aqueous extract of *Terminalia paniculata* (400 mg/kg) also reduced carrageenan-induced leukocyte migration ( $50.92 \pm \pm \pm 5.24\%$ ) in exudates found due to stimulation with LPS. These results show that the hydroalcoholic extract of *Laguncularia racemosa* has promising anti-inflammatory activity for the treatment of lung inflammation.

#### **In vitro antibacterial activity**

The results of antibacterial activity showed that the extract EHA-Lr proved to be very effective in inhibiting bacterial growth with considerably satisfactory values, being able to inhibit the growth of *Micrococcus luteus* strain (UFPEDA 100). The other strains showed moderate to low results when compared to the erythromycin control (Table 5). The mechanisms of antimicrobial activity promoted by different extracts are not yet well elucidated, however, it is known that phenolic compounds are responsible for the in vitro activity (Puupponen-Pimiä et al. 2001; Gomes et al. 2022).

Table 5. Determination of the minimum inhibitory concentration of EHA-Lr against the tested bacterial strains

Nd: Not determined of the evaluated concentrations 0.23 to 30mg/mL

| Microorganisms                             | Erythromycin<br>(mg/mL) | EHA-L.r (mg/mL) |
|--------------------------------------------|-------------------------|-----------------|
| <i>Staphylococcus aureus</i> (UFPEDA 02)   | 0,6                     | 7,5             |
| <i>Micrococcus luteus</i> (UFPEDA 100)     | 0,6                     | 0,93            |
| <i>Bacillus subtilis</i> (UFPEDA 86)       | 1,2                     | 7,5             |
| <i>Pseudomonas aeruginosa</i> (UFPEDA 416) | Nd                      | 3,75            |
| <i>Serratia marcescens</i> (UFPEDA 352)    | 0,6                     | 3,75            |
| <i>Escherichia coli</i> (UFPEDA 224)       | 1,2                     | 3,75            |
| <i>Enterococcus faecalis</i> (UFPEDA 138)  | 0,3                     | 3,75            |

Philomène-Kokora (2013) found that the ethanolic and aqueous extracts of *Terminalia mantaly* H. Perrier (Combretaceae) show inhibitory activity on all tested strains (*Escherichia coli* and *Staphylococcus aureus*). The inhibitory diameters ranged from 7.66 mm to 35 mm. The Minimum Inhibitory Concentrations (MIC) of the extracts ranged from 0.78 mg/mL and 2.5 mg/mL. The ethanolic extracts inhibit the growth of bacteria at lower concentrations than the aqueous extracts.

Kuet et al. (2010) when evaluating the antimycobacterial, antimicrobial and antifungal activities of a species from the same family found that individuals belonging to the combretaceae family have excellent minimum inhibitory concentration values for bacterial strains such as: *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Escherichia coli*. Anokwuru et al. (2021) evaluated the broad-spectrum antibacterial potential of methanolic extracts of species representing four genera of Combretaceae (*Combretum*, *Pteleopsis*, *Quisqualis*, *Terminalia*). They found that these were more active against *Bacillus cereus* and *Salmonella typhimurium* strains, with mean MIC values of 0.70 mg/mL, 0.52 mg/mL and 0.45 mg/mL, respectively. These findings show that the hydroalcoholic extract of *Laguncularia racemosa* has promising anti-inflammatory activity for the treatment of bacterial inflammation.

#### IV. CONCLUSION

The hydroalcoholic extract of *Laguncularia racemosa* showed moderate antioxidant and antibacterial activity in vitro. Regarding anti-inflammatory activity, it was able to reduce paw edema in mice and prevent acute lung inflammation. The results obtained in this study provide supportive data for the use of *Laguncularia racemosa* for therapeutic purposes.

#### V. CONFLICTS OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

#### ACKNOWLEDGMENTS

The authors thank CNPQ and CAPES for the structural and financial support to this work.

#### REFERENCES

- [1] Ahmed, A. S., McGaw, L. J., Elgorashi, E. E., Naidoo, V., & Eloff, J. N. (2014). Polarity of extracts and fractions of four Combretum (Combretaceae) species used to treat infections and gastrointestinal disorders in southern African traditional medicine has a major effect on different relevant in vitro activities. *Journal of Ethnopharmacology*, 154(2), 339-350.
- [2] Ahmed, A. S., McGaw, L. J., Elgorashi, E. E., Naidoo, V., & Eloff, J. N. (2014). Polarity of extracts and fractions of four Combretum (Combretaceae) species used to treat infections and gastrointestinal disorders in southern African traditional medicine has a major effect on different relevant in vitro activities. *Journal of Ethnopharmacology*, 154(2), 339-350.
- [3] Albuquerque Nerys, L. L., Jacob, I. T. T., da Silva, A. R., de Oliveira, A. M., da Rocha, W. R. V., Pereira, D. T. M., ... & de Lima, M. D. C. A. (2022). Photoprotective, biological activities and chemical composition of the non-toxic hydroalcoholic extract of *Clarisia racemosa* with cosmetic and pharmaceutical applications. *Industrial Crops and Products*, 180, 114762.
- [4] Anokwuru, C. P., Sandasi, M., Chen, W., van Vuuren, S., Elisha, I. L., Combrinck, S., & Viljoen, A. M. (2021). Investigating antimicrobial compounds in South African Combretaceae species using a biochemometric approach. *Journal of Ethnopharmacology*, 269, 113681.
- [5] Awotunde, O. S., Dhanabal, S. P., Rajeshkumar, R., & Chasitainya, M. V. N. L. (2017). Antioxidant activities of

- Hydro-ethanol and Saponin extracts of Terminalia schimperiiana root.
- [6] Bui, N. T., Pham, T. L. T., Nguyen, K. T., Le, P. H., & Kim, K. H. (2021). Effect of Extraction Solvent on Total Phenol, Flavonoid Content, and Antioxidant Activity of *Avicennia Officinalis*.
- [7] Costa, F. D. N., Jerz, G., Hewitson, P., Figueiredo, F. D. S., & Ignatova, S. (2021). Laguncularia racemosa phenolics profiling by three-phase solvent system step-gradient using high-performance countercurrent chromatography with off-line electrospray mass-spectrometry detection. *Molecules*, 26(8), 2284.
- [8] Daram, P., Jitta, S. R., Shreedhara, C. S., Misra, C. S., Gourishetti, K., & Lobo, R. (2021). Investigation of anti-inflammatory and anti-arthritis potentials of Terminalia catappa bark using in vitro assays and carrageenan-induced inflammation, complete Freund's adjuvant induced arthritis model in rats. *South African Journal of Botany*, 141, 313-321.
- [9] Daram, P., Jitta, S. R., Shreedhara, C. S., Misra, C. S., Gourishetti, K., & Lobo, R. (2021). Investigation of anti-inflammatory and anti-arthritis potentials of Terminalia catappa bark using in vitro assays and carrageenan-induced inflammation, complete Freund's adjuvant induced arthritis model in rats. *South African Journal of Botany*, 141, 313-321.
- [10] de Araújo Moreira, M. D. R., Sales-Campos, H., Fontanari, C., Meireles, A. F. G., Prado, M. K. B., Zoccal, K. F., ... & Faccioli, L. H. (2020). The ethanolic extract of Terminalia argentea Mart. & Zucc. bark reduces the inflammation through the modulation of cytokines and nitric oxide mediated by the downregulation of NF- $\kappa$ B. *Journal of Ethnopharmacology*, 261, 113150.
- [11] do Nascimento Santos, D. K., de Melo, C. M. L., da Silva, E. M., de Almeida, V. S., da Cruz Filho, I. J., de Souza Lima, G. M., ... & Vieira, J. R. C. (2021). Investigation of Nutritional Contents, Antioxidant and Immunostimulatory Activities of Aqueous Extract from Laguncularia racemosa Leaves. *The Natural Products Journal*, 11(2), 231-243.
- [12] Floegel, A., Kim, D. O., Chung, S. J., Koo, S. I., & Chun, O. K. (2011). Comparison of ABTS/DPPH assays to measure antioxidant capacity in popular antioxidant-rich US foods. *Journal of food composition and analysis*, 24(7), 1043-1048.
- [13] Gao, Y., Lv, X., Yang, H., Peng, L., & Ci, X. (2020). Isoliquiritigenin exerts antioxidative and anti-inflammatory effects via activating the KEAP-1/Nrf2 pathway and inhibiting the NF- $\kappa$ B and NLRP3 pathways in carrageenan-induced pleurisy. *Food & function*, 11(3), 2522-2534.
- [14] Gomes, L., Monteiro, P., Cotas, J., Gonçalves, A. M., Fernandes, C., Gonçalves, T., & Pereira, L. (2022). Seaweeds' pigments and phenolic compounds with antimicrobial potential. *Biomolecular Concepts*, 13(1), 89-102.
- [15] Hamad, K. M., Sabry, M. M., Elgayed, S. H., El Shabrawy, A. R., El-Fishawy, A. M., & Jaleel, G. A. A. (2019). Anti-inflammatory and phytochemical evaluation of Combretum aculeatum Vent growing in Sudan. *Journal of ethnopharmacology*, 242, 112052.
- [16] Ibrahim, H. A., Abdel-Latif, H. H., & Zaghloul, E. H. (2022). Phytochemical composition of Avicennia marina leaf extract, its antioxidant, antimicrobial potentials and inhibitory properties on Pseudomonas fluorescens biofilm. *The Egyptian Journal of Aquatic Research*, 48(1), 29-35.
- [17] Ita, B. N., & Eduok, S. I. (2022). In vitro antioxidant and antifungal activities of Rhizophora racemosa GFW Mey. stem bark extracts. *Scientific African*, 15, e01091.
- [18] Kaneria, M. J., Rakholiya, K. D., Marsonia, L. R., Dave, R. A., & Golakiya, B. A. (2018).
- [19] Nontargeted metabolomics approach to determine metabolites profile and antioxidant study of Tropical Almond (Terminalia catappa L.) fruit peels using GC-QTOF-MS and LC-QTOF-MS. *Journal of Pharmaceutical and Biomedical Analysis*, 160, 415-427.
- [20] Kpemissi, M., Metowogo, K., Melila, M., Veerapur, V. P., Negru, M., Taulescu, M., ... & Aklikokou, K. (2020). Acute and subchronic oral toxicity assessments of Combretum micranthum (Combretaceae) in Wistar rats. *Toxicology reports*, 7, 162-168.
- [21] Maobe, M. A. G., Gitu, L., & Gatebe, E. (2022). Evaluation of total content phenolic, flavonoid and tannin of herbs used in treatment of ailments in Kisii and Nyamira Counties region, Kenya. *Herbal Medicines Journal (Herb Med J)*, 7(1).
- [22] Melo, C. M. L. D., Sousa, G. F. D., Silva, G. A. D. S., Silva, R. S. D., Bezerra Júnior, N. D. S., Santos, D. K. D. D. N., ... & Cruz Filho, I. J. D. (2022). Pectin-like Polysaccharide Extracted from the Leaves Caesalpinia pulcherrima is a Promising Antioxidant and Immunomodulator Agent. *Brazilian Archives of Biology and Technology*, 65.
- [23] Mendes, R. J. D. A., Pereira Filho, A. A., Nogueira, A. D. J. L., Araújo, K. R. F., França, C. R. C., Carvalho, I. B. D., ... & Rosa, I. G. (2018). Evaluation of molluscicidal activity of three mangrove species (Avicennia schaueriana, Laguncularia racemosa and Rhizophora mangle) and their effects on the bioactivity of Biomphalaria glabrata Say, 1818. *Revista do Instituto de Medicina Tropical de São Paulo*, 60.
- [24] Philomène KOKORA, A. (2013). Antibacterial activity of ethanolic and aqueous extracts of four medicinal plants on the in vitro growth of escherichia coli and staphylococcus aureus. *Journal of Drug Delivery and Therapeutics*, 3(3), 113-116.
- [25] Puupponen-Pimiä, R., Nohynek, L., Meier, C., Kähkönen, M., Heinonen, M., Hopia, A., & Oksman-Caldentey, K. M. (2001). Antimicrobial properties of phenolic compounds from berries. *Journal of applied microbiology*, 90(4), 494-507.
- [26] Rodrigues, C. F. B., Gaeta, H. H., Belchor, M. N., Ferreira, M. J. P., Pinho, M. V. T., de Oliveira Toyama, D., & Toyama, M. H. (2015). Evaluation of potential thrombin inhibitors from the white mangrove (Laguncularia racemosa (L.) CF Gaertn.). *Marine Drugs*, 13(7), 4505-4519.
- [27] Royani, A., Hanafi, M., Julistiono, H., & Manaf, A. (2022). The total phenolic and flavonoid contents of Aloe vera and Morinda citrifolia extracts as antibacterial material against Pseudomonas aeruginosa. *Materials Today: Proceedings*.
- [28] Schaich, K. M., Tian, X., & Xie, J. (2015). Hurdles and pitfalls in measuring antioxidant efficacy: A critical

- evaluation of ABTS, DPPH, and ORAC assays. *Journal of functional foods*, 14, 111-125.
- [29] Sharma, V. C., Kaushik, A., Dey, Y. N., Srivastava, B., Wanjari, M., & Jaiswal, B. (2020). Analgesic, anti-inflammatory and antipyretic activities of ethanolic extract of stem bark of *Anogeissus latifolia* Roxb. *Clinical Phytoscience*, 6(1), 1-9.
- [30] Shokry, A. A., El-Shiekh, R. A., Kamel, G., Bakr, A. F., & Ramadan, A. (2022). Bioactive phenolics fraction of *Hedera helix* L.(Common Ivy Leaf) standardized extract ameliorates LPS-induced acute lung injury in the mouse model through the inhibition of proinflammatory cytokines and oxidative stress. *Heliyon*, e09477.
- [31] Silva Balin, P., Zanatta, F. C., Jorge, B. C., Leitão, M., Kassuya, R. M., Cardoso, C. A. L., ... & Arena, A. C. (2018). Toxicological evaluation and anti-inflammatory potential of an ethanolic extract from *Bromelia balansae* (Bromeliaceae) fruit. *Journal of ethnopharmacology*, 222, 79-86.
- [32] Siraj, M. A., Howlader, M. S. I., Islam, M. A., Irin, T., & Simal-Gandara, J. (2021). Regulation of the redox signaling and inflammation by *Terminalia myriocarpa* leaves and the predictive interactions of its major metabolites with iNOS and NF- $\kappa$ B. *Journal of Ethnopharmacology*, 280, 114459.
- [33] SOARES, C. L. R. (2018). *Avaliação da atividade cicatrizante in vitro e in vivo do extrato hidroalcoólico de Laguncularia racemosa (L) CF Gaertn* (Master's thesis, Universidade Federal de Pernambuco).
- [34] Sousa, H. G., Uchoa, V. T., Cavalcanti, S. M. G., de Almeida, P. M., Chaves, M. H., Lima Neto, J. D. S., ... & de Sousa, E. A. (2021). Phytochemical screening, phenolic and flavonoid contents, antioxidant and cytogenotoxicity activities of *Combretum leprosum* Mart.(Combretaceae). *Journal of Toxicology and Environmental Health, Part A*, 84(10), 399-417.
- [35] Stoppa, M. A., Casemiro, L. A., Vinholis, A. H. C., Cunha, W. R., Silva, M. L. A., Martins, C. H. G., & Furtado, N. A. J. C. (2009). Estudo comparativo entre as metodologias preconizadas pelo CLSI e pelo EUCAST para avaliação da atividade antifúngica. *Química Nova*, 32, 498-502.
- [36] Talwar, S., Nandakumar, K., Nayak, P. G., Bansal, P., Mudgal, J., Mor, V., ... & Lobo, R. (2011). Anti-inflammatory activity of *Terminalia paniculata* bark extract against acute and chronic inflammation in rats. *Journal of ethnopharmacology*, 134(2), 323-328.
- [37] Vilegas, W., Tangerina, M. M. P., Ascêncio, S. D., Soares, I. M., Pavan, E., Damazo, A. S., ... & de Oliveira Martins, D. T. (2018). Chemical characterisation and toxicity assessment in vitro and in vivo of the hydroethanolic extract of *Terminalia argentea* Mart. leaves. *Journal of ethnopharmacology*, 227, 56-68.
- [38] Wang, W., Xiong, P., Zhang, H., Zhu, Q., Liao, C., & Jiang, G. (2021). Analysis, occurrence, toxicity and environmental health risks of synthetic phenolic antioxidants: A review. *Environmental Research*, 201, 111531.
- [39] Xu, X., Liu, A., Hu, S., Ares, I., Martínez-Larrañaga, M. R., Wang, X., ... & Martínez, M. A. (2021). Synthetic phenolic antioxidants: Metabolism, hazards and mechanism of action. *Food Chemistry*, 353, 129488.

# The logistical challenges to implement the environmental management system in a natural gas company in the North Region

Darlene Ribeiro Pires<sup>1</sup>, Alexandra Amaro de Lima<sup>2</sup>

<sup>1</sup>Master's student in Engineering, Processes Management, Systems and Environmental, Galileo Institute of Technology and Education of the Amazon – ITEGAM, Brazil.

e-mail address: eng.darlene.pires@gmail.com

<sup>2</sup> Researcher in Galileo Institute of Technology and Education of the Amazon – ITEGAM, Brazil.

e-mail address: xanduca@gmail.com

Received: 15 Aug 2022,

Received in revised form: 07 Sep 2022,

Accepted: 11 Sep 2022,

Available online: 14 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Environmental management system, ISO 14001, Natural gas.*

**Abstract**— *The implementation of the environmental management system (EMS) in large companies arises from the need to standardize operations and reduce environmental impacts. The general objective of the study is to develop a protocol for an environmental management system based on ISO 14001 standards in a natural gas company in the region of Amazonas-AM. The monitoring data, indicators of the SGA used in this work were collected in a gas pipeline company in the North region, located in Manaus. In the development of this work, the methodology used consists of exploratory, documentary, with quali-quantitative data, where a survey of information about the EMS of the companies and the logistical system used for the execution of the EMS activities was carried out. The information was collected through interviews and questionnaires applied to the company's environmental professionals. It is concluded that in an internal context, the company is well strengthened because within its processes in the value chain, there are well-structured areas such as Social Management, Environmental Management in its licensing, monitoring and environmental auditing segments, which contribute to ensuring legal, contractual and international standardization requirements, such as those of the ISO 14001:2015 standard. However, the work found, in a comparative analysis with other regions, that the region's logistics system is the main challenge for the company that works with natural gas that affects organizational activities and, consequently, its EMS is affected. Therefore, it appears that the aspect that must be developed immediately to improve the EMS is logistics.*

## I. INTRODUCTION

Natural gas is a mixture of gaseous hydrocarbons, being composed almost entirely of methane. It also contains hexane, nitrogen, water vapor and some contaminants such as hydrogen sulfide – H<sub>2</sub>S and carbon dioxide – CO<sub>2</sub>.

Natural gas is lighter than air, has no smell or color. It is found in Nature, underground in large reservoirs, associated or not with oil. It is a non-renewable energy source. Like oil, natural gas results from the degradation of organic matter, animal fossils, plants that have been accumulated in rocks for many years. Withdrawal is

through drilling. Raw natural gas comes from three types of wells: oil well, gas well and condensate well.

In recent years, natural gas consumption has been directly linked to the growing need in Middle Eastern countries, with 16% of natural gas demand, and Asian countries, with 13%. As for the countries that are in the Organization for Economic Cooperation and Development (OECD) bloc, they use 46% of the natural gas extracted from various continents, and in the case of North American countries, only the United States uses 22% of the global production, followed by Russia with 11% and China with 8% [1].

In Brazil, in its greatness, there are numerous contributors to its fuel production, starting with the use of coal and fossil fuels as a source of energy. The use of natural gas chemically defined as a hydrocarbon based on methane, ethane, propane and butane, which allows conversion into energy production, has resulted in reduced deforestation and fires. Another factor that has been expanding the gas market is the dollar swings, which contributed to the rise in the prices of oil-derived fuels, causing a migration in the consumption of natural gas by the industry in the last 3 years, with a growth of 50%, followed by motor vehicles with 8% of the use of gas kits. For Brazil, in its gigantic territorial scale and water resources, natural gas is still an underexplored resource [2].

Amazonas has a benefit relationship with natural gas, after switching fuels in thermoelectric plants, reducing up to 73% of polluting gases. Other cities that are part of this route, which also had a significant improvement in air quality were Coari, Anori, Anamá, Codajás and Caapiranga. These cities also had an improvement in aspects of reducing the traffic of ferries and trucks that took the fuel to the plants [3].

The Urucu reserve has one of the lowest extraction costs compared to other Brazilian states. Its extraction capacity is set at 5.5 million m<sup>3</sup> per day. The distribution of this gas since 2009 is the responsibility of Companhia de Gás do Amazonas (Cigás), and the role of natural gas commercialization is also attributed, which resulted in a change in the environmental scenario of several cities after the implementation of pipelines that supply thirteen thermoelectric plants responsible for the production of electric energy in the state [3]. The change in the energy matrix, changing the use of diesel oil for natural gas, represented a reduction in the environmental impact of 70 million liters of diesel, responsible for releasing carbon monoxide (CO), Nitrogen Dioxide (NO<sub>2</sub>), Sulfur (S), among other gases identified as direct agents of global warming and damage to the ozone layer [4].

Thermoelectric plants have fossil fuel feeders that convert the burning (heat) into electrical energy and, although natural gas represents a reduction in pollutants, it is still quite shy, being used by only 9.6% of the energy produced by this energy matrix [5].

The role of thermoelectric plants in the northern region of Brazil has a strategic action in order to meet the electrical needs of the population and industry and can also help in the production of surplus energy in cases of water crisis and other problems that make the notorious blackouts possible. [6].

To achieve energy security, companies seek studies with an emphasis on the environment through ISO 14004:2018 or Integrated Management System (IMS). It seeks to minimize the environmental impact, reducing the pollutants generated in the process of extracting natural gas in all its stages. Another important step towards this objective is related to the electrical system, which allows for diversification in the energy matrix and reduces dependence on oil and conflicts in the fluctuating price of a barrel. And this contribution directly affects society, which now has a more competitive and secure market, thus avoiding energy production through coal and nuclear energy. For the economy, this is an expansion in the range of energy production through free market competitiveness. It attracts new investments to the sector and favors local development. In terms of business itself, it starts to use an old modal, which is the gas pipeline, which greatly avoids atmospheric pollution, congestion and favors the development and investment in new plants that represent cheaper energy production, new jobs and more local attractions. [7,8].

The implementation of Integrated Management Systems (IMS) in large companies arises from the need to standardize operations and reduce environmental impacts. In this sense, this study justifies the emphasis on directing a business policy establishing guidelines related to the quality system, well-being, environment, health and practices that guarantee labor, technical and environmental safety [9].

The environmental management system (EMS) of a natural gas company tends to communicate all other sectors, minimizing possible environmental impacts through public and private policies. To this end, the company under study was a pioneer in the reservoir-to-wire (R2W) management model, which allowed the production of thermal energy generated in the extraction fields and terrestrial producers of natural gas on shore, taking the surplus to the National Interconnected System (SIN) by the transmission networks deployed nearby. This ensured an improvement in regional supply in distant areas, minimizing the blackout in that region [10,11].



These actions must be related from the mission, vision and values perpetuated in organizational behavior and corporate culture. The extraction of natural gas is directly linked to that of oil, which puts it at risk of major environmental impacts, and, in the face of such risks, a functional system allows for direct action in cases of environmental accidents, preparing the company to reduce possible impacts and minimize those that may happen [12].

However, the operational competencies needed to engage with the EMS can also support the organization's efforts to minimize environmental impact along its supply chain. Organizations that practice EMS directly adapt green initiatives into their organizational supply chain operations. Therefore, EMS operators can rely more on knowledge-based resources that combine them to work with their networks of suppliers and customers to reduce environmental impact around the world.

However, Moreira, De Freitas Junior and Tolo [13] point out that in Brazil, it is estimated that 344 million reais are used in logistics costs per year, with the road system being one of the most used modes, and its participation comprises 61.1% in relation to other modes. However, the road network does not offer an adequate infrastructure when compared to other countries, since 12.9% of the roads are paved, taking into account that only 60% are considered to be in poor condition.

In the North region, this gap is even greater, as the lack of a land connection with Manaus currently represents a significant barrier to migration to Central and Northern Amazon. A variety of changes would be required prior to paving the road if these potential impacts are to be mitigated. This includes zoning, creating reserves and increasing governance in a variety of ways, including deforestation licensing and control programs, as well as heavy financial investments because it is a major highway.

In this way, this work brings the search not only to reduce the environmental impacts generated by natural gas activities, but to show the logistical challenges in carrying out environmental management in one of the most challenging regions of Brazil: Amazonas, which has unique and complex characteristics for the execution of large-scale activities such as gas pipelines. It has periods of floods and ebbs in its rivers and tributaries, and dense forests. As it is a basically isolated region, the purchase of equipment, products and services to carry out activities takes longer, which makes it much more difficult to carry out activities in the state. The logistics adopted in the state of Amazonas need to be well planned due to several local peculiarities. Transport is basically by waterway, which makes logistics time-consuming and expensive.

Therefore, the objective of the study is to analyze the logistical challenges to implement the environmental management system in a natural gas company in the North region.

## II. METHODOLOGY

The study areas are divided into 3 regions in Brazil, the North region being the main study area.

The city of Manaus is part of the Legal Amazon, located at 3°S latitude and 60° W longitude, between the Negro and Amazon rivers. Located in the interior of the state of Amazonas, the city of Coari is situated at an altitude of 34 meters, at 4° 5' 6" S and 63° 8' 30W. Operations of the Urucu-Coari-Manaus gas pipeline began in 2009, with the capacity to transport 6.85 million m<sup>3</sup> per day. Its extension is 139.3 km distributed in 09 branches. Its route crosses the municipalities of Manaus, Iranduba, Manacapuru, Caapiranga, Anori, Anamã, Codajás and Coari. The map below shows the location of the area covered by the gas pipelines in Amazonas.

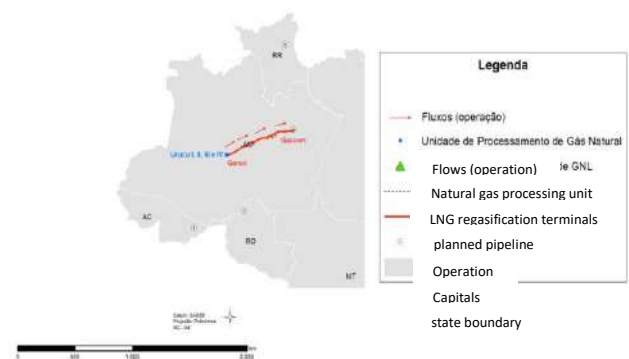


Fig.1: Scope of gas pipelines in the North region

Source: Adapted from Ministry of Mines and Energy [14]

Transpetro is responsible for the operation and maintenance of more than 7,155 km of gas pipelines. This network integrates the Northeast and Southeast regions, allowing great operational flexibility. It also includes the transport of natural gas from Urucu to Manaus, in the North region. 75% of all natural gas consumed in Brazil flows through this pipeline network [15].

The Gas Pipelines in the Northeast region cross 7 states: Bahia, Ceará, Paraíba, Sergipe, Rio Grande do Norte, Alagoas and Pernambuco and 147 municipalities, allowing a great operational activity.

However, in the Southeast region, the pipelines cross 2 cities from Rio de Janeiro to Espírito Santo, and 23 cities along the Southeast region. The map below shows the

location of the area covered by the gas pipelines in the Northeast and Southeast regions of Brazil.

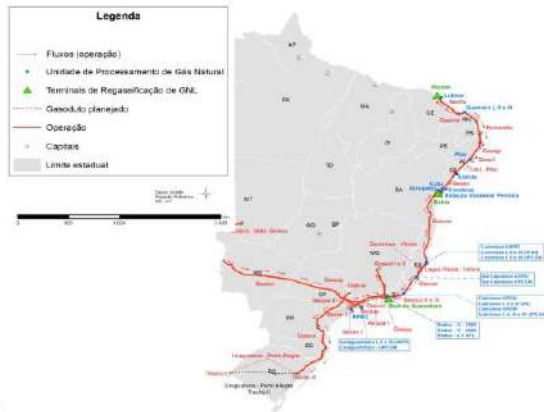


Fig.2: Coverage area of gas pipelines in the Northeast and Southeast regions of Brazil

Source: Adapted from Ministry of Mines and Energy [14]

Natural gas in Brazil is distributed in the North, Northeast and Southeast regions and has the capacity to move 74.67 million m<sup>3</sup>/day. Being of great importance to Brazil, within this chain of activities performed, is the Environmental Management System and its diversities of logistical modes. The North region stands out for the great challenges, since some points of the North gas pipeline are located in remote areas.

The work emphasizes the existing logistical challenges in the Environmental Management process in a natural gas company in the North region. The study was based on the collection of information related to the EMS indicators used by the company. For this, the company's management processes in three different regions of the country were analyzed. The purpose of this analysis is to obtain an overview of the possible logistical challenges in applying environmental management. Below is a description of the study steps to carry out this work, which is summarized in the flowchart shown in Fig. 3.

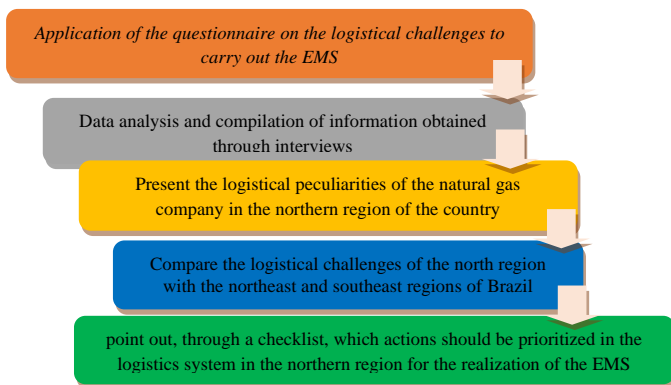


Fig.3: Flowchart for carrying out the study.

Source: Authours (2022).

**First Step:** Application of a questionnaire on the logistical challenges to carry out the EMS.

At first, a survey of information was carried out on the EMS processes carried out in the core of natural gas companies located in the North, Northeast and Southeast regions. The purpose of this step was to understand the logistical organization of the activities developed in the company, as well as the fulfillment of the activities schedule for each indicator of the Environmental Management System. For this, on-site visits were carried out, and in them interviews with the 10 specialized professionals of the SGI of the natural gas company. As an aid in the standardization of the process, 14 standard (discursive) questions were applied about the experience as environmental managers and the logistical challenges in the applicability of the EMS (Appendix A), in addition to topics such as logistics and waste management; of water resources and atmospheric emissions.

Through the application of the questionnaire, the logistical peculiarities of the natural gas company in the North region of the country are obtained, as well as information to compare the logistical challenges of the North region with the Northeast and Southeast regions of Brazil.

From the results obtained in the previous step, it was possible to obtain an overview of the reality of EMS managers today, in addition to the challenges faced by them regarding logistics in environmental management. The analysis of the information collected took place through a qualitative approach, which made it possible to compare the environmental management activities carried out, and the challenges of each of the regions analyzed.

Finally, the research is finished by presenting the actions that should be prioritized in the logistics system in the North region for the realization of the EMS.

### III. RESULTS AND DISCUSSION

*Application of a questionnaire on the logistical challenges to carry out the EMS*

With the application of the questionnaire to the employees of the natural gas company who apply the EMS in their daily lives, it was found that they have a series of challenges that will be presented below.

Through Question 1, it was possible to verify from the 10 employees trained for the function, that 90% of them pointed out that logistics would be the biggest challenge in the North region, due to the geographic and environmental conditions of the region. This problem was also pointed out by Ferreira [16] in a study on the challenges to logistics operations in the Amazon: the difficulties of

friction in the supply of border units. On the other hand, when the question was made to the same profile of employees, but in different regions of the country (Northeast and Southeast), they did not indicate any type of problem and/or challenge in logistics.

When the focus of the question was on the logistics used in the monitoring of sanitary and industrial effluents (Question 2), that is, the logistics to carry out the collections in their respective region for the environmental monitoring, according to CONAMA Resolution No. /11, 90% of the interviewees showed that: in the North region, effluent monitoring is done through an efficient schedule, since some units are in extremely remote areas, where the travel time between facilities and cities is around 9 hours by boat [17]. Therefore, a whole logistical planning is necessary. In this perspective, Teixeira et al. [18] points out that 50% of the inhabitants have an active connection to the sewage system, that is, half of the population residing in Manaus discard their effluents directly into the receiving water body, causing the pollution of water courses, as well as the proliferation of waterborne diseases, which are among the main reasons for the increase in infant mortality in the city of Manaus. On the other hand, in the Northeast and Southeast regions, the effluent collection process is carried out by means of a car, carried out in a single day, and in some points, it may take only a few hours.

As for the disposal of common waste (class II) - question 3, 90% of the answers show that in the North region, the disposal of waste is carried out at the Manaus facilities on a weekly basis by a duly licensed company. However, in cities in the interior of Amazonas, such as the city of Coari and nearby locations, logistics take place every six months or around 5 days for the process to be completed. In comparison to the other regions, the Northeast and Southeast give a destination to their common waste weekly, through the services of a duly licensed company, using a collection truck for transport.

Question 4 refers to the organization of Class I waste disposal activities. Employees of companies operating in the EMS in the North region show this class of waste as one of the biggest challenges in the region, where 90% responded that the logistics for the destination of these wastes in the interior of Amazonas is carried out through a schedule, taking into account all the security processes, as the activities are carried out through two different modes of transport (Munck truck and ferries), taking an estimated time of 9 to 10 days for the final destination. At the same time, at the Manaus units, the programming takes place in 1 day, being transported by trucks, following the indications of the norms and legislation in force. The biggest challenge of the units located in the municipalities

of the state of Amazonas is the lack of companies duly licensed for the correct disposal of waste, and that can comply with the legislation. According to Mello and Sehnem [19], 90% of the companies in the country dispose of Class I waste through outsourced companies, because depending on the type of Class I waste, this may require pre-treatment, such as sorting, neutralization and chemical stabilization. However, in the Northeast and Southeast, these residues are transported in trucks following the rules and legislation in force.

Question 5 asks what are the biggest challenges for carrying out waste disposal activities at the units where you operate. 80% of the people who participated in the survey pointed out that the biggest challenge in the North is the issue of logistics and the units located in the municipalities of the state of Amazonas do not have properly licensed companies, where waste can be disposed of correctly and in compliance with legislation. De Souza Mafra, Do Nascimento and Da Silva [20] explain that a study of data from the Municipal Department of Cleaning and Public Services (SEMULSP) proves that in Manaus, 163 tons of recyclable waste are collected monthly, which is equivalent to only 0.17 % of all waste produced. Due to the lack of waste processing industries, a good part of this input ends up being sent to the Southeast for reuse or returns to the common waste, and therefore the need to invest in public policies to attract investors is understood. Thus, when comparing the other regions of the country (Northeast and Southeast), it seems that the biggest challenges are the distances from one municipality to another, but all routes are carried out by land, public roads.

Following the compilations of the analyzed questions, in question 6 we try to identify what public bodies act in the transport of waste, which in the North region is carried out by the environmental agency of the state and municipality, in addition to the Brazilian Navy. In this line of reasoning, Viana [21] states that 56.6% of Brazilian cities had initiatives aimed at recycling materials in 2019. This number increased to 70%. However, despite advances, recycling rates in the country are below 4%. In cities like Manaus, the annual production of waste reaches almost 933 thousand tons, with less than 1% of this total being recycled or reused. But in the Northeast region, the institutes are IBAMA, a state and municipal environmental agency. Finally, in the Southeast region, those responsible are IBAMA, the state environmental agency.

Question 7 is related to the compliance with IBAMA Ordinance No. 85 of October 17, 1996, which stipulates the creation of an internal program to inspect emissions from diesel transport. Respondents pointed out that in the North, Northeast and Southeast regions, controls are carried out on vehicles, as recommended by the referred

standard [22]. Leite and Dutra [23] point out that the company analyzed by them maintained a performance of 84.6%, contributing to air quality and that the correct maintenance of this equipment is an indispensable factor to allow the control of emissions, due to the environmental impact caused by diesel-powered equipment.

When asked if the natural gas company to which they belong carries out the disposal of waste from the Oily Water System (OWS) (Question 8) in their region, 90% of respondents in the North region answered that the disposal of waste generated in the OWS of the units in the municipalities in the interior of Amazonas, are stored annually and sent by ferry to Manaus, taking around 10 days. And when it needs to be disposed of, a logistics schedule is carried out with risk analysis of the activity of the vessels that will be used, in line with the rules for the disposal of hazardous waste. However, in the Northeast and Southeast regions, a risk analysis of the activity is carried out, and a schedule and destination through public roads. Usually the final destination happens in 1 day.

Question number 9 addresses Ordinance No. 5/2017, which establishes the responsibility for controlling and monitoring the quality of water for human consumption, and its potability standard [24]. It was noticed that 90% of the interviewees pointed out that the collections for the analysis of water potability are carried out as a logistical schedule, given that some units are in extremely remote areas, where the estimated travel time is approximately 9 hours, using a speedboat. But in the Northeast and Southeast regions, the collection of water samples is carried out by car in a single day, and the activity can take place in some locations in a few hours.

The purpose of question 10 was to understand the logistics in cases of environmental emergencies at the facilities. Around 80% of the interviewees pointed out that in cases of emergency, the North region presents a very complicated logistics, and due to the geographic isolation of the region, displacements demand a lot of time. In some types of emergencies, heavy equipment and materials not available in the region are required. On the other hand, in the Northeast and Southeast regions, the biggest challenge may be the availability of materials available in the units at the time of the environmental emergency.

Regarding the challenges to meeting constraints in their region (Question 11), 90% of respondents point out that in the North region, logistical displacements to meet constraints require a schedule in advance, and in the case of inspections, meetings or technical follow-up by the agency environment, and sometimes it is necessary to reprogram. However, in the northeast and southeast

regions, compliance with conditions is well-organized, requiring no programming.

Question 12 presents the biggest challenges in hiring companies to provide environmental services to your region. According to the research participants, 90% point out that the North region has many difficulties in hiring companies both in Manaus, but mainly, as in the municipalities of the interior of the state. Companies from outside Manaus are usually hired, which greatly increases the costs of activities and equipment. However, the Northeast and Southeast regions have a greater diversity of companies and services, which makes hiring easier, and mainly because all logistics are basically by automotive transport.

Question 13 describes the biggest challenges to ensure that the EMS is complying with current legislation. After the investigation, 80% point out that in the North region the greatest difficulty is related to logistical challenges, compliance with legislation, as for some we do not have the necessary acceptable parameters as required by legislation, and hiring companies in places where they have facilities, and in cases of compliance with rules and legislation, reports are always made emphasizing compliance. In the Northeast and Southeast regions, the challenges are smaller than in the North, once the activities are carried out with more logistical facilities, and because the facilities are located close to more developed cities.

When asked about the biggest challenges for water scarcity in their region, 80% of the answers point out that each region has a peculiarity, since in the North, unlike other locations, in relation to water resources, there are no risks of scarcity. In the Northeast, in some points, due to water supply difficulties, a contract with a water truck is carried out to supply the facilities. Finally, in the Southeast, the units have an artesian well with controls and water rationing due to periods of drought.

The last question of the survey comprises management activities in which environmental indicators are carried out safely, and 90% pointed out that, in common to all regions, all environmental management activities in the natural gas company are always carried out with advance planning, with meetings of the areas involved, establishing a system for the application of the Preliminary Risk Analysis (PRA) technique, with a view to anticipating, identifying, evaluating and controlling the risks to Safety, Environment and Health in the facilities and/or areas covered by the company:

- Identification of the need for risk assessment;
- Constitution of the PRA team when necessary;
- Collection of data and information;
- Identification of aspects and hazards;

- PRA preparation when necessary;
- Analysis, completion and approval of the PRA when necessary.
- In cases of less critical activities, monitoring of these activities by a responsible professional is carried out.

For all regional offices, meetings are held before the activities to address safety, health and environmental aspects related to the activity to be carried out. Before entering the units, all service providers must attend the safety briefing, know the company's facilities and know how to leave the area in case of emergency siren alarms.

#### *Compilation and Analysis of information obtained by managers*

Improving environmental performance becomes increasingly important to the success of an organization. Through this study, which focuses on the interaction between environmental performance and logistics system in the North region, compared to the Northeast and Southeast regions of the country, we seek to find a way that helps organizations to achieve the ideal condition of obtaining cost efficiency. and environmental responsibility at the same time.

The best choice for organizations to achieve sustainable development is to effectively control costs as well as reduce waste and environmental pollution. This is a double effect that, once organizations adopt the Environmental Management System (EMS), they can examine the possibilities of improving the performance of their logistics system, reducing the negative impact on ecosystems in the logistics operation, as well as discovering proactive solutions to optimize their costs [25].

As discussed throughout the work, the ISO 14001:2015 standard (or Environmental Management System) is a tool created to assist the management of organizations and balance socioeconomic and financial interests with the impacts generated by their activities, which can help them to identify, prioritize and manage their environmental risks [7, 26]. Environmental performance indicators aim to demonstrate organizational practices in order to minimize the impacts on the environment resulting from their activities [27].

The study has the proposal to gather information about the EMS in a natural gas company, relating the challenges of logistics in Amazonas. The environment management system is used to increase its performance in relation to environmental responsibilities, being one of the most used standards by several sectors of the industry, including natural gas [28].

In general, the different variables that are part of this process are under the perspective of the ISO 14001:2015 standard, thus identifying the different stages that compose it and the impacts generated on the environment, which serve as an input to a starting point in order to establish and implement the different control alternatives aimed at the source of the impact, its environment and people, establishing then, environmental guidelines that contribute to preventing, mitigating, correcting and/or compensating for the damage generated in the environment caused by the identified environmental problem, as well as complying with the obligations established in the exploration and drilling contracts awarded to the company [7, 29].

The ISO 14001 standard is part of a family of standards that refer to environmental management and protection applied to the company with the aim of formalizing the systematization of processes and tasks that have a direct or indirect impact on the environment. This standard establishes requirements on the systematic work that must be carried out in relation to activities that generate an environmental impact [7, 30].

ISO 14001 is applicable to any organization, regardless of support, type or nature. It is used in the environmental aspects of its activities, products and services that the organization determines that it can control or influence its life cycle. It can be used in whole or in part with the idea of improving environmental management, however, it is necessary to fulfill all the requirements of environmental management in the organization [7, 31].

It is necessary to know that the adoption of ISO 14001 requirements does not in itself guarantee excellent environmental results. The success of the standard lies in the commitment of all functions and levels of the organization, under the leadership of senior management. Helping an organization to achieve the expected results, adding value to its environmental management system, adds value to the environment, to the organization itself and to its stakeholders [7, 32].

CONAMA Resolution 430 of May 13, 2011, provides for the conditions and standards of effluent discharge, in which the analysis parameters are: physical-chemical and biological: Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), total oils and greases, total and thermotolerant coliforms. These parameters are those required in the quarterly report to be sent to the State Environment Agency (CPRH), the State's environmental control agency [17, 33].

As we can see, the North and Northeast regions deal with the disposal of SAO waste differently, but they are carried out in different ways due to the logistical issue that impact on the destination. In Silva's view [34] the oily

waste is formed by heavy metals, oils and greases; thus, having a high toxic level. Therefore, if ill-disposed in Nature, they will have negative and lasting impacts. Consolidation Ordinance No. 5/2017, from the Ministry of Health (MS), establishes the procedures and responsibilities related to the control and surveillance of the water quality for human consumption and its potability standard, and other measures [24, 35]. Both are properly implemented and developed by the oil and gas company of the North region and more regions.

The challenges for water scarcity in the region were analyzed, and it was found that the North region does not have a lack of freshwater resources to meet the standard demand for water when compared to the Northeast, which due to difficulties in water supply, contracts with water trucks are carried out. The Southeast, on the other hand, has an artesian well with controls and water rationing due to periods of drought.

The consequences of water scarcity, which not only includes the lack of water, but also the worsening of its quality in water bodies, the imbalance between demand and availability, among other factors that may have to come from the reduction of biodiversity to the competition between different sectors and segments of the society for water [36].

However, after some scenarios of water scarcity and pollution, the initiative on the part of companies has increased. The organization invests in research and technological development related to the management of water resources in partnership with companies, research institutions and Brazilian universities in order to optimize the use of this resource through improvement development [37]. This strategy seeks to sponsor projects related to the management of water resources, the protection of springs and forests, the preservation of the biodiversity of aquatic species, rational use of water and monitoring and promotion of the quality of water resources. In addition, it seeks to implement conservation practices in production processes, in the restoration of forests, native fauna and environmental education actions [38].

Based on the fact that the level of pollutants caused by the emission of smoke from diesel engines, one of the actions carried out by the company to reduce atmospheric emissions is presented in IBAMA Ordinance n° 85/96 of 1996, which describes the internal program of self-inspection of the correct maintenance of vehicles in all companies. The correct maintenance of vehicles is important to allow the control of pollutants, minimizing the effects of pollution by black smoke, which in this way contributes to the degradation of the environment, altering air quality and causing problems related to health [22, 39]



Fig.4: System modules

Source: Abreu [40]

In Fig. 4. we noticed that in this Pressure Reduction Station (PRS) there are several mechanical, electrical and automation components. Among them, the logistics for maintenance in all the equipment of the main line of ducts, as in the Natural Gas Compression Station (ECOMP's), Pressure Reduction Station (ERP's) and Delivery Point (PE's), and observing the structure of these stations, the system allows the maintenance activity to be safe.

Regarding the waste indicators of its operational units, they are hazardous and non-hazardous, being classified as class I and II waste. Regarding common waste destinations (class I and II), Amazonas and other Northeast and Southeast regions carry it out according to existing legislation, but with different deadlines and longer programming of activities, and with various logistical modes.

Class I (hazardous) wastes are those that pose a risk to public health or the environment, characterized by having one or more of the following properties: flammability, corrosiveness, reactivity, toxicity and pathogenicity. Class II residues are divided into A and B. Class II-A wastes (low hazard) offer chemical reaction capability in certain modes. This type of waste may show properties such as biodegradability, combustibility or water solubility. Class II-B residues are those that have a low reaction capacity and can be disposed of in landfills or recycled, as they do not undergo any type of change in their composition over time [41].

Although hazardous wastes need special care because they contain chemical substances in their composition, such as heavy metals, these wastes are usually disposed of improperly, often together with Class II waste, culminating in the contamination of final disposal sites and causing damage to the soil and water table, and consequently to the health of the population [42].

In addition, the research sought to analyze the logistical challenges facing the EMS. Fig. 5 presents the National Control and Logistics Center (CNCL), located in the city of Rio de Janeiro, which monitors pipeline failures.



Fig.5: Meshes controlled by CNCL

Source: Abreu [40]

The operators electronically detect changes in the information transmitted by the system instruments, and activate the support, operation and maintenance team, which, depending on the dimension of the anomaly, will provide the emergency service, in the event of contingency or interference in service to the customer, or even wait for a greater contingency of orders for that station, to meet the request made by CNCL.

The biggest challenge in the North is the logistics issue and the units located in the municipalities of the state of Amazonas, which do not have properly licensed companies where waste can be disposed of correctly, in compliance with the legislation.

Each transport modal has its variation in the initial investment of capital (fixed costs), and in the maintenance of the system (variable costs) [43]. However, in a survey carried out by Fundação Dom Cabral, which tabulated the logistical costs on the billing of organizations, it was shown that in 2017, the sum of logistical costs incurred by companies corresponded, on average, to 12.37% (Fig. 6.) of their gross sales, which compared to foreign companies are relatively high costs [44].

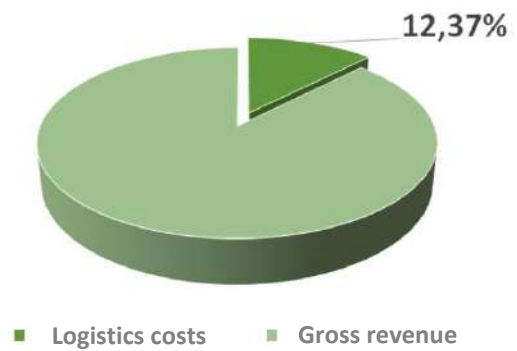


Fig.6: Average percentage of gross revenue of companies spent on logistics costs in 2017

Source: FDC [44]

Most of the production involves the movement of inputs such as raw materials, labor and fuel from different locations, so organizational strategies linked to logistics are important because they influence the organization revenue and the value of the final product. So, transport services are linked to the cost characteristics of each type of service, as each service has different cost characteristics, each modal may obtain advantages from the other transport service.

The latest statistical data published by the Brazilian Transport Planning Company indicated a total length of paved roads of approximately 123 thousand kilometers. To this total must be added about 1.3 million kilometers of unpaved roads. Today, the national road network is quite deteriorated, with extensive stretches requiring massive resources for its recovery. This situation greatly harms road freight transport, increasing travel times and increasing operational costs [45]. Fig. 7 shows the percentage of road infrastructure with pavement in Brazil.

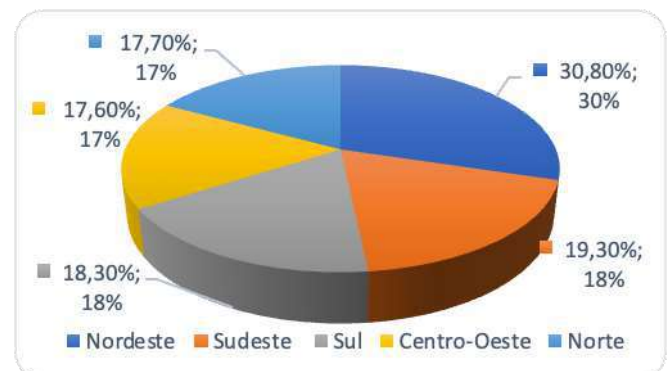


Fig.7: Percentage of road infrastructure with pavement in Brazil

Source: Adapted – CNT [46]

Fig. 7 shows, through data from the study carried out by the National Transport Confederation [46], that the road network in the normal region is one of the most outdated, with only 17.70% being paved, resulting in high logistical costs for companies, difficulty of locomotion for people and the search for other modal alternatives, often even more expensive or time-consuming for the transport of goods and people.

*Prioritization actions for the logistics system in the North region to implement the EMS system*

According to information found with the application of the questionnaire and through bibliographic research, it is understood that the logistics system in the North region should be prioritized considering the following aspects:

*Table 1: Prioritization of logistics in the North region of Brazil*

| ACTIONS                                                                                       | JUSTIFICATION                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Road resurfacing in the Industrial District;                                                  | one of the main ones is the problems of traffic accidents that can be caused by failures in the roads and delay for those who need to use them.                                                                                                           |
| Make the BR-319 and BR-230 highways passable for cargo vehicles;                              | they need to be paved to provide a continuous flow of vehicles                                                                                                                                                                                            |
| Decongest the cargo terminal at Manaus International Airport;                                 | increase business productivity, generate more jobs, connect urban and regional transport networks, recovering the economy, and offer new business opportunities.                                                                                          |
| Improve port facilities in Manaus Moderna; the economy, and offer new business opportunities. | Offer a supply system for fairs and markets, as this is the link that reciprocally feeds the city of Manaus and the interior of the State.                                                                                                                |
| Nautical signaling of the rivers' gutters in Amazonas;                                        | provide essential information to direct the movement of the ship or vessel safely and economically.                                                                                                                                                       |
| Improve the safety of navigability in the Amazon waterways;                                   | It makes it possible to contribute to the preservation of the environment in the Amazon Region, as it will assist in the training of the crew of the vessels that navigate the Amazonian rivers to transport important commodities for export, as well as |

|                                                                                                                                                  |                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
|                                                                                                                                                  | emphasizes the need for investments necessary to take advantage of the excellent potential of waterways. |
| Invest in regional infrastructure improvements through the implementation of maritime police stations and traceability of waterway communication | The model will contribute to the improvement of results in the transport market                          |
| Improve airports in the interior of the state to increase the transport flow                                                                     | increase connectivity, enabling the expansion of the flights offer                                       |

Soruce: Authours (2022)

According to ISO 14004:2018, "increased resources and logistics required to support regional product returns can significantly increase the cost per unit of production" (p. 69). Therefore, logistical support is adequate and contributes to the EMS, as it facilitates access for receiving and sending waste, as well as enabling good traffic flow [7, 47].

The ISO 14001 standard economically improves business results, as it saves on solid waste management, which implies market positioning, as it gives organizations an image of an environmentally friendly company that meets national and international standards [48]. The activities that most contribute to the eco-efficiency of the oil and gas production chain are energy reduction programs, environmental care in the selection of suppliers, solid waste management plans and environmental licensing [49].

However, it is important to note that not all companies have the necessary skills to reconfigure their processes so that they can reduce waste, material replacement and other activities that lead to a change in the organization operations [49].

In short, it should be noted that the EMS ensures that an organization is able to maintain performance in line with established goals and effectively respond to changes in regulatory, social, fiscal and financial pressures, as well as environmental risks. It provides the company with a structured process to achieve continuous improvement, always with a high degree of environmental awareness of all the people who make up the organization. Through ISO 14001, companies position themselves as socially



responsible, differentiate themselves from the competition and reinforce their corporate image internally, due to the international scope of the standard. Companies optimize the management of resources and waste, reducing the negative environmental impacts derived from their exercise. They also promote innovation and productivity, with the aim of reducing waste management costs, reducing risks, obtaining new lines of financing and obtaining a greater competitive advantage over competitors. For a better understanding of EMS activities in the North region, a checklist was prepared to guide the activities in the midst of the existing logistical challenges, presented in an appendix that can be implemented in the natural gas company in the North region and in others, with the purpose of working on the EMS and the logistics system.

#### IV. CONCLUSION

As exposed throughout the work, it is increasingly common to see how organizations choose to implement EMS that help them improve the efficiency of their procedures and improve their position in the global market. A fundamental reason why companies decide to implement an EMS resides in the fact that they must comply with a volume of environmental requirements imposed by the administration, customers and society.

Environmental management is integrated with the ISO 14001 standard, which establishes the environmental aspects and impacts associated with the company, implements environmental controls, requires suppliers to also implement environmental management in their processes, and all this to offer companies competitive advantages, encouraging them to adopt quality systems, environmental management and investment in new clean technologies that contribute to the environment. The ISO 14001 standard also gives companies institutional legitimacy and access to foreign markets by focusing not on the end product, but on the process. It is what will make the organization different, because even if there is an organization of the same sector, of the same size and performing the same activity, the implementation of ISO will make a difference, generating great economic benefits.

With the development of the EMS, many companies achieve environmental improvements through the implementation of the EMS. Also, "green logistics" turns out to be a popular issue. But the combination of environmental issues and logistics system is rarely found in previous research. Therefore, environment-oriented logistics system design becomes the topic described here.

Determining the most progressive options to shift the logistics industry towards more sustainable goals will

require careful planning and coordination between multiple parties. Consumers, the government and also the companies themselves will have a role in the implementation of solutions that will reduce environmental impacts, especially when talking about the North region, as it is an isolated location in Brazil.

The case study allowed us to evaluate several factors that can help a natural gas company in relation to its EMS. It is identified that the company's internal context is well strengthened, because within its processes in the value chain, there are well-structured areas such as social management, environmental management in its licensing, monitoring and environmental auditing segments, which contribute to ensuring legal, contractual and international standardization requirements, such as those of the ISO 14001:2015 standard.

During the process of diagnosing the company's environmental situation, it was possible to establish important points to be taken into consideration during the environmental review of the natural gas company. Thus, environmental aspects were identified in the development of activities carried out in the company located in the North region, compared to other Brazilian regions, such as legislation, challenges, processes, as well as the destination of production waste. However, it was found that the region logistics system is the main challenge for the company that works with natural gas, which affects organizational activities and, consequently, its EMS is affected.

As listed throughout the work, the main activities in the logistics system that must be carried out to achieve the EMS in the natural gas company, considering the reality of the North region, are: to requalify the roads of the Industrial District; to make the BR-319 and BR-230 Highways passable again for cargo vehicles; to decongest the cargo terminal at Manaus International Airport; to improve the facilities of the two ports of Manaus Moderna; to install nautical signposts on the rivers along the Amazon gutters; to improve the safety of navigability in the Amazon waterways; to invest in improving regional infrastructure through the implementation of maritime delegations and traceability of waterway communication; and to improve airports in the interior of the state to increase the transport flow.

That's why it seems that the aspect that must be developed immediately to improve the EMS is logistics. However, it appears that this responsibility is solely of the company, as these are federal highways. To carry them out, investment and environmental impact studies are required. In this sense, by creating workflow strategies for all EMS activities in this region, we were able to direct activities in a way not only to comply with legislation, but

also to carry out a set of adequate and safe working conditions. And for that, it is important to have a direction indicated in the work through a check-list so that everyone who comes to carry out EMS work in the North region, can understand the logistical issues in a broader way.

It is important to emphasize the need to recover the environment, as it belongs to everyone, and it is also our duty to care for and protect it. In this way, we can provide a better environment and future for our children. The responsibility of industries to raise awareness and implement ecologically correct technologies in their processes is essential for everyone who contributes to achieve positive results for the environment.

It is noteworthy that the execution and realization of this study are feasible, since all the objectives proposed at the beginning of the work were successfully achieved, in addition to enabling researchers to acquire practical knowledge about the theory studied. It is also worth mentioning that all the information and data cited in this research are real, reliable and valuable; These tools will contribute to interested parties a vision as an instrument of interest for further studies on the subject.

Of course, a case study is not enough to show all environmental activities in a logistics system. More research is needed to analyze the logistics activities of a company, and their influence on environmental performance. For an in-depth study of the possibilities in the challenges of implementing the EMS, it is necessary to analyze the reduction of environmental impact and the cost efficiency for the company. More quantitative research is needed to improve data collection for the analysis of the environmental management system.

As part of the company value chain processes, we recommend establishing a final report model in which the project closure dossier is generated, ensuring compliance with the requirements established in the orders issued by the control entities, as well as in the commitments acquired in the operation licenses. In addition, research is suggested in which it is highlighted how the deficient logistics system affects companies in other sectors such as civil construction, commerce or hospital institutions in relation to the EMS.

## REFERENCES

- [1] Brasil (2022). Demand for Natural Gas in national and international markets: Horizonte 2020-2030. Recovered from <https://www.epe.gov.br/sites-pt/publicacoes-dados-abertos/publicacoes/PublicacoesArquivos/>.
- [2] Rodrigues, M. D. S. (2021). *Rationality of investments in natural gas distribution in Brazil and the role of regulatory agencies* - (Doctoral dissertation).
- [3] Governo do Estado do Amazonas (2019). Use of natural gas in thermal plants in Amazonas improves air quality. Recovered from: <http://www.amazonas.am.gov.br/2019/07/uso-do-gas-natural-em-termicas-do-amazonas-melhora-qualidade-do-ar/>.
- [4] FGV – CERI (2019). Primer-transport-of-natural-gas-in-brazil-regulatory-aspects-FGV-CERI. Recovered from <https://ceri.fgv.br/sites/default/files/publicacoes/2019-01/cartilha-transporte-de-gas-natural-no-brasil-aspectos-regulatorios-fgv-ceri-jun-2016.pdf>.
- [5] Leal, D. S., Cabral, R. P. B., PEREIRA, K., & Cutrim, A. A. (2021). The use of natural gas in thermoelectric generation and the impacts caused by the pandemic. In *CONGRESSO NACIONAL DE ENGENHARIA DE PETRÓLEO, GÁS NATURAL E BIOCOMBUSTÍVEIS. Anais*.
- [6] ONS - National Electric System Operator. What is the SIN - National Interconnected System. Recovered from <http://www.ons.org.br/>.
- [7] ABNT NBR ISO 14001:2015. Environmental management systems — General guidelines for implementation. Recovered from: [https://edisciplinas.usp.br/pluginfile.php/4975832/mod\\_folder/content/0/NBRISO14004%20.pdf?forcedownload=1](https://edisciplinas.usp.br/pluginfile.php/4975832/mod_folder/content/0/NBRISO14004%20.pdf?forcedownload=1).
- [8] Stefano, N. M., & Laux, R. O. (2017). Corporate sustainability through the integrated management system (SGI). *Sustainable Business International Journal*, (70).
- [9] Benedito, E. S. (2021). ENVIRONMENTAL MANAGEMENT SYSTEM (EMS): THE EVOLUTION OF THE CERTIFICATION OF BRAZILIAN COMPANIES IN THE ISO 14001 STANDARD. *Livre de Sustentabilidade e Empreendedorismo Magazine*, 6(3), 54-67.
- [10] Pereira, J. M., & Silva, F. R. G. (2020). Proposal for the implementation of an environmental management system according to the ABNT NBR ISO 14001: 2004 standard - a case study. *Gestão & Sustentabilidade Ambiental Magazine*, 9(4), 884-905.
- [11] Baliza, A. R., Boloy, R. M., Púente, J., Mesquita, A. Z., & Morghi, Y. (2017). Review of requirements for implementing an Environmental Management System in accordance with ISO 14001: 2015. *III CIEEMAT*.
- [12] Ross, J. W., Santos Filho, J. O. Integrated management system (IMS) and the benefits for a mining company. Recovered from: <https://dspace.doctum.edu.br/bitstream/123456789/2513/1/SISTEMA%20DE%20GEST%C3%83O%20INTEGRADO%20%28SGI%29%20E%20OS%20BENEF%C3%8DCIOS%20PARA%20UMA%20SIDER%C3%9ARGICA%20MINEIRA.pdf>.
- [13] Moreira, M. A. L., de Freitas Junior, M., & Tolo, R. C. (2018). Road transport in Brazil and its shortcomings. *Refas-Magazine Fatec Zona Sul*, 4(4), 1-13.
- [14] Ministry of Mines and Energy (2020). Natural gas production and movement infrastructure. Recovered from <https://www.gov.br/anp/pt-br/centrais-de-contudo/publicacoes/anuario-estatistico/arquivos-anuario-estatistico>.

- estatistico-2021/cartogramas/industria-nacional-do-petroleo-e-gas-natural/cartograma-2-3\_2021.jpg.
- [15] Petrobras (2016). Natural gas. Recovered from <https://transpetro.com.br/transpetro-institucional/nossas-atividades/dutos-e-terminais/gas-natural.htm>.
- [16] Ferreira, L. F. T. (2020). Challenges to logistics operations in the Amazon: friction in the supply of border units. *Hoplos Magazine*, 4(6), 83-102.
- [17] CONAMA- National Environment Council. Resolution No. 430, of May 1, 2011: Provides for the conditions and standards for effluent discharge, complements and amends Resolution No. 357, of March 17, 2005, of the National Council for the Environment-CONAMA. Recovered from <http://www.mma.gov.br/port/conama/legiabre.cfm?codlegi=646>.
- [18] Teixeira, R. M., Pereira, I. N. A., & de Araújo, V. S. (2016) analysis of the efficiency of sewage treatment plants (etes) in multifamily residential homes in the city of Manaus that have combined anaerobic-aerobic systems. Pan-American Forum on Sanitary and Environmental Engineering.
- [19] de Mello, T. H. C., & Sehnem, S. Solid waste management: a case study in an industrial solid waste treatment center - solid waste management: a case study in central industrial solid waste treatment. 4º fórum internacional inovar, 2015.
- [20] de Souza Mafra, E., do Nascimento, T. P. S., & da Silva, M. C. (2020). The Amazonian logistic horizon: a view of the fragmented waste processes in MANAUS. *Somanlu: Revista de Estudos Amazônicos*, 1(1), 101-114.
- [21] Viana, G. (2019). Work Safety: and its importance in the strategic management of a company. *Science & Innovation*, 4(1).
- [22] Ministry of the Environment (1996). Ordinance of the Brazilian Institute for the Environment and Renewable Natural Resources – IBAMA. Portaria 85, de 17 de outubro de 1996.
- [23] Leite, A. D. O. S., & Dutra, M. G. (2018). Performance evaluation of companies specialized in the construction of industrial plants: management of environmental indicators. *Tecnologia Magazine*, 39(1), 1-20.
- [24] Brasil (2017). Consolidation Ordinance No. 5, of September 28, 2017. Consolidation of norms on actions and health services of the Unified Health System. Diário Oficial da União. 5 Set 2017.
- [25] Tambovcevs, A., & Tambovceva, T. (2012). Logistic system integration with environmental management system, a case study of international company. *World Academy of Science, Engineering and Technology*, 6(8).
- [26] Silveira, N. F. N.; De Faria, A. F. (2020). Study on ISO 14000 standardization focusing on municipal public organizations. *XI Brazilian Congress of Environmental Management*.
- [27] Campos, L. M. D. S., & Melo, D. A. D. (2008). Performance indicators of Environmental Management Systems (EMS): a theoretical research. *Production*, 18, 540-555.
- [28] Berneira, V. M., & Godecke, M. V. (2016). ISO 14004 standard: identification of environmental aspects in a food industry located in the state of Rio Grande do Sul. *Administração da Universidade Federal de Santa Maria Magazine*, 9, 149-164.
- [29] Builes Blandon, S., Machuca Muñoz, C. D., & Estévez Galeano, K. D. (2019) Implementation criteria ISO 14001: 2015 Case study hydrocarbons.
- [30] Moreira, P. A. S. (2015). *Formalization and Implementation of an Environmental Management System in accordance with the NP EN ISO 14001: 2012 standard in the company Maranhão-Sociedade de Construções, Ltd* (Doctoral dissertation, Instituto Politecnico do Porto (Portugal)).
- [31] Tavares, K. A. K. (2018). Operationalization of an environmental management system according to the ISO 14001 standard: 2015 in the direction of services to EDP Distribuição substations. Dissertation (Chemical Engineering of the Faculty of Engineering) University of Porto.
- [32] Pérez, G. Á. V., Ángel, G., & Cañon de Francia, J. (2019). The new ISO 14001: 2015 certification. An analysis of its implementation in the company saica, SL. Economics and Business College. Paríso Campus.
- [33] Faustino, A. M. C., & Silva, R. F. (2020). Environmental impacts and efficiency of the liquid effluent treatment system at the regional slaughterhouse in PAUDALHO-PE. *Sustentare*, v. 4, n. 1, p. 24-36.
- [34] Silva, C. R. (2021). Industrial production processes: a general approach to waste. Completion of course work (Bachelor of Science and Technology) Universidade Federal Rural do Semiárido – UFERSA.
- [35] de Oliveira, C. P., Maia, C. S., de Barros, D. L., & de Moraes Linhares, B. (2019). WATER ANALYSIS AND THE ROLE OF THE TECHNOLOGIST IN ENVIRONMENTAL SANITATION. *IFRR Teaching, Research, Extension and Technological Innovation Forum - e-ISSN 2447-1208*, 6(1).
- [36] Motta, M. B. (2022). Case study of water reuse as an alternative to water scarcity in a petrochemical industry. Completion of course work (Graduate in Chemical Engineering) - Universidade Federal Fluminense, School of Engineering, Niterói.
- [37] Guedes, D. M., & da Silva Manca, R. (2020). Needs and Difficulties of Participatory Water Management in the Industrial Sector: Implementation of a Pilot Project for Water Conservation in a Food Industry Company, Mogi Guaçu, São Paulo. *Interciência & Sociedade*, v. 5, n. 2, p. 319-338, 2020.
- [38] Latuf, M. D. O., Ribeiro, C. B. D. M., & Santos, C. A. D. (2021). Grants for the use of water resources in the Hydrographic Circumscription of the surroundings of the Furnas reservoir. Dissertation (Master in Geography) Federal University Alfenas.
- [39] Portela, R. R., Bisol, R. B., & Farias, I. R. (2020). Emission of black smoke by vehicles from the fleet of service providers of a large company and its impacts on air quality. *Connections-Science and Technology*, v. 14, n. 2, p. 61-66.
- [40] Abreu, A. T. (2020). Maintenance of the Urucu-Coari-Manaus gas pipeline: planning and logistics / André Teles de Abreu. Completion of course work (Mechanical

- Engineering) - Federal Institute of Education, Science and Technology of Amazonas, Downtown Manaus Campus.
- [41] Carvalho, P. A. M. (2018). Management of contaminated areas and waste at fuel stations. Completion of course work (Graduate in Petroleum Engineering) - Universidade Federal Fluminense, School of Engineering, Niterói.
- [42] Araujo, B. M. (2020). Social and sanitary environmental effects of the conditioning and destination of urban solid waste in Patos - PB. Completion of course work (Bachelor of Environmental Engineering) – Federal University of Campina Grande, Center for Agrifood Science and Technology.
- [43] SENAI – SP. Port and retroport fundamentals. SESI SENAI Editora, 2018.
- [44] FDC, Fundação Dom Cabral. Logistics Costs In Brazil 2017. Recovered from <https://www.fdc.org.br/conhecimento-site/nucleos-de-pesquisa-site/Materiais/pesquisa-custos-logisticos2017.pdf..>
- [45] Ministry of Transport. National waterway transport policy guidelines. Recovered from <http://www.transportes.gov.br/arquivo/arq1296243213.pdf>.
- [46] CNT. National Transport Confederation. Brazil has only 12.3% of the road network with pavement. (2016) Recovered from <http://www.cnt.org.br/Imprensa/noticia/brasil-tem- apenas-12-da-malha-rodoviaria-com-pavimento>.
- [47] Barbosa, F. G. (2021) Environmental regularization of a mechanical workshop in Ariquemes - RO: case study. / Fernanda Gomes Barbosa. Ariquemes, RO: Education and Environment College, 2021. 59 f.; il. Advisor: Prof. Ms. Felipe Cordeiro de Lima. Completion of course work – Graduation in Environmental and Sanitary Engineering – Education and Environment College, Ariquemes RO.
- [48] Lázaro, C. A. G., & López, M. A. J. (2018). Analysis of the environmental performance of the hydrocarbon sector, based on the implementation of the ISO 14001 environmental management system: an overall review. Environmental management and its impact on the development of productive activities. Environmental Engineering Program. North Santander, Colombia.
- [49] Bezerra, P. R. C.; Vieira, M. M.; De Rezende, J. F. D. (2018). Measuring of the eco-efficiency of micro and small companies in the Potiguar oil and gas production chain. Postgraduate Program in Petroleum Science and Engineering (PPGCEP).

# Hydrogen production by water electrolysis using TEA.PS-BF<sub>4</sub> ionic liquid and alternative electrocatalysts

Márcia R. Becker<sup>1</sup>, Sergio A. Arguello<sup>2</sup>, Janine C. Padilha<sup>3</sup>

Latin American Institute of Life and Nature Sciences - Federal University of Latin American Integration, Brazil

Email: <sup>1</sup>marcia.becker@unila.edu.br; <sup>2</sup>sergioarguello2411@gmail.com; <sup>3</sup>janine.padilha@unila.edu.br

Received: 11 Aug 2022,

Received in revised form: 05 Sep 2022,

Accepted: 09 Sep 2022,

Available online: 14 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Electrode, electrolyte, hydrogen,  
ionic liquid, water electrolysis.*

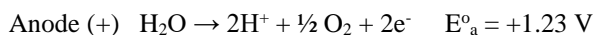
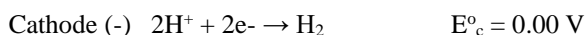
**Abstract**— *Studies on water electrolysis are in permanent development to improve its processes with electrodes and electrolytes that offer lower overpotential values. This work uses an ionic liquid (IL) – tetrafluoroborate of 3-triethylammonium-propane sulfonic acid (TEA-PS.BF<sub>4</sub>) – as electrolyte and studies the effect of different electroactive cathode materials on hydrogen production, such as platinum (Pt), nickel (Ni), palladium (Pd), gold (Au) or silver (Ag). Water electrolysis was performed in a Hoffman Cell and analysed by chronoamperometry (CA) and linear sweep voltammetry (LSV) techniques. For the electrodes studied here, in a 0.1 M TEA-PS.BF<sub>4</sub> solution, current density (j) values were 252-404 mA cm<sup>-2</sup>; for 0.3 M TEA-PS.BF<sub>4</sub>, values were 406-728 mA cm<sup>-2</sup>; and for 0.7 M, values were 822-1055 mA cm<sup>-2</sup>. Low activation energy (E<sub>a</sub>) of 5 kJ mol<sup>-1</sup> was found for the Au cathode, 9 kJ mol<sup>-1</sup> for Pt and Ag, and 24 kJ mol<sup>-1</sup> for Ni and Pd. Results show that the Ni electrode is an attractive alternative for hydrogen production by water electrolysis and using IL as electrolyte.*

## I. INTRODUCTION

Hydrogen and fuel cells are considered important alternatives for future sustainable energy systems in the stationary power, transportation, industrial and residential sectors. Moreover, hydrogen is used in oil refineries to produce fuels from petroleum hydrocracking, to manufacture fertilizers, [1, 2] in the food industry, in the semiconductor manufacturing process, among others. Hydrogen is a clean energy carrier with high specific energy density [3] that is usually produced by steam methane reforming, coal gasification and a simple process such as water electrolysis. The latter process yields high-purity, carbon dioxide-free hydrogen from renewable sources. [4, 5] Hydrogen produced by water electrolysis combined with other energy generation processes may be a solution to convert long-stored chemical energy back into electricity.

Water electrolysis is an electrochemical process determined by the circulation of an electric current through two electrodes immersed in an electrolyte solution to break water into hydrogen and oxygen. Pure water, although little dissociated, contains ions H<sup>+</sup> and OH<sup>-</sup> which, because of electric field action, migrate toward the cathode and the anode to form hydrogen and oxygen gases. The electricity needed for the electrolysis may come from renewable energy sources such as solar, wind, and hydroelectric installations, or excess power from existing generators to produce hydrogen during off-peak times. Due to the low electrical conductivity of pure water, electrolysis should be carried out in the presence of suitable dissolved electrolytes to increase the conductivity of the solution. The electrolytes to be added to water may be acids, bases, or salts. The reaction and standard equilibrium electrode potential (E<sup>0</sup>) at 298 K can be written as follows:

In acid electrolyte



Overall reaction is



In conventional water electrolysis, corrosive electrolytes such as NaOH, KOH and H<sub>2</sub>SO<sub>4</sub> are usually used as conductive materials. Metal electrodes used as catalysts and even the electrolyser may suffer serious damage in these corrosive electrolytes and lose catalytic activity. Ionic liquids (ILs) are low-melting salts that melt at or below 273 K, which are usually composed of a large asymmetric organic cation and an inorganic or organic anion. [6] ILs are materials with many interesting properties that may include low vapor pressure, wide electrochemistry window, solubility in a wide range of organic solvents and water, high conductivity, and thermal and chemical stability. [7] Because of these characteristics, ILs can be used as electrolytes in the electrolysis of water. [8] Fiegenbaum *et al* [9] used tetrafluoroborate of 3-triethylammonium-propane sulfonic acid (TEA-PS.BF<sub>4</sub>) in different concentrations as a conductive electrolyte to produce hydrogen by water electrolysis. A system using TEA-PS.BF<sub>4</sub> in an electrochemical cell with platinum electrodes had current densities up to 1.77 A cm<sup>-2</sup>, and the activation energy observed was 9.3 kJ mol<sup>-1</sup> – a low value that can be explained by the facilitation of proton transport in the organized aqueous ionic liquid media. The high efficiency of this system was discussed by considering the high conductivities associated with the Brønsted and Lewis acidity characteristics of the IL.

The water electrolysis process is continually subject to improvement, including, among other features, the use of new and better electrocatalytic materials, which reduce overpotential. [10] The cathodic material that is most active for hydrogen production by water electrolysis is platinum, but high price and limited availability are limiting factors for its extensive use. Several materials have been used to make electrodes, with different effective active areas, catalytic activity, electrical resistance, corrosion resistivity and average lifetime. Lima *et al* [11] investigated vitreous carbon and pyrolytic carbon covered by nickel particles as cathodes in an aqueous solution of tetrafluoroborate of the 3-triethylammonium-propane sulfonic acid (TEA-PS.BF<sub>4</sub>) ionic liquid for hydrogen production. They observed current density values for the pyrolytic carbon cathode that were higher than those found for the vitreous carbon cathode, indicating that adsorption of H<sup>+</sup> and desorption of H<sub>2</sub> were favoured in the former.

At present, several studies are being conducted on economically viable hydrogen production by water electrolysis, which means finding new materials that can be used as electrodes and electrolytes. This work presents water electrolysis performance using five different electrodes – Pt, Ni, Pd, Au and Ag – and using TEA-PS.BF<sub>4</sub> ionic liquid solutions as electrolytes.

## II. METHOD

### 2.1. Preparation of TEA-PS.BF<sub>4</sub>

TEA-PS and TEA-PS.BF<sub>4</sub> were prepared using procedures available in the literature. [9] In a reaction flask, 51.4 g of 1,3-propanesultone and 42.5 g of triethylamine were mixed with 20 mL of ethyl acetate. The reaction was stirred at 323 K for 2 h and filtered, producing a white solid. The precipitate was dried at 373 K for 2 h, producing 3-triethylammonium-propane sultonate (TEA-PS) as a white powder.

TEA-PS.BF<sub>4</sub> was prepared by reacting 56.7 g of TEA-PS dissolved in 5 mL of water and 33.8 mL of tetrafluoroboric acid at room temperature. After 2 h at 363 K, the water was removed under reduced pressure, producing 75.9 g of tetrafluoroborate of the 3-triethylammonium-propane sulfonic acid (TEA-PS.BF<sub>4</sub>) as a white viscous liquid. [1H NMR (300 MHz, DMSO, ppm): d 1.17 (t, 3H), 1.88 (m, 2H), 3.22 (m, 2H), 3.32 (m, 2H), 4.23 (s, 1H)].

### 2.2. Electrochemical measurements

The conductivity ( $\sigma$ ) of the IL solutions was measured using an MCA 150 conductivity meter calibrated with standard aqueous potassium chloride solutions (491 ± 2.5 mg L<sup>-1</sup> and 1000 ± 10 μS cm<sup>-1</sup>, 298 K). The electrochemical experiments used a Hoffmann's Cell with a three-electrode arrangement (Fig. 1), composed of a platinum counter electrode, a platinum wire as the quasi-reference electrode and five types of working electrodes: platinum (Pt), gold (Au), silver (Ag), palladium (Pd) and nickel (Ni) – all the metal electrodes with 99.9% of purity. Electrolysis was performed with 0.1 M, 0.3 M and 0.7 M TEA-PS.BF<sub>4</sub> aqueous solution. Chronoamperometry (CA) was performed in a 100 mL Hoffmann's Cell at room temperature at potentials from -1.3 to -2.0 V continuously over 60 min to evaluate the electrodes' stability and H<sub>2</sub> production. The residence time of the bubbles on the surface of the electrode was estimated between 15 and 30 min and consists of the average time between two peaks of maximum current. Linear-sweep voltammetry (LSV) measurements were performed in a 30 mL Hoffman's Cell from -2.0 to 0.0 V at a scan rate of 10 mV s<sup>-1</sup> and range temperature from 288 to 353 K (± 0.1 K). LSV reports the

steady-state current densities dependence on a variety of overpotential, obtained from Tafel plots according to (1):

$$\eta = a + b \log j \quad (1)$$

where  $b$  (V dec<sup>-1</sup>) is the Tafel coefficient, which indicates the rate of change in current density,  $j$  (mA cm<sup>-2</sup>), with the applied overpotential,  $\eta$  (V). CA and LSV were performed with an AUTOLAB model PGSTAT302N and its associated NOVA software to control the experiments and data acquisition.

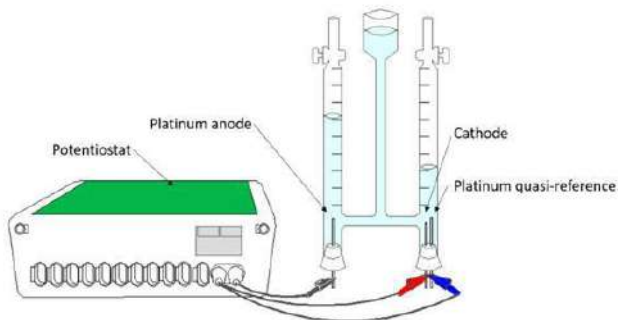


Fig 1. Hoffmann's Cell used for water electrolysis.

### III. RESULTS AND DISCUSSION

The nature of electrolytes and electrodes influences the electrolysis process. TEA-PS.BF<sub>4</sub> had its conductivities in aqueous solutions measured, and the results are shown in Fig. 2. Specific conductivity values increased with higher IL concentration, which may be attributed to its higher dissociation degree in water. At these concentrations – 0.1 M, 0.3 M and 0.7 M – water is in the TEA-PS.BF<sub>4</sub> network, breaking the strong Coulombic interactions, resulting in solvation and increase in the dissociation of the TEA-PS<sup>+</sup> and BF<sub>4</sub><sup>-</sup> ions. In this concentration range, the electric force attributed to the presence of the ions dissociated and subjected to the electric field seems to prevail over the frictional forces attributed to the increase in the viscosity of the medium due to IL concentration. This indicates that ionic conductivity is not only related to the viscosity but also to the ion-ion, ion-solvent, and solvent-solvent interactions.

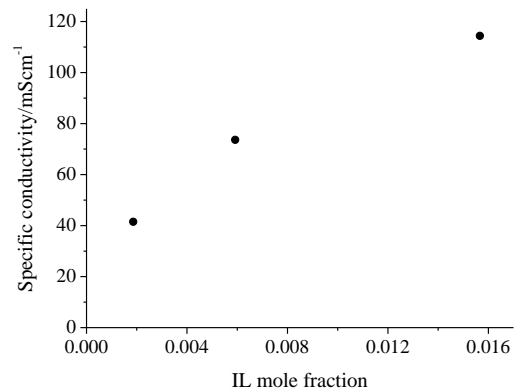


Fig. 2. TEA-PS.BF<sub>4</sub> molar fraction dependence on specific conductivity.

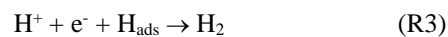
The rate of the electrode reaction, characterized by current density, depends on the nature of the electrode surfaces and on the composition of the electrolytic solution adjacent to the electrodes. The ions that are close to the electrodes in the solution and therefore under the effect of electrode form double layers, and the rate of the reaction depends on electrode potential characterized by the reaction's overpotential. The mechanism of the hydrogen evolution reaction is widely accepted [12] to be a step involving the formation of adsorbed hydrogen



which is followed by either chemical desorption



or electrochemical desorption



where the subscript *ads* represent the adsorbed status. Increasing overpotential could lead to a change in the mechanism rate. The rate-determining step will change at different potential ranges. When the potential is low, electron transfer (R1) is not as fast as desorption and hydrogen adsorption will be the rate-determining step. On the other hand, when the potential is high enough for the hydrogen adsorption rate to be higher than the desorption rate, hydrogen desorption will be the rate-determining step (R2 and R3). Fig. 3 shows increasing current density values with increasing potential for the electrodes tested, indicating that larger electric power is consumed by the electrolyser and therefore hydrogen production is higher. Pt with the IL presented the best performance at any potential range. Its current density increases from 200 to 400 mA cm<sup>-2</sup>. Similarly, Ni presented variation of 130 to 350 mA cm<sup>-2</sup>. Pd and Au, with small differences especially at lower potentials, presented behaviour similar to Ni. Ag presents the smallest current density variation, being subject to low or high overpotentials. Its variation was

only 140-250 mA cm<sup>-2</sup>, showing that working at smaller overpotentials (-1.3 V) may be more advantageous for Ag.

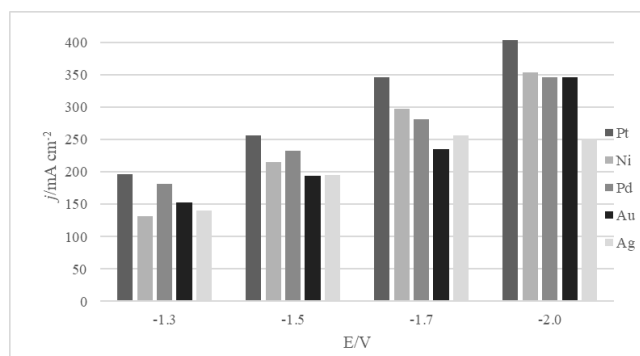


Fig 3. Potential effect on the current density for 0.1 M TEA-PS.BF<sub>4</sub> solution.

In addition to the overpotential imposed on the system, which is known to favour electrolysis, the system is affected by bubble formation on the work electrode's surface. The hydrogen bubbles produced tend to electrically insulate the active sites in the electrode surface, reducing its activity and consequently the current densities values. Fig. 4 and Table 1 show longer release time for bubbles produced at higher potential (-1.3 V) (Fig. 4a) than at lower potential (-2.0 V) (Fig. 4b). When several bubbles, represented by the circles, are produced, they adhered to the electrode, which remains with its active area unavailable for the reactions, and current values decrease. As soon as the bubbles are released, the reaction resumes and current increase again. Systems with higher amounts of bubbles tend to leave the electrode less exposed; therefore, those with higher potentials are privileged and present better performances. [13]

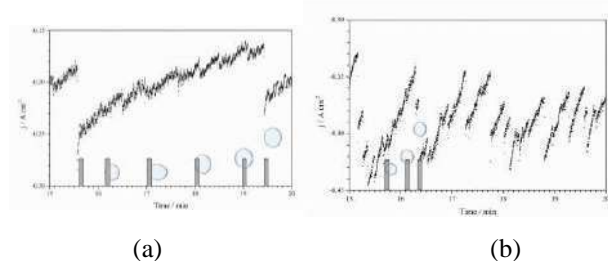


Fig. 4. Bubble release time to (a) -1.3 V or to (b) -2.0 V on Pt electrode with 0.1 M TEA-PS.BF<sub>4</sub> solution.

Interestingly, for the systems proposed here, the time during which the bubbles remain on the surface of the electrodes does not seem to vary significantly within the range of potentials studied. However, it can be inferred that on the Ag surface, the bubbles remain longer at -1.3 and -2.0 V potentials than on the surface of the other

electrodes. This may contribute to their poor performance in electrolysis compared to other electrodes.

Table 1: Release time of the H<sub>2</sub> bubbles on the electrodes surface.

|    | Release time (min) |           |           |           |
|----|--------------------|-----------|-----------|-----------|
|    | -1.3 V             | -1.5 V    | -1.7 V    | -2.0 V    |
| Pt | 2 ± 1              | 1.2 ± 0.6 | 1.0 ± 0.4 | 0.6 ± 0.2 |
| Ag | 4 ± 1              | 0.9 ± 0.5 | 1.2 ± 0.6 | 3.0 ± 2   |
| Au | 1.2 ± 0.6          | 1.4 ± 0.8 | 1.2 ± 0.2 | 1.4 ± 0.7 |
| Ni | 1.6 ± 0.6          | 2.2 ± 0.9 | 1.0 ± 0.5 | 2 ± 2     |
| Pd | 3 ± 2              | 1.1 ± 0.6 | 1.2 ± 0.6 | 1.0 ± 0.4 |

Fig. 5 shows the influence of TEA-PS.BF<sub>4</sub> concentration on current density at different potentials and with different electrodes. The results show an increase in current density values with increasing concentration of the IL. This behaviour agrees with those found in conductivity measurements where conductivity increases with higher concentration of the LI solution. The results also indicate strong dependence of water electrolysis on the electrode's material.

The data on Ni electrode showed efficiency only 10% lower than Pt, indicating Ni as a promising material to be used as a catalyst in water electrolysis with TEA-PS.BF<sub>4</sub>. In addition, systems using Pd, Au and especially Ag appear to be strongly influenced by the concentration of the IL, at least more than those using Pt and Ni. Electrodes made of Pt, Ni, Pd, Au and Ag were stable during the electrolysis process.

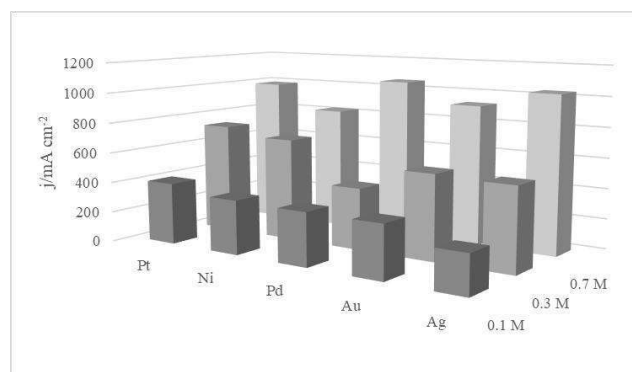


Fig. 5. Effect of TEA-PS.BF<sub>4</sub> concentration on current density at -2.0 V and 298 K.

Kinetic parameters for hydrogen production were evaluated by exchange current density at the open-circuit potential ( $j_0$ ) and cathodic slope ( $b_c$ ); both are shown in Table 2. Hydrogen production on the electrode is given by the slopes and intercept at  $E = E_{eq}$  by plotting  $\ln|j|$  versus  $E$ .



Table 2. Tafel parameters of the HER to different cathodes and TEA-PS.BF<sub>4</sub> solutions.

|    | $j_0$ ( $\mu\text{A cm}^{-2}$ ) |       |       | $b_c$ ( $\text{mV dec}^{-1}$ ) |       |       | $E_{\text{eq}}$ (V) |       |       |
|----|---------------------------------|-------|-------|--------------------------------|-------|-------|---------------------|-------|-------|
|    | 0.1 M                           | 0.3 M | 0.7 M | 0.1 M                          | 0.3 M | 0.7 M | 0.1 M               | 0.3 M | 0.7 M |
| Pt | 1.2                             | 2.8   | 6.5   | 104                            | 97    | 83    | 0.70                | -0.11 | -0.20 |
| Ni | 5.2                             | 3.0   | 0.8   | 120                            | 106   | 79    | -0.20               | -0.09 | -0.06 |
| Pd | 367                             | 320   | 324   | 61                             | 110   | 116   | -0.35               | -0.55 | -0.26 |
| Au | 4.9                             | 3.6   | 3.6   | 63                             | 125   | 44    | -0.35               | -0.21 | -0.03 |
| Ag | 1.2                             | 2.5   | 5.1   | 96                             | 66    | 6     | -0.20               | -0.04 | 0.28  |

It is worth noting that the highest exchange current density ( $j_0$ ) values were observed for Pd. Pt and Ag show increase in current density with increasing IL concentration. Ni and Au, in turn, present lower  $j_0$  with higher IL concentration. The lowest cathodic slope was observed for Ag with 0.7 M TEA-PS.BF<sub>4</sub> solution, followed by Au at the same concentration and Pd with 0.1 M solution. For Ag electrocatalyst, lower electrode polarization is needed for proton adsorption/desorption, and the reaction occurs faster (kinetic factor). It indicates that IL concentration influences electrode activity, and the best solution seems to be 0.7 M TEA-PS.BF<sub>4</sub> with Au, Ag, Ni and 0.1 M TEA-PS.BF<sub>4</sub> with Au and Pd.

Electrodes' catalytic performance was measured by activation energies ( $E_a$ ) for the HER. Arrhenius-type dependence predicts that the exponential increases with the reciprocal of the temperature, which, in a logarithmic form, is as (2):

$$\ln j = \ln A - E_a/RT \quad (2)$$

Where A is the pre-exponential factor ( $\text{cm s}^{-1}$ ),  $E_a$  is the activation energy, R is the universal gas constant ( $8.31 \text{ J K}^{-1} \text{ mol}^{-1}$ ), and T (K) is the absolute temperature.

The effect of temperature on the system with 0.1 M TEA-PS.BF<sub>4</sub> solution at 288-353 K with applied potential of -2.0 V is shown in Fig. 7.

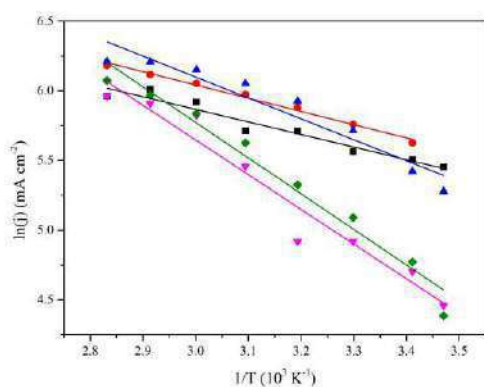


Fig. 7. Temperature effect on the current density for the system using 0.1 M TEA-PS.BF<sub>4</sub> at -2.0 V with Pt (■), Ni (●), Pd (◆), Au (▲) and Ag (▼).

Linear increase of the density current with temperature can be observed for all cathodes and between 298 and 318 K. Table 3 reports  $E_a$  values for each cathode studied. The adjusted R-square is shown to demonstrate the good approximation of the Arrhenius plots.

Table 3. Activation energy for the system with 0.1 M TEA-PS.BF<sub>4</sub> solution.

| Cathode   | $E_a/\text{kJ mol}^{-1}$ | $R^2$ |
|-----------|--------------------------|-------|
| Platinum  | 9                        | 0.94  |
| Nickel    | 24                       | 0.94  |
| Gold      | 5                        | 0.96  |
| Silver    | 9                        | 0.98  |
| Palladium | 25                       | 0.96  |

$E_a$  values are low for all electrodes, and Au, Ag and Pt have good performances and are promising materials to be used as working electrodes in water electrolysis with this IL. However,  $E_a$  values were higher for nickel and palladium than for those materials previously mentioned. Increase in temperature in the system may lead to higher density and diameter of the bubbles adsorbed on their surface. This increase in the surface area covered reduces the electrocatalytic area and therefore current density. This behaviour seems to be linear with increasing temperature but is more pronounced for Ni and Pd, making the slope of the line smaller. These values are comparable to those found in the literature when the electrolyte used is 30% KOH solution, that is,  $16 \text{ kJ mol}^{-1}$ . [9]

#### IV. CONCLUSIONS

Water electrolysis was performed with Pt, Ni, Pd, Au or Ag electrodes using TEA-PS.BF<sub>4</sub> as electrolyte. The Ni electrode's efficiency was only 10% lower than Pt, pointing to it as a promising material to be used as a catalyst in water electrolysis. Pt, Ni, Pd, Au and Ag electrodes were stable during the electrolysis process.

The best IL/cathode combination was obtained at 0.7 M TEA-PS.BF<sub>4</sub> for Au, Ag, Ni and at 0.1 M TEA-PS.BF<sub>4</sub> for Au and Pd, with high hydrogen production.

The major point of these studies is the economical attractiveness of performing water electrolysis using an inexpensive electrode such as Ni and a very stable IL. The system constituted by these elements must be considered

as an alternative to the currently employed to produce high-purity hydrogen through electrolysis.

### ACKNOWLEDGEMENTS

Thanks to University of the Latin-American Integration (UNILA), Graduate Support Program (PROAP) and Itaipu Technological Park Foundation/Araucaria Foundation (FPTI/FA) by the financial support, to Hydrogen Research Center (NUPHI) and to Federal University of Rio Grande do Sul (UFRGS).

### REFERENCES

- [1] Yue, M., Lambert, H., Pahon, E., Roche, R., Jemei, S., Hissel, D. (2021). Hydrogen energy systems: A critical review of technologies, applications, trends and challenges. *Renewable and Sustainable Energy Reviews*, 146, 111180. <https://doi.org/10.1016/j.rser.2021.111180>
- [2] Hashmi, M. H., & Dubey, N. (2018). Experimental Investigation of the Effects of Hydrogen Addition with Diesel on Performance and Emission of a Single Cylinder Diesel Engine. *International Journal of Advanced Engineering Research and Science*, 5(4), 135-145. <https://dx.doi.org/10.22161/ijaers.5.4.19>
- [3] Lui, J., Chen, W. H., Tsang, D. C.W., You, S. (2020). A critical review on the principles, applications, and challenges of waste-to-hydrogen technologies. *Renewable and Sustainable Energy Reviews*, 134, 110365. <https://doi.org/10.1016/j.rser.2020.110365>
- [4] Haverkort, J. W., Rajaei, H. (2021). Voltage losses in zero-gap alkaline water electrolysis. *Journal of Power Sources* 497, 229864. <https://doi.org/10.1016/j.jpowsour.2021.229864>
- [5] Anwar, S., Khan, F., Zhang, Y., Djire, A. (2021). Recent development in electrocatalysts for hydrogen production through water electrolysis. *International Journal of Hydrogen Energy*, 46(63), 32284–32317. <https://doi.org/10.1016/j.ijhydene.2021.06.191>
- [6] Thimmappa, R., Walsh, D., Scott, K., Mamlouk, M. (2020). *Journal of Power Sources* 449, 227602. <https://doi.org/10.1016/j.jpowsour.2019.227602>
- [7] Nordness, O. & Brennecke, J. F. (2020). Ion Dissociation in Ionic Liquids and Ionic Liquid Solutions. *Chem. Rev.* 120, 23, 12873–12902. <https://doi.org/10.1021/acs.chemrev.0c00373>
- [8] Amaral, L., D.S.P. Cardoso, D.S.P., Šljukić, B, Santos, D.M.F., Sequeira, C.A.C. (2019). Electrochemistry of hydrogen evolution in RTILs aqueous mixtures. *Materials Research Bulletin*, 112, 407-412. <https://doi.org/10.1016/j.materresbull.2018.04.041>
- [9] Fiegenbaum, F., Martini, E. M., Souza, M. O., Becker, M. R., Souza, R. F. (2013) Hydrogen production by water electrolysis using tetra-alkyl-ammonium-sulfonic acid ionic liquid electrolytes. *Journal of Power Sources*, 243, 822-825. <https://doi.org/10.1016/j.jpowsour.2013.06.077>
- [10] Fiegenbaum, F., Souza, M. O., Becker, M. R., Martini, E. M., Souza, R. F. (2015). Electrocatalytic activities of cathode electrodes for water electrolysis using tetra-alkyl-ammonium-sulfonic acid ionic liquid as electrolyte. *Journal of Power Sources*, 280, 12-17. <https://doi.org/10.1016/j.jpowsour.2015.01.082>
- [11] Lima D. W., Trombetta, F., Benvenuti, P. P., Teixeira, S. R., Martini, E. M. A. (2019) Effect of different carbon supports for Ni particles for the HER in tetra-alkylammonium-sulfonic acid media. *Int J Energy Res.* 1–12. <https://doi.org/10.1002/er.4765>
- [12] Zeng, K. & Zhang, D. (2010) Recent progress in alkaline water electrolysis for hydrogen production and applications. *Progress in Energy and Combustion Science*, 36, 307-326. <https://doi.org/10.1016/j.pecs.2009.11.002>
- [13] Zeradjanin, A. R., Narangoda, P., Spanos, I., Masa, J., Schlögl, R. (2021). How to minimise destabilising effect of gas bubbles on water splitting electrocatalysts? *Current Opinion in Electrochemistry*, 30, 100797. <https://doi.org/10.1016/j.coelec.2021.100797>
- [14] Bae, M., Kang, Y., Lee, D. W., Jeon, D., Ryu, J. (2022). Superaerophobic Polyethyleneimine Hydrogels for Improving Electrochemical Hydrogen Production by Promoting Bubble Detachment. *Adv. Energy Mater.*, 12, 2201452, 1-9. <https://doi.org/10.1002/aenm.202201452>

# The training of health students during the COVID-19 pandemic: Changing scenarios

Adriana Duarte de Souza Carvalho da Silva<sup>1</sup> Enderson Rodrigues de Carvalho<sup>2</sup>, Master Leandro Henrique Tavares Pauletti<sup>3</sup>

<sup>1</sup>PHD. Professor in the Medicine Department of Centro Universitário Claretiano.

<sup>2</sup>Candidate for a PHD at Universidade Estadual de Campinas and professor at Centro Universitário Claretiano.

<sup>3</sup>Dean of Centro Universitário Claretiano.

Received: 11 Aug 2022,

Received in revised form: 07 Sep 2022,

Accepted: 11 Sep 2022,

Available online: 15 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** COVID-19, Pandemic, Health Education, Health Training.

**Abstract—** *The COVID-19 pandemic has radically changed our relationships with the world, making our social interactions more distant and colder than we saw before the spread of the disease. The impact of this seclusion of people and the departure from their routines should have positive and negative consequences over the years. In this reflection, we discussed what adaptations were made so that students and educational institutions could count on a horizon in the maintenance of their activities during the pandemic, without students, teachers and even the schedules, being impacted by the scenario that happened. The article shows that there were many investments so that the interaction was not compromised and so that the technological resources could compose all the support that was already available for the training of students in health courses.*

## I. INTRODUCTION

Since the end of 2019, the world has been hostage to an unprecedented pandemic, which has had an impact not only because it is a disease that has killed thousands of people across the planet, but also because has changed everyone's routine and radically transformed our habits and mores. Our economy was impacted, thousands of people lost their jobs and large corporations closed their doors during this time. It was not just the health of the population that was affected, but everything around it (Lauro, Vicente. 2020).

In this new scenario, in the months following the beginning of the pandemic it was demanded a reclusion of families in their homes, changing the way of interacting with their work, studies, new buying habits and even relating to people. All this change was aimed at maintaining their health and removing any possibility of being contaminated with the SARS-CoV2 virus and its mutations (Bezerra, et al. 2020).

After studies and verification of a vaccine against the disease, several countries entered a race to buy an immunizer that could end the pandemic and bring normality back. More than two years after the beginning of the proliferation of COVID-19, it seems that activities around the world are returning to what they were before 2019, bringing a certain relief and enormous hope to everyone for the future (Castro, 2021).

However, before we get to that moment, in which what is outlined from now on is an extremely positive and hopeful scenario, in the midst of the pandemic it was necessary to maintain some crucial activities for the world to continue working. Industries, health services, schools and colleges, among other activities, could not interrupt their work for a long time, given the loss that they would have within their schedules and needs of supply and demand for their products and services.

Given this scenario, health courses had to develop strategies to maintain teaching, including practical classes. In this

context, this article wants to understand how this was done during the first months of the pandemic and the strategies created.

## II. METHODS

This is an exploratory research, built on the experience of the Dean of a medical course at a Brazilian university, who had to adapt to new teaching-learning strategies during the pandemic.

Claretiano University Center has a degree in medicine of excellence in the region where it is located. The medical course is part of a federal public policy called Mais Médicos, which aims to increase the number of doctors in Brazil in line with family health strategies. That is why the course is focused on public policies for family medicine and primary health care. The course offers labs and practical classes since the first semester. With the pandemic, all that changed.

With the pandemic, all changed and the institution needed to create new strategies to continue with the practices, maintaining the quality of your practical classes. Therefore, this is an experience report and study case, based on the experience of the team responsible for managing the course, on how to keep lessons going, with the same experiences and high level.

## III. RESULTS

Within this universe, educational institutions had to create possibilities for interaction and resignify the education models practiced so far so that educational activities could take place during the pandemic. Efforts and investments were made so that classes and monitoring took place at a distance, maintaining a quality standard in the improvement of students and reducing losses as much as possible at this time. In addition, professors and students had to broaden their view of this technology, training was offered by educational institutions so that those involved were familiarized with the technology as soon as possible (Matos de Oliveira. 2021).

This was also a troubled and apprehensive period on the part of the training schools, as students and family members questioned the format of the classes, which was changed from the traditional learning model. The adoption of technologies and digital media, such as films and series in the increase of remote classes, ended up triggering in some people the feeling that the lack of interaction and low participation of students with remote media, would frustrate students' learning ambitions. (Nóbrega, Oliveira. 2021).

Specifically for health courses, maintaining practical activities during the pandemic was an extremely difficult

task to perform. In the first months of 2020, when the disease aggressively arrived in our country, educational institutions and the government immediately ended up removing students from practice scenarios, given the risks offered to this audience. For many students, this was a very troubled moment, giving them a feeling of insecurity regarding the fulfillment of their goals, generating anxiety and concerns for students and families (Girundi, Aveiro, Uchôa-Figueiredo. 2021).

At this time, many institutions ended up investing and putting all the capacity of their simulation laboratories into the maintenance of practical activities, they used recordings and videos of situations of the course practice as a discussion scenario, they discussed medical records, among other forms of bring knowledge to the student. All this effort was aimed at not harming student learning and the commitment of their training period, this is because many trainees were already in boarding school at the time of the pandemic or in more advanced semesters, where practice takes care of much of the your study day (Costa, et.al. 2021).

Professors who were on the front lines of the fight against COVID-19, doctors and nurses mainly, carried out the exercise of taking to the discussions with the students, at the moment when it was possible to give in person or even virtual, the analysis on top of the attendance records. This exercise was extremely positive for the student to have a broader understanding of how medical practice was carried out at the time of a pandemic, something unthinkable in the construction of knowledge, however, an experience that trainees in this period will hardly forget (Matos de Oliveira. 2021).

## IV. DISCUSSION

Undergoing a health course during a pandemic is something quite peculiar and unprecedented in the literature. There were certainly gains and losses in this process. Investments in technology in the application of hybrid and totally remote models, showed that there is a path that can be traveled by students and educational institutions without significant losses and optimizing learning. The maintenance of subjects from these courses in this format showed that, at times, the lack of interaction did not harm the process (Grossi, Minoda, Fonseca. 2020).

On the other hand, it was noticeable that students, preceptors and professionals from multidisciplinary teams, distributed in units of the Family Health Strategy - ESF, Basic Health Unit (UBS), Emergency Care Units (UPA) and public and private hospitals, became closer and made very powerful exchanges of theoretical and practical knowledge. The construction of this multidisciplinary relationship while the student is still in the institution of higher education, collaborates considerably so that there are no barriers in the

construction of collective work, reducing the power struggle within the spaces of practice.

At this time, many institutions ended up investing and putting all the capacity of their simulation laboratories into the maintenance of practical activities, they used recordings and videos of situations of the course practice as a discussion scenario, they discussed medical records, among other forms of bring knowledge to the student. All this effort was aimed at not harming student learning and the commitment of their training period, this is because many trainees were already in boarding school at the time of the pandemic or in more advanced semesters, where practice takes care of much of the your study day (Costa, et.al. 2021).

Another important interaction that gained a lot of space in this period and that is certainly here to stay was Telemedicine. Some universities were able to put their students to monitor the care provided by a medical professor at the institution and analyze the entire context behind this way of bringing health to the population. Fast, economical and with the possibility of having more agility in diagnoses and treatments, the trainees were able to make powerful discussions from these analyzes and maintain a good level of knowledge retention (Massucato, et.al. 2021).

It was possible to see the participation of students from courses in the health area participating in meetings and moments where public health units carried out Permanent Health Education. This important policy and advocated by the Unified Health System was fundamental at the beginning of the pandemic in the dissemination and exchange of relevant information about what was known about COVID-19. The collaboration of the student, when he was present in the unit, brought even more notability to this process, since the student has the obligation to seek knowledge and innovations in the practice of his profession to update himself and form his framework. As he takes this information to these moments of exchange within the units, he collaborates in a fundamental way for the training of other agents.

## V. CONCLUSION

Many innovations and adaptations were made in order to maintain normality in educational activities during the COVID-19 pandemic, all so that students and educational institutions could envision, as soon as possible, an encouraging scenario for the gradual and definitive return of their routine. This pandemic moment ended up lasting longer than we imagined, making some changes in the way of educating become positive and even as an option to be considered in the increase of knowledge. It is still difficult to make a diagnosis of what the model that institutions will adopt with this return will be like, if we will have contributions from this moment where many changes have

been made, if we will return to the traditional model to which we were used to, or if we will have a third way, where the adaptations we've made will be added to new technologies that we don't even know about yet. If I were to choose one of them, I'd say the last one makes the most sense.

## REFERENCES

- [1] BEZERRA, ACV. SILVA; CEM. SOARES; FRG. SILVA, JAM. Fatores associados ao comportamento da população durante o isolamento social na pandemia de COVID-19. *Ciênc. saúde coletiva*; vol 25 (suppl 1), Jun 2020. p. 2411-2421. <https://doi.org/10.1590/1413-81232020256.1.10792020>
- [2] CASTRO, R. Vacinas contra a Covid-19: o fim da pandemia?. *Physis: Revista de Saúde Coletiva*, Rio de Janeiro, v. 31(1), e310100, 2021. p. 1-5. <https://doi.org/10.1590/S0103-73312021310100>
- [3] COSTA, RRO; et.al. Laboratório de habilidades e simulação clínica em época de Covid-19: possibilidades e recomendações práticas. *Medicina (Ribeirão Preto)* 2021;54(1): e-177075. p. 1-14. <https://doi.org/10.11606/issn.2176-7262.rmrp.2021.177075>
- [4] GIRUNDI, C; AVEIRA, M.C; UCHÔA-FIGUEIREDO, L.R. Formação para o cuidado interprofissional: ressignificando a prática de saúde em tempos de pandemia. *Interface (Botucatu)*. 2021; 25 (Supl. 1): e210034. p. 1-14. <https://doi.org/10.1590/interface.210034>
- [5] GROSSI, M.G.R; MINODA, D.S; FONSECA, R.G.P. IMPACTO DA PANDEMIA DO COVID-19 NA EDUCAÇÃO: REFLEXOS NA VIDA DAS FAMÍLIAS. *Teoria e Prática da Educação*, v. 23, n.3, Setembro/Dezembro 2020. p. 150-170. <https://doi.org/10.4025/tpe.v23i3.53672>
- [6] LAURO, M; VICENTE, L.H. Impactos da crise da Covid-19 no mercado de trabalho brasileiro. *Revista de Economia Política*, vol. 40, nº 4, outubro-dezembro/2020. p. 647-668. <https://doi.org/10.1590/0101-31572020-3200>
- [7] MATOS DE OLIVEIRA, J. V. O cenário da educação médica brasileira na pandemia da Covid-19. *Revista Portal: Saúde E Sociedade*, 6 (Fluxo contínuo), e02106024. 2021. p. 1-5. <https://doi.org/10.28998/rpss.e02106024>
- [8] MASSUCATO, M.A.O; RIBEIRO, A.L.G; PESSALACIA, J.D.R; NEVES, V.J.R; SNOLTE-RODRIGUES, V.P. Telessaúde como ferramenta na formação médica durante a pandemia da COVID-19: relato de experiência. *REVISTA BRASILEIRA DE EDUCAÇÃO MÉDICA*. 45 (3): e172, 2021. p. 1-6. <https://doi.org/10.1590/1981-5271v45.3-20210195>
- [9] NÓBREGA, L; OLIVEIRA, F.L. Os desafios da educação remota em tempos de isolamento social. *Revista Educação Pública*, v. 21, nº 14, 20 de abril de 2021. p. 1-5. Disponível em: <https://educacaopublica.cecierj.edu.br/artigos/21/14/os-desafios-da-educacao-remota-em-tempos-de-isolamento-social>

## Innovation as humanity's resource: How play can make the UN's 2030 goals achievable

Waldir Ventura Filho<sup>1</sup>, Júlio Francisco Blumetti Facó<sup>2</sup>, Alexandre Acácio de Andrade<sup>3</sup>, Lina Maria Moreira Garai da Silva<sup>4</sup>

<sup>1,2,3</sup>Centro de Engenharia, Modelagem e Ciências Sociais Aplicadas, Universidade Federal do ABC, Brasil

<sup>4</sup> Universidade Metodista de São Paulo, UMESp, Brasil

Received: 11 Aug 2022,

Received in revised form: 05 Sep 2022,

Accepted: 10 Sep 2022,

Available online: 14 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** Play, Gamification, Innovation,  
Digital Games, Sustainable Development  
Goals.

**Abstract—** With the ever-growing demand for solving problems common to all countries, world forums have seen a rise in its protagonism in the discussion of these issues. Since definition of the Sustainable Development Goals in 2015, discussions have increased on how the goals can be achieved to ultimately generate a more sustainable world. Each country should bring its, but so far, many goals are below expectations, worrying the UN - especially after the COVID-19 pandemic that shook the planet. Some of the adversities encountered in joining forces in the face of these challenges are the lack of unity between countries, distrust in supranational bodies, poor knowledge of how similar situations are treated and lack of creativity in generating ideas and solving these problems. From this, it is suggested that playful play can help to save humanity in setbacks since, through play, people can develop a sense of empathy, as well as an understanding of different material conditions, which leads to improving creativity and, as a result, innovative solutions. There are already some games both physical and digital that are in line with the SDG (Sustainable Development Goals). However, the digital games industry is increasingly growing among young people and adults alike, and they can maximize the power of gamification, which is to make playable a real situation. This research, with an exploratory theoretical character, concludes that playability - especially gamification - is on the rise and can help civilization to build a more humane and sustainable world.

### I. INTRODUCTION

In the past decades, discussions about globally commutual problems have intensified. Except for a few locally specific issues for each country, there are concerns – almost all derived from social inequality - that are common to every country, such as poverty, conscious use of resources, health, famine, climate change, *et al.*

In 1972, in Sweden, embryonic dialogs emerged through governments' spokespeople of several countries at the United Nations Conference on the Human

Environment. The event aimed to understand the rights that families should have in a healthy and productive environment. There was also a series of meetings to discuss adequate food, housing, and clean water as human rights along with the need to reconnect humanity's touch with nature, which led the UN to create global institutions to closely monitor the subject [1].

In the period of the following 20 years, a consensus – culminated in 1987 - was achieved by the UN, which pointed out to the reaffirmation of the environment as not

being in a separate sphere from human actions, ambitions and needs. In this regard, it would be necessary to create a global agenda to change the human mentality, then, take actions to make development more sustainable. Subsequently, environmental agendas were discussed at the meetings of Rio 92 (1992), Rio +10 (2002), and Rio +20 (2012), in addition to the Kyoto protocol (1997) and the Paris Agreement (2016).

After the RIO+20 Conference, the document “The future we want” was published, aligning global monitoring goals with a focus on sustainable development. In view of this, a transparent process that encompassed the largest number of governments was launched with its aim set at universal development goals with a long-term vision, beyond the year 2015[1].

In detail, the Millennium Development Goals (MDGs) were created (figure 1). The MDGs described superficially, the focus points in the eradication of extreme poverty. The MDGs were incorporated by the UN members in the year 2000, which encouraged that these goals were put to action in favor of global social development.



Fig.1: Millennium Development Goals [2] (MDGs, 2000)

Furthermore, conversations and discussions in working groups in 2015 the “UN 2030 Agenda” was approved as a direct continuation of the project. A declaration described superficially a revised version of the previous MDGs, this time, made up of 17 Sustainable Development Goals (SDGs – Figure 2). Until 2030, the committee seeks to engage all countries in building a better future and meet all SDGs.



Fig.2: Sustainable Development Goals from UN's 2030 agenda.

According to the World Bank (2019)[3], the levels of poverty have been reduced by more than 50% since the 1990's. On the other hand, one in ten people still live on less than \$1.92 a day. Out of the most affected by extreme poverty, children make up for most of the numbers, for instance, one in nine children are undernourished, the vast majority living in developing countries. [4].

As for hygiene, six out of ten people still do not have access to proper services, and three out of ten do not have safe drinking water [4]. To make matters worse, even though the proportion of people living in precarious housing dropped from 39% in 2000 to 30% in 2014, the absolute numbers increased from 792 to 880 million people[1].

The weather is another worrying factor, as global warming encounters itself at a rampant level. According to NASA (2019), 2016 was the warmest year recorded since 1880. In addition, the Amazon rainforest, the most preserved green area in the world, of which roughly 60% belongs within the legal territories of Brazil, is currently in a delicate state. In February 2018, the deforested area was 17% of the total. If these numbers reach 20%, many predict that the world's largest rainforest would face an unrecoverable point, in a tendency to become a savanna-like biome [5].

In 2014, the Pew Research Center surveyed nearly 40,000 people in 39 countries to find out what they considered the main global concerns were. The most pointed out were climate change, the global financial crisis, Islamic extremist groups, Iran and North Korea's nuclear program and the power and influence of the United States and China [6].

Additionally, the World Economic Forum, in 2017, listed that 31,000 millennials from more than 186 countries indicated that the world's biggest concerns are: climate change and nature destruction, large-scale conflicts and wars, income inequality and discrimination, poverty, religious conflicts, corruption or lack of transparency, water and food security, lack of education, security, and unemployment rates [7].

These mentioned facts indicate that for the SDGs to be met within the established deadline, more than a union between countries and their people is needed. Many problems are still far from being solved and have a high complexity degree. Thus, we can observe a lack in creativity and innovation to be resolved.

Aware of this challenge, Canada conceived in 2001 the World Day of Creativity, adopted by the UN and held on April 21 every year in more than 50 countries. The day

promotes the use of creativity and innovation so that the 17 SDGs can be achieved [8]. The need for creativity in social, environmental, and economic development is increasingly visible. Ali (2014) cites that nothing is as important historically as innovation, industrial and economic progress and, consequently, the well-being of humanity depends on it. Hence, where there is high technology such as manufacturing or pharmaceutical industries, innovation is most responsible for both increasing and sustaining quality and productivity, making it an essential factor in almost every aspect of human life.

For Schumpeter (1988)[9], innovation refers to any new policy that an entrepreneur undertakes to reduce the overall cost of production or increase the demand for his products. In consequence, it always represents a displacement in the previously existing equilibrium state. When changes occur in the economy, the circular flow is disturbed, and the development process evolves.

In this case, changes can take five forms: the introduction of a new product; the introduction of a new production method; opening of a new market; the appropriation of a new source of raw materials; the achievement of a new industrial organization method of any kind. The combinations of these factors are essential for the beginning of the development process. The development process is to be carried out by development agents: innovators/entrepreneurs. The entrepreneur is considered responsible for creating the imbalance in Schumpeterian development [10].

However, these definitions do not cover all 17 SDGs, as some are not directly linked to economic factor. Farfus [11] (2008, p. 36) mentions that current organizational models fail in terms of social demand - which form the backbone of the 2030 Agenda. This factor created by these social gaps allow for new initiatives to emerge. Thus, one of the strategies to overcome the challenges posed is the concept of social innovation.

Whether social or economic, innovation needs creativity which, in turn, can be developed through recreative activities. Playing is a pleasurable and recurrent creative activity in life as a child, generating and promoting the search for knowledge. It is fundamental to ideas and creativity, which are essential for innovation.

Consequently, the act of playing - in addition to being educational [12] can bring innovative ideas that are necessary to achieve the Sustainable Development Goals.

All things considered, the purpose of this work is to show how playing can lead to creativity and, consequently, to innovation, which are key in creating a more sustainable world for everyone. This research has an exploratory

character and addresses concepts of play, creativity, digital games, and innovation.

## II. WHAT IS PLAYING

According to Psychology studies based on a historical and social view of child development processes, from which Vygotsky [13](2007) is one of its main representatives, playing is a creative human activity, in which imagination, fantasy and reality interact in the production of new possibilities, interpretations, expressions, and actions by children, as well as new ways of building social relationships with other individuals, both children and adults.

The act of playing has a fundamental role in child development, as it is a natural behavior for children. Games have been around throughout all the formation of our individual lives, whether in schools, assisting learning, or at home in moments of leisure and relaxation. Such activity has fundamental role in the development of creativity, by providing a diversity of experiences [14].

According to Borba [22](2006, p.38):

“It is important to emphasize that the proper way of communicating while playing does not refer to illogical thinking, but to an organized discourse with its own logic and characteristics, which allows children to transpose spaces and times and transit between the planes of imagination and reality, fancifully exploring its contradictions and possibilities. Thus, the planning of an informal play or game enables the construction and expansion of skills and knowledge in terms of cognition and social interactions, which certainly has consequences for the acquisition of knowledge in terms of formal learning”.

Then, it becomes apparent that playing places the child in a social context, as it provides interaction with other children, with an environment created for a given situation, and with the toys available. When playing, the child will create a scenario, a context, select what will be part of it and apply the real knowledge they have already learned in the situations created during the game. According to Vygotsky [13] (2007), such recreation helps children to appropriate and mentalize the world in the social context in which they were born at, internalizing the concepts and materiality that occur in the external environment.

Salomão et.al. [15] mentions that playing is one of the main ways of learning - if not the only from which we



obtain concrete cognitive process. To learn, one must attain distance from itself, a situation that is practiced through playing. From the point a child is separated from the mother, this adjunction is generated, which stimulates the child to think and learn different things than they might already know. Such stimulus can generate a discernment that can even differ from what is proposed as learning in such activity.

In this context, the importance of the toy is highlighted. It serves as a tool of a playful function, since it is directly linked to the feelings of fun and pleasure of the child, in addition to having an educational function, as it teaches to complement the individual and the context around him [16]. A toy can be defined as an object or a playful activity, usually aimed at children's leisure.

According to [17], the types of toys can be separated into the following segments: affective development, early age, technical world, physical activities, intellectual activities, creativity, and social relationships. Any of these segments stimulate the mind and therefore the cognitive process.

On another hand, Kishimoto [18] defines a toy simply as the support object of play. Brougère and Wajskop [19] associate the toy with a cultural object, with its meanings influenced by the environment/ historical context in which they are inserted. An example is the Barbie doll, which represents the standard of female beauty in modern western society, but in other times it could have been synonymous with excessive thinness.

These plays, in turn, symbolize the function that a particular toy represents for the child. A broom, for example, can be used to symbolize a horse in a game. For Vygotsky [13] (2007), play is an imaginary situation created by the child, in which they manage to satisfy their impossible fantasies in the real world, thus born of a frustrated desire for reality.

The author also states that child's games provide great leaps in their development and learning. According to Leontiev [20], children can, through the act of playing, compare their abilities with those of others, as well as understand his social role.

## 2. Play and creativity

As argued by Lira and Rubio [21], it is in moments of free play that children express themselves and develop their creative process. These authors call these moments of total creative freedom "spontaneous play". In this sense, Vygotsky [13] states that "playing is a creative human activity." (p.18). This same author, on the concept of playing says that when a child play there is a relationship

between memory and imagination and between reality and fantasy.

Vygotsky [20], presents a perspective or idea similar to the authors mentioned above, but goes a little further, saying that creativity is everything that human beings create anew. He argues that human beings can have two types of impulses that are at the base of a creative attitude. These impulses are called "reproductive" and "creator" or "combiner". The first impulse is related to memory and the fact that humans can reproduce something they have already seen or experienced, the second impulse concerns the creation of something new or the reformulation of something already done, based on previous experiences. This way, they can adapt better to the world around them. It is with this second impulse that the human being may go further, creating something new and innovative. This same author states that the imagination of the human being to create something new is related to his reality and experience. For this reason, Nascimento [22] (2004) says, "the richer the experience of man, the greater the material available to the imagination." (p. 15).

According to the psychoanalyst Winnicott [23] (1975), "It is in playing and only in playing that the individual child or adult is able to be creative and to use the whole personality, and it is only by being creative that the individual discovers his self." This quote demonstrates the essential relationship between creating and playing.

## III. THE DIGITAL GAME INDUSTRY AND THE GAMIFICATION OF REAL SITUATIONS

The Digital Games Industry (DGI) became one of the study objects of this work, as it can provide technological innovation and a new way of playing.

Digital games can be defined as games built through digital technology [24]. According to [25], digital technology is a set of technologies that mainly allows the transformation of any language or data into binary numbers, that is, into zeros and ones (0 and 1). All the technology we know is translated into numbers, which are read by computers.

The Digital Games Industry has achieved significant growth in recent years. According to consultant PricewaterhouseCoopers [26], the digital games market moved US\$ 65.7 billion in 2013, and was expected to reach US\$ 89 billion in 2018, projecting a growth rate of 6.3% per year in this period. It is worth noting that according to Forbes magazine [27], the global gaming industry moved US\$ 175.8 billion in 2021. One of the reasons for the growing importance of digital games is that they are not only consumed by young men, as is

traditionally thought, but also by children, women, and the elderly [28]. This breaks the paradigm that games are only for children and for fun, as they can be seen used for other purposes.

Videogames are used in the education sector, training in companies or institutions, architecture, and civil construction, by companies or people who need to carry out a selection or coaching process in, for example, the health sector, gyms, and personal trainers, among others, practically covering all the sectors. In addition, it is noted that the use of technology is more attractive even when the function is really to play.

Consequently, they are attractive to all ages, regardless of gender, and can serve for multiple professional purposes, as pointed out. The main difference with respect to physical games is the need for a digital device so that it can be executed, which can be a video game console, portable console, computer or even cell phones. On another note, DGI can be classified according to its different platforms, which are: console (for television), mobile (for cell phones and tablets), PC (for computers) or even online (internet connection dependent games) [28].

Lately, evidence of recognition of the importance of the DGI have been expressed from the governments of several countries, such as Canada, the United States, France, England, South Korea, China, and Australia, from which all chose to adopt public policy mechanisms to stimulate its development.

According to Mello and Zendron [24] (2015), it is a very dynamic and innovative industry, whose compromises with high technical knowledge for the development of games, creativity on the part of the industry, uncertainty in investments and the patenting of hardware and software. Innovation is related to both the modernization of game platforms and the development of games that are increasingly attractive, and that are increasingly complex.

Parenthetically, another interesting feature of the videogame industry concerns its very interactive and concise communication language, since such language is based on the need for computer programming knowledge, which adds value to the product [24].

Technological advances have contributed to progressive changes at the DGI, including the expansion of hardware processing power, the increase in graphics capacity, the expansion of the internet and mobile broadband, in addition to the insertion of smartphones. Such changes provided the rise and popularization of online games, which aids in connecting people even more, generating growth in the industry as a whole. Figure 3,

taken from PwC [26], shows the evolution of different digital game platforms in terms of revenue.

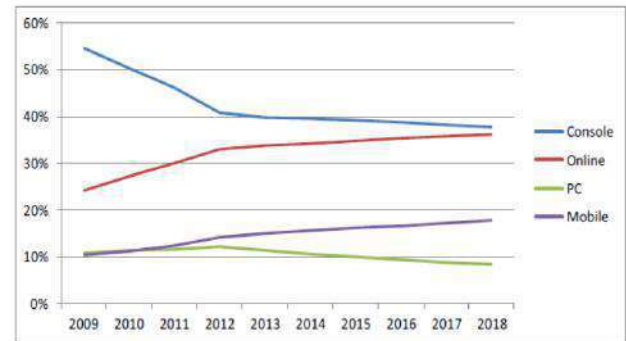


Fig. 3: Plataformas de jogos digitais em termos de receita mundial

As previously mentioned, digital language can be applied both for entertainment and for professional purposes, in the areas of training in companies, selection processes in the human resources and teaching sectors, in a more playful and “gamified” way. This ultimately attracts people from the newer generations and achieve better/more efficient results for companies.

Finally, this same gamification format or trend can be used as a ludic way of solving problems directly related to sustainable development.

#### IV. GAMIFICATION OF UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

One of the 169 goals defined by the UN concerns the need for “students to have acquired, by 2030, the necessary knowledge to promote sustainable development”.

In general, the student's interest in his role in sustainable development is not always latent [29], which implies that the educator has the role of fomenting their interest, offering new teaching and learning methods that can connect and make the student aware for his conscience as a responsible citizen and professional in the future [34]; [35].

As mentioned in the previous chapter, the implementation of gamification amidst the solutions for commonly pointed out problems, can increase young people's interest in solving them, hence, sustainable development is at aim.

According to Cheng and Su [30] (2012), students proposed to game-based learning models can obtain better results in knowledge acquisition, content understanding, perception, and cognition, as well as behavioral, affective, motivational, and physiological changes.

Gamification can be considered an educational approach, extracted from games, and transplanted to contexts whose purpose goes beyond entertainment.

According to Hammer and Lee [31] (2011), the gamified approach aims to transpose the design of games to other situations. It has already been widely diffused as in use by the military, education, and management areas.

Prensky [32] (2001) states that, in teaching, games are used as an alternative to reach a generation of “digital native” students from a globalized and more technological context than previous ones, who do not feel connected, emotionally, and cognitively, with the conventional teaching model.

According to Charsky [33] (2010), several games are a result of gamification itself and offer a rich and risk-free environment for the active exploration of topical, intellectual, and social problems, thus extending the use of the game as more than just entertainment.

The student, in the current global context, is the protagonist of sustainable development, in addition to being beneficiary [36]; [37]; [38] - a fact that happens because they will be the ones living surrounded by this reality in their daily lives, just as in their future professional career.

Taking this fact into account, education training institutions must be critical in their teaching policies and practices so that disciplines that encourage diversity, interdisciplinarity and discussion on global agendas, such as the SDGs are included [36]; [34]; [35].

Yuan [29] (2013) mentions that the student has moments of alternation in feeling as a protagonist in this sustainable development, even though there is a greater discussion of these issues in the curricula [37]. Therefore, the role of educators is to raise awareness on the subject, using different and dynamic didactics, which can attract attention to the resumption of constant consciousness of a citizen, having the power to influence the future of everyone in the world, as well as understanding that their professional trajectory is directly affected [34]; [35].

By identifying that gamification may involve employees better than other more conventional ways, as well as learning in a more fun and productive way, organizations and companies are increasingly adhering to games to instruct and educate people.

Taspinar [39] state that, theoretical content is essentially extremely boring and promotes the brief disinterest of those who are consuming it. Games mitigate that effect, since they combine content with self-directed learning, as they are interactive and do not allow space for boredom to fill the player. Thus, it is an excellent option to

meet the demand of the content, but with a focus on learning.

Still, Van Eck [40] cites that the effectiveness of games in learning is not only because they are fun, but also because they have the ability to immerse the player, in a way that requires frequent interaction and that makes them think about the decision that is being made, as well as adapting to needs, promoting inclusion and socialization.

Teaching sustainability through games, is viable, since there is an interdisciplinary approach, given that games can connect several different individuals and would act as complementary resources to those that already exist within conventional methodologies for education and training.

On the whole, Games, by elevating the aforementioned characteristics responsible for promoting useful experiences, are also an alternative education for sustainability, as long as it has student-centered approaches [41]. This point reinforces the indication that gamification can be put to work on the UN Sustainable Development Goals, fomenting situations to contextualize and generate ideas for achieving the goals of the 2030 Agenda.

## V. STATE OF THE ART: GAMIFICATION

Some authors have studied gamification as a problem-solving tool. In this section, some of these works will be cited.

Gamification has the purpose of inserting, in a game, a certain real context. Taking this fact into account, Carse, - one of the most promising individuals on the subject - says that: “there are two kinds of games. One could be called finite and the other infinite. A finite game is played for the purpose of winning and an infinite game with that of continuing to play” [42].

Forgiarini and de Quadros [43], studied the state of the art of gamification, which identified an expansion in this technique and that the world is moving towards a job market with a more ludic format, aiming at increasing productivity and problem solving.

Araujo [44] studied the importance of playing games, and its relevance in the context of the COVID 19 pandemic for the development of early childhood education students. The author concluded that the use of physical and digital games were strong allies for the new methodologies that teachers have been adopting.

Kim and Lee [45] did dynamic modeling to assess the educational effectiveness of gamification for learning. The authors proposed a dynamic model of learning - based on games - that aims to maximize educational effectiveness,

featuring four main factors: curiosity, challenge, fantasy, and control.

As revealed, the study, based on the MDE framework (mechanics, dynamics, and aesthetics), created an equation for educational effectiveness. The result of the model showed that the efficacy of gamification of the learning process is educationally superior to traditional ways of learning in a specific environment.

Roy and Zaman [46] studied the efficaciousness of implementing game design elements in an online learning environment, addressing three main points: (1) analysis of the underlying motivational processes of gamification from a Self-Determination Theory perspective, thus explaining the motivational effects of various game design implementations; (2) subtle motivational changes empirically assessed over time, and (3) account for potential individual differences in the motivational effects of gamification.

The results illustrated the significance of the individual nature of motivational processes, the importance of sensitive motivation measures and the relevance of the design features of the implemented game elements.

Khuffash [47] developed a database of gamified systems. A total of 79 systems were studied, which focused on the following sectors: consumer, education, business, governmental, health, social good, research and finance.

The authors concluded that gamification is here to stay and will become an important tool for solving problems: whether they are business-oriented, personal, or social.

## VI. CONCLUSION

When carrying out the research, it is noted that several authors have reviews about gamification and its positive impacts on learning and the contextualization of a situation for a person.

Already widespread in corporate environments and gaining more and more space in educational institutions, gamified approaches to sustainability present themselves as good alternatives for the advancement and dissemination of the UN Sustainable Development Goals.

It is also noteworthy that, according to the literature review, the method can be used to simulate a context that is not experienced by everyone and can generate similar ideas and open innovation to accelerate the ideal of a more sustainable world.

For future work, the following can be mentioned: performing an empirical analysis of a group that plays a game on the SDGs thematic; to analyze further how SDG gamification can generate innovation to solve similar problems in different countries.

## ACKNOWLEDGEMENT

The authors are grateful to the UFABC Innovation and Sustainable Competitiveness Forum (FICS / UFABC) for intellectual support.

## REFERENCES

- [1] RIO+20 UN Conference on Sustainable Development. "The History of Sustainable Development in the United Nations". UN. 20–22 June 2012. Available at: <https://web.archive.org/web/20120618171731/http://www.uncsd2012.org/history.html>. Accessed on August 28, 2022.
- [2] ODM Brasil website. Available at: [shorturl.at/jLMST](http://shorturl.at/jLMST). Accessed on August 28, 2022.
- [3] THE WORLD BANK ANNUAL REPORT 2019 : Ending Poverty, Investing in Opportunity. Available at: <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/156691570147766895/the-world-bank-annual-report-2019-ending-poverty-investing-in-opportunity>. Accessed on August 28, 2022.
- [4] UNICEF. Annual Report 2018. For every child, every right. Available at: <https://www.unicef.org/reports/annual-report-2018>. Accessed on August 28, 2022.
- [5] OLIVEIRA, E. Balanços oficiais de desmatamento da Amazônia confirmam dados de sistema de alerta; entenda. Available at: <https://g1.globo.com/natureza/noticia/2019/08/18/balancos-oficiais-de-desmatamento-da-amazonia-confirmam-dados-de-sistema-de-alerta-entenda.ghtml>. Accessed on November 15, 2021.
- [6] DEARO, G. Os 8 problemas que mais preocupam os países no mundo. Available at: <https://exame.com/mundo/os-8-problemas-que-mais-preocupam-os-paises-no-mundo/>. Accessed on August 28, 2022.
- [7] WORLD ECONOMIC FORUM. The Global Risks Report 2017. 12th Edition. Available at: <https://www.weforum.org/reports/the-global-risks-report-2017/> Accessed on August 28, 2022.
- [8] CAMPOS, P. ONU e especialistas destacam importância da criatividade. 2018. Available at: <https://portalatualidade.com.br/noticia/4401/onu-e-especialistas-destacam-importancia-da-criatividade>. Accessed on August 28, 2022.
- [9] SCHUMPETER, J. A. (2017). The theory of economic development: An inquiry into profits, capita I, credit, interest, and the business cycle. Routledge.
- [10] TORRES, R. L. A indústria automobilística brasileira: uma análise da cadeia de valor. 2011. Dissertação (Mestrado em Economia). Universidade Federal de Santa Catarina. Florianópolis, 2011. Available at:

- <https://repositorio.ufsc.br/handle/123456789/95276>  
Accessed on August 28, 2022.
- [11] FARFUS, Daniele. Empreendedorismo social e desenvolvimento local: um estudo de caso no SESI Paraná. Curitiba: UNIFAE, 2008. Dissertação (Mestrado em Organizações e Desenvolvimento), Centro Universitário Franciscano do Paraná, 2008. Available at: <https://docplayer.com.br/7753723-Centro-universitario-franciscano-do-parana-unifae-mestrado-em-organizacaoes-e-desenvolvimento.html> Accessed on August 28, 2022.
- [12] KARAM, B. F., de MORAES, A. B., Blumetti, J. F., ANDRADE, A. A., & CANDIAGO, A. Serious games como ferramenta de apoio ao ensino das quatro operações matemáticas para crianças. Available at: <https://www.revistaespacios.com/a17v38n30/a17v38n30p29.pdf>. Accessed on August 28, 2022.
- [13] VYGOTSKY, L. S. A formação social da mente. São Paulo: Martins Fontes, 2007.
- [14] BRASIL. Ministério da Educação e do Desporto. Secretaria de Educação Fundamental. Referencial Curricular Nacional para a Educação Infantil. Vol. 1 e Vol. 2, Brasília: MEC/SEF, 1998.
- [15] Salomão, H. A. S., Martini, M., & Jordão, A. P. M. (2007). A importância do lúdico na educação infantil: enfocando a brincadeira e as situações de ensino não direcionado. Portal de psicologia.
- [16] Silva, L. I. D. (2014). A importância do brincar na educação infantil. Available at: <https://repositorio.ufpb.br/jspui/handle/123456789/3678>. Accessed on August 28, 2022.
- [17] Ramos, J., & Gomes, M. D. F. C. (2021). Sentidos do brincar no parquinho em uma Instituição de Educação Infantil. *Infâncias e Juventudes em contextos educacionais no Brasil*, 107.
- [18] KISHIMOTO, T. Jogo, Brinquedo, Brincadeira e Educação. São Paulo: Cortez, 1994.
- [19] BROUGÈRE, G. Jogo e Educação. Porto Alegre: Artes Médicas, 1998.
- [20] LEONTIEV, A.N. Os princípios psicológicos da brincadeira pré-escolar. In: Vygotsky, L. S.; Luria, A. R.; Leontiev, A. N. (Orgs.), *Linguagem, desenvolvimento e aprendizagem*. São Paulo: Moraes, 1994.
- [21] LIRA, N. A. B.; RUBIO, J. A. S. A Importância do Brincar na Educação Infantil. *Revista Eletrônica Saberes da Educação – Volume 5 – nº 1 – 2014* Available at: [http://docs.uninove.br/artefac/publicacoes\\_pdf/educacao/v5\\_n1\\_2014/Natali.pdf](http://docs.uninove.br/artefac/publicacoes_pdf/educacao/v5_n1_2014/Natali.pdf) Accessed on August 28, 2022.
- [22] BORBA, Ângela M. O brincar como um modo de ser e estar no mundo. In: BRASIL, MEC/SEB *Ensino fundamental de nove anos: orientações para a inclusão da criança de seis anos de idade/ organização Jeanete Beauchamp, Sandra Denise Rangel, Aricélia Ribeiro do Nascimento – Brasília: Ministério da Educação, Secretaria de Educação Básica, 2006*
- [23] Winnicott, D. W. (1975). O brincar: uma exposição teórica. *O brincar & a realidade*, 59-77.
- [24] Mello, G. A. T. D., & Zendron, P. (2015). Como a indústria brasileira de jogos digitais pode passar de fase. Available at: <https://web.bndes.gov.br/bib/jspui/handle/1408/9616>  
Accessed on August 28, 2022.
- [25] Pinto, A. C., de Andrade, A. A., & Blumetti, J. F. (2021). Evaluation and selection of scenario-based digital Transformation Projects. *International Journal of Advanced Engineering Research and Science*, 8(1). <https://dx.doi.org/10.22161/ijaers.82.12>
- [26] PricewaterhouseCoopers Global Annual Review 2014 Available at: <https://www.pwc.com/gx/en/global-annual-review/assets/pwc-global-annual-review-2014.pdf> Accessed on August 28, 2022.
- [27] 2022 promissor: mercado de games ultrapassará US\$ 200 bi até 2023, *Revista Forbes* Available at: <https://forbes.com.br/forbes-tech/2022/01/com-2022-decisivo-mercado-de-games-ultrapassara-us-200-bi-ate-2023/> Accessed on August 28, 2022.
- [28] FLEURY, A., Nakano, D., & Cordeiro, J. H. D. O. (2014). Mapeamento da indústria brasileira e global de jogos digitais. São Paulo: GEDIGames/USP, 32-33.
- [29] YUAN, X.; ZUO, J. A critical assessment of the Higher Education For Sustainable Development from students' perspectives – a Chinese study. *Journal of Cleaner Production*, v. 48, p. 108–115, jun. 2013.
- [30] CHENG, Ching-Hsue; SU, Chung-Ho. A Game-based learning system for improving student's learning effectiveness in system analysis course. *Procedia-Social and Behavioral Sciences*, v. 31, p. 669-675, 2012.
- [31] LEE J., Hammer J. (2011) Gamification in Education: What, How, Why Bother? *Academic Exchange Quarterly*, 15(2). <http://www.gamifyingeducation.org/files/Lee-Hammer-AEQ-2011.pdf>
- [32] PRENSKY, M. (2001). Fun, play and games: What makes games engaging. *Digital game-based learning*, 5(1), 5-31.
- [33] CHARSKY, Dennis. From edutainment to serious games: A change in the use of game characteristics. *Games and culture*, v. 5, n. 2, p. 177-198, 2010.
- [34] ANNAN-DIAB, F.; MOLINARI, C. Interdisciplinarity: Practical approach to advancing education for sustainability and for the Sustainable Development Goals. *The International Journal of Management Education*, v. 15, n. 2, p. 73–83, jul. 2017.
- [35] ARRUDA FILHO, N. DE P. The agenda 2030 for responsible management education: An applied methodology. *The International Journal of Management Education*, v. 15, n. 2, p. 183–191, jul. 2017
- [36] AGBEDAHIN, A. V. (2019). Sustainable development, Education for Sustainable Development, and the 2030 Agenda for Sustainable Development: Emergence, efficacy, eminence, and future. *Sustainable Development*, 27(4), 669-680.
- [37] BEYNAGHI, A., Trencher, G., Moztarzadeh, F., Mozafari, M., Maknoon, R., & Leal Filho, W. (2016). Future sustainability scenarios for universities: Moving beyond the United Nations Decade of Education for Sustainable Development. *Journal of Cleaner Production*, 112, 3464-3478.
- [38] HØGDAL, C., Rasche, A., Schoeneborn, D., & Scotti, L. (2021). Exploring student perceptions of the hidden

- curriculum in responsible management education. *Journal of Business Ethics*, 168(1), 173-193.
- [39] TASPINAR, B., Schmidt, W., & Schuhbauer, H. (2016). Gamification in education: A board game approach to knowledge acquisition. *Procedia Computer Science*, 99, 101-116.
- [40] VAN ECK, R. (2006). Digital game-based learning: It's not just the digital natives who are restless. *EDUCAUSE review*, 41(2), 16.
- [41] FIGUEIRÓ, P. S., & Raufflet, E. (2015). Sustainability in higher education: a systematic review with focus on management education. *Journal of cleaner production*, 106, 22-33.
- [42] CARSE, J. P. Finite and infinite games: a vision of life as game and possibility. The Free Press: New York, 1986.
- [43] DE QUADROS, G. B. F. (2015). Projetos Educacionais Baseados Em Gamificação. *Redin-Revista Educacional Interdisciplinar*, 4(1).
- [44] ARAUJO, F.S. A importância da ludicidade durante a pandemia do COVID-19 como instrumento metodológico na educação infantil e para o desenvolvimento integral do educando. VII Congresso Nacional de Educação – CONEDU. Maceió – AL, 2020.
- [45] KIM, J.T.; LEE, W.H. Dynamical model for gamification of learning (DMGL). *Multimedia Tools and Application*, v. 74, p. 8483-8493, 2015.
- [46] ROY, R.V.; ZAMAN, B. Need-supporting gamification in education: an assessment of motivational effects over time. *Computers & Education*, v. 127, p.283-297, 2018
- [47] . KHUFFASH, A.E. Gamification, 2014. Available at: [http://lynnehall.co.uk/knowledgegap/wp-content/uploads/2014/01/gamification\\_report.pdf](http://lynnehall.co.uk/knowledgegap/wp-content/uploads/2014/01/gamification_report.pdf). Accessed on August, 2021.

# Food Feasibility and Safety in Animal Protein Production in Urban and Periurban Area

James Lima Chaves<sup>1</sup>, Jairton Fraga Araújo<sup>2</sup>, Luciano Sergio Ventin Bomfim<sup>3</sup>, Alexandre Boleira Iopo<sup>4</sup>

<sup>1</sup>Student of the Graduate Program in Agroecology and Territorial Development at the State University of Bahia, UNEB, Brazil e-mail: [jamesufrb@gmail.com](mailto:jamesufrb@gmail.com)

<sup>2</sup>Doctor in Agronomy, Professor at the University of the State of Bahia and from the Graduate Program in Agroecology and Territorial Development (PPGADT) at the State University of Bahia – UNEB, Brazil e-mail: [jairtonfraga@bol.com.br](mailto:jairtonfraga@bol.com.br)

<sup>3</sup>Doctor in Philosophy, Professor at the University of the State of Bahia and the from the Graduate Program in Agroecology and Territorial Development (PPGADT) at the State University of Bahia - UNEB, Brazil e-mail: [lsvbomfim@gmail.com](mailto:lsvbomfim@gmail.com)

<sup>4</sup>Doctor of Science, Professor at the University of the State of Bahia and the from the Graduate Program in Agroecology and Territorial Development (PPGADT) at the State University of Bahia - UNEB, Brazil e-mail: [alopo@uneb.br](mailto:alopo@uneb.br)

Received: 14 Aug 2022,

Received in revised form: 07 Sep 2022,

Accepted: 12 Sep 2022,

Available online: 17 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** *Urban and periurban agriculture, animal production, family production, food security.*

**Abstract—** *The present study aimed to present a literature review on animal husbandry experiences in order to identify the feasibility of animal production in urban and periurban agriculture as a food security instrument, observing its limitations and potential. A systematic literature review was carried out on the topic and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses methodology was used to select the articles. From the data analysis, the understanding emerged that animal husbandry in urban and periurban areas has existed for hundreds of years and has always been present in several cities around the world. This practice can represent an inevitable challenge, with positive aspects, such as being an ally of domestic food security and enabling the generation of income and employment, as well as negative aspects, such as the presence of odors, noise and dissemination of zoonoses. Faced with this conflict, as well as the verification of the feasibility of this practice, the importance of public policies capable of organizing the activity, minimizing health risks and possible resulting conflicts is highlighted.*

## I. INTRODUCTION

The industrialization process, added to the expansion of cities, were responsible for changes not in the demographic profile, but also in the nutritional quality of life, consumption habits and food production, resulting in significant changes in food sovereignty and security.

According to [1] describing a study carried out by the United Nations (UN), in the year 2050 the world population will exceed 9.5 billion people, which represents an approximate growth of 20% in relation to the current number. In this process that is already underway, there is a migration of families to cities, at the same time that urban

areas and their economic systems are not able to make all these people economically active, not having adequate conditions to satisfy their economic and culture and quality of life.

However, these migrants, even in the face of a change in habits, did not undergo a complete process of erosion of their knowledge and transformation of food habits and still maintain a relationship with nature, plants and animals that continue to be produced or raised in the areas. urban and periurban, bringing up the discussion on this theme [2].

In fact, several international entities and development agencies such as International Development Research

(IDRC), Resource Centers on Urban Agriculture and Food Security (RUAFF FUNDATION), United Nations Development Program (UNDP) and United Nations Agriculture Organization and Food (FAO), pointed to the practice of urban and peri-urban agriculture (AUP) as one of the public policy strategies to generate income and mitigate food and nutritional insecurity in the face of the accelerated urbanization process [3].

According to [4], the benefits of urban and peri-urban agriculture are diverse: it improves access to food for low-income families, generates jobs, contributes to the supply of fresh, nutritious products available all year round, allows families to earn income from the sale of these products and, moreover, minimizes food expenses. Therefore, this activity covers food security, with a consequent improvement in the quality of life, environmental quality, in addition to generating job opportunities that do not require a level of education, allowing the creation of employment and income for the poorest population, precisely for this reason has gained greater political recognition.

All these aspects show that the UPA is in fact a viable alternative in order to alleviate some of the many problems caused by urbanization [5].

AUP uses spaces in and around cities and in small areas (such as backyards, terraces, patios and urban gardens) to produce various vegetables (grains, roots, seeds, tubers, fruits), animals (poultry, rabbits, goats, sheep, cattle, pigs, fish, horses, etc.) and non-food products, such as aromatic and medicinal plants and ornamental plants [3; 6; 7].

In this scenario, while the practice of agriculture in urban and periurban areas enjoys greater acceptance, animal husbandry is surrounded by a series of limitations, largely due to the inconvenience that can be generated by their presence, such as noise, elimination of excrement and transmission of zoonoses [8]. Butler [9] notes that poultry, pigs, cattle, goats and horses, often raised in a precarious way, have always accompanied the inhabitants of the city's neighborhoods.

However, this same precariousness justified the creation of restrictive laws and their exclusion from the urban scenario in some cities around the world, based on a series of political, legal, sanitary and environmental limitations.

Therefore, the present study aimed to present a literature review on livestock experiences in order to identify the feasibility of animal production in urban and periurban agriculture as a food security instrument, observing its limitations and potential.

In addition to this introduction, the review has a theoretical framework that encompasses the historical course of animal husbandry in urban and periurban areas. Next, the methodological procedures used are presented, followed by the results and discussions. Finally, the conclusions are drawn and the references used are indicated.

### **History of animal husbandry in urban and periurban areas**

The act of raising animals in and around cities, while often more restricted than urban agriculture, is as old a phenomenon as cities themselves. This is because, for centuries, municipal administrations sought to protect direct access to productive lands, as a way of safeguarding and guaranteeing an adequate supply of food for the urban population. Therefore, for a long time people had to live close to where their food was grown or raised [10; 11; 9; 12].

In fact, animal husbandry in urban and periurban areas has existed for hundreds of years, [13] reports that it dates back to ancient Egyptian, Greek, Roman and Byzantine cultures, continuing to the present day. Still, [14] states that despite the contradictions surrounding the theme, animal husbandry has never been completely extirpated from cities, it is a practice that remains even if silently.

As one of the components of urban and periurban agriculture, animal husbandry has always been present in several cities around the world: in the Middle East (including Israel), Africa (North and Sub-Saharan), Asia (Central, South, East and Southeast), Europe East, Latin America and the Caribbean, where initiatives in Havana - Cuba, Mexico City - Mexico, Antigua and Barbuda, Tegucigalpa - Honduras, Managua - Nicaragua, Quito - Ecuador, Lima - Peru, El Alto - Bolivia, Belo Horizonte - stand out. Brazil and Rosario - Argentina [3; 15; 16; 17]. An example of this practice is also noted in the immigrant populations that took their cattle breeding and slaughtering practices to cities in the United States [18; 9], despite this, urban animal husbandry in the United States is a clandestine and unevenly regulated activity in the various states [8].

In this sense, [19] highlights that, in Brazil, animals are an essential part of culture: especially in cooking and at parties. Its influence on the construction of regional identities is clear. The duck with tucupi and fish stews, in the Amazon; goat meat and buchada in the Northeast; the chicken in the Cerrado; feijoada and chicken with okra in the Southeast; beef jerky in the south are good examples of this remarkable presence of small animals in rural life and urban customs.



According to [9], despite this long history of the practice of raising animals in cities or nearby areas, technological advances in the second half of the 19th century made this proximity no longer mandatory, since they suggest not only the installation of refrigerated storage systems in transport, but also in homes. In addition, with the advent of the train, products of animal origin could be purchased in distant locations, in addition to this, cars replaced the use of horses and animal husbandry was falling into disuse. Soon, products of animal origin, such as fresh meat, milk and dairy products, could be transported over long distances and kept in homes for long periods of time [20].

This fact meant that animal husbandry and agriculture were displaced outside the cities, at the same time that there was a growth in the industrialization processes of food production and agriculture, which, among other objectives, aimed not only at large-scale production scale and price reduction, but also to enhance the population's shift to an urban diet [9].

In the second half of the 20th century, a global food system was inaugurated, characterized by abundance and convenience, establishing a new relationship with food, marked by the removal of people from production habits, by the offer of fast food and processed products. As people distanced themselves from the production of foodstuffs, a new group of consumers emerged, those who assimilate food as commodities and devalue the entire production process [21].

However, currently, as a result of criticism of the globalized food model and the search for food security and sovereignty, the practice of urban and periurban animal production has resurfaced in the global north and reaffirmed in the global south, allowing the population access to food with nutritional quality, family self-consumption and income generation.

## II. MATERIALS AND METHODS

The systematic literature review was carried out based on the scientific literature available on the Scientific Electronic Library Online Platform (SciELO), the Coordination for the Improvement of Higher Education Personnel (CAPES) and Google Scholar. The survey included publications carried out from 1999 to 2020. To meet the objectives of the work, the search keyword "urban and periurban agriculture", "food and nutritional security", "animal husbandry in urban and periurban agriculture" was used. in English, Portuguese and Spanish.

The PRISMA methodology (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) was used to

select the articles. For [22], the systematic review that adopts the PRISMA protocol is based on the formulation of an objective question, as well as the use of systematic methods in order to identify, select and critically evaluate the studies considered most relevant on the subject researched.

Articles were included that had as their central research theme the creation of small animals in urban and periurban agriculture in Brazil and in the world. Scientific articles published in indexed or non-indexed journals, technical reports, legislation, technical and research bulletins were searched. The selected articles were read in full and make up the references used for the analysis of this article.

## III. RESULTS AND DISCUSSION

Searches in the portal and databases returned a total of 265 productions, 26 from the SciELO database, 80 from Google Scholar and 159 from the CAPES journal portal. Of these 265 studies, 34 were excluded because they represented a duplicate record, leaving 231. Then, the titles and abstracts of the 231 publications were read, 195 were excluded. The remaining 36 productions were read in full, composing the sample according to (Fig. 1). In addition, 05 technical reports from international organizations, 01 epidemiological technical bulletin and the law n° 11.346 of 2006 were used.

From the data analysis emerged the in-depth understanding of the history of animal husbandry in urban and periurban areas, the viability of animal husbandry, the generation of income and employment through this activity, as well as the factors that negatively impact it.

### Feasibility of animal husbandry in urban and periurban areas

Animal husbandry in cities can be an unavoidable challenge, with positive and negative aspects, of the former it is emphasized that this practice is allied with domestic food security, enables income and employment generation.

In a definition established at the World Food Conference (WC) in Rome in 1996, food security occurs when all people have permanent physical, social and economic access to safe, nutritious food in sufficient quantities to satisfy their nutritional needs and food preferences, thus having an active and healthy life [23].

In Brazil, Law No. 11,346, of September 15, 2006, in its article 3, defines food and nutrition security as: Food and nutrition security consists in realizing the right of everyone to regular and permanent access to quality food, in sufficient quantity, without compromising access to other essential needs, based on health-promoting food

practices that respect cultural diversity and that are environmentally, culturally, economically and socially sustainable [24].

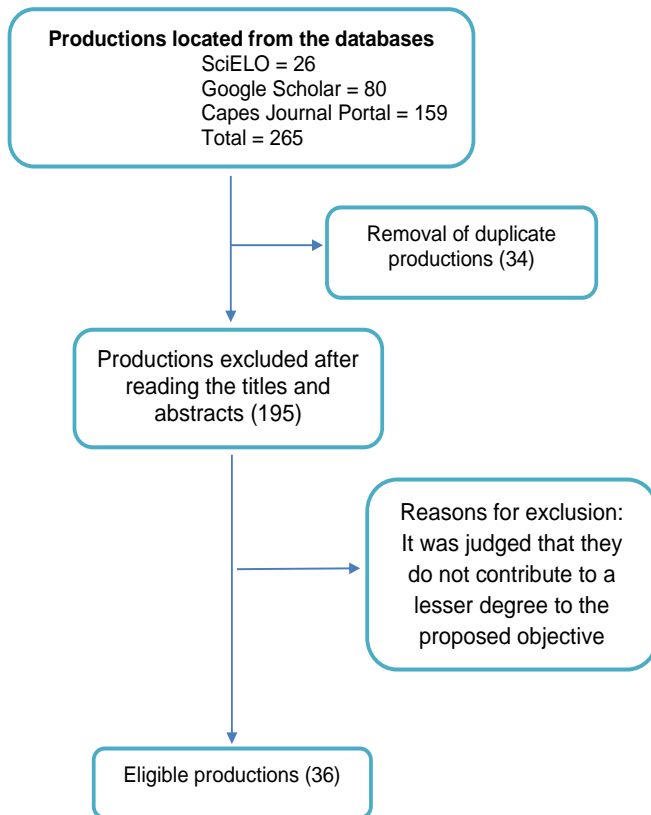


Fig. 1. Flowchart of selection of studies for review on the practice of animal husbandry in urban and peri-urban agriculture

In this way, it is evident that it is only possible to enjoy this condition if there is a constant supply of nutritious and safe food throughout the year. It is in this scenario that the production of animals in vacant lots, public areas, backyards and in the vicinity of cities, as long as they are carried out with due health care, assumes great importance, as they provide products to feed many families.

Therefore, foods of high nutritional quality, such as honey, meat, fish, shellfish, offal, fat, eggs and milk, are essential to guarantee food and nutritional security for people with low purchasing power, who have little space to drive. creations, and who also have limited financial resources to purchase products of animal origin, whose cost is relatively high [19].

In fact, with regard to nutrient intake, small animal production can make a big difference in places where access to income is restricted. In this situation, animal husbandry in urban areas is no longer a choice of lifestyle and assumes the status of a survival strategy, making it

possible to consume, for example, meat, milk and eggs that would not be possible otherwise.

Florez [11] presents the example of poultry farming practiced in urban and periurban areas of Colombia as an activity that greatly contributes to the food security of the population. SILVANA [25] reported the crisis experienced in Córdoba, Argentina, between 1994 and 1995, when the Cooperativa Agropecuária San Martín went bankrupt, as an episode that explained the importance of small animal husbandry, since at the time the municipal authorities mobilized resources to encourage more vulnerable families to practice livestock in vacant lots, in urban and periurban areas, aiming to contribute to their food security.

Another particularly exemplary case is that which occurred in Cuba after 1989. On this occasion, the Cuban model of agriculture, based on the model of green revolution, collapsed due to oil shortages and the end of external support from the Union of Soviet Socialist Republics – USSR. This crisis boosted the emergence of one of the largest urban livestock programs in the world, with the creation of cattle, poultry, sheep, goats, pigs, bees and fish [26].

#### Income and employment generation

Sousa and Calaça [3], analyzing a report published in 2014 by the Food And Agriculture Organization The United Nations (FAO), found that the urban and periurban agriculture network in Havana includes five municipal agricultural companies, which manage 170 livestock centers, in addition to two municipal establishments for raising pigs and other small animals. This entire structure resulted in the production of 10.5 million liters of milk and 1,700 tons of meat in 2012

Studies such as the one carried out [27], in the city of Nairobi, capital of Kenya, show that urban animal husbandry can be a significant means of generating income. Urban swine farming and poultry farming, in particular, are profitable ventures that guarantee a quick return on capital. It also highlights that despite requiring little capital investment, animal husbandry in urban and periurban areas can generate significant profits from small-scale farming. For example, in Addis Ababa, Ethiopia, rearing dairy cows in backyards has proven to be a profitable activity.

In addition, pigs represent an affordable source of protein, as they are often fed household, restaurant and hotel food scraps and vegetation, thus reducing the cost of production. On the other hand, this practice puts the health of animals at risk. In the twin cities of Hubli-Dharwad, in the state of Karnataka, India, it is common to raise pigs in the streets, however health concerns, from local and

national authorities, have questioned the viability of the future of this practice [28].

In addition to generating income and employment, small animal farms constitute a strategic saving, because in times of crisis or need, can be mobilized for rapid acquisition of financial resources [19].

According to [29; 30; 31] report that in Brazil, a study carried out in Belo Horizonte-MG, Curitiba-PR, Porto Alegre-RS, Rio de Janeiro-RJ, São Paulo-SP, Brasília-DF, Goiânia-GO, Belém-BA, Fortaleza-CE, Recife-PE and Salvador-BA registered 635 initiatives, of spontaneous or governmental origin, of urban agricultural production. Of this total, 160 of these included animal husbandry, indicating the relevance of this activity in the country. This study, entitled “Panorama of Urban and Periurban Agriculture in Brazil and political guidelines for its promotion: identification and characterization of UPA initiatives in Brazilian metropolitan regions”, in 2007, was the first at the federal level with the purpose of mapping the situation of “state of the art” in all regions of the country.

Another initiative, no longer in force, but which became a landmark in Brazil was the Small Agricultural Production Verticalization Program – Prove, created in 1995, in the Federal District - DF, with the aim of also promoting animal husbandry in urban and peri-urban areas, as well as its processing and commercialization [32].

Regarding the potential of urban and periurban agriculture and one of its components, small animal husbandry, to generate income and employment, [33] states that it is a tool for reducing poverty. In this sense, data from FAO shows that 800 million people are engaged in this activity worldwide, 200 million market their production and employ 150 million people full-time [34]. In addition, there is the possibility of supplementing income earning with some type of pre-processing.

Despite constituting a reinforcement for domestic food security and the generation of employment and income, animal husbandry in urban and peri-urban agriculture faces challenges that directly impact its viability, we will address the main of these in the next topic.

### **Factors that negatively impact the viability of animal husbandry in urban and periurban areas**

The risk posed by zoonoses, such as mad cow, foot-and-mouth disease, swine flu, swine fever, avian flu, spotted fever, glanders and others has led to restrictions on animal husbandry in cities. Added to this, there are other nuisances arising from the creations, such as the occurrence of noise, odors and waste.

As for zoonoses, it is known that birds raised in the backyard of houses can pose risks to the general public, an example of which was the outbreak of avian influenza (HPAI, H5N1) in Egypt, where most cases of clinically confirmed human infection from 2006 to 2009 were linked to direct contact of sick birds, resulting in human-to-human transmission and 36 deaths [35]. The Newcastle disease outbreak in California in 2002 can also be cited, which originated in backyard farms and resulted in the depopulation of more than 3 million birds, costing taxpayers \$161 million at the time [12].

According to [12], a survey carried out in the United States showed that contact with backyard birds is associated with hundreds of outbreaks caused by contamination with Salmonella. Despite this, worryingly, 25% of participants in a survey conducted in that country do not wash their hands after handling birds or eggs. In addition to this, another survey showed that most backyard owners knew little about preventing poultry diseases [36].

In Brazil, some species of flatworm worms, which need free pigs to complete their life cycle, such as *Taenia solium* (pig tapeworm), cause the diseases taeniasis and cysticercosis, constituting a public health problem, especially in regions in that basic sanitation conditions are deficient.

An episode that took place in 2020, in the municipality of Cruz das Almas, drew attention to the practice of raising horses in the urban and periurban perimeter of this city in the interior of Bahia, Brazil. On March 20 of that year, the Secretary of Health of the State of Bahia (SESAB) released an epidemiological alert n° 01/2020 reporting the occurrence of an outbreak of Glanders, an infectious disease caused by the bacterium *Burkholderia mallei* and which primarily affects equines (horses, donkeys and mules), and may occasionally be transmitted to other animals and to [37]. This situation raises the alarm for the various localities where it is common to employ horses to load loads in carts, usually these animals feed on vacant lots and on the edges of highways, they do not enjoy the correct food and sanitary management.

The fact is that any animal husbandry, if not managed correctly, will bring problems. Zoonoses, defined as diseases that affect both humans and animals, are more likely to occur when hygienic conditions are inadequate.

Considering that creations generate waste, handling them close to homes and in a limited space can also pose risks to the environment, contaminating soils and water courses, attracting insects or rodents and generating unpleasant odors, causing conflicts with the neighborhood [11]. Indeed, the act of storing food for small farms, if not properly taken care of, can become a problem, as this

favors the proliferation of rats, which in turn can spread the hanta virus, a serious disease for populations.

As an aggravating factor of this whole situation, in most cases, breeders are in a situation of illegality, given that the breeding and sale of animals is an activity prohibited or not contemplated in land use or urban planning plans [38].

In view of this, and at the same time considering the economic and social relevance of animal husbandry in urban and periurban areas, especially for the livelihood of vulnerable populations, it is necessary for municipalities to find participatory solutions, located between total repression and the lack of control, carefully examining the impact of this practice, so ancient and current, on the health of the environment, people and animals.

It was precisely in the search for solutions that Mexico City, Mexico, adopted two main measures: (1) Creation of the Secretariat for Rural Development and Equality for Communities, responsible for coordinating municipal efforts aimed at ecological production and (2) Elaboration of the Ecological Planning Program, a legal instrument that determines Land Use and Occupancy [3].

In Vancouver, Canada, the solution to the problems of raising animals in the AUP was sought through the adoption of Public Policies, such as such as the creation of a Nutrition Policy Council, urban management and planning strategies and the creation of an Agricultural Land Reserve (RTA) maintained by the Government, the latter being a way of limiting urban growth and guaranteeing the maintenance of arable land for the AUP [39]. Similarly, in Lisbon, Portugal, through the Green Plan, created in 2007, the government also plays a fundamental role in promoting the UAP [40].

In Brazil, the responsibility for developing rules for animal husbandry in urban and periurban areas is the responsibility of municipal authorities. However, as they are unable to carry out proper supervision and guidance, many creations cause odors, noise and fear of zoonoses, a great nuisance in the neighborhood, as an issue that occurred in Belo Horizonte and reported by [41], in the state Paraná, Brazil, in view of the imminent vote on a bill in the Municipal Chamber of Curitiba-PR, which allows the creation of animals in urban and periurban areas, the Animal Welfare Laboratory of the Federal University of Paraná (LABEA/UFPR) , issued a statement criticizing in 10 items the permission of this activity.

It is evident that any intervention strategies in search of solutions to problems related to animal husbandry require the participation of governments through public policies of territorial planning and management, credit offer,

provision of technical assistance and the involvement of civil society.

An example of this government support occurs in some cities where there are local policies that regulate animal husbandry in urban and periurban areas [42], also in places where there are municipal laws that regulate animal husbandry, establishing, for example, the need authorization or consent of neighbors, size for the construction of shelters and limitation of the types and numbers of animals [43].

Florez [11] draws attention to the importance of local and national governments reviewing the Land Use Plan and taking effective measures to regulate urban and periurban animal husbandry, since private organizations and the government itself can only develop projects if this activity is regulated.

It is also worth mentioning the need for research, extension projects and training of small breeders to guide them in handling, methods and sanitary techniques, capable of taking this activity out of irregularity and leading it to a rational breeding system.

#### IV. CONCLUSION

Given its importance in generating income and employment, strengthening food and nutritional security, as well as providing protein to the public in socially vulnerable situations, the feasibility of raising animals in urban and periurban areas is evident. However, it is worth mentioning that without the proper elaboration and implementation of public policies that support this practice so old and at the same time current, there is serious health risks, in addition, the neighborhood of the breeders, which should recognize them as source of healthy food, starts to have friction and to condemn the practice.

#### REFERENCES

- [1] SAATH, K. C. O.; FACHINELLO, A. L. (2018). Crescimento da Demanda Mundial de Alimentos e Restrições do Fator Terra no Brasil. *Revista de Economia e Sociologia Rural*, v. 56, n. 2.
- [2] UNDP. UNITED NATIONS DEVELOPMENT PROGRAMME. (1996). *Urban Agriculture: food, jobs and sustainable cities* New York. Publication Series for Habitat II, v. 1.
- [3] SOUSA, R. P. O.; CALAÇA, M. (2019). *Agricultura urbana: uma nova alternativa para a produção de alimentos e melhor qualidade ambiental para a cidade*. *Campo-Território*, v. 14, n. 32, p. 239-265.
- [4] CINÀ, G.; KHATAMI, F. (2017). *Integrating urban agriculture and urban planning in Mashhad, Iran; ashort*

- survey of current status and constraints. *Agroecology and Sustainable Food Systems*, v. 41, n. 8, p. 921-943.
- [5] PIRES, V. C. (2016). Agricultura urbana como fator de desenvolvimento sustentável: um estudo na região metropolitana de Maringá. *Revista Pesquisa & Debate*, São Paulo, v. 27, n. 2, p. 69-84.
- [6] RICH, K. M.; RICH, M.; DIZYEE, K. (2018). Participatory systems approaches for urban and peri-urban agriculture planning: the role of system dynamics and spatial group model building. *Agricultural Systems*, v. 160, p. 110-123.
- [7] FAO. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS. (2017). *The state of food security and nutrition in the world*. Rome.
- [8] BELLOWES, A. C.; ROBINSON, V.; GUTHRIE, J.; MEYER, T.; PERIC, N.; HAMM, M. W. (2000). A criação urbana de animais em Nova Jersey, Estados Unidos. *Urban Agriculture Magazin*, Leusden, n. 2, p. 19-20.
- [9] BUTLER, W. H. (2012). Welcoming animals back to the city: navigating the tensions of urban livestock through municipal ordinances. *Journal of Agriculture, Food Systems, and Community Development*, v. 2, n.2, p.193-215.
- [10] SCHIERE, H.; TEGEGNE, A.; VEENHUIZEN, R. V. A. (2002). Criação de Animais nas cidades e seus arredores. *Agriculture Magazin*, n. 5, p. 5- 10.
- [11] FLÓREZ, C. E. S. (2011). Revisión de experiencias urbanas y periurbanas de cría animal como alternativa de seguridad alimentaria. *Revista de Investigación Agraria y Ambiental*, v. 2, n.2, p. 51- 63.
- [12] BRINKLEY, C., VITIELLO, D. (2014). From farm to nuisance: animal agriculture and the rise of planning regulation. *J. Plan. Hist*, v. 13, 113 135.
- [13] FUENTES, A. N. (2015). Urban agriculture in the framework of sustainable urbanism. *Temas de Disseny*, Barcelona, n. 31, p. 93-103.
- [14] GAYNOR, A. (1999). Regulation, resistance and the residential area: the keeping of productive animals in twentieth-century Perth, Western Australia. *Urban Policy and Research*, v.17, n.1, p. 7-16.
- [15] AQUINO, A. M.; ASSIS, R. L. (2007). Agricultura orgânica em áreas urbanas e periurbanas com base na agroecologia. *Ambiente & Sociedade*, Campinas, v. 10, n. 1, p. 137-150.
- [16] FAO. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS. (2014). *Growing greener cities in Latin America and the Caribbean*. An fao report on urban and periurban agriculture in the region. Rome.
- [17] FAO. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS. (2007). *Profitability and sustainability of urban and periurban agriculture*. Rome.
- [18] BRINKLEY, C.; KINGSLEY, J. S.; MENCH, J. (2018). A Method for Guarding Animal Welfare and Public Health: Tracking the Rise of Backyard Poultry Ordinances. *Journal of Community Health*, v 43, p. 639-646.
- [19] SALES, M. N. G. (2005). Pequenas criações nos sistemas produtivos familiares: a diversidade na unidade. *Revista Agriculturas*, v. 2, n. 4, p. 4-6.
- [20] POTHUKUCHI, K.; KAUFMAN, J. L. (1999). Placing the food system on the urban agenda: The role of municipal institutions in food systems planning. *Agriculture and Human Values*, v. 16, n. 2, p. 213–224.
- [21] SANTOS, M.; MACHADO, M. C. M. (2020). Agricultura Urbana e Periurbana: Segurança Alimentar e Nutricional, comportamento alimentar e transformações sociais em uma horta comunitária. *Revista Segur. Aliment. Nutr.*, Campinas, v. 27, p. 1-20.
- [22] MOHER, D.; LIBERATI, A.; TETZLAFF, J.; ALTMAN, D. G. (2015). Principais itens para relatar Revisões sistemáticas e Meta-análises: a recomendação PRISMA. *Epidemiol. Serv. Saúde*, Brasília, v. 24, n. 2, p. 335-342.
- [23] ALENCAR, A. G. (2001). Conceito estratégico de segurança alimentar ao plano de ação da FAO para combater a fome. *Revista Brasileira de Política Internacional*, v. 44, n. 1.
- [24] BRASIL. Lei no 11.346, de 15 de setembro de 2006. Cria o Sistema Nacional de Segurança Alimentar e Nutricional – SISAN, com vistas em assegurar o direito humano à alimentação adequada e dá outras providencias. *Diário Oficial da União*.
- [25] SILVANA, M. (2000). Criação de galinhas para autoconsumo: uma experiência em Camilo Aldao. *Urban Agriculture Magazine*, n. 2, p. 26-29.
- [26] SANTOS, E. V. M.; HESPANHOL, R. A. M.; LORENZO, X. A. M. (2020). Agricultura urbana nas cidades cubanas de camaguey e cienfuegos urban and periurban agriculture in the cuban cities of Camaguey and Cienfuegos. *Confins*, v. 46, p. 1-20.
- [27] MIRERI, M. Private investment in urban agriculture in Nairobi, Kenya. *Urban Agriculture Magazine*, n. 7, p. 19 - 21, 2002.
- [28] NUNAN, F. Criação de animais e sustento em Hubli-Dharwad. *Urban Agriculture Magazin*, n. 5, p. 21-25, 2002.
- [29] AZEVEDO, F. F.; PERXACS, H.; ALIÓ, M. A. Dimensão social da agricultura urbana e periurbana. *Revista Mercator*, Fortaleza, v.19, 2020.
- [30] ROSA, P. P. V. Políticas públicas em agricultura urbana e periurbana no Brasil. *Revista Geográfica de América Central*, Costa Rica, v. 2, p. 1-17, 2011.
- [31] COUTINHO, M. N.; COSTA, H. S. M. Agricultura urbana: prática espontânea, política pública e transformação de saberes rurais na cidade. *Geografias Artigos Científicos*, Belo Horizonte, v. 7, n. 2, p.81-97, 2011.
- [32] CARVALHO, J. L. H. de. PROVE - Programa de verticalização de la pequeña producción agrícola. *Urban Agriculture Magazin*, n. 5, p. 35-36, 2002.
- [33] MADALENO, I. M. Agricultura urbana em Presidente Prudente. *Revista Geonotas*, Maringá, v. 5, n. 3, 2001.
- [34] FAO - ORGANIZAÇÃO DAS NAÇÕES UNIDAS PARA A ALIMENTAÇÃO. *Criar cidades mais verdes*. Rome, 2012.
- [35] ABDELWHAB, E. M., HAFEZ, H. M. An overview of the epidemic of highly pathogenic H5N1 avian influenza virus in Egypt: epidemiology and control challenges. *Epidemiology and Infection*, v 139, n. 5, p. 647-657. 2011.
- [36] ELKHORAIBI, C.; BLATCHFORD, R. A.; PITESKY, M. E.; MENCH, J. A. Backyard chickens in the United States: a

- survey of flock owners. *Poultry Science*, v. 93, n. 11, p. 2920–2931, 2014.
- [37] BAHIA. SECRETARIA DA SAUDE DO ESTADO DA BAHIA. Alerta epidemiológico nº 01/2020 - DIVEP/SUVISA/SESAB: epizootia por Mormo confirmada em equídeos. Salvador, 2020. Disponível em: <<https://ufrb.edu.br/ccaab>>. Acesso em: 01 mai. 2022.
- [38] CASTRO, G.; LOZANO, A.; FERNÁNDEZ, G.; RONCA, F.; RODRÍGUEZ, D. Agrobiodiversidad y pobreza. *Archivos de Zootecnia*, v. 54, p. 206-207, 2005.
- [39] MULLINIX, K.; FALLICK, A.; HENDERSON, D. Más allá de la seguridad alimentaria: la agricultura urbana como una forma de resiliencia en Vancouver, Canadá. *Urban Agriculture Magazin*, n. 22, p. 41-42, 2009.
- [40] HENRIQUES, J. C. Agricultura Urbana y Resiliencia en Lisboa: el papel del gobierno municipal. *Urban Agriculture Magazin*, n. 22, p. 49-50, 2009.
- [41] LAUREANO, D. S. A criação de pequenos animais em áreas urbanas – aspectos legais e socioambientais. *RPGMBH*, n. 2, p. 53-61, 2008.
- [42] BUTT, A.; TAYLOR, E. Smells like politics: planning and the inconvenient politics of intensive peri-urban agriculture. *Geographical Research*, v. 56, n. 2, p. 206-218, 2018.
- [43] MEENAR, M.; MORALES, A.; BONAREK, L. Regulatory practices of urban agriculture: a connection to planning and policy. *Journal of the American Planning Association*, v. 83, n. 4, p. 389-403, 2017.

# Data-Driven Decision Making in the Public Sector: A Systematic Review

Rodrigo Speckhahn Soares da Silva, Claudelino Martins Dias Junior, Rogério Tadeu de Oliveira Lacerda

The Graduate Program in Administration, Federal University of Santa Catarina, Brazil

Received: 11 Aug 2022,

Received in revised form: 07 Sep 2022,

Accepted: 12 Sep 2022,

Available online: 17 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— data driven, decision making,  
public sector, open government.

**Abstract**— This study presents the selection process of a bibliographic portfolio and bibliometric analysis related to Data-Driven Decision-making (DDD) in the context of Public Administration using the ProKnow-C framework. We proceeded to search and select articles to compose a portfolio and then analyze their characteristics. The journals where the theme is recurrent were evaluated, as well as the authors and articles that stand out. With the dissemination of ICTs and the Open Government movement, it has been noticed that the volume of articles on the subject has grown significantly in the last decade. In this context, the methodology used proves to be a useful tool for building knowledge in a given field of research, providing a structured and rigorous procedure that minimizes the use of randomness and subjectivity in the literature review process.

## I. INTRODUCTION

With the rapid technological changes in data storage and processing, managers and administrators have been changing the way they make decisions. They have relied less on their intuitions and more on data. This change has become necessary, as Jetzek *et al.* (2014) point out, because of the myriad possibilities for creating, collecting, and storing data in our increasingly digital world. According to data from Statista (2022) through 2021, and estimates from 2022 through 2025, the growth in the creation, capture, and consumption of information and data is evident, as presented in Fig. 1.

In this sense, Brynjolfsson and McElheran (2016) conducted a systematic empirical study regarding the diffusion of what has been termed Data-Driven Decision-Making (DDD).

At the industrial level, DDD has been primarily concentrated on the following characteristics: (i) large-scale companies, (ii) owning and using information technology, (iii) having skilled workers, and (iv) significant levels of awareness.

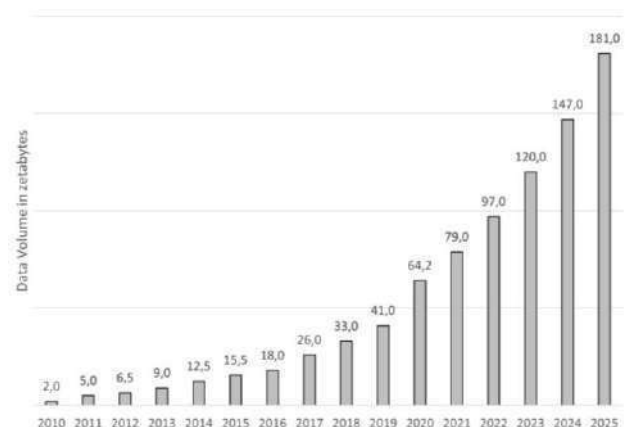


Fig. 1: Volume of data/information created, captured, copied, and consumed worldwide from 2010 to 2025 adapted from (Statista, 2022)

In the scope of Public Administration, typically the owner of large volumes of data and information, information technologies are increasingly used and, despite the different realities and specificities of each state

or nation, there are trained professionals in greater or lesser numbers. In addition, there is a movement toward making government data available, known as Open Government Data (OGD).

According to Matheus *et al.* (2020) efforts in this direction can result in more democracy, greater administrative efficiency, transparency, accountability, collaboration, engagement, and trust in government. In addition, it can also potentially result in the generation of considerable economic and social value. However, according to Jetzek *et al.* (2014), there is still a lack of understanding of how this can happen indicating the need for greater attention and further exploration of the topic.

Birchall (2015) states that OGD is part of a necessary component of the new "data economy." To participate and gain benefits from the so-called "infocapitalism" democracy, where the data subject is called to be: (i) auditor who monitors granular state transactions in the name of accountability, (ii) entrepreneur who makes data profitable through apps and visualizations, and (iii) consumer of these apps and visualizations.

In this growing context of data and information comes Data Science which is intrinsically intertwined with other concepts of growing importance such as big data, artificial intelligence, and the DDD. This perspective provides a framework and principles that allow the manager to systematically address problems to extract useful knowledge from data and thus make more assertive decisions (Provost & Fawcett, 2013).

Data scientists in the government context need not only a solid knowledge of statistics and data analysis, the use of techniques and tools for predictive purposes and for visualizing results. But also an understanding of other elements such as policy-making, organization, legislation, and public values. This combined knowledge allows the data to be placed in context and to understand its use and the implications involved (Matheus et al., 2020).

## II. LITERATURE REVIEW

DDD, as a new paradigm, emerges from digitalization and networks and is based on a new and valuable resource, data. Thus, new practices have been spreading rapidly among companies regardless of organization sizes, as well as in Public Administration (Klingenberg et al., 2019).

Provost e Fawcett (2013) define DDD as the practice of basing decisions on data analysis rather than purely on intuition. They also emphasize that it is not an all-or-nothing practice, meaning that it can be used to a greater or lesser degree within organizations.

In this context, there is also the movement called "Open Government" or "Open Data", defined by Kassen (2013a), as one in which government data is available for use and distribution by anyone without any copyright restrictions. Thus, the dichotomous world (Market and State) has been transformed into an open and interconnected world in which the traditional roles and relationships between these agents are being replaced by complex interdependencies. Therefore, the production and use of these data for decision-making and their availability by public authorities become even more significant to the extent that citizens and public and private organizations have, not only the opportunity but also the motivation and ability to use data to achieve social and economic value (Jezek et al., 2014).

Brynjolfsson *et al.* (2011) statistically showed that the more a company is data-driven, the more productive it is, and it can achieve gains of around 4% to 6%. They also highlight the correlation (almost causal) with a higher return on assets, equity, asset utilization, and market value. Similarly, they point out that productivity increases in the context of Public Administration when DDD is used, with gains of around 5% to 6% beyond what can be explained by traditional inputs and the use of IT.

Data Science has supported and increasingly overlapped with DDD through automated computational systems. Whether it is decisions for which discoveries need to be made within the data or decisions that are repeated especially on a large scale. Another critical aspect is the support of analytical thinking from data, the reason is that this skill is important for both data scientists and employees across the organization. For it allows one to understand the fundamental concepts and have frameworks to organize analytical thinking. It not only enables interaction with competence but also in visualizing opportunities to improve DDD or to see data-driven competitive threats. However, investments in analytics can be useless, and even harmful, unless employees can also incorporate that data into complex decision-making. Therefore, for Data Science to flourish as a field, it must think beyond the commonly used algorithms, techniques, and tools. It needs to think about the elementary principles and concepts that underlie the techniques and the systematic thinking that promotes success in DDD. The success desired in the DDD business environment requires the ability to think about how the fundamental concepts apply to specific problems and businesses (analytical thinking) (Provost & Fawcett, 2013).

Public value is another related concept in the OGD and e-government literature. The public value framework is based on the premise that public resources should be used



to increase value, not only in the economic sense but also more broadly in terms of what is valued by citizens.

### 2.1. The methodological framework of this study

This is an exploratory study as regards its purpose and bibliographical as regards the means of investigation because it is a systematic study developed based on published articles (Vergara, 2004).

According to Broadus (1987) bibliometrics is a type of quantitative and statistical bibliographic research that originated in Information Science. However, this study is also qualitative because the data obtained will be analyzed according to interests, delimitations, and criteria defined by the authors.

Thus, to obtain a set of bibliographic references about data-driven decision-making in the context of public administration; and from this portfolio which is the articles, authors, and prominent journals dealing with this theme, the structured procedure called Knowledge Development Process - Constructivist (*ProKnow-C*) was used.

The *ProKnow-C* framework starts by considering the researcher's interest in a theme, as well as some delimitations and restrictions that help him, in a structured way, to select and analyze relevant articles. According to Ensslin et al (2010) the concept of bibliometric analysis is based on the quantitative evidencing of the parameters of a selected set of articles: the selected articles themselves, their sets of bibliographic references, authors, relevant journals, and the number of citations..

The next section presents the methodological procedures used in the search, collection, selection, and analysis of relevant publications related to the theme under study.

## III. METHODOLOGICAL PROCEDURES

Kitchenham (2004) summarizes that systematic reviews are means to assess and interpret relevant research available for a research question, thematic area, or phenomenon of interest. Among the main motivations for studies of this nature, he highlights the possibility of (i) synthesizing evidence concerning treatment or technology to summarize, for example, empirical evidence of the benefits and limitations of a specific method; (ii) identifying gaps in current research in order to suggest areas for further investigation; (iii) providing a framework to adequately position new research activities and; (iv) assessing the extent to which empirical evidence may support or contradict theoretical hypotheses, or assist in the generation of new hypotheses.

Karlsson (2009), regarding the use of systematic reviews, highlights (i) the scientific support when basing work on relevant publications; (ii) justify the choice of a theme and the consequent contribution of a research proposal; (iii) substantiate the methodological framework of the research; (iv) by delimiting the scope of research, the researcher, makes it feasible and; (v) allows the researcher to develop his analytical capacity of the information and criticism of the specific literature.

### 3.1. The filters

Thus, as to the procedures adopted in this study, the procedures described in the sequence were carried out in the months of May and June 2022.

Two databases were selected as sample fields. The base *Web of Science* (or ISI) gives rise to the JCR index (*Journal Citation Report*) that evaluates the impact factor of journals and the base Scopus (Elsevier) which currently holds the title of the largest database of scientific articles in the world.

The first filter for the selection of articles was the choice of keywords grouped into two thematic axes: "data-driven" and "public sector". The keywords and their respective synonyms initially selected relative to each axis are presented in Table 1.

Table.1: Selected keyword combinations

| Nº | Axis 1         | Axis 2           |
|----|----------------|------------------|
| 1  |                | "Public*"        |
| 2  |                | "Public Admin*"  |
| 3  |                | "Public Sec*"    |
| 4  | "data-driven*" | "Public Serv*"   |
| 5  |                | "Public Manage*" |
| 6  |                | "Govern*"        |
| 7  |                | "Open Gov*"      |
| 8  |                | "Open Data*"     |

Synonyms and wildcard characters were used so as not to restrict too much the search results in the databases. The searches with these words were carried out only in the titles, keywords defined by the authors of the articles, and in the abstract of the articles ("TOPIC" selection in the search fields of the databases).

Only articles (type: "ARTICLE") published in the last 10 years were selected, that is, published from 2012 until June 2022, when this research was carried out.

The areas of interest selected in each base are presented in Table 2.

Table.2: Selected areas of interest on each basis

| Web of Science                                                                                                                                                                                                                                                                               | Scopus                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| “Mathematics Interdisciplinary Applications”, “Management”, “Business”, “Business Finance”, “Economics”, “Interdisciplinary Applications”, “Public Administration”, “Management”, “Multidisciplinary Sciences”, “Social Sciences Mathematical Methods” e “Social Sciences Interdisciplinary” | “Business”, “Management and Accounting”; “Economics”, “Econometrics and Finance”, “Decision Sciences”; “Social Sciences” e “Multidisciplinary”. |

These were the preliminary filters adopted in the search for each keyword combination in each database. The next section will present the results and respective analyses conducted.

#### IV. PRESENTATION AND DISCUSSION OF RESULTS

The search results for each keyword combination, on each basis, are shown in Table 3.

Table.3: Database search results

| Combinations                        | Web of Science | Scopus       |
|-------------------------------------|----------------|--------------|
| “data-driven*” AND “Public*”        | 264            | 888          |
| “data-driven*” AND “Public Admin*”  | 21             | 18           |
| “data-driven*” AND “Public Sec*”    | 19             | 41           |
| “data-driven*” AND “Public Serv*”   | 12             | 41           |
| “data-driven*” AND “Public Manage*” | 9              | 11           |
| “data-driven*” AND “Govern*”        | 600            | 615          |
| “data-driven*” AND “Open Gov*”      | 9              | 20           |
| “data-driven*” AND “Open Data*”     | 31             | 83           |
| <b>Total</b>                        | <b>965</b>     | <b>1.717</b> |

From the total of articles obtained in each base, 745 duplicate articles were identified, resulting in a total of 1.937 distinct articles.

The next step was to read the titles of the articles in search of articles aligned with the theme of interest. After this step, 1.633 articles were excluded, i.e., 304 were aligned with the proposed theme.

We then proceeded to analyze the scientific recognition of these 304 articles. For this, using the Google Scholar (GS) tool, the number of citations of each article was obtained.

As a cut-off criterion, the articles that represent around 80% of the total number of citations (8.599) were selected. Thus, of the 304 articles aligned by title 56 (or 18.43% of the total) concentrated 80,044% of the citations. In other words, the articles that received at least 38 citations were selected.

The 248 less cited articles will still be evaluated according to other criteria, and some may still be part of the final portfolio of articles selected as part of the theoretical framework of the research.

With the articles with the greatest scientific recognition, they were evaluated as to the alignment of the abstract with the theme of interest. In this process, 11 non-aligned articles were eliminated.

Thus, 45 articles remained that were aligned as to the title and the abstract, which presented a relevant quantity of citations

The 248 articles with few or no citations were also evaluated according to the following criteria: (i) articles published less than 2 years before the analysis, since there was not enough time to be cited yet; and (ii) when published more than 2 years before, being from researchers who are already among the authors of the 45 articles selected so far.

Among the 248 articles under review, 174 were published in 2020, 2021, or 2022. And among the 74 articles with a publication date of more than 2 years, only 1 was by an author present in the bibliographic portfolio.

After reading the abstracts of these 175 articles, 6 were selected based on their alignment with the research objective.

Thus, these 6 articles were added to the set of 45 previously selected for further reading. After the full reading of the 51 articles, 7 were excluded for being misaligned with the research theme, resulting in a set of 44 articles for the final portfolio.

In summary, the results obtained in the first two stages of the framework (Search and Selection) are shown in Fig. 1. And the results of the bibliometric analysis itself (Analysis) will be presented in the next section.

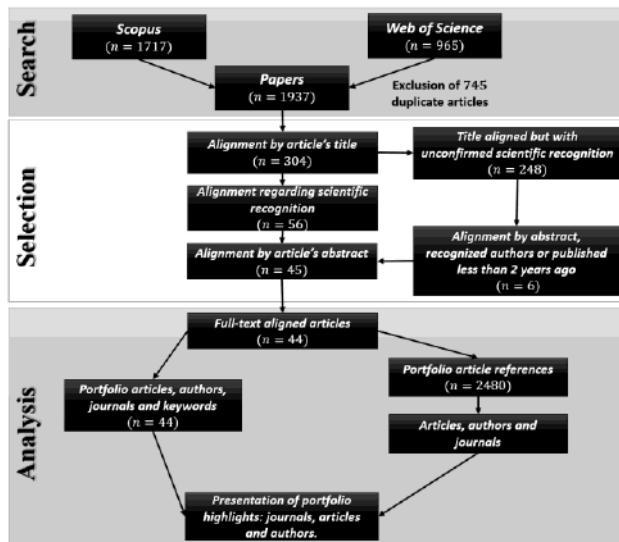


Fig. 1: Main steps of ProKnow-C framework adapted from Lacerda et al. (2016)

The 44 articles in the portfolio are presented in alphabetical order of the first author in Table 4.

Table.4: Articles from the bibliographic portfolio

| Nº  | Article                           | Nº of citations in GS |
|-----|-----------------------------------|-----------------------|
| 1.  | (Provost & Fawcett, 2013)         | 1.477                 |
| 2.  | (Williamson, 2016)                | 413                   |
| 3.  | (Kassen, 2013)                    | 362                   |
| 4.  | (Chakraborty & Ghosh, 2020)       | 293                   |
| 5.  | (Jetzek et al., 2014)             | 248                   |
| 6.  | (Liang et al., 2018)              | 218                   |
| 7.  | (Bansak et al., 2018)             | 210                   |
| 8.  | (Barns, 2018)                     | 205                   |
| 9.  | (Elish & Boyd, 2018)              | 196                   |
| 10. | (Matheus & Janssen, 2020)         | 149                   |
| 11. | (Parycek et al., 2014)            | 137                   |
| 12. | (Phillips-Wren & Hoskisson, 2015) | 121                   |
| 13. | (Chen et al., 2017)               | 90                    |
| 14. | (Appelbaum et al., 2018)          | 88                    |
| 15. | (Khalifa et al., 2014)            | 81                    |
| 16. | (Birchall, 2015)                  | 76                    |
| 17. | (Batarseh & Latif, 2016)          | 73                    |
| 18. | (Tenney & Sieber, 2016)           | 72                    |
| 19. | (Klingenberg et al., 2019)        | 69                    |
| 20. | (McBride et al., 2019)            | 66                    |
| 21. | (Katsonis & Botros, 2015)         | 61                    |

| Nº  | Article                       | Nº of citations in GS |
|-----|-------------------------------|-----------------------|
| 22. | (Kassen, 2017)                | 59                    |
| 23. | (Choi et al., 2018)           | 58                    |
| 24. | (Hino et al., 2018)           | 53                    |
| 25. | (Gupta & Rani, 2019)          | 51                    |
| 26. | (Moro Visconti & Morea, 2019) | 49                    |
| 27. | (Poel et al., 2018)           | 48                    |
| 28. | (Waheed et al., 2018)         | 48                    |
| 29. | (Marda, 2018)                 | 47                    |
| 30. | (Matheus et al., 2020)        | 43                    |
| 31. | (van Oort et al., 2015)       | 43                    |
| 32. | (Toufaily et al., 2021)       | 42                    |
| 33. | (Kassen, 2018)                | 41                    |
| 34. | (Lourenço et al., 2017)       | 41                    |
| 35. | (French, 2014)                | 39                    |
| 36. | (Dencik et al., 2019)         | 38                    |
| 37. | (Hummel et al., 2021)         | 38                    |
| 38. | (Severo et al., 2016)         | 38                    |
| 39. | (M. Janssen et al., 2022)     | 18                    |
| 40. | (Pereira et al., 2018)        | 14                    |
| 41. | (Kassen, 2020)                | 6                     |
| 42. | (Kim et al., 2019)            | 6                     |
| 43. | (Chen & Ji, 2022)             | 0                     |
| 44. | (Cheung & Chen, 2021)         | 0                     |

#### 4.1. Bibliometric analysis of the bibliographic portfolio

This section is dedicated to the bibliometric analysis of the selected portfolio to build a theoretical framework for data-driven decision-making in the context of Public Administration. The results will be presented in three stages: (i) a bibliometric analysis of the articles selected; (ii) a bibliometric analysis of the references of the articles in the portfolio; and (iii) the classification of the articles according to their relevance to the scientific community.

From the bibliometric analysis, the journals with the largest number of articles are shown in Fig. 2.

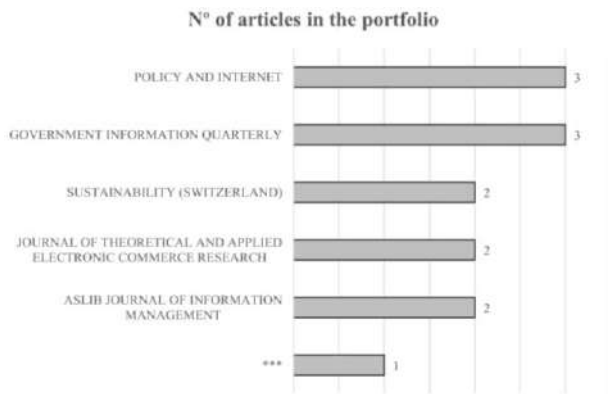


Fig. 2: Journals with the highest number of articles in the portfolio

The journals “Policy and Internet” and “Government Information Quarterly” presented 3 articles, each one, among those selected for the portfolio. The other periodicals (*Annals of Operations Research, Australian Journal of Public Administration, Behaviour and Information Technology, Big Data, Big Data and Society, Big Data Research Chaos Solitons & Fractals City Culture and Society, Communication Monographs, European Journal of Social Theory, Information & Management, Information Technology and People, International Journal of Disaster Risk Reduction, International Journal of Electronic Government Research, Internet Policy Review, Journal of Accounting Literature, Journal of Decision Systems, Journal of Education Policy, Journal of Information Science, Journal of Manufacturing Technology Management, Law and Social Inquiry, Nature Sustainability, Philosophical Transactions of the Royal Society a-Mathematical Physical and Engineering Sciences, Public Performance & Management Review, Public Transport, Science, Social Science Computer Review, Surveillance and Society, Transforming Government: People Process and Policy, Transportation Research Part D: Transport and Environment, Urban Education e Urban Planning*), which appear, indicated with \*\*\* in Fig. 2, contributed only 1 article each.

The authors who stood out within the portfolio with the highest number of articles are shown in Fig. 3.

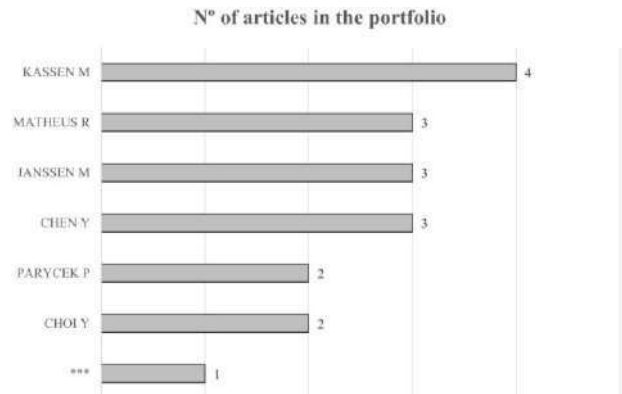


Fig. 3: Authors with the highest number of articles in their portfolio

Researcher Maxat Kassen from Nazarbayev University (Kazakhstan) had 4 papers selected for the final portfolio, followed by Ricardo Matheus, Marijn Janssen, and Chen Yang with 3 papers, and Peter Parycek and Youngseok Choi with 2 papers each. The remaining 101 authors had only one of their papers selected.

As for scientific recognition, by the number of citations in GS, the articles are presented in descending order in Fig. 4.

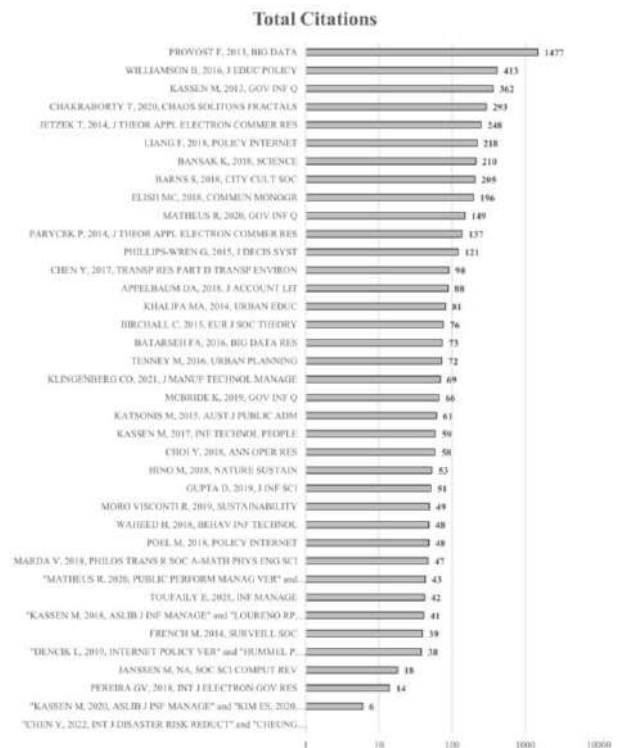


Fig. 4: Portfolio articles are ordered by the number of citations

The most prominent article, with 1,477 citations, is the one by Foster Provost and Tom Fawcett entitled “Data

Science and its Relationship to Big Data and Data-Driven Decision Making”.

In time, within the final portfolio, the occurrences of keywords indicated by the authors were analyzed. The results are presented in Fig. 5.

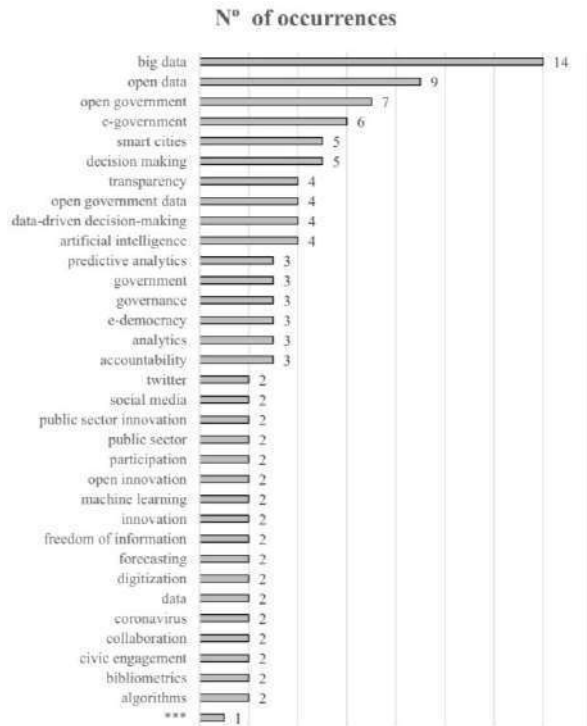


Fig. 5: Keywords most frequently used by authors in the articles in the portfolio

We identified 33 keywords cited at least twice by the authors. The most frequent was “big data” with 14 mentions, followed by “open data” with 9 mentions and “open government” with 7, and “smart cities” and “decision-making” with 5 mentions each. In addition to these, another 156 keywords were mentioned only once by the authors of the portfolio, as can be seen qualitatively in Fig 6.



Fig. 6: Wordcloud with the author's keywords

4.2. Bibliometric analysis of references from the bibliographic portfolio

From the 44 articles in the portfolio, 2,480 different references were obtained. As for the analysis of the most frequent journals in the portfolio references, the results are shown in Fig. 7.

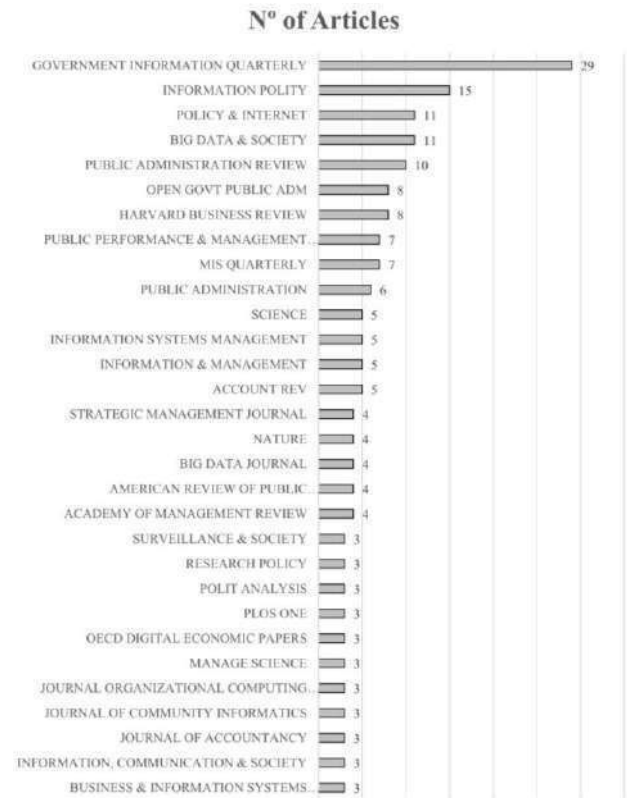


Fig. 7: Most Relevant Periodicals in the Portfolio References

These are the 30 most prominent journals among the references found in the portfolio. The most prominent journal is “Government Information Quarterly” with 29 occurrences, followed by “Information Polity” with 15 occurrences and “Policy & Internet” and “Big Data” with 11 occurrences each.

Among the 3,374 authors cited by the articles in the portfolio, 34 authors stood out with 6 or more citations. These authors are shown in Figure 8.

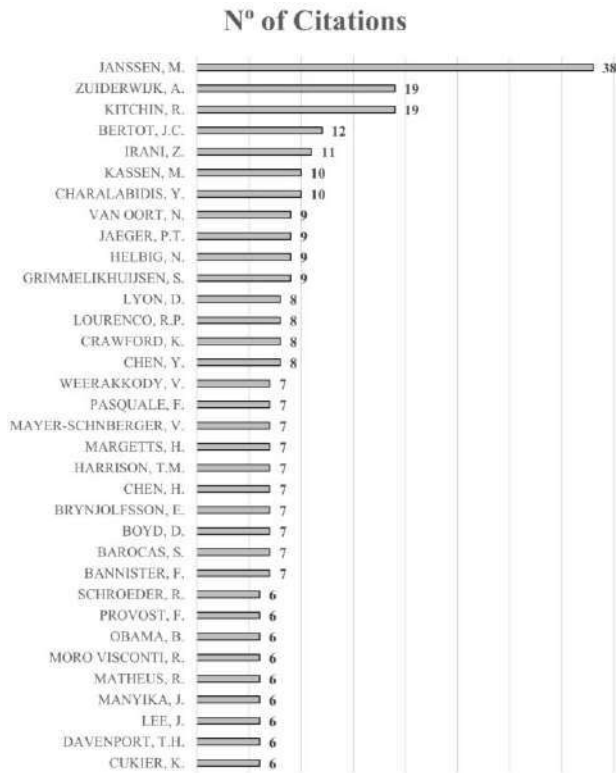


Fig. 8: Most cited authors among the references of the articles in the bibliographic portfolio

The most prominent author in the portfolio references is Marijn Janssen from the Delft University of Technology with 38 citations, followed by Anneke Zuiderwijk and Rob Kitchin with 19 citations each, and John Bertot with 12 citations.

The 20 most prominent articles (number of citations in the GS in the portfolio references are shown in Table. 5.

Table.5: Most prominent articles among those cited in the portfolio references

| Nº  | Article                   | Nº of citations |
|-----|---------------------------|-----------------|
| 1.  | (Boyd & Crawford, 2012)   | 5.189           |
| 2.  | (Albino et al., 2015)     | 3.255           |
| 3.  | (Bertot et al., 2010)     | 2.846           |
| 4.  | (Kitchin, 2014b)          | 2.675           |
| 5.  | (Kitchin, 2014a)          | 2.666           |
| 6.  | (Kitchin, 2014c)          | 2.279           |
| 7.  | (M. Janssen et al., 2012) | 2.053           |
| 8.  | (Burrell, 2016)           | 1.514           |
| 9.  | (Butler, 2013)            | 645             |
| 10. | (Gurstein, 2011)          | 616             |
| 11. | (K. Janssen, 2011)        | 380             |
| 12. | (Kassen, 2013)            | 378             |

| Nº  | Article                                  | Nº of citations |
|-----|------------------------------------------|-----------------|
| 13. | (Lourenço, 2015)                         | 318             |
| 14. | (Gonzalez-Zapata & Heeks, 2015)          | 259             |
| 15. | (M. Janssen & Zuiderwijk, 2014)          | 211             |
| 16. | (Peled, 2011)                            | 200             |
| 17. | (Clarke & Margetts, 2014)                | 186             |
| 18. | (M. Janssen & Kuk, 2016)                 | 83              |
| 19. | (Barocas, Solon; Selbst, Andrew D, 2016) | 60              |
| 20. | (Kashin et al., 2015)                    | 7               |

The article “Critical Questions for Big Data” by Danah Boyd and Kate Crawford, both contributors at Microsoft Research, was the most cited in GS among the 2,480 articles in the bibliographic references in the portfolio.

Among the 109 authors of the portfolio presented, in Fig. 9, the 39 authors presented at least 2 articles in the portfolio and 1 in the portfolio references.

Nº of articles in the Bibliographical Portfolio and in the References

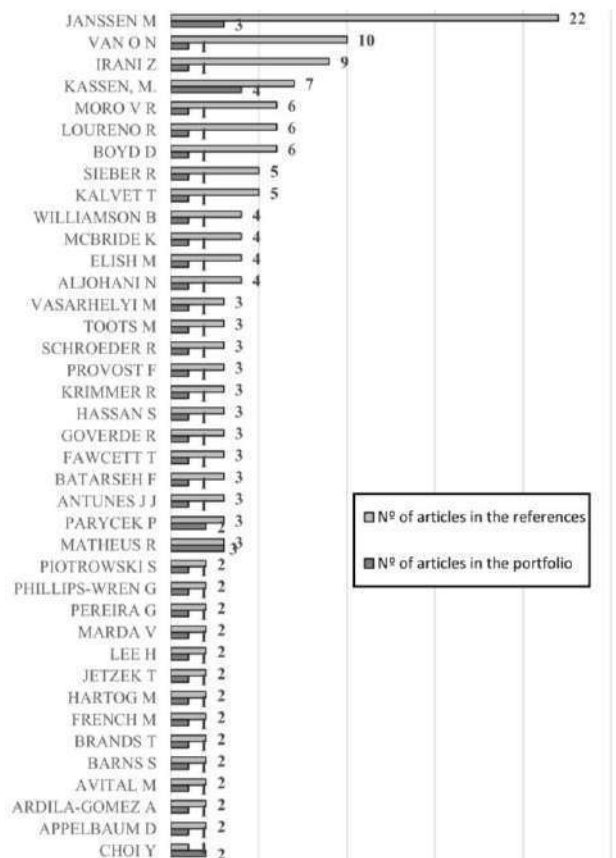


Fig. 9: Authors with the highest number of articles in the bibliographic portfolio and the references in the bibliographic portfolio

Again, the author Marijn Janssen appears as the leading author among the references with 22 articles. Niels van Oort, also from the Delft University of Technology, with 10 articles, and Zahir Irani, from the Business School of Brunel University, with 9 articles. And Maxat Kassen, the most prominent author in the portfolio (with 4 articles, Fig. 3) had 7 articles cited in the references.

From the bibliometric analysis, the most relevant journals and articles in academia can be evidenced through the combined analysis between the journals where the articles in the portfolio were published and the journals in the references, as shown in Fig. 10.

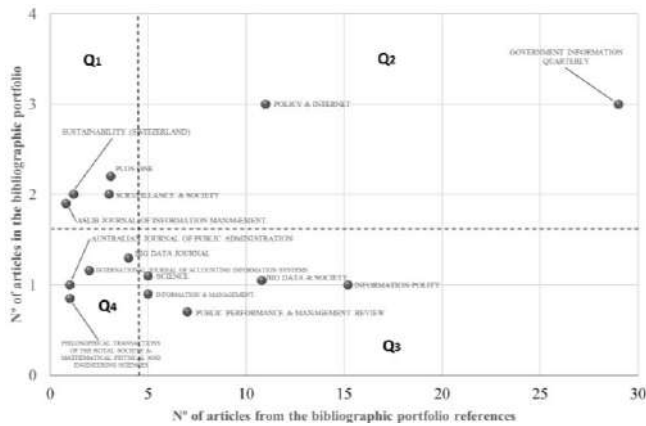


Fig. 10: Top journals in the bibliographic portfolio and references

Fig. 10 was divided into 4 quadrants, in quadrant Q1 we observe the prominent journals in the portfolio (“ASLIB Journal Information Management”, “Plos One”, “Surveillance & Society” e “Sustainability”) all with 2 articles each in the bibliographic portfolio. In Q2 are the periodicals that stand out in the portfolio and in the portfolio references (“Government Information Quarterly” and “Policy & Internet”), which together have almost 45% of the citations in the portfolio references and 3 articles each in the bibliographic portfolio. In Q3 the journals that stood out in the portfolio references (“Big Data & Society”, “Information & Management”, “Information Polity”, “Public Performance & Management Review” and “Science,”) with at least 5 citations. And in Q4 the relevant periodicals in the portfolio and the references of the portfolio (“Australian Journal of Public Administration”, “Big Data Journal”, “International Journal of Accounting Information Systems” and “Philosophical Transactions of the Royal Society A-Mathematical Physical and Engineering Sciences”) with one article in the portfolio each and less than 5 citations in the references of the bibliographic portfolio.

When analyzing the scientific relevance of the articles (obtained by the number of citations of each article) and

the incidence of articles by the same author in the bibliographic portfolio references, we obtained the scatter plot shown in Fig. 11.

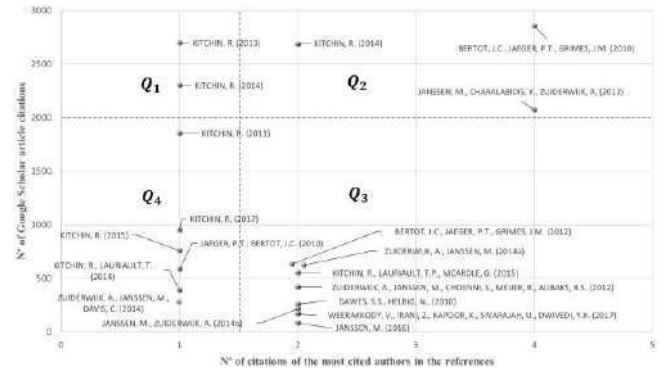


Fig. 11: Top articles and authors in the bibliographic portfolio

Fig. 11 was also divided into 4 quadrants, in quadrant Q1 are the top articles in terms of citations in GS (Kitchin, 2014b) and (Kitchin, 2014c) both with more than 2,000 citations. In Q2 are the prominent articles performed by prominent authors (Bertot et al., 2010), (M. Janssen et al., 2012) and (Kitchin, 2014a) that got more than 2,000 citations in the GS and more than 2 citations in the portfolio. In Q3 are articles by prominent authors (Bertot et al., 2012), (Dawes & Helbig, 2010), (M. Janssen & Kuk, 2016), (M. Janssen & Zuiderwijk, 2014), (Kitchin et al., 2015), (Weerakkody et al., 2017), (Zuiderwijk et al., 2012) and (Zuiderwijk & Janssen, 2014) all with 2 citations in the references and less than 1000 citations in the GS. And in Q4 the articles relevant to the topic (Jaeger & Bertot, 2010), (Kitchin & Dodge, 2011), (Kitchin & Lauriault, 2014), (Kitchin, 2017), (Kitchin, 2015) and (Zuiderwijk et al., 2014).

V. CONCLUSION

The objective of this study focuses on the use of a systematized procedure to select relevant articles to compose a theoretical framework about DDD in the context of Public Administration, given the relevance and timeliness of the topic and the economic and social impacts.

This study initially presented the procedures for searching and selecting relevant articles and an analysis to assess the main works, authors, and journals that have been published on the topic. As summarized in Fig. 1, using the ProKnow-C framework, from an initial volume of 1,937 articles we obtained a bibliographic portfolio composed of 44 articles presented in Table 4.

In addition to the article selection process, which aims to compose a theoretical referential on the theme, a bibliometric analysis was carried out. It was possible to highlight the journals “*Policy and Internet*” and “*Government Information Quarterly*” as the most prominent in terms of publications on the theme.

As for the authors, the framework evidenced the contributions of Maxat Kassen, Ricardo Matheus, Marijn Janssen, and Chen Yang, with at least 3 papers each.

Furthermore, from the analysis of the bibliographic references of the articles in the portfolio, it was verified the relevance of the journals “*Government Information Quarterly*”, “*Information Polity*”, “*Policy & Internet*” and “*Big Data*”.

Thus, the use of data and new Big Data and Artificial Intelligence technologies and the creation of transparency through OGD initiatives are key areas of research on DDD. This systematic review allowed us to verify the increase in the production of studies related to open data, transparency, and the use of new technologies to treat data, classify, and group data, helping the public manager to obtain insights and make decisions with the help of technical and quantitative elements.

However, we emphasize that the results presented are limited to the sample of journals and articles researched because they cannot be extrapolated to the entire set of publications in an area.

As a suggestion for further and future work, we recommend the application of the next stage of the *ProKnow-C* framework, which proposes a systemic content analysis of this bibliographic portfolio.

## REFERENCES

- [1] Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart Cities: Definitions, Dimensions, Performance, and Initiatives. *Journal of Urban Technology*, 22(1), 3–21. <https://doi.org/10.1080/10630732.2014.942092>
- [2] Appelbaum, D. A., Kogan, A., & Vasarhelyi, M. A. (2018). Analytical procedures in external auditing: A comprehensive literature survey and framework for external audit analytics. *Journal of Accounting Literature*, 40(1), 83–101. <https://doi.org/10.1016/j.acclit.2018.01.001>
- [3] Bansak, K., Ferwerda, J., Hainmueller, J., Dillon, A., Hangartner, D., Lawrence, D., & Weinstein, J. (2018). Improving refugee integration through data-driven algorithmic assignment. *Science*, 359(6373), 325–329. <https://doi.org/10.1126/science.aao4408>
- [4] Barns, S. (2018). Smart cities and urban data platforms: Designing interfaces for smart governance. *City, Culture and Society*, 12, 5–12. <https://doi.org/10.1016/j.ccs.2017.09.006>
- [5] Barocas, Solon; Selbst, Andrew D. (2016). *Big Data's Disparate Impact*. <https://doi.org/10.15779/Z38BG31>
- [6] Batarseh, F. A., & Latif, E. A. (2016). Assessing the Quality of Service Using Big Data Analytics. *Big Data Research*, 4, 13–24. <https://doi.org/10.1016/j.bdr.2015.10.001>
- [7] Bertot, J. C., Jaeger, P. T., & Grimes, J. M. (2010). Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies. *Government Information Quarterly*, 27(3), 264–271. <https://doi.org/10.1016/j.giq.2010.03.001>
- [8] Bertot, J. C., Jaeger, P. T., & Grimes, J. M. (2012). Promoting transparency and accountability through ICTs, social media, and collaborative e-government. *Transforming Government: People, Process and Policy*, 6(1), 78–91. <https://doi.org/10.1108/17506161211214831>
- [9] Birchall, C. (2015). ‘Data.gov-in-a-box’: Delimiting transparency. *European Journal of Social Theory*, 18(2), 185–202. <https://doi.org/10.1177/1368431014555259>
- [10] Boyd, D., & Crawford, K. (2012). CRITICAL QUESTIONS FOR BIG DATA: Provocations for a cultural, technological, and scholarly phenomenon. *Information, Communication & Society*, 15(5), 662–679. <https://doi.org/10.1080/1369118X.2012.678878>
- [11] Broadus, R. N. (1987). Toward a definition of “bibliometrics”. *Scientometrics*, 12(5–6), 373–379. <https://doi.org/10.1007/BF02016680>
- [12] Brynjolfsson, E., Hitt, L. M., & Kim, H. H. (2011). Strength in Numbers: How Does Data-Driven Decisionmaking Affect Firm Performance? *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1819486>
- [13] Brynjolfsson, E., & McElheran, K. (2016). The Rapid Adoption of Data-Driven Decision-Making. *American Economic Review*, 106(5), 133–139. <https://doi.org/10.1257/aer.p20161016>
- [14] Burrell, J. (2016). How the machine ‘thinks’: Understanding opacity in machine learning algorithms. *Big Data & Society*, 3(1), 205395171562251. <https://doi.org/10.1177/2053951715622512>
- [15] Butler, D. (2013). When Google got flu wrong. *Nature*, 494(7436), 155–156. <https://doi.org/10.1038/494155a>
- [16] Chakraborty, T., & Ghosh, I. (2020). Real-time forecasts and risk assessment of novel coronavirus (COVID-19) cases: A data-driven analysis. *Chaos, Solitons & Fractals*, 135, 109850. <https://doi.org/10.1016/j.chaos.2020.109850>
- [17] Chen, Y., Ardila-Gomez, A., & Frame, G. (2017). Achieving energy savings by intelligent transportation systems investments in the context of smart cities. *Transportation Research Part D: Transport and Environment*, 54, 381–396. <https://doi.org/10.1016/j.trd.2017.06.008>
- [18] Chen, Y., & Ji, W. (2022). Estimating public demand following disasters through Bayesian-based information integration. *International Journal of Disaster Risk Reduction*, 68, 102713. <https://doi.org/10.1016/j.ijdr.2021.102713>
- [19] Cheung, A. S. Y., & Chen, Y. (2021). From Datafication to Data State: Making Sense of China’s Social Credit System and Its Implications. *Law & Social Inquiry*, 1–35. <https://doi.org/10.1017/lisi.2021.56>
- [20] Choi, Y., Lee, H., & Irani, Z. (2018). Big data-driven fuzzy cognitive map for prioritising IT service procurement in the



- public sector. *Annals of Operations Research*, 270(1–2), 75–104. <https://doi.org/10.1007/s10479-016-2281-6>
- [21] Clarke, A., & Margetts, H. (2014). Governments and Citizens Getting to Know Each Other? Open, Closed, and Big Data in Public Management Reform: Open, Closed, and Big Data in Public Management Reform. *Policy & Internet*, 6(4), 393–417. <https://doi.org/10.1002/1944-2866.POI377>
- [22] Dawes, S. S., & Helbig, N. (2010). Information Strategies for Open Government: Challenges and Prospects for Deriving Public Value from Government Transparency. Em M. A. Wimmer, J.-L. Chappellet, M. Janssen, & H. J. Scholl (Orgs.), *Electronic Government* (Vol. 6228, p. 50–60). Springer Berlin Heidelberg. [https://doi.org/10.1007/978-3-642-14799-9\\_5](https://doi.org/10.1007/978-3-642-14799-9_5)
- [23] Dencik, L., Redden, J., Hintz, A., & Warne, H. (2019). The ‘golden view’: Data-driven governance in the scoring society. *Internet Policy Review*, 8(2). <https://doi.org/10.14763/2019.2.1413>
- [24] Elish, M. C., & Boyd, D. (2018). Situating methods in the magic of Big Data and AI. *Communication Monographs*, 85(1), 57–80. <https://doi.org/10.1080/03637751.2017.1375130>
- [25] Ensslin, L., Ensslin, S. R., Lacerda, R. T. de O., & Tasca, J. E. (2010). *ProKnow-C, knowledge development process-constructivist* (INPI Patent).
- [26] French, M. (2014). Gaps in the gaze: Informatic practice and the work of public health surveillance. *Surveillance & Society*, 12(2), 226–242. <https://doi.org/10.24908/ss.v12i2.4750>
- [27] Gonzalez-Zapata, F., & Heeks, R. (2015). The multiple meanings of open government data: Understanding different stakeholders and their perspectives. *Government Information Quarterly*, 32(4), 441–452. <https://doi.org/10.1016/j.giq.2015.09.001>
- [28] Gupta, D., & Rani, R. (2019). A study of big data evolution and research challenges. *Journal of Information Science*, 45(3), 322–340. <https://doi.org/10.1177/0165551518789880>
- [29] Gurstein, M. B. (2011). Open data: Empowering the empowered or effective data use for everyone? *First Monday*. <https://doi.org/10.5210/fm.v16i2.3316>
- [30] Hino, M., Benami, E., & Brooks, N. (2018). Machine learning for environmental monitoring. *Nature Sustainability*, 1(10), 583–588. <https://doi.org/10.1038/s41893-018-0142-9>
- [31] Hummel, P., Braun, M., Tretter, M., & Dabrock, P. (2021). Data sovereignty: A review. *Big Data & Society*, 8(1), 205395172098201. <https://doi.org/10.1177/2053951720982012>
- [32] Jaeger, P. T., & Bertot, J. C. (2010). Transparency and technological change: Ensuring equal and sustained public access to government information. *Government Information Quarterly*, 27(4), 371–376. <https://doi.org/10.1016/j.giq.2010.05.003>
- [33] Janssen, K. (2011). The influence of the PSI directive on open government data: An overview of recent developments. *Government Information Quarterly*, 28(4), 446–456. <https://doi.org/10.1016/j.giq.2011.01.004>
- [34] Janssen, M., Charalabidis, Y., & Zuiderwijk, A. (2012). Benefits, Adoption Barriers and Myths of Open Data and Open Government. *Information Systems Management*, 29(4), 258–268. <https://doi.org/10.1080/10580530.2012.716740>
- [35] Janssen, M., Hartog, M., Matheus, R., Yi Ding, A., & Kuk, G. (2022). Will Algorithms Blind People? The Effect of Explainable AI and Decision-Makers’ Experience on AI-supported Decision-Making in Government. *Social Science Computer Review*, 40(2), 478–493. <https://doi.org/10.1177/0894439320980118>
- [36] Janssen, M., & Kuk, G. (2016). Big and Open Linked Data (BOLD) in research, policy, and practice. *Journal of Organizational Computing and Electronic Commerce*, 26(1–2), 3–13. <https://doi.org/10.1080/10919392.2015.1124005>
- [37] Janssen, M., & Zuiderwijk, A. (2014). Infomediary Business Models for Connecting Open Data Providers and Users. *Social Science Computer Review*, 32(5), 694–711. <https://doi.org/10.1177/0894439314525902>
- [38] Jetzek, T., Avital, M., & Bjorn-Andersen, N. (2014). Data-Driven Innovation through Open Government Data. *Journal of Theoretical and Applied Electronic Commerce Research*, 9(2), 15–16. <https://doi.org/10.4067/S0718-18762014000200008>
- [39] Karlsson, C. (Org.). (2009). *Researching operations management*. Routledge.
- [40] Kashin, K., King, G., & Soneji, S. (2015). Explaining Systematic Bias and Nontransparency in U.S. Social Security Administration Forecasts. *Political Analysis*, 23(3), 336–362. <https://doi.org/10.1093/pan/mpv011>
- [41] Kassen, M. (2013). A promising phenomenon of open data: A case study of the Chicago open data project. *Government Information Quarterly*, 30(4), 508–513. <https://doi.org/10.1016/j.giq.2013.05.012>
- [42] Kassen, M. (2017). Open data in Kazakhstan: Incentives, implementation and challenges. *Information Technology & People*, 30(2), 301–323. <https://doi.org/10.1108/ITP-10-2015-0243>
- [43] Kassen, M. (2018). Adopting and managing open data: Stakeholder perspectives, challenges and policy recommendations. *Aslib Journal of Information Management*, 70(5), 518–537. <https://doi.org/10.1108/AJIM-11-2017-0250>
- [44] Kassen, M. (2020). Open data and its peers: Understanding promising harbingers from Nordic Europe. *Aslib Journal of Information Management*, 72(5), 765–785. <https://doi.org/10.1108/AJIM-12-2019-0364>
- [45] Katsonis, M., & Botros, A. (2015). Digital Government: A Primer and Professional Perspectives: Digital Government. *Australian Journal of Public Administration*, 74(1), 42–52. <https://doi.org/10.1111/1467-8500.12144>
- [46] Khalifa, M. A., Jennings, M. E., Briscoe, F., Oleszweski, A. M., & Abdi, N. (2014). Racism? Administrative and Community Perspectives in Data-Driven Decision Making: Systemic Perspectives Versus Technical-Rational Perspectives. *Urban Education*, 49(2), 147–181. <https://doi.org/10.1177/0042085913475635>
- [47] Kim, E. S., Choi, Y., & Byun, J. (2019). Big Data Analytics in Government: Improving Decision Making for R&D Investment in Korean SMEs. *Sustainability*, 12(1), 202. <https://doi.org/10.3390/su12010202>

- [48] Kitchenham, B. (2004). *Procedures for Performing Systematic Reviews* [Technical Report TR/SE-0401]. [https://www.researchgate.net/profile/Barbara-Kitchenham/publication/228756057\\_Procedures\\_for\\_Performing\\_Systematic\\_Reviews/links/618cfae961f09877207f8471/Procedures-for-Performing-Systematic-Reviews.pdf](https://www.researchgate.net/profile/Barbara-Kitchenham/publication/228756057_Procedures_for_Performing_Systematic_Reviews/links/618cfae961f09877207f8471/Procedures-for-Performing-Systematic-Reviews.pdf)
- [49] Kitchin, R. (2014a). *The data revolution: Big data, open data, data infrastructures and their consequences*. Sage.
- [50] Kitchin, R. (2014b). The real-time city? Big data and smart urbanism. *GeoJournal*, 79(1), 1–14. <https://doi.org/10.1007/s10708-013-9516-8>
- [51] Kitchin, R. (2014c). Big Data, new epistemologies and paradigm shifts. *Big Data & Society*, 1(1), 205395171452848. <https://doi.org/10.1177/2053951714528481>
- [52] Kitchin, R. (2015). Making sense of smart cities: Addressing present shortcomings. *Cambridge Journal of Regions, Economy and Society*, 8(1), 131–136. <https://doi.org/10.1093/cjres/rsu027>
- [53] Kitchin, R. (2017). Thinking critically about and researching algorithms. *Information, Communication & Society*, 20(1), 14–29. <https://doi.org/10.1080/1369118X.2016.1154087>
- [54] Kitchin, R., & Dodge, M. (2011). *Code, space: Software and everyday life*. MIT Press.
- [55] Kitchin, R., & Lauriault, T. P. (2014). *Towards critical data studies: Charting and unpacking data assemblages and their work*. 19.
- [56] Kitchin, R., Lauriault, T. P., & McArdle, G. (2015). Knowing and governing cities through urban indicators, city benchmarking and real-time dashboards. *Regional Studies, Regional Science*, 2(1), 6–28. <https://doi.org/10.1080/21681376.2014.983149>
- [57] Klingenberg, C. O., Borges, M. A. V., & Antunes Jr, J. A. V. (2019). Industry 4.0 as a data-driven paradigm: A systematic literature review on technologies. *Journal of Manufacturing Technology Management*, 32(3), 570–592. <https://doi.org/10.1108/JMTM-09-2018-0325>
- [58] Lacerda, R. T. de O., Ensslin, L., Rolim Ensslin, S., Knoff, L., & Martins Dias Junior, C. (2016). Research Opportunities in Business Process Management and Performance Measurement from a Constructivist View: Research Opportunities in BPM. *Knowledge and Process Management*, 23(1), 18–30. <https://doi.org/10.1002/kpm.1495>
- [59] Liang, F., Das, V., Kostyuk, N., & Hussain, M. M. (2018). Constructing a Data-Driven Society: China's Social Credit System as a State Surveillance Infrastructure: China's Social Credit System as State Surveillance. *Policy & Internet*, 10(4), 415–453. <https://doi.org/10.1002/poi3.183>
- [60] Lourenço, R. P. (2015). An analysis of open government portals: A perspective of transparency for accountability. *Government Information Quarterly*, 32(3), 323–332. <https://doi.org/10.1016/j.giq.2015.05.006>
- [61] Lourenço, R. P., Piotrowski, S., & Ingrams, A. (2017). Open data driven public accountability. *Transforming Government: People, Process and Policy*, 11(1), 42–57. <https://doi.org/10.1108/TG-12-2015-0050>
- [62] Marda, V. (2018). Artificial intelligence policy in India: A framework for engaging the limits of data-driven decision-making. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 376(2133), 20180087. <https://doi.org/10.1098/rsta.2018.0087>
- [63] Matheus, R., & Janssen, M. (2020). A Systematic Literature Study to Unravel Transparency Enabled by Open Government Data: The Window Theory. *Public Performance & Management Review*, 43(3), 503–534. <https://doi.org/10.1080/15309576.2019.1691025>
- [64] Matheus, R., Janssen, M., & Maheshwari, D. (2020). Data science empowering the public: Data-driven dashboards for transparent and accountable decision-making in smart cities. *Government Information Quarterly*, 37(3), 101284. <https://doi.org/10.1016/j.giq.2018.01.006>
- [65] McBride, K., Aavik, G., Toots, M., Kalvet, T., & Krimmer, R. (2019). How does open government data driven co-creation occur? Six factors and a ‘perfect storm’; insights from Chicago’s food inspection forecasting model. *Government Information Quarterly*, 36(1), 88–97. <https://doi.org/10.1016/j.giq.2018.11.006>
- [66] Moro Visconti, R., & Morea, D. (2019). Big Data for the Sustainability of Healthcare Project Financing. *Sustainability*, 11(13), 3748. <https://doi.org/10.3390/su11133748>
- [67] Parycek, P., Höchtel, J., & Ginner, M. (2014). Open Government Data Implementation Evaluation. *Journal of Theoretical and Applied Electronic Commerce Research*, 9(2), 13–14. <https://doi.org/10.4067/S0718-18762014000200007>
- [68] Peled, A. (2011). When transparency and collaboration collide: The USA Open Data program. *Journal of the American Society for Information Science and Technology*, 62(11), 2085–2094. <https://doi.org/10.1002/asi.21622>
- [69] Pereira, G. V., Eibl, G., Stylianou, C., Martínez, G., Neophytou, H., & Parycek, P. (2018). The Role of Smart Technologies to Support Citizen Engagement and Decision Making: The SmartGov Case. *International Journal of Electronic Government Research*, 14(4), 17. <https://doi.org/10.4018/IJEGR.2018100101>
- [70] Phillips-Wren, G., & Hoskisson, A. (2015). An analytical journey towards big data. *Journal of Decision Systems*, 24(1), 87–102. <https://doi.org/10.1080/12460125.2015.994333>
- [71] Poel, M., Meyer, E. T., & Schroeder, R. (2018). Big Data for Policymaking: Great Expectations, but with Limited Progress?: Big Data for Policymaking. *Policy & Internet*, 10(3), 347–367. <https://doi.org/10.1002/poi3.176>
- [72] Provost, F., & Fawcett, T. (2013). Data Science and its Relationship to Big Data and Data-Driven Decision Making. *Big Data*, 1(1), 51–59. <https://doi.org/10.1089/big.2013.1508>
- [73] Severo, M., Feredj, A., & Romele, A. (2016). Soft Data and Public Policy: Can Social Media Offer Alternatives to Official Statistics in Urban Policymaking?: Soft Data and Public Policy. *Policy & Internet*, 8(3), 354–372. <https://doi.org/10.1002/poi3.127>
- [74] Statista. (2022). *Volume of data/information created, captured, copied, and consumed worldwide from 2010 to 2025* [Statista]. <https://www.statista.com/statistics/871513/worldwide-data-created/>

- [75] Tenney, M., & Sieber, R. (2016). Data-Driven Participation: Algorithms, Cities, Citizens, and Corporate Control. *Urban Planning*, 1(2), 101–113. <https://doi.org/10.17645/up.v1i2.645>
- [76] Toufaily, E., Zalan, T., & Dhaou, S. B. (2021). A framework of blockchain technology adoption: An investigation of challenges and expected value. *Information & Management*, 58(3), 103444. <https://doi.org/10.1016/j.im.2021.103444>
- [77] van Oort, N., Sparing, D., Brands, T., & Goverde, R. M. P. (2015). Data driven improvements in public transport: The Dutch example. *Public Transport*, 7(3), 369–389. <https://doi.org/10.1007/s12469-015-0114-7>
- [78] Vergara, S. C. (2004). *Projetos e Relatórios de Pesquisa em Administração*. Atlas.
- [79] Waheed, H., Hassan, S.-U., Aljohani, N. R., & Wasif, M. (2018). A bibliometric perspective of learning analytics research landscape. *Behaviour & Information Technology*, 37(10–11), 941–957. <https://doi.org/10.1080/0144929X.2018.1467967>
- [80] Weerakkody, V., Irani, Z., Kapoor, K., Sivarajah, U., & Dwivedi, Y. K. (2017). Open data and its usability: An empirical view from the Citizen's perspective. *Information Systems Frontiers*, 19(2), 285–300. <https://doi.org/10.1007/s10796-016-9679-1>
- [81] Williamson, B. (2016). Digital education governance: Data visualization, predictive analytics, and 'real-time' policy instruments. *Journal of Education Policy*, 31(2), 123–141. <https://doi.org/10.1080/02680939.2015.1035758>
- [82] Zuiderwijk, A., & Janssen, M. (2014). Open data policies, their implementation and impact: A framework for comparison. *Government Information Quarterly*, 31(1), 17–29. <https://doi.org/10.1016/j.giq.2013.04.003>
- [83] Zuiderwijk, A., Janssen, M., Choenni, S., Meijer, R., & Alibaks, R. S. (2012). *Socio-technical Impediments of Open Data*. 10(2), 17.
- [84] Zuiderwijk, A., Janssen, M., & Davis, C. (2014). Innovation with open data: Essential elements of open data ecosystems. *Information Polity*, 19(1,2), 17–33. <https://doi.org/10.3233/IP-140329>

## The use of technology in the classification of obstetric risk: An integrative literature review

Michele de Pinho Barreiros<sup>1</sup>, Hanna Ariane Monteiro Carrera<sup>2</sup>, Elisângela da Silva Ferreira<sup>3</sup>, Maria Elizabete de Castro Rassy<sup>4</sup>, Regina Racquel dos Santos Jacinto<sup>5</sup> Carla Monique Lavareda Costa<sup>6</sup>, Luiza Karla Alves de Paula<sup>7</sup>, Karla Vanessa Silva dos Santos<sup>8</sup>, Cristiane Patrícia Siqueira Monteiro<sup>9</sup>, Fabiane Lima da Silva<sup>10</sup>, Anne Caroline Gonçalves Lima<sup>11</sup>, João Victor Elyakim Pantoja Magno<sup>12</sup>, Jhennifer Pereira Rodrigues<sup>12</sup>, Andressa Torres Oliveira<sup>13</sup>, Elane Magalhães Oliveira<sup>14</sup>, Júlio Éliton Lima Guimarães<sup>15</sup>, Janaína Cunha Romeiro<sup>16</sup>, Josiane Macedo de Oliveira Rupf<sup>17</sup>, Creusa Barbosa dos Santos Trindade<sup>18</sup>, Adams Brunno Silva<sup>19</sup>, Luciana Gonçalves de Oliveira<sup>20</sup>, Anna Thalita de Souza Cardoso<sup>21</sup>, Caroline Saraiva Farias<sup>22</sup>, Ana Caroline Guedes Souza Martins<sup>23</sup>, Heliana Helena de Moura Nunes<sup>24</sup>

<sup>1</sup> Nurse. Specialist in Obstetric Nursing from the Federal University of Minas Gerais - UFMG/Federal University of Pará - UFPA; Master's student at the Postgraduate Program in Management and Health in the Amazon at Fundação Santa Casa de Misericórdia do Pará - FSCMPA; CO/PPP coordinator of the Santa Casa de Misericórdia do Pará Foundation - FSCMPA., Belém, Pará, Brazil. Correspondent author: E-mail: [michelebarreiros@outlook.com](mailto:michelebarreiros@outlook.com)

<sup>2</sup> Nurse. Resident in Obstetric Nursing at the Federal University of Pará - UFPA., Belém, Pará, Brazil.

<sup>3</sup> Nurse. Resident in Oncology Nursing at Hospital Ophyr Loyola; Specialist in Obstetric Nursing at Faculdade Metropolitana da Amazônia - FAMAZ; Master in Biology of Infectious and Parasitic Agents from the Federal University of Pará; PhD in Engineering of Natural Resources of the Amazon from the Federal University of Pará.- UFPA Belém, Pará, Brazil.

<sup>4</sup> Nurse. Specialist in Epidemiology from the Federal University of Pará - UFPA; Specialist in Health Education for SUS preceptors at Hospital Sírío Libanês; Master in Tropical Diseases from the Federal University of Pará - UFPA; PhD in Nursing from the Federal University of Rio de Janeiro - UFRJ, Belém, Pará, Brazil.

<sup>5</sup> Nurse. Specialist in Obstetrics and Neonatology from INESUL Instituto Superior de Londrina and Maternal and Child and Family Health from the Federal University of Maranhão. Belém, Pará, Brazil.

<sup>6</sup> Nurse. Fundação Santa Casa de Misericórdia do Pará - FSCMPA; Specialist in Indigenous Health from the Venda Nova do Imigrante College – FAVENI; Specialist in Integrated Clinic at the Federal University of Pará – UFPA; Specialist in Obstetric and Gynecological Nursing at Escola Superior da Amazônia – ESAMAZ; Master in Nursing from the State University of Pará – UFPA. Belém, Pará, Brazil.

<sup>7</sup> Nurse. Fundação Santa Casa de Misericórdia do Pará, Post-graduation. Belém, Pará, Brazil.

<sup>8</sup> Nurse. Fundação Santa Casa de Misericórdia do Pará, Specialist in Obstetric Nursing from the University Center of the State of Pará – CESUPA; Belém, Pará, Brazil.

<sup>9</sup> Nurse. Fundação Santa Casa de Misericórdia do Pará, Nurse graduated from the Federal University of Pará – UFPA; Specialist in Obstetric Nursing from the Federal University of Pará – UFPA. Belém, Pará, Brazil.

<sup>10</sup> Nurse. Fundação Santa Casa de Misericórdia do Pará, Specialist in Obstetric Nursing from the Federal University of Pará – UFPA; Belém, Pará, Brazil.

<sup>11</sup> Nurse. Hospital de Clínicas Gaspar Vianna - FHCGV, Master in Public Health at UFRJ. Specialist in Obstetric Nursing ESAMAZ, Nursing specialists in Surgical Center, CME and RPA CGESP Goiânia, Specialist in health education for SUS preceptors (Hospital Sírío Libanes / MS), Preceptor of the multiprofessional residency program in cardiovascular health FHCGV. Belém, Pará, Brazil.

<sup>12</sup> Nurse. State University of Pará -UEPA, Belém, Pará, Brazil.

<sup>13</sup> Nurse. Federal University of Piauí, Postgraduate in Pediatric and Neonatal ICU, Belém, Pará, Brazil.

<sup>14</sup> Nurse. Hospital Universitário João de Barros Barreto, Postgraduate in Infectious Diseases Nursing from the Integrated Faculty of Brasília, Pediatric and Neonatal ICU Nursing from the IBRA Faculty and ICU Nursing - Intensive Care Unit from the FAECH. Belém, Pará, Brazil.

<sup>15</sup> Nurse. Federal University of Pará - UFPA, Belém, Pará, Brazil.

<sup>16</sup> Doctor at UFPA. Residency in Family and Community Medicine at UEPA. Professor of the Community Health Interaction Module at CESUPA. Master's Student of the Professional Master's Program Teaching in Health - Medical Education - CESUPA. Belém, Pará, Brazil.

<sup>17</sup> Nurse. Specialist in Epidemiology and Hospital Infection Control; Specialist in Quality and Patient Safety and Specialist in Intensive Care Nursing; Master's student in Tropical Diseases. Belém, Pará, Brazil.

<sup>18</sup> Pedagogue graduated from the Federal University of Pará - UFPA; School Supervisor graduated from the Federal University of Pará - UFPA; Master in Management and Regional Development from the University of Taubaté – UNITAU; PhD in Science and Mathematics Education from the Federal University of Pará – UFPA;

<sup>19</sup> Nurse in surgical Clinic. Master in Nursing at UEPA, Belém, Pará, Brazil.

<sup>20</sup> Doctor. Belém, Pará, Brazil.

<sup>21</sup> Obstetrician Nurse Specialist in Women's and Children's Health, Fundação Santa Casa de Misericórdia do Pará – FSCMPA. Belém, Pará, Brazil.

<sup>22</sup> Nurse, Fundação Santa Casa de Misericórdia do Pará – FSCMPA. Belém, Pará, Brazil.

<sup>23</sup> Nurse. Doctoral Student in Clinical Research in Infectious Diseases at National Institute of Infectious Diseases-INI-FIOCRUZ-RJ. Professor at UEPA, Belém, Pará, Brazil.

<sup>24</sup> Nurse. Specialist in Higher Education Methodology for Health from the State University of Pará – UEPA; Specialist in Obstetric Nursing from the State University of Pará – UEPA; Master in Nursing from the Anna Nery School of Nursing Federal University of Rio de Janeiro – UFRJ; PhD in Nursing from the Anna Nery School of Nursing at the Federal University of Rio de Janeiro – UFRJ., Belém, Pará, Brazil.

Received: 12 Aug 2022,

Received in revised form: 07 Sep 2022,

Accepted: 12 Sep 2022,

Available online: 19 Sep 2022

©2022 The Author(s). Published by AI Publication.

This is an open access article under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** *Morbimortality. Maternal Mortality. Prevention. Technology.*

**Abstract — Objective:** *To analyze from scientific productions how technology with the insertion of Modified Obstetric Alert Scores (MEOWS) can support the health professional responsible for carrying out the reception and risk classification in obstetrics in maternity hospitals. Method: This is an integrative literature review that selected 20 articles in the MEDLINE, LILACS, SciELO and PUBMED databases, which were analyzed and the inclusion criteria applied: articles available in full, published in Portuguese, English and Spanish, that answered the research question. Results: The selected articles were grouped into thematic categories, 1) Nurse's role in welcoming with Obstetric Risk Classification; 2) Insertion of the Modified Obstetric Warning Scoring System (MEOWS) in the Obstetric Urgency and Emergency Unit; 3) Technology and its contribution to Nursing Care. Final considerations: The technology offers a better guarantee for patient safety, as it allows intervention and quick access to the obstetric care needed in the face of the evidenced risk.*

## I. INTRODUCTION

In Brazil, public health has undergone several changes which challenge the health professional in the formulation of new strategies for the prevention and complications of diseases. Faced with this reality, professionals who work directly in care need to always be updated about the dynamic care process, especially the nursing team. [1]

In 2011, the Ministry of Health released the Rede Cegonha Program with the objective of promoting to women and children the improvement of assistance and quality in health, emphasizing actions to reduce maternal and infant mortality, similar to the National Policy for the Humanization of Attention and Management of the

Unified Health System. In addition, in 2014, the use of the Welcoming and Risk Classification in Obstetrics Manual (A&CRO), updated in 2017, was established in all obstetric urgency and emergency services in the country. [2]

This manual was created to provide guidelines and standardized procedures, preventing unfavorable outcomes, enabling access for pregnant women, offering adequate assistance in resolving complications in a timely manner for each case. [2]

The high rates of maternal and neonatal mortality, added to the high rates of cesarean surgeries in recent years, highlight the need to deepen discussions that support

bolder changes in the obstetric and neonatal care model prevailing in the country. [3]

In 1997, in the United Kingdom, the first early warning system was developed based on abnormal physiological parameters, with the aim of early identification of patients at risk of complications. According to some research, changes in physiological parameters were found up to eight hours before unfavorable events happened. [4]

In addition, it became evident that in pregnant women it would be unfeasible to use this method, since the woman undergoes several changes in her body during her gestational period, it was then that in 2007, the United Kingdom validated and recommended the use of an early warning score adapted for the obstetric population (Modified Early Obstetric Warning System-MEOWS). [4]

In this way, several preventive actions are designed every day, in order to improve reception with the obstetric risk classification, one of them is the implementation of the early deterioration alert score (Modified Early Warning System - MEOWS), still in obstetric screening.

In view of this, the world, in recent decades, has been going through a process of transformation and innovation in the technological area of health. In this context, the incorporation of new technologies has contributed a lot to the improvement of the population, as well-planned technology has helped to prevent errors and damages caused to the patient, with this, there is an improvement in the quality of health care provided to society. [5]

Several studies report the benefits of using mobile technologies in health interventions, since they help in clinical decision-making, patient education and qualification of health professionals. The vast majority of these technologies are considered health promotion, well-being and disease prevention strategies. [5]

The insertion of the early warning score has been adopted by several institutions which have shown significant results, with this, this score of early deterioration during reception and risk classification in obstetrics still in the urgency and emergency unit, constitutes a strategy that enables a faster response to maternal complications.

Thus, with the objective of analyzing from the scientific productions, how technology with the insertion of Modified Obstetric Alert Scores (MEOWS) can serve as support to the health professional responsible for carrying

out the reception and risk classification in obstetrics in maternity hospitals.

## II. METHOD

The present study is an integrative literature review, defined from the elaboration of the following research question: "How can technology, from the insertion of the Modified Obstetric Alert Score (MEOWS), contribute to the improvement of of reception with obstetric risk classification?".

For the selection of articles, the platforms MEDLINE (Medical Literature Analysis and Retrieval System online), PUBMED of the U.S National Library of Medicine National Institutes of Health, LILACS (Literatura Latinoamericana e do Caribe em Ciências Health) and SCIELO (Scientific Electronic Library Online).

The search took place between October and December 2020. The inclusion criteria for the articles present in the review were the free availability of abstracts, publication in the last five years (March/2015-December/2020) in Portuguese, English or Spanish and those related to the research topic, that is, from the descriptors "Technology", "Prevention", "Morbimortality" and "Maternal Mortality".

The present review included the choice of 19 articles, which were subjected to analysis through an instrument containing information regarding the identification of the publication, authors, type of publication, objective, methodological detail, results and recommendations/conclusions.

After the analysis, a table was created in order to promote a broader view of the studies, in addition to synthesizing them, considering aspects such as authors, year and main findings, presented in a descriptive way in the results.

## III. RESULTS

Nineteen articles were selected from the MEDLINE, LILACS, SciELO and PUBMED databases, from which the inclusion and exclusion criteria of fully available articles published in Portuguese, English and Spanish were analyzed and applied, which met the selection criteria, to compose the sample in this integrative review, as explained in table 1, below:

*Table 1. Synthesis of the main findings on the use of technology with the insertion of MEOWS in the obstetric risk classification, Brazil, 2021.*

| N  | Authors (Year)                                                                         | Main findings                                                                                                                                                                                                                                                                                          |
|----|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Serafim RC, Temer MJ, Parada CMGL, Peres HHC, Serafim CTR, Jensen R. (2020)            | The evaluation of the Reception System and Risk Classification in Obstetrics was considered excellent technical quality by nurses and health professionals.                                                                                                                                            |
| 2  | Tuyishime E, Ingabire H, Mvukiyehe JP, Marcel Durieux & Theogene Twagirumugabe. (2020) | The use of the MEOWS tool is a viable tool, being considered for expansion of other DHs.                                                                                                                                                                                                               |
| 3  | Edwards W, Dore S, van Schalkwyk J, Armson BA. (2020)                                  | The standardized approach facilitates assessment based on scientific evidence, and allows for the reduction of preventable maternal morbidity and mortality from sepsis, as well as all duplicate causes.                                                                                              |
| 4  | Costa RLM, Santos AAP dos, Sanches MET de L. (2019)                                    | It showed that the profile of the studied clientele provides subsidies for the care practice of health professionals during prenatal care.                                                                                                                                                             |
| 5  | Schuler L, Katz L, Melo BCP, Coutinho IC. (2019)                                       | The use of MEOWS showed that a significant number of patients have trigger events, which were not recognized by the nursing team in 99.2% of cases.                                                                                                                                                    |
| 6  | Blumenthal EA, Hooshvar N, McQuade M, McNulty J. (2019) [18]                           | The performance of early warning systems in an American population, influence cases of maternal morbidity by SHEG.                                                                                                                                                                                     |
| 7  | Rashidi Fakari F, Simbar M, Zadeh Modares S, Alavi Majd H. (2019) [19]                 | The study demonstrated the need for a standardized and widely approved system with high validity and reliability, with standard definitions for obstetric triage to determine the correct priority and waiting times for obstetric care services.                                                      |
| 8  | Silva RM, Brasil CCP, Bezerra IC, Queiroz FFSN. (2019)                                 | It was evidenced as a technology, it is a facilitator and an adjunct in the empowerment of pregnant women interested in obtaining knowledge about pregnancy.                                                                                                                                           |
| 9  | Camargo Neto O, Andrade GKS; Kapiuck, LB, Ganassin, AR. (2018)                         | It was found that the performance of health professionals, with notoriety to nurses, who, regardless of the protocol they use, are supported, in a legal and scientific way, to carry out decision-making about the reception with risk classification of those who seek care in the health services.  |
| 10 | Carvalho SS, Oliveira BR, Nascimento CSO, Gois CTS, Pinto IO. (2018) [20]              | The study recognized the need for differentiated assistance to pregnant women and that the implementation of the sector establishes improvements that guarantee a relationship of trust between users and professionals, as well as effectiveness in attending to urgencies and pregnancy emergencies. |
| 11 | Galvão J, Silva JC. (2017)                                                             | MEOWS is the most appropriate tool for maternal conditions, not validated, and which requires adaptation to physiological changes related to different morbidities.                                                                                                                                    |
| 12 | Figueiroa MN, Menezes MLNM, Monteiro EMLM, Aquino JM, Mendes NOG, Silva PVT. (2017)    | It was concluded that the service under analysis needs agreements and evaluations to promote strategies for coping with difficulties.                                                                                                                                                                  |
| 13 | Ryan HM, et al. (2017)                                                                 | Changing MEOWS trigger parameters can improve your prediction on ICU admission.                                                                                                                                                                                                                        |
| 14 | Pereira IM, Bonfim D, Peres HHC, Góes RF, Gaidzinski RR. (2017)                        | The application enabled a more dynamic data collection; maintained the integrity of the information; assisted data transmission and storage; facilitated the organization and processing of information and provided                                                                                   |

|    |                                                                                         |                                                                                                                                                                                                                                                                                                                                                            |
|----|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |                                                                                         | greater security of results.                                                                                                                                                                                                                                                                                                                               |
| 15 | Silva AKC, Matos CGS, Freitas KSPF, Costa EA, Sousa MC. (2017)                          | It is concluded that the contact of the pregnant woman with the nurse is of paramount importance, they feel more relaxed in addition to placing full confidence in the work developed by the nursing team.                                                                                                                                                 |
| 16 | Brilhante AF, Vasconcelos CTM, Bezerra RA, Lima SKM, Castro RCMB, Fernandes AFC. (2016) | The clientele that seeks gynecological and obstetric care needs to be better informed in primary care about the signs and symptoms that characterize emergency and urgency, since the high demand for the service unnecessarily and the lack of training of professionals led to a waiting time above the recommended by the Ministry of Health of Brazil. |
| 17 | Singh A, Guleria K, Vaid NB, Jain S. (2016)                                             | Monitoring MEOWS rigorously and documenting all vital parameters should be a fundamental part of any patient's assessment to detect acute illness at a very early stage and make a difference in outcome.                                                                                                                                                  |
| 18 | Sandy EA, Kaminski R, Simhan H, Beigi R. (2016) [21]                                    | Contemporary obstetric triage is important to both providers and healthcare leadership.                                                                                                                                                                                                                                                                    |
| 19 | Lee SH, Nurmatov UB, Nwaru BI, Mukherjee M, Grant L, Pagliari C. (2016)                 | Improvements in intermediate outcomes have been reported in many studies and there is modest evidence that interventions delivered through technology can improve health care.                                                                                                                                                                             |

Source: Research Protocol, 2019.

The articles selected in the table above were carefully evaluated and grouped into categories Technology and its contribution to Nursing Care. themes. The categories were: Nurse's role in reception with Obstetric Risk Classification; Insertion of the Modified Obstetric Warning Scoring System (MEOWS) in the Obstetric Urgency and Emergency Unit.

#### IV. DISCUSSION

##### **Nurse's role in welcoming with obstetric risk classification**

Many authors emphasize in their research on urgency and emergency services in Brazil, characterized by a scenario with the existence of immense queues, with disputes for care without risk criteria, taking into account only the order of arrival. Thus, it is noted that overcrowding in hospitals favors dehumanized care, generating dissatisfaction among users. [6]

Costa, Santos and Sanches (2019) discuss in their research that in order to improve the organization of the work process, the Ministry of Health, through the National Humanization Policy, suggests the implementation of the Reception and Risk Classification (A&CR), having as the main strategy, the regulation of care, with the nurse as the main agent. [7]

Other authors discuss the triage models in force today, which have the duty to organize the demands of patients, who seek care in the units, carrying out the identification of immediate assistance needs, as well as recognizing those who can wait. a safe service. [8]

Demand for emergency services has increased in recent decades, with the need to develop other care organization strategies. Risk classification, still in reception, has been an essential practice in human care, as

it aims at quality based on a policy of prioritization of patient needs. [7]

With this, the implementation of the "Reception with Risk Classification" service, in maternity hospitals, constitutes a marker that allows the guarantee of access and the realization of the principle of equity, as it allows the identification of priorities in care. In this way, when the pregnant woman or the postpartum woman seeks the urgency/emergency service, she starts to be attended according to the complexity of her case. [9]

Still in this context, Brilhante, Vasconcelos, Bezerra, Lima, Castro, Fernandes emphasize that the reception in obstetric emergency must have peculiarities according to the needs related to the pregnancy- puerperal process. Because the anxiety that permeates pregnancy, childbirth and birth lead to insecurity and concern for women and their families. For this researcher, this is mainly due to the lack of information during prenatal care, which makes the search for emergency services in maternity hospitals frequent. Because of this, welcoming the woman and companion has the function of favoring the role of pregnant women, especially in labor and delivery. [9]

Therefore, Camargo Neto, Andrade, Karpiuck and Ganasin (2018) understand that the role of welcoming and screening this patient belongs to the nurse, since he/she meets all the necessary conditions for the application of



evaluation scales, which leads him/her to critical judgment, ordering the order and form of care. [10]

### **Insertion of the modified obstetric warning scoring system (MEOWS) in the obstetric urgency and emergency unit**

The study carried out by Schuler, Katz, Melo and Coutinho (2019) brings data from Brazil on the maternal mortality rate, based on the proportion of maternal deaths for every 100,000 live births, in the country this rate is still very high, being 64.5 per 100,000 live births. In addition, it was shown that about 40 to 50% of maternal deaths could be avoided. Delay in recognition, diagnosis, and treatment precede most deaths from bleeding, preeclampsia/eclampsia, and infection. [4]

As a result, some physiological changes in vital signs that can occur during pregnancy in young/healthy patients end up hindering the early recognition of clinical decompensation, since these patients have a good response to pathological mechanisms. [11]

Edwards, Dore, Van Schalkwyk and Armson (2020) observed in their study that there was a period for the occurrence of physiological deterioration in patients with severe morbidity, and although this event happens slowly and progressively, it ends up going unnoticed. and/or is treated inappropriately. According to some authors, signs of abnormality can usually be detected up to eight hours before unfavorable events, such as admission to the Intensive Care Unit (ICU) and cardiorespiratory arrest. [12-13]

Galvão and Silva (2017) found in their study that the MEOWS is a modified alert score adapted to the obstetric population, as it correlates physiological parameters with maternal morbidity. In addition to being an easy-to-understand score, it uses the following signs: HR, RR, T, BP, AVDI consciousness level and urinary output with a score ranging from -3 to +3. Therefore, when performing the patient assessment, he follows a reassessment pattern according to the presented score or following specific standardized measures. [11]

Tuyishime, et al. (2020) state that this system is not a system that will define the treatment of pregnant women, but it is a tool that will assist in the early recognition of deteriorating women. Therefore, Shuler et al. (2019) found that in a sample of 83% of patients who were classified as high obstetric risk, 49% of them had abnormalities in physiological parameters, demonstrated by changes in MEOWS scores. [14]

Thus, the authors state that MEOWS is a tool created to offset the need for a specific early warning system for the obstetric population, in order to identify patients at risk

of severe obstetric complications and promote early intervention. [13;15]

### **Mobile technology and its contribution to nursing care**

Technology in the field of health has evolved and the increase in the use of smartphones has brought opportunities to improve health conditions, as many people use this resource to obtain access to information, in addition to using it as a tool for health management. [16]

For Silva, Brasil, Bezerra and Queiroz (2019) mobile devices (telephony, texts, videos, Internet and smartphone applications) have a technology that has transformed people's daily lives, as they offer different learning and entertainment experiences. With this, he states that technology brings benefits to health care and greater possibility of apprehending knowledge by users, professionals and researchers, especially when these resources are associated with therapeutic measures. [17]

Other authors have reported in their research on the benefits of using an application in health interventions, as this tool improves the choice of clinical decisions, patient education and qualification of health professionals. Most available health apps are considered health promotion, wellness and disease prevention strategies. [5]

Therefore, the use of mobile technology in nursing care has been essential to ensure agility in the organization and improvement in the processing of a large amount of information, in a shorter period of time, minimizing error rates. [17]

## **V. FINAL CONSIDERATIONS**

In view of what was studied in this review, it can be concluded that the technology offers a better guarantee of patient safety, as a rapid intervention for pregnant women allows access to necessary care in the face of the evidenced risk. In addition, continued use of these tools reduces manual resource failures.

Therefore, welcoming the pregnant woman in the risk classification shows skills that facilitate communication between the team and the pregnant woman, revealing attitudes that emphasize the importance of studies and team training in the identification of warning signs. Furthermore, understanding the use of technological resources in the adequacy of care is essential for the qualification of nursing care provided not only in obstetric triage, but throughout the hospital complex.

## **REFERENCES**

- [1] Silva, M. H. S., Santana, M. M., de Lima, A. M., de Santana Teles, W., da Silva, M. C., Debbo, A., ... & Calasans, T. A.

- S. Estratégias para aumento da adesão dos usuários aos atendimentos em uma unidade de saúde da família no interior da Bahia. *Research, Society and Development*, 10(11), 2021, e381101119345-e381101119345.
- [2] Serafim, R.C., Temer, M.J., Parada, C.M.G.L., Peres, H.H.C., Serafim, C.T.R., & Jensen, R. System for reception and risk classification in obstetrics: a technical quality assessment. *Revista Latino-Americana de Enfermagem*, 28, 2020.
- [3] Brazil. Secretaria de Saúde. Manual de Acolhimento e Classificação de risco em obstetrícia, 64 p. 2017
- [4] Schuler, L., Katz, L., Melo, B.C.P., & Coutinho, I.C. The use of the Modified Early Obstetric Warning System (MEOWS) in women after pregnancies: a descriptive study. *Revista Brasileira de Saúde Materno Infantil*, 19(3), 545-555. 2019.
- [5] Lee, S.H., Nurmatov, U.B., Nwaru, B.I., Mukherjee, M., Grant, L., & Pagliari, C. Effectiveness of mHealth interventions for maternal, newborn and child health in low- and middle-income countries: Systematic review and meta-analysis. *J Glob Health*, 6(1), 010401. 2016.
- [6] Silva, A.K.C., Matos, C.G.S., Freitas, K.S.P.F., Costa, E.A., & Sousa, M.C. A importância do Enfermeiro na Classificação de Risco em Urgência e Urgência Obstétrica. In: 6 Seminário Pesquisar, 1-6. 2017.
- [7] Costa, R.L.M., Santos, A.A.P., & Sanches, M.E.T. Assesment of the Profile of Assisted Women During the Obstetric Risk Classification Process / Avaliação do Perfil de Mulheres que Receberam Assistência Durante a Classificação de Risco Obstétrica. *R. pesq. cuid. Fundam*, 11(2), 488-94. 2019.
- [8] Figueiroa, M.N., Menezes, M.L.N.M., Monteiro, E.M.L.M., Aquino, J.M., Mendes, N.O.G., & Silva, P.V.T. User embracement and risk classification at obstetric emergency: evaluating operationalization in a maternity hospital school. *Escola Anna Nery*, 21(4). 2017.
- [9] Brilhante, A.F., Vasconcelos, C.T.M., Bezerra, R.A., Lima, S.K.M., Castro, R.C.M.B., & Fernandes, A.F.C. Implementação do protocolo de acolhimento com classificação de risco em uma emergência obstétrica. *Rev Rene*, 17(4), 569-75. 2016.
- [10] Camargo Neto, O., Andrade, G.K.S., Karpiuck, L.B., & Ganassin, A.R. A atuação do enfermeiro no sistema de acolhimento e classificação de risco nos serviços de saúde. *J. health sci*, 20(4). 2018.
- [11] Galvão, J., & Silva, J.C. Sistemas de avaliação precoce na identificação de morbidades maternas: revisão sistemática. *Saúde e Pesquisa*, 10(3). 2017.
- [12] Edwards, W., Dore, S., Van Schalkwyk, J., & Armson, B.A. Prioritizing Maternal Sepsis: National Adoption of an Obstetric Early Warning System to Prevent Morbidity and Mortality. *J Obstet Gynaecol Can*, 42(5), 640-643. 2020.
- [13] Ryan, H.M., et al. Validating the Performance of the Modified Early Obstetric Warning System Multivariable Model to Predict Maternal Intensive Care Unit Admission. *Journal of obstetrics and gynaecology Canada: JOGC = Journal d'obstetrique et gynecologie du Canada: JOGC*, 39(9), 728-733. 2017.
- [14] Tuyishime, E., Ingabire, H., Mvukiyehe, J.P., Durieux, M., & Twagirumugabe, T. Implementing the Risk Identification (RI) and Modified Early Obstetric Warning Signs (MEOWS) tool in district hospitals in Rwanda: a cross-sectional study. *BMC Pregnancy Childbirth*, 568(20). 2020.
- [15] Singh, A., Guleria, K., Vaid, N.B., & Jain, S. Evaluation of maternal early obstetric warning system (MEOWS chart) as a predictor of obstetric morbidity: a prospective observational study. *European journal of obstetrics, gynecology, and reproductive biology*, 11-17. 2016.
- [16] Pereira, I.M., Bonfim, D., Peres, H.H.C., Góes, R.F., & Gaidzinski, R.R. Tecnologia móvel para coleta de dados de pesquisas em saúde. *Acta Paulista de Enfermagem*, 30(5), 479-488. 2017.
- [17] Silva, R.M., Brasil, C.C.P., Bezerra, I.C., & Queiroz, F.F.S.N. Uso de tecnologia2 móvel para o cuidado gestacional: avaliação do aplicativo GestAção. *Rev. Bras. Enferm*, 72(3). 2019.
- [18] Blumenthal, E.A., Hooshvar, N., McQuade, M., & McNulty, J. A. Validation Study of Maternal Early Warning Systems: A Retrospective Cohort Study. *Am J Perinatol*, 36(11), 1106-1114. 2019.
- [19] Rashidi Fakari, F., Simbar, M., Zadeh Modares, S., & Alavi Majd, H. Obstetric Triage Scales; a Narrative Review. *Arch Acad Emerg Med*, 7(1). 2019.
- [20] Carvalho, S.S., Oliveira, B.R., Nascimento, C.S.O., Gois, C.T.S., & Pinto, I.O. Perception of a nursing team in the implantation of a reception with risk classification sector for pregnant women. *Revista Brasileira de Saúde Materno Infantil*, 18(2), 301-307. 2018.
- [21] Sandy, E.A., Kaminski, R., Simhan, H., & Beigi, R. Contemporary Obstetric Triage. *Obstet Gynecol Surv*, 71(3), 165-177. 2016.

# Integration of Acupuncture as a Rehabilitation Model Applied in the Integral University Clinic of the State University of the Ecatepec Valley

Angèlica Castañeda Duarte, Miguel Alberto Gutiérrez Nava, Irma García Moreno, Ana Lilia González Santiago,

Full-time Professor at the Ecatepec Valley State University

Received: 10 Aug 2022,

Received in revised form: 08 Sep 2022,

Accepted: 12 Sep 2022,

Available online: 19 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article under  
the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** *Acupuncture, Rehabilitation,  
Chinese Medicine*

**Abstract—** *Mexico is a country with deep-rooted uses and customs, mainly in health care, different practices have been carried out that have passed from generation to generation, within these practices are herbalism and the use of massage that today belong to the complementary medicine sector. The Integral University Clinic represents a community service space, it has a care model conceptualized according to the profiles of each career to meet the needs in terms of health and social intervention of the population of the region of Ecatepec and the surrounding municipalities, offering a different care service where the knowledge, skills and abilities acquired in the classroom are integrated. In this way, UNEVE fulfills its social commitment by linking the University with its environment in order to strengthen the role of the institution in society; promote resources for the solution of community problems; foster a sense of social responsibility among students and contribute to training for the professional performance of service provider students, so that it is understood as an academic activity and on the other hand, an awareness of solidarity with the society to which it is promoted is fostered. belongs. METHODOLOGY A retrospective, comparative review of the registry of consultations of the Integral University Clinic (CIU) corresponding to the period March-April 2014-2015 was carried out, in order to establish the importance of treatment with Rehabilitative Acupuncture, and that said model can be replicated by different health institutions in Mexico. OBJECTIVE. Analyze the epidemiological report prepared by the students, the data presented and interpret the data obtained, Integrate and analyze the variables based on the treatment and improvement of the applied treatments. RESULTS. In the Integral University Clinic (CIU), acupuncture, chiropractic and gerontology services are offered, every six months the students enter in order to carry out clinical practices in the month of September the students of the Lic Rehabilitative Human Acupuncture entered the area of Rehabilitation, from admission to November of the same year, 90 consultations were attended, of which, they were provided to people from 13 years old to more than 62 years old, we divided it by age group in decades, being patients 51 years old and older, those more attended the consultations followed by the group of 29 to 50*

years, in terms of the sex of the users, we observed that women are the ones who most attended the acupuncture service in . . . 27 first-time consultations were provided and 45 subsequent consultations were carried out, ranging from 2 to 10 subsequent sessions, 9 interconsultations were supported, and 9 reassessments were made. 78 patients are referred to have a disability process, we observed that the majority have visual impairment. We can observe that the most affected region corresponds to the lower and upper limbs, the most common injuries are in muscles and tendons. Regarding the pathologies, syndromic diagnoses were detected, as well as the relevant treatments, the improvement percentages range from 25% to 75% observing the effectiveness of the proposed treatments in an integral way. The data presented shows that acupuncture is a tool that should be used for rehabilitative and preventive purposes, so the profile of the Bachelor of Rehabilitative Human Acupuncture as a health professional developed at the State University of the Valley of Ecatepec meets the needs social health in osteomyoarticular injuries, providing comprehensive and decisive treatments generating improvements in 4 sessions. Therefore, it is suggested to generate care protocols based on Chinese medicine to provide care effectively and efficiently.

## I. INTRODUCTION

Mexico is a country with deep-rooted uses and customs, mainly in health care, different practices have been carried out that have passed from generation to generation, within these practices are herbalism and the use of massage that today belong to the complementary medicine sector.

“Traditional medicine” (TM) is a broad term used to refer both to traditional medicine systems such as traditional Chinese medicine, Hindu Ayurveda and Unani Arab medicine, and to various forms of indigenous medicine. TM therapies include medication therapies, if they involve the use of herbal medicines, animal parts, and/or minerals, and non-medication therapies, if they are performed primarily without the use of medication, as in the case of TM. acupuncture, manual therapies and spiritual therapies. In countries where the dominant healthcare system is based on allopathic medicine, or where TM has not been incorporated into the national healthcare system, TM is often classified as 'complementary', 'alternative' or 'unconventional' medicine. (ORGANIZACION MUNDIAL DE LA SALUD, 2002)

The goals of conventional medicine and complementary and alternative medicine are similar: to preserve health, to cure or give hope, and to prevent early death. Complementary and alternative medicine refers to a large set of medical systems that are not based on Western allopathic medicine. Among its systems are some beneficial and others harmful. Complementary and alternative medicine has spread widely and a large part of the population has used it at least once in their lives, both in developed and developing countries:

Africa 80%, China 40%, Canada 70%, France 49 % and the United States 42%. (López Guevara Verónica, 2004)

Within this group of TM is acupuncture, which is part of the fundamental basis of the therapeutics of Traditional Chinese Medicine, practices that have been developed through knowledge of an ancient healing system that appeared in written form in China in 100 BC This system describes human physiology and psychology in a similar way to modern medicine, however it also describes the body and its functions in terms of vital energy called qi. (Jingdian Yang MD, 2000)

The World Health Organization in 1979 published a compendium of diseases where it indicates in which acupuncture can have therapeutic effects, others where more research is needed and others where intervention is not suggested

## II. DEVELOPING

TCM is widely used throughout the world and is appreciated for a variety of reasons. At the International Conference on Traditional Medicine for South-East Asian Countries, held in February 2013, WHO Director-General Dr. Margaret Chan stated that “traditional medicines of proven quality, safety and efficacy help to ensure access to of all people to health care. For many millions of people, herbal medicine, traditional treatments and traditional medicine practitioners represent the main, and sometimes the only, source of health care. This form of care is close to home, accessible and affordable. In addition, it is culturally accepted and trusted

by many people. The affordability of most traditional medicines makes them more attractive in the context of skyrocketing health care costs and near-universal austerity. Traditional medicine also stands out as a means of coping with the relentless rise in chronic non-communicable diseases.”<sup>1</sup> Regardless of the reasons why TCMs are being used, there is no doubt that interest in them has increased, and will surely continue to increase. all over the world.(A. Burton, 2013)

Given the above, the State University of the Valley of Ecatepec, which functions as a decentralized organization, offers the Degree in Rehabilitative Human Acupuncture, with the purpose of training professionals through an innovative career, thus professionalizing the MT, in said institution the student is trained in the approach to the patient, the taking of clinical history and the completion of the clinical file based on NOM-004-SSA3-2012, it is prepared for the correct diagnosis and treatment of the symptoms presented by the patient.

The Integral University Clinic represents a community service space, it has a care model conceptualized according to the profiles of each career to meet the needs in terms of health and social intervention of the population of the Ecatepec region and of the conurbation municipalities, offering a different attention service where the knowledge, skills and abilities acquired in the classrooms are integrated.

In this way, UNEVE fulfills its social commitment by linking the University with its environment in order to strengthen the role of the institution in society; promote resources for the solution of community problems; foster a sense of social responsibility among students and contribute to training for the professional performance of service provider students, so that it is understood as an academic activity and on the other hand, an awareness of solidarity with the society to which it is promoted is fostered. belongs.

The University helps to solve health problems at a low cost to the population that requests it, thus fulfilling its social commitment to the community.

**METHODOLOGY**

A retrospective, comparative review of the registry of consultations of the University Comprehensive Clinic (CIU) corresponding to the period March-April 2014-2015 was carried out, in order to establish the importance of treatment with Rehabilitative Acupuncture, and that said model can be replicated by the different health institutions in Mexico.

**III. OBJECTIVE.**

Analyze the epidemiological report prepared by the students, the data presented and interpret the data obtained, Integrate and analyze the variables based on the treatment and improvement of the applied treatment

**IV. RESULTS**

In the Integral University Clinic (CIU), acupuncture, chiropractic and gerontology services are offered, every six months the students enter in order to carry out clinical practices in the month of September the students of the Lic Rehabilitative Human Acupuncture entered the area of Rehabilitation, from admission to November of the same year, 90 consultations were attended, of which, they were provided to people from 13 years old to more than 62 years old, we divided it by age group in decades, being patients 51 years old and older, those more attended the consultations followed by the group from 29 to 50 years old, in terms of the sex of the users, we observed that women are the ones who most attended the acupuncture service in See TABLE 1

Table 1 Patients treated by sex and age group

| AGE           | MEN | WOMAN |
|---------------|-----|-------|
| 7-17 YEARS    | 0   | 3     |
| 18-28 YEARS   | 3   | 6     |
| 29-39 YEARS   | 6   | 12    |
| 40-50 YEARS   | 6   | 12    |
| 51-61 YEARS   | 12  | 9     |
| OVER 62 YEARS | 9   | 12    |

Of the 90 consultations provided, it was detected by age group with whom they lived, since it is the primary caregivers who are used to reinforce the rehabilitative therapeutic indications that are assigned to the patients. See TABLE 2. Where we observe that the groups that attended the consultation the most have the support of a wife or children, while 5% live alone at a mature age and do not have support.

Table 2 Relationship of Primary Caregivers with the Age Group

**PRIMARY CAREGIVERS**

| Age           | FATHER AND MOTHER | WIFE AND SONS | WIFE | ONLY |
|---------------|-------------------|---------------|------|------|
| 7-17 YEARS    | 3                 | 0             | 0    | 0    |
| 18-28 YEARS   | 9                 | 0             | 0    | 0    |
| 29-39 YEARS   | 0                 | 12            | 0    | 6    |
| 40-50 YEARS   | 0                 | 18            | 0    | 0    |
| 51-61 YEARS   | 0                 | twenty-one    | 0    | 0    |
| OVER 62 YEARS | 0                 | 9             | 6    | 6    |

The consultations provided are distributed as follows TABLE 3. 27 consultations were provided for the first time and 45 subsequent consultations were carried out, ranging from 2 to 10 subsequent sessions, 9 interconsultations were supported, and 9 reassessments were made.

Table 3 Type of Consultation

**TYPE OF CONSULTATION**

|                   |         |
|-------------------|---------|
| First time        | 27      |
| two               | fifteen |
| 3                 | 3       |
| 4                 | 6       |
| 5                 | 6       |
| 6                 | 6       |
| 8                 | 3       |
| 10                | 6       |
| Interconsultation | 9       |
| Reassessment      | 9       |

Of the 90 consultations you provide, 78 patients are referred to have a disability process, we observe that the majority have visual impairment (by this we refer to patients who wear glasses), motor disability follows with 18 patients and 3 adults older students are hearing impaired. See TABLE 4

Table 4 Present Disability by Age Group

**PRESENT DISABILITY**

| AGE           | VISUAL  | DRIVE | AUDITORY |
|---------------|---------|-------|----------|
| 7-17 YEARS    | 3       | 0     | 0        |
| 18-28 YEARS   | 6       | 3     | 0        |
| 29-39 YEARS   | fifteen | 3     | 0        |
| 40-50 YEARS   | 18      | 0     | 0        |
| 51-61 YEARS   | 18      | 3     | 0        |
| OVER 62 YEARS | 3       | 3     | 3        |

Therefore, the Official Mexican Standard of acupuncture NOM.SSA2 017 indicates that the proposed acupuncture treatment is provided for 4 sessions and then the patient is reassessed as soon as this standard has the following results. Table 5, only 90 patients completed 4 sessions of which, and were reassessed.

Table 5 Sessions Completed by Patients

**WHAT HAPPENED TO THE PATIENT**

| <i>COMPLETE 4 SESSIONS</i> | <i>I ABANDON THE TREATMENT</i> | <i>IT WAS REVALUED</i> |
|----------------------------|--------------------------------|------------------------|
| 81                         | 0                              | 9                      |

Therefore, the reason for which the patients were treated is reflected in TABLE 6, as well as the affected region. We can see that the most affected region corresponds to the lower and upper limbs, the most common injuries are in muscles and tendons.

Table 6 Reason for the Consultation and Affected Region

| <i>REASON FOR CONSULTATION</i>      | <i>HEAD AND NECK</i> | <i>TRUNK</i> | <i>SUPERIOR M.</i> | <i>LOWER M.</i> |
|-------------------------------------|----------------------|--------------|--------------------|-----------------|
| <i>JOINT AND LIGAMENT INJURIES</i>  | 3                    | 0            | 17                 | 12              |
| <i>INJURY IN MUSCLE AND TENDONS</i> | 8                    | 14           | 6                  | twenty-one      |
| <i>NERVOUS SYSTEM INJURY</i>        | 0                    | 3            | 3                  | 3               |

A correlation of variables reason for the consultation is made, with syndromic diagnosis to verify the correspondence between these two variables, which presents a positive correlation, tables are presented by reason for consultation, where we observe the management given and the improvement in patients with in order to make the information more digestible.

In the case of patients who attended with joint and ligament injuries, we observed that there were 27 consultations in total, of which they were diagnosed with 3 different syndromes, management was given with acupuncture points, combined with fascia release, and only 18 patients received treatment. I provide them with nutritional recommendations, the improvement after 4 sessions was from 0 to 75%, the most detailed data is shown in TABLE 7.

Table 7 Correlation of Variables for Joint and Ligament Injuries

**CORRELATION OF VARIABLES SYNDROMATIC DIAGNOSIS TREATMENT AND IMPROVEMENT**

| JOINT AND LIGAMENT INJURIES | SYNDROMATIC DIAGNOSIS                                                                         | SELECTION OF POINTS                                                                               | FASCIA RELEASE               | NUTRITIONAL TREATMENT                                                            | IMPROVEMENT                                                                 |
|-----------------------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 27                          | Stagnation of bladder channels and collaterals<br>Kidney yin deficiency, Liver xue stagnation | Tendinomuscular and canals and collaterals<br>Old Points<br>Old points and canals and collaterals | Head, Upper limb, Lower limb | Nutrition according to the present syndrome<br>ONLY 18 RECOMMENDATIONS WERE MADE | 15 patients had 0-25% improvement<br>3 patients 26-50%<br>9 patients 51-75% |

Regarding the patients who attended with muscle and tendon injuries, we observed that there were 42 consultations in total, of which they were diagnosed with 7 different syndromes, management was given with acupuncture points, combined with fascia release and only 27 nutritional recommendations were made. , the improvement after 4 sessions was from 0 to 85%, the most detailed data is shown in TABLE 8.

Table 8 Correlation of Variables for Muscle and Tendon Injuries

**CORRELATION OF VARIABLES SYNDROMATIC DIAGNOSIS TREATMENT AND IMPROVEMENT**

| INJURY IN MUSCLE AND TENDONS | SYNDROMATIC DIAGNOSIS                                                                                                                                                                                                   | SELECTION OF POINTS                                                                                                                                                                                 | FASCIA RELEASE                         | NUTRITIONAL TREATMENT                                                            | IMPROVEMENT                                                                                                    |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| 42                           | 1. Bladder channel and collateral stagnation<br>2. Spleen qi deficiency<br>3. Kidney jing deficiency<br>4. Kidney yin deficiency<br>5. Liver xue deficiency<br>6. Liver xue stagnation<br>7. Liver qi sinking<br>Spleen | 1. Tendinomusculars and canals and collaterals,<br>2. Old points<br>3. Old points<br>4. Old and channel and collateral points<br>5. Old points<br>6. Channel and collateral points<br>7. Old points | Trunk, Abdomen, Upper limb, Lower limb | Nutrition according to the present syndrome<br>ONLY 27 RECOMMENDATIONS WERE MADE | 12 patients had improvement of 0-25%<br>9 patients of 26-50%<br>18 patients of 51-75%<br>3 patients of 76-100% |

.For the reason for consultation, we observed that there were 21 consultations in total, of which they were diagnosed with 5 different syndromes, management was given with acupuncture points, combined with fascia release and only 15 nutritional recommendations were made, the improvement after 4 sessions was 0 to 75%, the most detailed data can be seen in TABLE 9.



Table 9 Correlation of Variables for Nervous System Injuries

**CORRELATION OF VARIABLES SYNDROMATIC DIAGNOSIS TREATMENT AND IMPROVEMENT**

| <b>NERVOUS SYSTEM INJURY</b> | <b>SYNDROMATIC DIAGNOSIS</b>                                                                                                             | <b>SELECTION OF POINTS</b>                                                                                                                                   | <b>FASCIA RELEASE</b>              | <b>NUTRITIONAL TREATMENT</b>                                                  | <b>IMPROVEMENT</b>                                                                   |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <b>twenty-one</b>            | 1. Bladder channel and collateral stagnation 2. Spleen qi deficiency 3. Liver yang rising 4. Liver xue stagnation 5. Liver qi stagnation | 1.Tendinomusculares and channels and collaterals, 2.Old points 3.Old points and channels and collaterals 4. Old points 5. Points of channels and collaterals | Head, Neck, Upper limb, Lower limb | Nutrition according to the present syndrome ONLY 15 RECOMMENDATIONS WERE MADE | 3 PATIENTS HAD IMPROVEMENT FROM 0-25% 12 Patients FROM 26-50% 6 PATIENTS FROM 51-75% |

**V. CONCLUSIONS.**

The data presented shows that acupuncture is a tool that should be used for rehabilitative and preventive purposes, so the profile of the Bachelor of Rehabilitative Human Acupuncture as a health professional developed at the State University of the Valley of Ecatepec meets the needs social health in osteomyoarticular injuries, providing comprehensive and decisive treatments generating improvements in 4 sessions. Therefore, it is suggested to generate care protocols based on Chinese medicine to provide care effectively and efficiently.

**REFERENCES**

[1] A. Burton, T. F. (2013). *WHO Strategy on Traditional Medicine 2014-2023*. Hong Kong: WHO.

[2] Jingduan Yang MD, BM (2000). *Acupuncture and Traditional Chinese Medicine for MS*. Philadelphia: Jefferson University.

[3] Lopez Guevara Veronica, RP (2004). Complementary and alternative medicine. *Universal Medicine* , 264-271.

[4] WORLD HEALTH ORGANIZATION. (2002). *WHO Strategy on Traditional Medicine 2002 - 2005*. WHO.

# Approach to death in the school context: a study anchored in the school's organizational documents

Maria de Fátima da Silva Monteiro<sup>1</sup>, Maria Regina Teixeira Ferreira Capelo<sup>2\*</sup>

<sup>1</sup>Escola Secundária Adolfo Portela, Portugal

Email: fatimadouto@gmail.com

<sup>2</sup> CLEPUL/Polo da Madeira, Portugal

Email : [m.regina.capelo@gmail.com](mailto:m.regina.capelo@gmail.com)

\*Corresponding author

Received: 10 Aug 2022,

Received in revised form: 06 Sep 2022,

Accepted: 11 Sep 2022,

Available online: 19 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *death, education, school's  
organizational documents*

**Abstract**—*The study aims to verify if the theme of death is addressed in a private elementary and secondary school, with a Christian origin, located on the northern coast of Portugal. The qualitative, exploratory, transversal and descriptive research is based on the analysis of the school's organizational documents, specifically, the School Educational Project, the School Curriculum Project, the Internal Regulation and the Annual Activity Plan. The results suggest that it is not possible to identify explicit mentions of the theme of death in the organizational documents, expressive of the curricular concerns of the School. However, they emphasize related themes referring to the limits of the human condition, such as finitude, vulnerability, integral formation, attitudes and values. A new educational project on death and finitude becomes fundamental to ground the education of young people in the meanings that reward their lives.*

## I. INTRODUÇÃO

A morte ocupa um lugar tabu e de interdição na cultura ocidental, que impede as pessoas de a aceitarem como algo inerente à vida [1, 2]. Ela é um fenómeno integrante da vida porque constitui-se como algo inseparável à própria existência [3].

A morte representa “o último ato” da comédia humana; “provavelmente o mais difícil”, reportando-se às dimensões de desconhecido, vulnerabilidade, finitude e limite da condição humana, inspira temores e receios ao ponto de poder dizer-se que se “morre de medo de falar da morte” [4, p. 78]. Porém, o ser humano não só é um ser mortal, como é um ser consciente dessa sua condição de finitude.

A morte define a consciência de um ser temporal, de um ser que sabe que está condenado a desaparecer, surgindo associada aos acontecimentos existenciais que desafiam a liberdade, como a doença, o sofrimento, o

luto e uma série de situações limite que ocorrem durante toda a vida. Em todos os casos, a morte é explicada como o que constitui, para um ser vivo, uma dupla figura negativa da alteridade: é a negação pura, total, do ser; ela surge sempre como o resultado de um confronto com algo que não é e que pode destruí-lo [5]. Como tal, a ideia de morte é geradora de angústia e medo. Um medo que é necessário vencer, dado que o medo é paralisante, o medo não abre horizontes, o medo impede-nos de viver a vida em toda a sua plenitude durante o tempo que lhe está destinado. Porém, apesar da morte integrar o quotidiano dos alunos, a escola não contempla no seu currículo essa temática [3].

Todos os dias, crianças e adolescentes convivem com a morte e simultaneamente são poupados para não sofrerem. Banida da comunicação, a morte continua cada vez mais próxima das pessoas, sobretudo, através das telecomunicações e das redes sociais. Ela é concomitantemente interdita e companheira cotidiana,

invasiva, sem limites e apesar de próxima, impera a conspiração do silêncio, pautado pela evasão da abordagem ao assunto por medo do sofrimento que poderá imprimir [6]. No entanto, falar da morte modifica a forma de se relacionar com ela, com as perdas e com o luto [1]. Esse pressuposto pode indiciar a importância e a potencialidade da abordagem à morte na promoção da saúde mental.

Os pressupostos enunciados levam a crer que se torna essencial ampliar o escopo da educação para a morte, fundamentada na importância de discussão do tema numa sociedade na qual convivem a morte interdita e reumanizada e a morte escancarada no cotidiano das pessoas [6]. Ora, precisamente, a educação institui-se como um lugar de mudança e de formação crítica, funcionando nessa medida como antídoto contra o fatalismo e o pessimismo, ajudando o indivíduo a passar do plano ideal ao plano da concretização prática. Neste processo, a propósito do fundamento bio antropológico da existência, Morin [7] salienta que é preciso partir, não do caráter surpreendente, paradoxal e escandaloso da morte em relação à ordem viva, mas do caráter surpreendente, paradoxal e escandaloso da vida em relação à ordem física, porque a vida é novidade, a vida é surpresa, a vida é construção criativa e esperançosa, enquanto a morte representa a dimensão do desconhecido e de alteridade que interpela, ensina e desafia permanentemente.

Atualmente, em conformidade com as metas educacionais privilegiadas pela sociedade educativa, as escolas adotam uma visão lata de currículo de forma a valorizar um leque amplo de aprendizagens, sejam formais, não formais ou informais. Assim, ao contrário do cenário tradicional em que toda a dinâmica pedagógica da escola estava subordinada ao que se encontrava prescrito nos programas oficiais, apela-se agora a uma intervenção qualificada dos professores num quadro de autonomia da própria organização escolar.

Esta inscrição da palavra autonomia no contexto educacional evidencia a tendência descentralizadora das políticas educativas, que idealizam a escola, não só como um local estratégico de decisão curricular, mas também como espaço de mudanças organizacionais e funcionais tendentes à melhoria do ensino e à adequação do sistema educativo às exigências com que hoje se confronta. Tendo em conta as considerações supracitadas, o presente estudo tem como objetivo verificar se o tema da morte é abordado nos documentos orientadores de uma escola do ensino secundário.

## II. MÉTODO

Em função do objetivo delineado, este estudo exploratório, transversal e descritivo, posiciona-se numa abordagem qualitativa [8], de caráter essencialmente interpretativo uma vez que buscou a compreensão do problema em pauta. A ênfase do paradigma qualitativo é colocada na compreensão do mundo social a partir da experiência subjetiva concebida como um complexo de pressupostos e significados partilhados intersubjetivamente [9].

Com o foco na exploração da presença do tema “morte” nos documentos orientadores da vida escolar, foi nossa intenção aclarar a problemática que preside a este estudo. Neste âmbito, as questões de partida equacionadas foram:

- Quais são os documentos referenciais da organização e gestão da escola?
- A temática “morte” é considerada de forma explícita nos documentos organizacionais da escola?

Este artigo consiste num recorte de um estudo mais vasto alusivo à “Educação, Morte e Esperança. Exigência de pedagogia escolar e social”. O estudo desenrolou-se numa escola privada, de matriz cristã, localizada no litoral norte de Portugal mediante anuência prévia do órgão de gestão. Para proteger a identidade do estabelecimento de educação e ensino, a mesma foi denominada pela letra X.

A recolha dos dados emergiu da leitura e análise acurada dos documentos que, no âmbito da autonomia conferida, explicitam a organização da vida da escola e se constituem instrumentos referenciais e curriculares fundamentais.

Os dados obtidos foram sujeitos a análise de conteúdo em consonância com os pressupostos teóricos preconizados por Bardin [10], considerando as três etapas: a pré-análise, a exploração do material e o tratamento dos resultados. Os procedimentos sistemáticos e objetivos de descrição das mensagens concederam indicadores que permitem a extração de inferências. No final do processo os dados foram sintetizados em categorias e comparados com o referencial teórico-metodológico, aos pressupostos e ao objetivo previamente estabelecido.

## III. RESULTADOS

Os documentos orientadores das dinâmicas cotidianas da escola X, elaborados num contexto de responsabilização, autonomia e flexibilidade curricular, em conformidade com os normativos legalmente estipulados, são: o Projeto Educativo de Escola (PEE), o Projeto Curricular de Escola (PCE), o Regulamento Interno (RI) e o Plano anual de Atividades (PAA) (Quadro 1).

Quadro. 1: Documentos orientadores das dinâmicas da escola

| Documentos                         | Normativo                                                                                                                                                                      | Propósito                                                                                                                                                                                                   |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Projeto Educativo da Escola (PEE)  | Decreto Lei n.º 75/2008 de 22 abril [11]                                                                                                                                       | Instrumento que expressa o planeamento institucional e estratégico da escola Aborda de forma clara, a missão, a visão e os objetivos gerais da escola: Visa orientar toda a ação educativa                  |
| Projeto Curricular de Escola (PCE) | Decreto-Lei n.º 55/2018, de 6 de julho [12]<br>Decreto-Lei n.º 139/2012, de 5 de julho [13]                                                                                    | Instrumento de gestão curricular que que permite adequar as necessidades da escola às orientações curriculares definidas pelo governo                                                                       |
| Regulamento Interno (RI)           | Lei n.º 51/2912, de 5 de setembro [14], na versão retificada pela Declaração de Retificação n.º 46/2012, de 17 de setembro Estatuto do Aluno e Ética Escolar (artigo 49º) [15] | Instrumento de regulação da vida interna da escola e da sua articulação com a comunidade educativa<br><br>Determina o regime de funcionamento, gestão e organização da escola                               |
| Plano Anual de Atividades (PAA)    | Decreto-Lei 183/96, de 27 de setembro [16]                                                                                                                                     | Instrumento que, em função do PEE consagra a arquitetura espaço-temporal das atividades a desenvolver ao longo de cada ano letivo, os respetivos intervenientes e os recursos a afetar à sua implementação. |

Na essência, o PEE, o PCE, o RI e o PAA traduzem a intencionalidade, os valores e a orientação da ação educativa.

Em rigor, não foi possível identificar menções explícitas à temática da morte e da finitude humana nos documentos orientadores da ação educativa expressivos das preocupações curriculares da Escola X. No entanto, temas conexos referentes aos limites da condição humana como finitude, vulnerabilidade, formação integral, atitudes e valores foram mensagens inferidas, categorizadas e sistematizadas no quadro sinóptico 2.

Quadro. 2: O tema “morte” nos documentos orientadores da Escola

| Morte              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Categorias         | Excertos de texto                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Finitude humana    | <i>Em colaboração com a Família a Escola proporciona espaços de discernimento e reflexão consciente e responsável sobre a pessoa, a vida e as relações humanas, no prisma dos valores morais e espirituais fundamentais do humanismo cristão, (...) “amor ao próximo”, (...) vocação para o “transcendente” ou “absoluto”... (PEE, p. 14)</i><br><br><i>A escola procurará contribuir para a realização do aluno através do pleno desenvolvimento da sua personalidade, da formação do caráter e da cidadania, preparando-o para uma reflexão consciente sobre os valores espirituais, estéticos, morais e cívicos (RI, p. 2)</i>                                       |
| Vulnerabilidade    | <i>No sentido de chegar mais longe no seu aperfeiçoamento e crescimento pessoais, no respeito pela dignidade da natureza humana e pelos valores da solidariedade e tolerância para com os outros (PCE, p. 2)</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Formação integral  | <i>Usufruir do ambiente e do Projeto Educativo que lhe proporcionem as condições para o seu pleno desenvolvimento físico, intelectual, moral, cultural e cívico e para a formação da sua personalidade (RI, p. 24)</i><br><br><i>Com efeito, a escola pressupõe sempre um projeto educativo que tem que ver, para além das questões associadas aos meios e metodologias, com um universo de conceções e convicções acerca do homem, do mundo, da vida e da sociedade (PEE, p. 5)</i><br><br><i>A formação integral da pessoa pressupõe o vértice essencial das emoções e dos afetos (PEE, p. 17)</i>                                                                    |
| Valores e atitudes | <i>A tarefa prioritária na construção do Projeto Educativo desta Escola radica no pressuposto de o tornar um projeto global de educação em atitudes e valores (PEE, p. 14)</i><br><br><i>As atitudes e os valores podem ser aprendidos (ser melhorados, alterados, incorporar outros novos) e, portanto, devem ser ensinados: os valores que englobam toda a existência, sendo essenciais para a pessoa chamada a viver em sociedade; os que são necessários para realizar qualquer processo de aprendizagem escolar; finalmente, os mais modestos, os valores que resultam dos conteúdos específicos de cada programa disciplinar e que condicionam a aquisição de</i> |

|  |                                                                                                                                                                                                                                                                                                                                                                      |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <i>competências</i> (PEE, p. 16)                                                                                                                                                                                                                                                                                                                                     |
|  | <i>São deveres específicos do aluno: (...) Empenhar-se na sua educação e formação integral</i> (RI, p. 27)                                                                                                                                                                                                                                                           |
|  | <i>Para esta Escola X constitui um desafio, e uma responsabilidade, ajudar a formar cidadãos livres, responsáveis, solidários e autónomos. Educar e ser educador consiste em assumir responsabilidades relativamente ao mundo. A ação educativa consiste na transmissão do melhor legado moral com que contamos que é aquele que lhe dá autoridade</i> (PEE, p. 15). |

#### IV. DISCUSSÃO

O propósito formativo da escola portuguesa X, de ensino privado, de matriz cristã, expresso nos documentos orientadores analisados (PEE, PCE, RI e PAA) assinala a referência axiológica que orienta o currículo dos alunos, direcionada para a formação de valores e atitudes, traduzida no propósito de mobilizar todos os educandos para a participação ativa na transformação da sociedade. Nessa medida, a escola apela aos seus alunos para que sejam testemunho de espiritualidade num mundo materializado.

Na busca de sentidos que pudessem enunciar morte, a finitude, a espiritualidade ou a transcendência, a partir a análise dos textos, num olhar intersubjetivo, foram extraídas categorias conexas com o tema norteador, nomeadamente, finitude humana (PEE; RI), vulnerabilidade (PCE), formação integral (PEE; RI) e atitudes e valores (PEE; RI).

Salienta-se o facto de estarmos perante uma escola que, no seu PEE, assume preocupações com uma formação marcadamente humanista subordinada a uma matriz cristã, cuja missão fundamental consiste em Educar e preparar para a vida, associando a este repto valores de índole religiosa como o “amor ao próximo” e a vocação para “o transcendente” ou “absoluto” e ainda outros valores comuns como: liberdade, autonomia, responsabilidade, justiça, igualdade de oportunidades, civismo e solidariedade. Neste sentido, proclama a intenção de tentar atingir, em todos os domínios da vida escolar, uma Educação alicerçada em dinâmicas pedagógicas de respeito e proximidade humana, concebida como uma educação integral que busca potenciar o desenvolvimento de todas as faculdades dos educandos.

No que concerne ao PCE evidencia-se, novamente, a necessidade de educar para os valores e para a preparação para a vida, promovendo o desenvolvimento

articulado de todas as capacidades dos alunos e potenciando qualidades, talentos e destrezas que farão deles membros ativos na transformação da sociedade, atuando com sentido de justiça, de não-violência e almejando o progresso humano. Neste domínio, o RI elaborado em conformidade com o artigo 49º do Estatuto do Aluno e Ética Escolar [14, 15], emerge como o documento mais ilustrativo. Sob o ponto de vista legal, o referido normativo corresponde ao instrumento que define o regime de funcionamento da escola, de cada órgão de gestão, das estruturas de orientação e dos serviços de apoio educativo, bem como explicita os direitos e os deveres da comunidade educativa. Deste modo, espera-se que o RI possa tornar-se num instrumento indispensável à construção de um clima de cooperação entre os diferentes membros da comunidade escolar, de modo a promover a ação educativa, no respeito por valores, direitos e deveres, regras e normas de conduta a cumprir por todos. Porém, nenhum dos capítulos que compõem o RI faz referência explícita e objetiva a questões concretas relacionadas com o tema da morte ou outros temas conexas. Mais uma vez, este documento orientador deixa transparecer o princípio diretor da ação formativa e pedagógica da Escola X, assente na educação para os valores. O RI não reporta nenhum procedimento prático ou quaisquer recomendações alusivas a situações de morte, perda ou luto que possam afetar qualquer membro da comunidade escolar. Também não contém referências a procedimentos face a situações críticas e inesperadas ou a outras ocorrências perturbadoras que possam afetar a comunidade educativa.

Do mesmo modo, não encontramos referências atinentes à planificação de iniciativas alusivas à morte no PAA. Neste âmbito, também não encontramos estudos que permitissem infirmar ou contrastar os resultados obtidos.

Este estudo descortina deficit na abordagem à morte nos documentos referenciais do quotidiano escolar, tal como asseveraram Aquino, Aguiar, Vasconcelos e Santos [3]. Essa lacuna espelha a presentemente sociedade ocidental, transmite inquietações acerca da ausência de educação para a morte nos contextos escolares [3, 6, 17], confirma a ideia de que a morte é percebida como tabu. Em contrapartida, é imperativo falar sobre a morte porque modifica a forma de se relacionar com ela, com as perdas e com o luto [1]. Crê-se, no entanto, que a morte não está totalmente ausente da vida escolar, encontrando-se presente de modo implícito e sujeita a abordagens fragmentadas e episódicas.

O estudo sobre *Educação para a morte*, ancorado numa revisão da literatura sobre os conceitos humanos da

morte, permitiu deduzir que a fuga da morte muitas vezes repetida pelo homem, significa a fuga da própria vida [18]. Também alerta que não é nenhuma forma de educação religiosa que prepara para a conquista do céu. Reitera a necessidade de ser instituída a educação para a morte, defendendo que é através desse processo educacional tendente a ajustar os educandos à realidade da vida, que não se resume no viver, mas sobretudo no existir e no transcender. Esta evidência permite acreditar que, apesar da morte fazer parte da existência e estar presente no dia-a-dia de todos nós, ainda são necessários investimentos de natureza pedagógica na formação dos indivíduos, para que possam, de forma natural, lidar com o fenómeno.

## V. CONCLUSÃO

O objetivo do presente estudo consistiu em verificar se o tema da morte é abordado numa escola de ensino secundário, privada, de matriz cristã, localizada no litoral norte de Portugal.

Considera-se que o intuito da pesquisa foi alcançado, tendo em conta que foram examinados os principais documentos orientadores do quotidiano da Escola X, concretamente, o PEE, o PCE, o RI e o PAA. Da análise dos documentos sobressaíram referências a preocupações de ordem espiritual decorrentes da matriz cristã da escola. Porém, foi possível confirmar que o tema “morte” não consta de modo explícito, mantendo-se interdito nos seus referenciais.

A capacitação dos professores e dos psicólogos e/ou de outros agentes educativos sobre a forma de lidar com a questão da morte ou com outras questões conexas, designadamente as estratégias de apoio aos alunos ou a outros elementos da comunidade escolar que estejam a vivenciar situações especialmente dolorosas, de luto, doença terminal ou perda imprevista é fundamental.

A promoção de espaços de discussão que integrem a díade vida-morte é imperiosa tanto para os alunos como para docentes, não docentes, pais e encarregados de educação e demais membros da comunidade educativa porque abordar a morte corresponde a refletir sobre a própria vida. Além disso, um novo projeto educacional sobre a morte e a finitude torna-se fundamental para alicerçar a educação dos jovens nas significações que premeiam as suas vidas.

## AGRADECIMENTOS

Agradecimento a todos os que direta ou indiretamente colaboraram para a realização deste estudo.

## REFERENCES

- [1] Meira, M. M., & Fensterseifer, L. (2020). Death Caf. Um convite para falar sobre a morte em tempos de interdição. *Pretextos*, 5(9), 275-291.
- [2] Rebelo, J. E. (2004). *Desatar o nó do luto*. Cruz Quebrada: Casa das Letras.
- [3] Aquino, T. A. A., Aguiar, A. A., Vasconcelos, S. X. P., & Santos, S. (2014). Falando de Morte e Finitude no Ambiente Escolar: Um estudo à Luz do Sentido da Vida. *Psicologia: Ciência e Profissão*, 34(2), 302-317. Retirado de <https://doi.org/10.1590/1982-3703000092012>
- [4] Montaigne, M. (1962). *Ensaaios Livro 2*. Porto Alegre: Editora Globo.
- [5] Moreau, D. (2010). *Les Voies du Salut: un essai philosophique*. France: Bayard.
- [6] Kovacs, M. J. (2021). *Educação para a morte: Quebrando paradigmas*. Novo Hamburgo: Synopsys Editora.
- [7] Morin, E. (1988). *O Homem e a Morte*. Mem Martins: Publicações Europa-América.
- [8] Bogdan, R., & Biklen, S. (1994). *Investigação Qualitativa em Educação. Uma Introdução à Teoria e aos Métodos*. Porto: Porto Editora.
- [9] Afonso, N. (2005). *Investigação Naturalista em Educação. Um guia prático e crítico*. Porto: Edições ASA.
- [10] Bardin, L. (1995). *Análise de Conteúdo*. Lisboa: Edições 70, Lda.
- [11] Decreto-Lei n.º 75/2008, de 22 de Abril, publicado no Diário da República n.º 79/2008, Série I.
- [12] Decreto-Lei n.º 55/2018, de 6 de julho, publicado no Diário da República n.º 129/2018, Série I.
- [13] Decreto-Lei n.º 139/2012, de 5 de julho, publicado no Diário da República n.º 129/2012, Série I.
- [14] Lei n.º 51/2012, de 5 de setembro, publicada no Diário da República n.º 172/2012, Série I.
- [15] Declaração de retificação n.º 46/2012, de 17 de setembro, publicada no Diário da República n.º 180/2012.
- [16] Decreto-Lei n.º 183/96, de 27 de setembro, publicado no Diário da República n.º 225/1996.
- [17] Azevedo, M. C. (2006). Valores culminantes: Educação para a morte / Educação para a vida. *Revista Portuguesa de Pedagogia*, 40(2), 159-183. Retirado de [https://doi.org/10.14195/1647-8614\\_40-2\\_5](https://doi.org/10.14195/1647-8614_40-2_5)
- [18] Pires, H. (2020). *Educação para a Morte*. São Bernardo do Campo – SP: Editora Espírita Correio Fraternal.

## Determination of Elastic and Mechanical Properties in CA-50 Steel by using Ultrasonic Waves

Álvaro Barbosa de Carvalho Júnior<sup>1</sup>, Maria Helena Teles Lopes<sup>2</sup>, Maurílio José Inácio<sup>3</sup>, Samara Guedes Ramos<sup>4</sup>, Debora Santos Rodrigues<sup>5</sup>, Gustavo Dias Froes<sup>6</sup>, Vinícius Marques Botelho Fonseca<sup>7</sup>, Jairo Andrei Vieira de Oliveira<sup>8</sup>

<sup>1,2,3,4</sup>Graduate Program of Computational Modeling and Systems, State University of Montes Claros, Brazil

<sup>5,6,7</sup>Department of Sciences Exact, State University of Montes Claros, Brazil

<sup>8</sup>Engineering and Maintenance Company, Montes Claros, Brazil

Received: 15 Aug 2022,

Received in revised form: 09 Sep 2022,

Accepted: 14 Sep 2022,

Available online: 19 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords** — *ultrasonic, elastic properties, steel.*

**Abstract** — *The aim of this study was to characterize the elastic and mechanical properties of CA-50 steel using the ultrasonic through-transmission technique. The electronic system used is composed of piezoelectric transducers, one emitter and another receiver of ultrasonic waves with 2 MHz frequency. Elastic properties such as Young's modulus, shear, bulk, Poisson's ratio and anisotropy factor were estimated. In order, to estimate the mechanical properties, one mathematical model proposed in the literature was used, which related the longitudinal ultrasonic velocity with the values of tensile strength. The results obtained were compared with reference values found, attesting the feasibility of low-cost method to investigate carbon steels.*

### I. INTRODUCTION

Steel bars with minimum yield strength of 500 MPa are widely used in civil construction for structural purposes [1, 2]. This steel grade must satisfy some requirements that establish minimum values for the yield and tensile strength, whose properties are important to characterize the final product.

The mechanical properties of structural steel bars are generally determined by conventional destructive testing such as the tensile test [1-3]. However, it is important to highlight that the tensile test demand more cost and time, in addition to causing permanent deformation of the material until its rupture, which makes impossible to repeat measurements. It is also known that the results obtained from the tensile test are greatly dependent on the geometry and superficial condition of the samples, besides the stress velocity [4].

On the other hand, the steels hardness is a property which measure the resistance to plastic deformation. A

small indentation is produced by the hardness test and it does not make the material useless. For this reason, it is common that the hardness test is sometimes classified as nondestructive [4].

Over recent years, the hardness measurements have been investigated as a quick way to estimate some mechanical properties of steels. Thus, some mathematical models suggest a possibility to determine wear resistance, yield point and ultimate tensile strength, by using only the hardness test [1-7]. The relationship between mechanical properties and hardness of steels represents an alternative method of characterization which can reduce wastage, cost and time of samples and equipment preparation.

Another possibility to estimate the steel mechanical properties by a single test can be found in the Ultrasonic Technique. Ultrasonic testing has a great prominence for relating propagation velocity measurements of ultrasonic waves to some physical and mechanical properties of materials, such as Young's modulus, shear, bulk, Poisson's

ratio, acoustic impedance, anisotropy factor and hardness [8-12].

With the advancement in knowledge of electronic instrumentation, low-cost ultrasonic devices with high level of reliability in measurements can be developed and applied in study of mechanical properties of metallic and non-metallic materials [13-15].

Ultrasonic pulse-echo and transmission techniques are the most known methods for characterization and inspection of metallic materials. The ultrasonic pulse-echo technique uses a single piezoelectric transducer which is capable of generating and detecting ultrasonic waves propagated through the studied material [16]. On the other hand, the ultrasonic pulse transmission technique utilizes two piezoelectric transducers on opposite faces of the material, one of them is responsible for generating and the other for capturing the ultrasonic waves [17].

Recently, a group of researchers from the Graduate Program of Computational Modeling and Systems at the State University of Montes Claros (PPGMCS/UNIMONTES) has investigated the possibility of non-destructive characterization of metallic alloys by using the ultrasonic transmission technique. Developing an electronic system for emission and reception of signals it was possible to verify the viability of this method with interesting results obtained in 6061 aluminum, AZ31 Magnesium and AISI 1020 carbon steel.

Therefore, according to the above reports, this study sought to characterize the elastic and mechanical properties of CA-50 steel using the electronic ultrasonic system developed by researchers from PPGMCS/UNIMONTES. The structural CA-50 steel was chosen for representing one of the primary civil building inputs utilized in Brazil and also for considering the scarcity of researches with ultrasound in this steel grade.

## II. MATERIAL AND METHODS

### 2.1 Characteristics of the sample

To carry out this study, was acquired a CA-50 steel bar of 25 mm in diameter and 200 mm in length. According to the manufacturer, this bar has a yield strength  $Y_s \geq 500$  MPa and a minimum ultimate tensile strength  $T_s \geq 540$  MPa, which corresponds to an 8% increase in the yield strength. CA-50 and TMT 500W structural steels present similar chemical composition and mechanical properties [1, 18, 19].

### 2.2 Calculation of the ultrasonic velocities

To calculate the velocities of ultrasonic waves propagated through the bar, it was measured the travel

time of the longitudinal waves with an ultrasonic electronic system. In this system, which is based on the ultrasonic transmission technique, the emitter and receiver circuits were powered by symmetrical supplies of 30 V and 12 V, respectively.

The emitter circuit was designed for generating pulses with amplitude of 60 V and length of 400 ns (nanoseconds), in time intervals of 5 ms (milliseconds). The pulses were produced by a piezoelectric transducer of longitudinal waves, model AW190, with 20 mm of diameter and frequency equal to 2 MHz. Another transducer of the same model was used to capture the pulsed signal in the receiver circuit.

The captured signal in the receiver circuit was amplified using an operational amplifier, model THS4271D, designed to work from supply voltages between  $\pm 5$  V and  $\pm 15$  V. The electronic circuits and the components utilized in the ultrasonic testing with the transmission technique are shown in Figure 1.

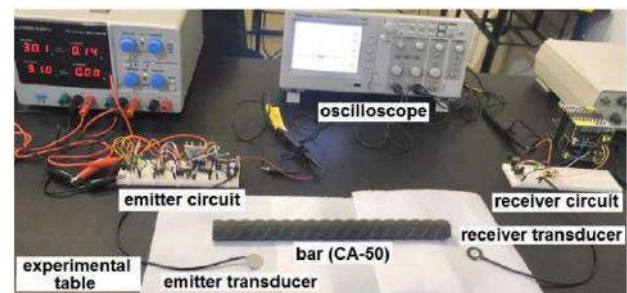


Fig. 1: Set up of the experiment to generate and capture ultrasonic signals

It is important to highlight that the receiver circuit generates an amplified signal with a predefined gain at the output, reducing interferences which may harm the measurement process. Figure 2 shows the transducers aligned at the CA-50 steel bar ends to carry out the measurements.

Before carrying out the measurements, the bar ends were polished. The bee honey, whose acoustic impedance value  $Z_2$  is  $2.89 \times 10^6$  kg/m<sup>2</sup>s and density of 1360 kg/m<sup>3</sup>, was used as the couplant material between the bar ends and the transducers.

The signal measurements provided at the receiver circuit output were accomplished using a digital oscilloscope, model TBS1062 by Tektronix. The time measured in microseconds between the emitted and detected ultrasonic wave was observed on the oscilloscope screen, as illustrated in Figure 3. Then, the average time was calculated from three measures obtained by removing and repositioning the transducers at the bar ends. All



measurements were executed at an ambient temperature of 25 °C.

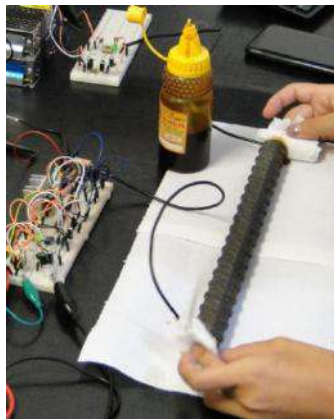


Fig. 2: Positioning of the transducers for emitting and receiving the ultrasonic waves

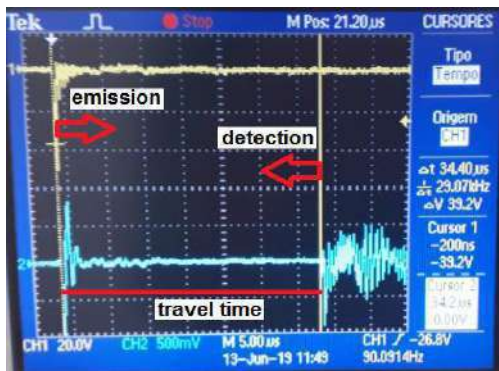


Fig. 3: Travel time of ultrasonic wave

The distance between the vertical lines displayed on the oscilloscope screen represents the time spent by the ultrasonic wave to travel along the bar length. In that way, Equation 1 was considered to calculate the propagation velocity of the longitudinal wave ( $V_L$ ).

$$V_L = \frac{L}{t} \tag{1}$$

In which:  $L$  = bar length and  $t$  = travel time

The ratio between longitudinal and transverse ultrasonic velocities is approximately 0.50 for most metallic materials [16]. Thus, to estimate the value of the transverse ultrasonic wave velocity ( $V_S$ ) was used the ratio  $V_S/V_L$  obtained from the reference values for 1020 steel, which are indicated in Table 1. This procedure was adopted due the scarcity of information about the values of ultrasonic velocities propagated through the CA-50 steel and the similarity between chemical compositions of these steels.

Table. 1: Ultrasonic velocities for the 1020 steel

| $V_L$ (m/s) | $V_S$ (m/s) | $V_S/V_L$ | Reference |
|-------------|-------------|-----------|-----------|
| 5890        | 3240        | 0.550     | [20]      |
| 5899        | 3237        | 0.549     | [21]      |

Therefore, it was possible to estimate the transverse ultrasonic wave velocity ( $V_S$ ) from the value of the longitudinal velocity ( $V_L$ ) by using the Equation 2.

$$V_S = 0.55V_L \tag{2}$$

### 2.3 Density determination

To determine CA-50 steel density, a cylindrical sample was obtained from the bar by a conventional machining process, whose approximate dimensions are of 22.10 mm in diameter and 22.90 mm in height. The dimensions of the cylinder were measured with a digital caliper and the weight was determined using an analytical balance with a resolution of 0.001 g. The bar and the cylindrical sample are illustrated in Figure 4.



Fig. 4: CA-50 steel bar and cylindrical sample

The density ( $\rho$ ) was calculated from the determination of weight (kg) and volume ( $m^3$ ), described in Equation 3. The calculated density of the CA-50 steel bar was considered uniform, once the cylinder had constant inertia and homogeneous weight distribution.

$$\rho = \frac{weight}{volume} \tag{3}$$

### 2.4 Hardness measurements

To determine the Brinell hardness, a sample with 10 mm in thickness was cut from the cross section of the bar, as illustrated in Figure 5. Afterward, the sample was undergone Brinell hardness test ( $HB$ ). The test was executed according to the ASTM E10 standard, using the  $HBW$  2.5/187.5 scale and a 2.5 mm tungsten carbide ball. The applied load was of 187.5 kgf. The average value  $HB$  was obtained from four measurements performed on the sample.

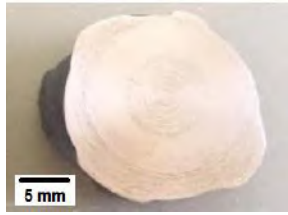


Fig. 5: Sample for hardness test

2.5 Calculation of the elastic and physical properties

The elastic properties of the CA-50 steel bar were calculated using the values of density ( $\rho$ ), longitudinal ultrasonic velocity ( $V_L$ ) and transverse velocity ( $V_S$ ). Table 2 shows some elastic and physical properties which can be described from the ultrasonic velocities and density values. Among them are: Young's modulus ( $E$ ), shear modulus ( $G$ ), bulk modulus ( $B$ ), Poisson's ratio ( $\nu$ ), acoustic impedance ( $Z$ ) and anisotropy factor ( $A_o$ ) [8, 12, 16, 22].

Table. 2: Equations for the elastic properties

| Property                                                              | Equation | Reference |
|-----------------------------------------------------------------------|----------|-----------|
| $E = \rho V_S^2 \left( \frac{3V_L^2 - 4V_S^2}{V_L^2 - V_S^2} \right)$ | (4)      | [8]       |
| $G = \rho V_S^2$                                                      | (5)      | [8]       |
| $B = \rho \left( V_L^2 - \frac{4V_S^2}{3} \right)$                    | (6)      | [22]      |
| $\nu = \frac{(V_L^2 - 2V_S^2)}{2(V_L^2 - V_S^2)}$                     | (7)      | [8]       |
| $Z = \rho V_L$                                                        | (8)      | [16]      |
| $A_o = \frac{2C_{44}}{C_{11} - C_{12}}$                               | (9)      | [12]      |

To calculate the anisotropy factor, the elastic constants in Equation 9 were described as a function of the ultrasonic velocities and the density of the bar, in which:  $C_{11} = \rho V_L^2$ ,  $C_{44} = G = \rho V_S^2$  e  $C_{12} = C_{11} - 2C_{44}$  [23].

2.6 Calculation of mechanical properties

The ultimate tensile strength ( $Ts$ ), yield strength ( $Ys$ ), modulus of resilience ( $Ur$ ) and Brinell hardness ( $HB$ ) were calculated using the mathematical relationships proposed in Table 3. Then, the found results were compared with reference values reported in the literature and discussed according the results of hardness  $HB$  measured.

Table. 3: Equations for the mechanical properties

| Property                 | Equation | Reference |
|--------------------------|----------|-----------|
| $Ts = 0.66V_L - 3194.29$ | (10)     | [24]      |
| $Ys = Ts/1.2$            | (11)     | [1]       |
| $Ur = \frac{(Ys)^2}{2E}$ | (12)     | [4]       |
| $HB = Ts/3.45$           | (13)     | [4]       |

Equation 10 relate the ultimate tensile strength ( $Ts$ ) with the longitudinal velocity ( $V_L$ ) of the ultrasonic waves propagated through cast iron samples [24]. Therefore, this equation was utilized by the authors to verify its application in CA-50 steel.

III. RESULTS AND DISCUSSION

3.1 CA-50 steel density

Table 4 shows the density value calculated for the CA-50 steel bar. The found result was approximately 7848 kg/m<sup>3</sup> and it is in accordance with the expectations. For example, some authors report that the structural steels with 0.24% of carbon can have a density of 7851 kg/m<sup>3</sup> [12]. In the same way, percentages of carbon around 0.24% are also observed in CA-50 steel.

Table. 4: Density of steel bar CA-50

| Weight (kg)          | Volume (10 <sup>-6</sup> m <sup>3</sup> ) | $\rho$ (kg/m <sup>3</sup> ) |
|----------------------|-------------------------------------------|-----------------------------|
| 0.0690               | 8.7923                                    | 7848                        |
| Reference value [12] |                                           | 7851                        |

3.2 Velocities of ultrasonic waves for CA-50 steel

The calculated values of the longitudinal ( $V_L$ ) and transverse ( $V_S$ ) ultrasonic velocities are presented in Table 5. The average travel time of the longitudinal ultrasonic wave was 34 x 10<sup>-6</sup> s, which only a small variation in values was observed caused by removing and repositioning the transducers. Thus, the values  $V_L = 5882$  m/s e  $V_S = 3235$  m/s were calculated for the CA-50 steel bar. These results are very close to the ones reported in the technical notes by Olympus for the 1020 steel, which are  $V_L = 5890$  m/s e  $V_S = 3240$  m/s [20]. The approximated  $V_L$  values between these steels also indicates a suitable use of the Equation 2 to estimate the  $V_S$  value.

Table. 5: Ultrasonic velocities for the CA-50 steel

| Steel | Time (10 <sup>-6</sup> s) | $V_L$ (m/s) | $V_S$ (m/s) |
|-------|---------------------------|-------------|-------------|
| CA-50 | 34.00 ± 0.01              | 5882        | 3235        |
| 1020  | Reference [20]            | 5890        | 3240        |

### 3.3 Elastic properties of CA-50 steel

Table 6 shows the elastic properties calculated for CA-50 steel. The Young's modulus ( $E$ ) represents a proportional relationship between stress and strain of steels subjected to mechanical load, while the shear modulus ( $G$ ) is an important parameter to investigate the elastic behavior of steels when there is a load applied over the cross section [4]. Generally, carbon steel has  $E$  and  $G$  values around 207 GPa and 83 GPa, respectively [4]. The  $E$  value of 1020 steel, which has a chemical composition similar to CA-50 steel, can vary between 210.98 GPa and 212.01 GPa, and the  $G$  value between 81.97 GPa and 82.41 GPa [25]. For TMT 500W, the Young's modulus is 210.52 GPa at ambient temperature of 25°C [26]. Therefore, the calculated  $E$  and  $G$  values for CA-50 steel are similar to those reported for structural steels in other studies.

Bulk modulus ( $B$ ) represents the stiffness to volumetric deformation, whose values for carbon steel are around 160 GPa [27, 28]. The reference value also agrees with the calculated result of  $B = 162$  GPa for the CA-50 steel.

$B/G$  ratio can be utilized to understand the ductile–brittle transition of metallic alloys with cubic structure, in which  $B/G < 1.75$  for brittle materials and  $B/G > 1.75$  for ductile materials [29, 30, 31]. Thus, the achieved value of  $B/G = 1.97$  implies that the CA-50 steel bar presents a ductile property, as expected.

Table 6: Calculated properties: Young's modulus ( $E$ ), Shear modulus ( $G$ ), bulk modulus ( $B$ ), Pugh's modulus ( $B/G$ ), Poisson's ratio ( $\nu$ ) and impedance acoustic ( $Z$ )

| $E$ (GPa) | $G$ (GPa) | $B$ (GPa)                         | $B/G$ |
|-----------|-----------|-----------------------------------|-------|
| 211       | 82        | 162                               | 1.97  |
| $\nu$     | $A_o$     | $Z$ ( $10^6$ kg/m <sup>2</sup> s) |       |
| 0.28      | 0.95      | 46.16                             |       |

Poisson's ratio ( $\nu$ ) represents the relationship between the transverse and longitudinal strains of materials. For carbon steels,  $\nu$  values can vary from 0.28 to 0.30 [4, 28]. Hence, the calculated result of  $\nu = 0.28$  for CA-50 steel are in the range of expected values for most carbon steels.

For perfectly isotropic materials the elastic anisotropy factor ( $A_o$ ) is adopted as 1 [32]. For high-resistance, low-carbon structural steels the anisotropy value can vary between 0.90 and 1.2 [33]. In this case, the CA-50 steel presents isotropic features as indicated by the calculated value of  $A_o = 0.95$ .

Acoustic impedance ( $Z$ ) can be described as the opposition the passage of acoustic wave energy through a material [16]. This property can be calculated by the

product between density and longitudinal ultrasonic velocity, as shown in Equation 8. Usually, the  $Z$  value adopted for carbon steel is  $45 \times 10^6$  kg/m<sup>2</sup>s [16]. For 1020 steel, this value is around  $45.56 \times 10^6$  kg/m<sup>2</sup>s [34]. As observed, the reference values are close to the result for the CA-50 steel, which was  $Z = 46.16 \times 10^6$  kg/m<sup>2</sup>s.

### 3.4 Mechanical properties of CA-50 steel

The calculated values of the CA-50 steel mechanical properties are presented in Table 7. From Equation 10 an attempt was made to estimate the ultimate tensile strength ( $T_s$ ) using the  $V_L$  value. As a result, it was found a  $T_s$  value of 688 MPa, approximately.

Table 7: Mechanical properties for the CA-50 steel

| $T_s$ (MPa) | $Y_s$ (MPa) | $U_r$ (MPa) | $HB$ |
|-------------|-------------|-------------|------|
| 668         | 557         | 735         | 199  |

According to the manufacture of the CA-50 steel bar, the minimum  $T_s$  value must not be less than 540 MPa. For the TMT 500W steel, which is similar to CA-50 steel, the  $T_s$  value may vary from 661 to 703 MPa [27]. However, lower values between 602 and 665 MPa can be found [1]. For this reason, the suggested result of  $T_s$  close to 668 MPa agrees with the range of values found for TMT 500W steels.

The Yield strength ( $Y_s$ ) in TMT 500W steels can be estimate by applying  $T_s$  in Equation 11. Using this procedure, a  $Y_s$  value close to 557 MPa was obtained for CA-50 steel. The  $Y_s$  value in TMT 500W steel can vary between 500 and 550 MPa [1]. Higher values can be observed in some cases, which are between 526 and 590 MPa [27]. Therefore, the calculated result of  $Y_s$  is also similar to those found for TMT 500W steels.

Modulus of resilience ( $U_r$ ) was calculated by applying the  $Y_s$  and  $E$  values in Equation 12. Thus, the found  $U_r$  value was approximately 735 MPa. Average values of  $Y_s = 559.77$  MPa and  $E = 204.88$  MPa are related for TMT 500W steel [27]. Using these values, it can be calculated a result of  $U_r = 765$  MPa for TMT 500W steel, which is not divergent from the one found for the CA-50 steel.

As regards CA-50 steel hardness, the estimated value applying  $T_s$  in Equation 13 was 199.42  $HB$ . This value was confirmed by the hardness test, whose average result obtained from the CA-50 steel sample was  $200.25 HB \pm 0.5 HB$ . This result indicates a good estimation of the  $T_s$  value by the mathematical model presented in Equation 10.

#### IV. CONCLUSION

The results of this study showed the possibility of characterizing the elastic and mechanical properties of CA-50 steel with an electronic system that consists of the ultrasonic transmission technique. The values of the properties calculated with the equations proposed for isotropic materials were very close to the reference values reported in the literature, attesting to the feasibility of the non-destructive method used.

Regarding the mechanical properties, the mathematical model used to estimate the tensile strength of cast iron seems to be suitable for studying the mechanical properties of CA-50 steel in the as-received condition. This hypothesis was reinforced after a comparative analysis between the calculated and measured HB hardness values in the CA-50 steel sample.

#### REFERENCES

- [1] Ahmad, S. & Sajal, W. R. (2020). An experimental investigation of relationship between surface hardness and strength of locally produced TMT 500W bar in Bangladesh. *International Journal of Applied Engineering Research*, 11, pp. 113-122.
- [2] Bahleda, F., Bujňáková, P., Koteš, P., Hasajová, L. & Nový, F. (2019). Mechanical Properties of Cast-in Anchor Bolts Manufactured of Reinforcing Tempcore Steel. *Materials*, 12(13), 2075. Doi: <https://doi.org/10.3390/ma12132075>
- [3] Kabir, I. R. (2014). Modelling of structure-property relationship of TMT high strength structural steel bars.
- [4] Callister Jr, W. D. & Rethwish, D. G. (2018). *Materials science and engineering: an introduction* (10th ed.) New Jersey: *John Wiley & Sons, Inc.*
- [5] Pavlina, E. J. & Vantyne, Chester. (2008). Correlation of Yield Strength and Tensile Strength with Hardness for Steels. *Journal of Materials Engineering and Performance*, 17, pp. 888-893. 10.1007/s11665-008-9225-5.
- [6] Dani, M. S. & Palit, M. P. (2015). Correlation of micro-macro properties with mechanical properties in rebar, *International Journal of Engineering Research & Technology (IJERT)*, 4(12).
- [7] Fujita, Masanori & Kuki, Keiichi. (2016). An Evaluation of Mechanical Properties with the Hardness of Building Steel Structural Members for Reuse by NDT. *Metals*. 6. 247. DOI: 10.3390/met6100247.
- [8] Kumar, Anish & Jayakumar, T. & Raj, Baldev & Ray, K.K.. (2003). Correlation Between Ultrasonic Shear Wave Velocity and Poisson's Ratio for Isotropic Solid Materials. *Acta Materialia*. 51. 2417–2426. DOI: 10.1016/S1359-6454(03)00054-5.
- [9] Rodríguez-Sastre, M. A., & Calleja, L. (2006). The determination of elastic modulus of slates from ultrasonic velocity measurements. *The Geological Society of London. IAEG*, 775, 1-11.
- [10] Hamidnia, M., & Honarvar, F. (2013). Measurement of elastic properties of AISI 52100 alloy steel by ultrasonic nondestructive methods. *Journal of Mechanics of Materials and Structures*, 7(10), 951–961. doi:10.2140/jomms.2021.7.951
- [11] Yamagishi, H., Fukuhara, M., & Chiba, A. (2010). Determination of the mechanical properties of extruded pure magnesium during tension–tension low-cycle fatigue using ultrasonic testing. *Materials Transactions*, 51(11), 2025–2032. DOI:10.2320/matertrans.m2010188
- [12] Wiskel, J. B., Kennedy, J., Ivey, D. G., & Henein, H. (2015). Ultrasonic velocity evaluation of three grades of heat treated steel. Department of Chemical and Materials Engineering, University of Alberta, Canada.
- [13] Zukri, M.N. & Bakar, E.A. (2018). Motion Analysis of A Low Cost Customized A-Scan Non Destructive Testing Unit.
- [14] Mestre, P., Calçada, A., Carvalho, N., Serôdio, C., Couto, P., Matias, J., Melo-Pinto, P. & Morais, J.J. (2013). Low-cost Ultrasonic Probe to Assess Wood Defects and Parameters.
- [15] Mak, Se-Yuen. (2003). Wave experiments using low-cost 40 kHz ultrasonic transducers. *Physics Education*. 38. 10.1088/0031-9120/38/5/310.
- [16] Krautkramer, J. & Krautkramer, H. (1990). *Ultrasonic testing of materials* (4th ed.) Berlin: Springer-Verlag.
- [17] Aydin, A. (2013). Upgraded ISRM Suggested Method for Determining Sound Velocity by Ultrasonic Pulse Transmission Technique. *Rock Mechanics and Rock Engineering*, 47, 255-259.
- [18] Priyesh, K. (2013). Studies on Properties of TMT Steels for Structural Applications. *International Journal of engineering research and technology*. DOI: 10.17577/IJERTV2IS80657
- [19] Domínguez, A. O., Mennucci, M. M. & Molin, D. C. C. Dal. (2018). Performance Analysis of Corrosion Inhibitors in Pore Solution and Reinforced Concrete for Carbon Steel CA 50. *Materials Research Proceedings*, 7, pp 428-439.
- [20] Olympus (2006). *Material Sound Velocities*. Recovered: <https://blog.mbedded.ninja/docs/olympus-ultrasonic-transducers-technical-notes.pdf>
- [21] Gür, C. H., & Keles, Y. (2003). Ultrasonic characterization of hot rolled heat treated steels. *Materials Characterisation* 45(9), 615-620.
- [22] Pham, T. V., & Kien, D. T. (2017). Influence of temperature on mechanical characteristics of 1018 low carbon steel estimated by ultrasonic non-destructive testing method. *Indian Journal of Pure & Applied Physics*, 55, 431-435.
- [23] Carvajal, Linton, Artigas, Alfredo, Monsalve, Alberto, & Arévalo, Elizabeth. (2017). Monitoring Heat Treatments in Steels by a Non Destructive Ultrasonic Method. *Materials Research*, 20(Suppl. 2), 347-352. Epub August 24, 2017. <https://doi.org/10.1590/1980-5373-mr-2016-1083>
- [24] Orłowicz, W., Tupaj, M., Mróz, M., Guzik, E., Nykiel, J., Zajac, A., & Piotrowski, S. (2009). Defining the relation between mechanical properties and ultrasonic wave velocity in spheroidal cast iron manufactured in the foundry Metal-Odlew s.c. *Archives of Foundry Engineering*, 121-124.

- [25] Freitas, V. L. de A., Albuquerque, V. H. C. de, Silva, E. de M., Silva, A. A., & Tavares, J. M. R. S. (2010). Nondestructive characterization of microstructures and determination of elastic properties in plain carbon steel using ultrasonic measurements. *Materials Science and Engineering A*, 527(16-17), 4431–4437. doi:10.1016/j.msea.2010.03.090
- [26] Shaown, M. R. N., Shahriar, M. S., Islam, M.A. (2018). Fire resistance of locally produced 500W structural steel bars. *IOP Conf. Series: Materials Science and Engineering*. DOI:10.1088/1757-899X/438/1/012034
- [27] Kim, S. A., & Johnson, W. L. (2007). Elastic constants and internal friction of martensitic steel, ferritic-pearlitic steel, and  $\alpha$ -iron. *Materials Sciences and Engineering A*.
- [28] Fukuhara, M., & Sanpei, A. (1993). Elastic moduli and internal friction of low carbon and stainless steels as a function of temperature. *ISIJ International*.
- [29] Liu, Yu & Wang, Kai & Xiao, Hui & Gang, Chen & Wang, Zhipeng & Hu, Te & Fan, Touwen & Ma, Li. (2020). Theoretical study of the mechanical properties of CrFeCoNiMo<sub>x</sub> (0.1 ≤ x ≤ 0.3) alloys. *RSC Advances*. 10. 14080-14088. DOI: 10.1039/D0RA00111B.
- [30] Senkov, Oleg & Miracle, Dan. (2021). Generalization of intrinsic ductile-to-brittle criteria by Pugh and Pettifor for materials with a cubic crystal structure. *Scientific Reports*. 11. DOI: 10.1038/s41598-021-83953-z.
- [31] Boucetta (2014) Theoretical study of elastic, mechanical and thermodynamic properties of MgRh intermetallic compound. *Journal of Magnesium and Alloys*, 2(1). DOI: 10.1016/j.jma.2014.04.001.
- [32] Meyers, M. A., & Chawla, K. K. (2009). *Mechanical behavior of materials* (2nd ed.). New York: Cambridge, University Press.
- [33] Kalpakjian, S., & Schmid, S. R. (2009). *Manufacturing engineering and technology* (6th ed.). Upper Saddle River: Prentice Hall.
- [34] Ginzel, E., & Turnbull, B. (2016). Determining approximate acoustic properties of materials. *NDT*.

## Agribusiness at the interface of a liberal economy

## O Agronegócio na Interface de uma Economia Liberal

Warley Lopes Martins

Advogado, Professor Universitário, Especialista em Direito Processual Civil, Especialista em Direito Eleitoral e Mestrando em Direito do Agronegócio e Desenvolvimento. E-mail: [warleylopesmartins@gmail.com](mailto:warleylopesmartins@gmail.com)

Received: 14 Aug 2022,

Received in revised form: 09 Sep 2022,

Accepted: 13 Sep 2022,

Available online: 19 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *data driven, decision making,  
public sector, open government.*

**Abstract**— *This work presents an approach inherent to the relevance of agribusiness and its extreme importance in job creation, income generation, maintenance of the nation's food security, and the consequent contribution to the economy and national development. The study is based on bibliographic research, and analysis of documental content backed by statistical data, initially navigating through the theoretical basis of economic liberalism according to the classical tradition, with an approach to the vision of one of the main classical thinkers and theorists, Ludwig Von Mises (1881). -1973), which emerged after the propagation of Adam Smith's basic ideas of freedom. The hypothesis is that the success of Brazilian agribusiness was also possible thanks to the guidelines established by the free market economy, with a system based on the supply and demand of goods and services, without forced and coerced transactions and with minimal government involvement in the business. In this way, it is concluded that agribusiness needs to be minimally guided by freedoms, thus fulfilling its social function of supplying food to domestic and foreign trade, generating employment and income, and consequently contributing to the economy and national development, thus having to the State to interfere minimally in the respective sector, based on preserving the system of voluntary action or cooperation between the negotiation of individuals.*

**Resumo**— *Este trabalho apresenta uma abordagem inerente a relevância do agronegócio e sua extrema importância na criação de empregos, geração de renda, manutenção da segurança alimentar da nação, e a consequente contribuição para a economia e desenvolvimento nacional. Baseia-se o estudo em pesquisa bibliográfica, e análise de conteúdo documental lastreada em dados estatísticos, navegando inicialmente pela base teórica do liberalismo econômico segundo a tradição clássica, com abordagem da visão de um dos principais pensadores e teóricos clássicos, Ludwig Von Mises (1881-1973), que surgiu após a propagação das ideias base de liberdade de Adam Smith. Trabalha-se a hipótese que o êxito do agronegócio brasileiro foi possível também graças as diretrizes estabelecidas pela economia de livre mercado, com um sistema baseado na oferta e demanda de bens e serviços, sem transações forçadas e coagidas e com o mínimo envolvimento governamental nas vias negociais. Dessa forma, conclui-se a necessidade de o agronegócio pautar-se minimamente nas liberdades, cumprindo assim sua função social de fornecer alimentos*

*ao comércio interior e exterior, gerando emprego e renda, e contribuindo consequentemente para a economia e o desenvolvimento nacional, devendo assim o Estado interferir minimamente no respectivo setor, tendo como base preservar o sistema de ação ou cooperação voluntária entre a negociação dos indivíduos.*

## I. INTRODUÇÃO

O tema que se aborda neste trabalho, é de extrema relevância, não somente jurídica como social e econômica, e tem como objetivo analisar as diretrizes do agronegócio brasileiro e suas interfaces com o liberalismo econômico.

O agronegócio é um dos setores econômicos mais dinâmicos no Brasil, levando a debates sobre como sua expansão pode oferecer oportunidades para o desenvolvimento local, superando a atual estratégia simplificada de expansão para novas fronteiras agrícolas com altos custos sociais e ambientais (MEDINA; SANTOS, 2016).

O desenvolvimento do agronegócio está sendo realizado sob a égide do liberalismo econômico, trazendo esta grande importância a respectiva atividade.

Adam Smith (1723-1790) foi o precursor do estudo da atuação e do impacto do liberalismo e do livre-mercado na economia. Ele alegava que o mercado seria regulado por “forças invisíveis” que contribuiriam para que o comércio e indústria descobrissem continuamente novas tecnologias e aprimorassem seus serviços, assim reduzindo preços e aumentar empregos, sem a necessidade de constante intervenção estatal. Com o tempo, outros teóricos passaram a estudar e a aprimorar as ideias de liberdade econômica propostas por Adam Smith, demonstrando os benefícios de um mercado livre da intervenção estatal para a sociedade de maneira geral.

Ludwig Von Mises (1881-1973), Friedrich Hayek (1899-1992) e Milton Friedman (1912-2006) são alguns dos principais pensadores e teóricos liberais clássicos, que surgiram após a propagação das ideias base de liberdade de Adam Smith (WOLLMANN, 1994).

Quando essas liberdades são garantidas, as pessoas começam a produzir, a inovar, a aprimorar suas propriedades, a contratar e a trocar com outros indivíduos. Logo se verifica, assim, uma dinâmica de trocas que envolve milhões de pessoas, em cidades e países diversos; e essa dinâmica é tão ordenada que pode parecer que alguém a coordena — que há burocratas, ou um computador central, que orientam todas as ações dos indivíduos na economia.

A liberdade econômica pode ser entendida como sendo o exercício real, por parte dos indivíduos, de todas aquelas atividades de geração, produção e comercialização

de bens e serviços que se desenvolvem de maneira natural e espontânea e que satisfazem as necessidades individuais e coletivas, no quadro mais amplo de possibilidades, onde as limitações diferentes das próprias ou intrínsecas da atividade, devem ser uma rara exceção em função de manter uma ordem racional (MISES, 1987).

Assim o trabalho tem como objetivo é elucidar que o agronegócio é de extrema importância e é responsável fundamental para o desenvolvimento socioeconômico do Brasil, e está cumprindo consequentemente com brilhantismo também sua função social, conseguido resultados expressivos diante da liberdade econômica de mercado.

## II. LIBERALISMO ECONÔMICO SEGUNDO A TRADIÇÃO CLÁSSICA

Historicamente, o liberalismo foi o primeiro movimento de cunho político que almejou a promoção e o bem-estar de todas as pessoas, e não de grupos especiais individualizados (MISES, 2010, pag. 38).

O liberalismo privilegia a atitude racional nas escolhas individuais e atribui à cooperação e à coordenação as origens das instituições, ainda que essa cooperação seja alcançada para prevenir conflitos.

A economia clássica concebe o crescimento econômico baseado em mercados livres, em vantagens competitivas e na baixa intervenção governamental (SMITH, 1776).

O liberalismo busca a produção do bem-estar exterior, porque sabe que as riquezas de cunho interiores, espirituais, não podem atingir o homem de fora, mas somente no aspecto interior. O liberalismo não visa a criação de qualquer outra coisa, a não ser as condições externas para o devido desenvolvimento da vida interior, não havendo dúvida de que por exemplo um indivíduo prospero do século XX pode satisfazer suas necessidades espirituais mais prontamente do que, um indivíduo do século X, que não podia nem se livrar da ansiedade de viver com o ínfimo que detinha para sua sobrevivência (MISES, 2010, pág. 36).

Uma referida sociedade que os princípios liberais são levados a aplicação é, costumeiramente chamada de sociedade capitalista, e de referido capitalismo e condição

em que se encontra a dita sociedade (MISES, 2010, pág. 40).

A sociedade humana é uma associação de pessoas que buscam pela cooperação, ao contrário de uma ação isolada dos indivíduos, a ação cooperada, na base da principiologia de divisão do labor, traz a consequente vantagem da maior produtividade. Se um referido número de homens labora em dita colaboração, segundo o princípio da divisão do labor, esses referidos homens produzirão não apenas a quantidade do que teriam produzido, se trabalhassem como indivíduos autossuficientes, mas muito mais do que isso, sendo toda civilização sendo alicerçada neste fato (MISES, 2010, pág. 49).

O trabalho humano, não é sozinho capaz de aumentar nosso bem-estar, para que tenha frutos, o trabalho humano tem que ser aplicado aos materiais e aos recursos da terra que foi colocado a nossa disposição pela natureza. A terra, com suas abundâncias, e o trabalho humano constituem os ditos dois fatores de produção, que cuja cooperação intencional procedem todas as mercadorias que são destinadas para satisfação de nossas necessidades. Para que se possa produzir, o homem tem que combinar trabalho e os fatores materiais de produção, incluindo não só as matérias-primas e os recursos da natureza, mas também os produtos intermediários destes fatores de produção primários naturais, que já anteriormente processados pelo trabalho humano, ou seja, na linguagem econômica, foi distinguido, portanto os três fatores de produção, trabalho, terra e capital (MISES, 2010, pág.49).

Por terra, deve-se entender tudo o que a natureza coloca à disposição do homem, na forma de substâncias e de energia nela encontradas, sob e acima de sua superfície, na água e na atmosfera; por bens de capital, todos os bens intermediários produzidos com elementos originários da terra, com auxílio do trabalho humano, que são feitos para servir à produção posterior, tais como máquinas, ferramentas, artigos semimanufaturados de todos os tipos (MISES, 2010, pág. 49/50).

De acordo com Mises (2010, pág. 50) “os liberais mantêm a opinião de que o único sistema de cooperação humana que, de fato, funciona numa sociedade baseada na divisão de trabalho, é a propriedade privada dos meios de produção”.

Ao lado da palavra “propriedade” no programa do liberalismo, são colocados, de forma totalmente apropriada, as palavras “liberdade” e “paz”. A liberdade e a paz estão colocadas na vanguarda do liberalismo, não porque muitos dos antigos liberais as consideravam coordenadas com o princípio fundamental do liberalismo

em si, ao invés de, simplesmente, considerá-las consequência necessária do princípio fundamental da propriedade privada dos meios de produção. Assim estão, tão somente, porque liberdade e paz passaram a sofrer ataques especialmente violentos dos oponentes do liberalismo, e os liberais não desejavam dar a aparência, pela omissão desses princípios, de que eles de algum modo reconheciam a justiça das objeções contra eles levantadas pelos detratores (MISES, 2010, pág. 50).

De acordo com (MISES, 2017, pág. 17), todas as conquistas da ação humana foram resultado da cooperação voluntária entre os homens. O que o governo faz, ou deveria fazer, é proteger essas práticas contra as pessoas que não cumprem as regras necessárias para a preservação da sociedade e tudo que ela produz, e a principal função do governo, para não dizer a única e exclusiva, é preservar o sistema de ação ou cooperação voluntária entre pessoas impedindo-as de recorrer à violência.

O liberalismo surge como alternativa teórica ao Estado de Bem-Estar Social, o “Welfare-State”, já no fim da Segunda Guerra Mundial (1944), com as ideias precursoras do economista e filósofo Friedrich Hayek, que criticava o referido modelo econômico, pautado no keynesianismo, isto é, na intervenção e prestação positiva do Estado para com seus cidadãos, principalmente no que se refere à garantia do pleno emprego e ao controle inflacionário.

No entanto, nesse período, as teorias neoliberais de Hayek – e posteriormente as de Milton Friedman (década de 1960) – ficaram no plano das ideias, sem aplicação política efetiva – o mundo se recuperava dos impactos causados pela Segunda Grande Guerra e, por isso, era necessária maior intervenção estatal na reconstrução dos países envolvidos.

Suas ideias somente começaram a ser pragmaticamente discutidas no decorrer da Guerra Fria, a qual o discurso liberal deveria prevalecer sobre a ideologia socialista, e a aplicação da teoria econômica na política aconteceu de fato no fim da década de 1970 com os governos britânico de Margareth Thatcher e norte-americano de Reagan, que se embasaram em Hayek para superar a crise econômica que os países industrializados enfrentavam com as reivindicações operárias de caráter social e de bem-estar (CARVALHO, 2019).

Segundo os princípios gerais do liberalismo, cumpre à ordem econômica regular de forma principal a dinâmica das atividades empresariais, de modo a emparelhar eficientemente a produção, industrialização, distribuição e consumo. Ou seja, “a atividade econômica [deve ser] condicionada por meio do sistema jurídico a



determinado fins políticos do Estado (BURANELLO, 2018, pág. 48).

Nesse sentido, caberia ao Estado intervir indiretamente no complexo do agronegócio, se limitando a criar diretrizes institucionais a serem observadas pelos agentes econômicos. Essas diretrizes com caráter de normas gerais, conferindo aos indivíduos e empresas a liberdade necessária para atingir – cada qual com seus objetivos – os propósitos do Estado.

Conforme explica o renomado jurista Eros Grau, somente através do planejamento estratégico do Poder Público que “haverá formulação explícita dos objetivos e definição dos meios de ação coordenadamente dispostos, mediante a qual se procura ordenar, sob o aspecto macroeconômico para melhor funcionamento da ordem social, em condições de mercado.” (BURANELLO, 2018, pág. 49).

Veja que esse entendimento quanto ao posicionamento do Estado em relação ao negócio agroindustrial não são contraditórios aos princípios de liberalismo econômico defendidos por Hayek e Friedman, principalmente no que diz respeito aos conceitos de liberdades individuais, livre mercado e Estado Mínimo.

### III. O DESENVOLVIMENTO DO AGRONEGÓCIO SOB A EXIGE DO LIBERALISMO ECONÔMICO

Do ponto de vista histórico, a atividade econômica do Brasil sempre foi ligada ao exercício do ruralismo, desde o processo de colonização extrativista até o modelo atual que prioriza a exportação.

A lei 8.023 especificamente em seu artigo 2º, traz que são consideradas atividades rurais <sup>1</sup> a “agricultura,

<sup>1</sup> Art. 2º Considera-se atividade rural:

I - a agricultura;

II - a pecuária;

III - a extração e a exploração vegetal e animal;

IV - a exploração da apicultura, avicultura, cunicultura, suinocultura, sericultura, piscicultura e outras culturas animais;

V - a transformação de produtos decorrentes da atividade rural, sem que sejam alteradas a composição e as características do produto *in natura*, feita pelo próprio agricultor ou criador, com equipamentos e utensílios usualmente empregados nas atividades rurais, utilizando exclusivamente matéria-prima produzida na área rural explorada, tais como a pasteurização e o acondicionamento do leite, assim como o mel e o suco de laranja, acondicionados em embalagem de apresentação.

Parágrafo único. O disposto neste artigo não se aplica à mera intermediação de animais e de produtos agrícolas.

<sup>1</sup> Art. 1º Esta lei fixa os fundamentos, define os objetivos e as competências institucionais, prevê os recursos e estabelece as ações e instrumentos da política agrícola, relativamente às

a pecuária, a extração e exploração vegetal e animal, a exploração da apicultura, avicultura, cunicultura, suinocultura, sericultura, piscicultura e outras culturas animais, e conseqüentemente a transformação de produtos decorrentes da respectiva atividade rural, que sejam alteradas a composição e as características do produto *in natura*, feita pelo próprio criador ou agricultor, com equipamentos e utensílios empregados nas atividades de cunho rural, utilizando exclusivamente matéria prima produzida na área rural explorada”.

Conceitualmente, a atividade rural atravessou por inúmeras transformações, passando do laboro meramente agrário (trato direto com a terra) e do setor primário, para considerar o somatório de toda cadeia operacional derivada, principalmente no seu aspecto negocial.

O termo agronegócio foi implementado no Brasil com base no conceito de *agribusiness*, formulado na Escola de Negócios e Administração da Universidade de Harvard, Estados Unidos, em 1957, com a publicação da obra “A concept of agribusiness”, de autoria de John Davis e Ray Goldberg (MENDONÇA, 2013).

A noção de *agribusiness* apareceu no Brasil através da esfera pública em meados das décadas de 50 e 60, e foi primeiramente notada por entidades controladas pela agricultura de ramificação patronal, exemplo da Sociedade Rural Brasileira (SRB) e da Confederação Nacional da Agricultura (CNA), atual Confederação da Agricultura e Pecuária do Brasil (POMPEIA, 2021, pág.87).

O agronegócio é definido como conjunto de atividades econômicas compreendidas entre o fornecimento de insumos, de formação e produção nas unidades agropecuárias, até o processamento, acondicionamento, armazenamento, distribuição e consumo de alimentos, fibras, e até bioenergia. Uma visão sistemática do negócio agrícola envolve também fundamentalmente as formas de financiamento, as bolsas de mercadorias e as políticas públicas estabelecidas ao setor (BURANELLO, 2018, pág. 23).

O agronegócio é indiscutivelmente uma realidade mundial no tempo contemporâneo, e sua existência e expressão corroboram o entendimento da complexidade do estudo da agricultura e das questões do campo no século XXI, pois trata-se de uma conceituação que nasceu em

atividades agropecuárias, agroindustriais e de planejamento das atividades pesqueira e florestal.

Parágrafo único. Para os efeitos desta lei, entende-se por atividade agrícola a produção, o processamento e a comercialização dos produtos, subprodutos e derivados, serviços e insumos agrícolas, pecuários, pesqueiros e florestais.

pleno vigor da superação das ditas “amarras” que então prendiam este respectivo setor na simplicidade da relação agricultura e comércio ou mesmo na definição simplória que o enquadra como o setor primário da economia.

O agronegócio então surge para designar uma etapa de transformação da agricultura, ou seja, remetendo-a a posição de destaque quando vista a partir da sua relação com a indústria.

A nível de Brasil, o agronegócio é tido como um dos propulsores da economia nacional, expressando valores significativos em relação a sua participação no mercado no que diz respeito ao número elevado de empregos gerados pelo setor, refletindo diretamente na renda. Esse histórico referente ao desempenho desse setor se perpetua ao longo do tempo positivamente, de acordo com os registros, sendo esses, expressos nas formas quantitativas ou/e qualitativas, evidenciando assim, a importância do agronegócio na esfera global, superando até o setor industrial no que diz respeito à capacidade média produtiva, devido a sua dinâmica e participação na economia (COSTA, 2006).

O agronegócio é responsável fundamental para o desenvolvimento socioeconômico interno brasileiro e internacional, fornecendo alimentos para humanos e para animais, fibras, subprodutos, resíduos e energia – alimento, veste e faz parte da vida de todos (BASTOS, 2019).

Assim, o agronegócio é estudado em seus diversos ramos como umnexo de contratos, compostos de sucessivas etapas que vão desde o produtor e revendedor de insumos até o consumidor, passando pelo produtor rural, pela indústria e pelo comércio.

O agronegócio brasileiro se desenvolveu constantemente diante da pesquisa e inovação aplicadas em todos os seus seguimentos, fazendo consequentemente que o país se posicionasse no mercado de forma amplamente competitiva.

Vemos, assim, que o termo agronegócio é delineado pelo que temos chamado de complexo agroindustrial, ou conjunto geral dos sistemas agroindustriais, consideradas todas as empresas que fornecem os insumos necessários, produzem, processam e distribuem produtos, subprodutos e resíduos de origem agrícola, pecuária de reflorestamento ou aquicultura (BURANELLO, 2018, pág. 32-33).

A atividade econômica relacionada ao agronegócio tornou-se fundamental para a balança comercial e um dos principais dinamizadores da economia brasileira, inclusive da indústria relacionada à produção agropecuária.

Para Santos e Filho (2016), no âmbito nacional, o agronegócio exerce papel essencial no crescimento econômico ampliado, pois os efeitos de transbordamento não se limitam ao próprio mercado de produção de alimentos, mas envolvem outros agentes e processos, desde a obtenção dos insumos até a disposição final do produto.

Para Vital (2018, pág. 119) “o agronegócio responde por quase um terço do Produto Interno Bruto do país e há muito tempo é responsável pelo equilíbrio de nossa balança comercial”.

Com a perda relativa da participação industrial na economia, o agronegócio tornou-se fundamental para a balança comercial e um dos principais dinamizadores da economia nacional, inclusive da indústria relacionada à produção agropecuária.

Mises (2015) “estabelece que quando mencionamos sobre capitalismo, é importante lembrar a diferença entre bens de capital e capital, sendo bens de capital coisas materiais e o capital teoria dentro da estrutura de um determinado método de cálculo e contabilidade, e que os agricultores também começaram a se familiarizarem com a temática”.

Há um falso dilema, de propagação puramente ideológica, segundo o qual o capitalismo seria incompatível com a justiça social, sendo que a história demonstra justamente o contrário, somente a produção de riqueza permite eficaz combate à pobreza, e somente a economia de mercado – o capitalismo – produz riqueza (DOURADO E TEIXEIRA, 2020, pág. 07).

Podere parecer que a importância da economia para a vida diária é de certo modo pequena, mas isso não é verdade, visto que de fato, a teoria econômica é de extrema importância, para podermos dar os passos adequados na conquista de um objetivo específico, precisamos primeiramente conhecer o estado atual de coisas, a situação existencial, mas, para isso precisamos de conhecimento econômico, da compreensão econômica, para tomar decisões, para agir, para fazer julgamentos de valores devidos (MISES, 2017, pág. 75).

(BURANELLO, 2018, pág. 49-50) cita que aos anseios de uma sociedade cada vez mais exigente, a uma agenda de desenvolvimento fortemente centrada na sustentabilidade e aos mercados cada vez mais dinâmicos e competitivos. Portanto, a construção de um futuro sustentável para nossa agricultura dependerá, necessariamente, da nossa capacidade de integrar e gerir sistemas cada vez mais dinâmicos, mutáveis e complexos.

Dito isso, é preciso analisar o agronegócio enquanto uma rede contratual que interliga firmas de

diferentes segmentos (o “antes”, o “dentro” e o “depois da porteira”), a fim de tornar seu fluxo operacional eficiente, de modo que às expectativas do mercado global sejam atendidas.

A atual situação de um ambiente de negócios liberal e globalizado em que o país se insere resulta na necessidade de um novo paradigma de desenvolvimento baseado em oportunidades criadas por setores econômicos dinâmicos como é o caso do agronegócio.

Nos termos de Buranello (2018, pág.46) “embora centrado na produção rural, o agronegócio é uma rede de negócios que perpassa os três setores tradicionalmente identificados na economia (primário, secundário e terciário)”.

A gestão do mundo rural brasileiro não pode ser feita na lógica das fazendas ou das lavouras, vistas e compreendidas em isolamento. Essa gestão precisará ser feita, cada vez mais, na escala do território, levando em conta a diversidade, a dinâmica e a riqueza das relações e interações ali presentes, dentro das nuances de um livre comércio.

Os desafios são muito complexos e vão muito além dos limites do “dentro da porteira”. Para responder a tais desafios, é necessário ampliar a capacidade de olhar para além da unidade produtiva, em escala que permita monitorar a dinâmica da agricultura no espaço geográfico, simulando os cenários mais adequados e promissores para uso e ocupação das terras, considerando seus contextos natural, agrícola, socioeconômico e de infraestrutura” BURANELLO, 2018, pág. 52).

É fundamental que as firmas integrantes do agronegócio, inclusive e principalmente as fazendas produtivas, sejam guiadas pelas necessidades, exigências e competição do mercado, sem a intervenção direta do Estado. Essas empresas devem ser dotadas de presunção de boa-fé para que tenham liberdade plena de contratar e empreender, tendo liberdade e paz, conforme os ditames basilares do liberalismo econômico.

Nesse sentido, Luis Filipe Reis (2010, pág. 31) entende que “a mudança é fator de sobrevivência para as empresas rurais brasileiras, que devem se guiar pelo mercado e pelo planejamento estratégico para alcançar seus objetivos”.

É o Estado Democrático de Direito que nos assegura essa liberdade empreendedora essencial numa economia capitalista, o que é o inverso de aventuras radicais, greves e paralisações ilegais, de qualquer politização ou partidarização nociva que, longe de resolver nossos problemas, certamente os agravará.

Está estabelecido no artigo 170<sup>2</sup>, da CF as questões basilares envolvendo a ordem econômica, é fundada na valorização do trabalho e na livre iniciativa, sob a observância de princípios específicos.

As atividades econômicas exercidas pelo agronegócio exerce uma postura de salvaguarda coletiva, contribuindo com o desenvolvimento nacional, erradicando a pobreza e combatendo a fome, consequentemente contribuindo para a segurança alimentar, conforme está presente no artigo 1<sup>o</sup> da CF.

A CF traz também em seu artigo 3<sup>o</sup> o dever estatal de erradicar a pobreza, sendo que o agronegócio contribui diretamente para tal finalidade.

#### IV. CONSIDERAÇÕES FINAIS

Diante das considerações tecidas no decorrer da pesquisa, foi possível analisar na literatura existente, as nuances do liberalismo econômico lastreado segundo a teoria clássica, tendo como principal referência teórica Ludwig Von Mises.

Desta forma, observou-se que o crescimento econômico do agronegócio se deu sob a égide do livre mercado, com uma sistemática baseada na liberdade

<sup>2</sup> Art. 170. A ordem econômica, fundada na valorização do trabalho humano e na livre iniciativa, tem por fim assegurar a todos existência digna, conforme os ditames da justiça social, observados os seguintes princípios:

I - soberania nacional;

II - propriedade privada;

III - função social da propriedade;

IV - livre concorrência;

V - defesa do consumidor;

VI - defesa do meio ambiente, inclusive mediante tratamento diferenciado conforme o impacto ambiental dos produtos e serviços e de seus processos de elaboração e prestação

VII - redução das desigualdades regionais e sociais;

VIII - busca do pleno emprego;

IX - tratamento favorecido para as empresas de pequeno porte constituídas sob as leis brasileiras e que tenham sua sede e administração no País.

<sup>3</sup> Art. 1<sup>o</sup> A República Federativa do Brasil, formada pela união indissolúvel dos Estados e Municípios e do Distrito Federal, constitui-se em Estado Democrático de Direito e tem como fundamentos:

III - a dignidade da pessoa humana;

<sup>3</sup> Art. 3<sup>o</sup> Constituem objetivos fundamentais da República Federativa do Brasil:

I - construir uma sociedade livre, justa e solidária;

II - garantir o desenvolvimento nacional;

III - erradicar a pobreza e a marginalização e reduzir as desigualdades sociais e regionais;

<sup>4</sup> Art. 3<sup>o</sup> Constituem objetivos fundamentais da República Federativa do Brasil:

III - erradicar a pobreza e a marginalização e reduzir as desigualdades sociais e regionais;

negocial, prezando pela liberdade e paz, e com o mínimo de envolvimento governamental nos ditames negociais.

Com os resultados, foi possível concluir pela necessidade de o agronegócio pautar-se minimamente nas liberdades, cumprindo assim sua função social de fornecer alimentos ao comércio interior e exterior, gerando emprego e renda, e contribuindo conseqüentemente para a economia e o desenvolvimento nacional, devendo assim o Estado interferir minimamente no respectivo setor, tendo como base preservar o sistema de ação ou cooperação voluntária entre a negociação dos indivíduos.

## REFERÊNCIAS

- [1] BASTOS, Júlia Pedroni Batista. **O agronegócio brasileiro sob a perspectiva do liberalismo econômico**. 2019. Disponível em: <https://direitoagrario.com/o-agronegocio-brasileiro-sob-a-perspectiva-do-liberalismo-economico/> Acesso em: 07 mai.2022.
- [2] BURANELLO, Renato. **Manual do Direito do Agronegócio**. 2ª ed. – São Paulo: Saraiva Educação, 2018.
- [3] CARVALHO, Elaine de. **Hayek e Frindman e as origens do neoliberalismo**. Disponível em: <https://www.periodicos.ufes.br/dimensoes/article/view/2339>. Acesso em: 10 mai.2022.
- [4] COSTA, M. **Agronegócio: o motor da economia Brasileira e o dinamismo da economia Paranaense**. Disponível em: <http://www.agronline.com.br/artigos/artigo.php?id=331> Acesso em: 05 abri. 2022.
- [5] DOURADO, Paulo Henrique Marques; TEIXEIRA, Thiago Brum. **Negócio Social: conhecer o bem para fazer o bem**. Campinas, SP: Editora Auster, 2020.
- [6] MENDONÇA, Maria Luisa. **Modo capitalista de produção e agricultura: a construção do conceito de agronegócio**. 2013. Tese (Doutorado em Geografia). Universidade de São Paulo, São Paulo, 2013.
- [7] MEDINA, G.; RIBEIRO, G.; BRASIL, E. **Participação do capital brasileiro na cadeia produtiva da soja: lições para o futuro do agronegócio nacional**. Revista de Economia e Agronegócio, Viçosa, v. 13, n. 1, 2, 3, p. 3-38, 2016.
- [8] MISES, Ludwig von. **O Mercado**. Rio de Janeiro: José Olympio: Instituto Liberal, 1987.
- [9] MISES, Ludwig von. **Sobre dinheiro e inflação**. Tradução de Alexandre S. Campinas, SP: Vide Editorial, 2017.
- [10] MISES, Ludwig von. **O Marxismo Desmascarado**. Tradução de Alexandre S. Campinas, SP: Vide Editorial, 2015.
- [11] MISES, Ludwig von. **O livre mercado e seus inimigos: pseudo-ciência, socialismo e inflação**. Tradução de Flávio Quintela. Campinas, SP: Vide Editorial, 2017.
- [12] MISES, Ludwig von. **Sobre dinheiro e inflação**. Tradução de Alexandre S. Campinas, SP: Vide Editorial, 2017.
- [13] POMPEIA, Caio. **Formação política no agronegócio**. São Paulo, SP: Editora Elefante, 2021.
- [14] REIS, Luis Filipe Sousa Dias. **Agronegócios: qualidade na gestão**. Rio de Janeiro: Qualitymark, 2010, p. 31.
- [15] SANTOS, M. A; FILHO, J. E. R. V. **O agronegócio brasileiro e o desenvolvimento sustentável**. Repositório do conhecimento (IPEA). Ano 13. Edição 87: 2016.
- [16] SMITH, A. **The wealth of nations**. London: William Strahan: Thomas Cadell, 1776.
- [17] VITAL, Nicholas. **Agradeça aos agrotóxicos por estar vivo**. 3ª edição. Rio de Janeiro: Record, 2018.
- [18] WOLLMANN, Sergio. **O conceito de liberdade no Liviata de Hobbes**. Porto Alegre: EDIPUCRS, 1994.

# Metabolic Syndrome in Quilombola Populations Environmentally Exposed to Organophosphate Pesticides in the State of Pará- Brazil

Amanda Cavalcante Lopes<sup>1</sup>, Núbia Rocha Marques<sup>2</sup>, Rosivaldo de Alcantara Mendes<sup>3</sup>,  
Kleber Raimundo Freitas Faial<sup>4</sup>, Antônio Marcos Mota Miranda<sup>5</sup>

<sup>1</sup>Medical student at the State University of Pará (UEPA), State University of Pará (UEPA).

Email: amandacavlopes@gmail.com

<sup>2</sup>Medical student at the Federal University of Pará (UFPA), Federal University of Pará (UFPA)

Email: marquesnubia7@gmail.com

<sup>3</sup>Public Health Researcher, Instituto Evandro Chagas

E-mail: rosivaldomendes@iec.gov.br

<sup>4</sup>Public Health Researcher, Instituto Evandro Chagas

E-mail: kleberfaial@iec.gov.br

<sup>5</sup>Public Health Researcher, Instituto Evandro Chagas

E-mail: marcosmota@iec.gov.br

Received: 16 Aug 2022,

Received in revised form: 06 Sep 2022,

Accepted: 13 Sep 2022,

Available online: 20 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords— Agrochemicals, Risk to Human  
Health, Organophosphate Compounds.**

**Abstract—** The quilombola community Médio Itacuruçá in the municipality of Abaetetuba is in permanent contact with Organophosphate pesticides. Knowledge about this environmental exposure and the Metabolic Syndrome (MS) can be especially useful for understanding its impact on human health. Materials and methods: descriptive, cross-sectional study. Sample of 115 individuals, over 18 years old, both genders. Erythrocyte Acetylcholinesterase (AChE) values between 2.6-4.1 IU/mL and butyrylcholinesterase (BChE) values between 1.5-3.5 IU/mL were considered within the normal range. The diagnosis of Metabolic Syndrome (MS) was established according to the Joint Interim Statement protocol. Results and Conclusion: 33% of the quilombola population had MS. In the group with MS, the average value of BChE was 3.60 IU/mL, and in the control group, 3.94 IU/mL. The Mann-Whitney U test was also performed to define the p-value, getting a result of 0.38. The AChE values were 6.92 IU/mL in the research group and 6.94 IU/mL in the control group, obtaining p-value by the Mann-Whitney U test of 0.974. Thus, there was a low association between AChE, BChE and MS.

## I. INTRODUCTION

The Metabolic Syndrome (MS) is based on a set of factors that predispose the individual to a greater cardiovascular and metabolic risk, associated with dyslipidemia, insulin resistance, changes in blood pressure levels and central obesity, therefore, representing an influencing factor for the greater cause of global morbidity

and mortality, cardiovascular events<sup>7</sup>.

In the world, it is estimated that 25% of the population has MS, while in Brazil, there is a prevalence of almost 40% of the entire population<sup>9</sup>. There is a high incidence because of the expanded screening and the vulnerability of part of the inhabitants, because of their socioeconomic and demographic situation, including low

education, precarious access to information, insufficient economic power to acquire better nutritional habits, and sedentary lifestyle.<sup>14</sup>

Despite the alarming public health problems represented by MS, its association with pesticides contacts and its impact on human health is not consolidated in the current literature. The consumption of pesticides in agricultural practice intensifies daily, with Brazil being the country with the largest consumer market in the world due to its agrarian system dependent on this usage. As an implication of this rampant practice, it is estimated that a Brazilian citizen consumes, on average, 5.2 kg of pesticides annually.<sup>15</sup> In addition, in the country, pesticide poisoning represents the second cause of non-communicable diseases in the population, which can increase the rate of general mortality<sup>16</sup>.

In Brazil, the main class of agrochemicals used in agriculture are insecticides, represented by three large groups: Organochlorines, Cholinesterase Inhibitors (Organophosphates, Carbamates) and Pyrethroids. The mechanism of action consists of the reversible and irreversible inhibition of the cholinesterase enzyme, depending on the type of pesticide, denouncing an environmental or occupational exposure<sup>3</sup>.

The introduction of the National Biodiesel Production Program (PNPB) and the Sustainable Palm Oil Production Program, driven by the state and federal incentive policy in the northeast mesoregion of the Pará state, from the 1980s onwards, introduced the monoculture of palm oil to the region, which uses agrochemicals for cultivation, with the replacement of traditional production activities by palm oil<sup>1</sup>.

In general, exposure to pesticides occurs in the environmental form in a chronic way, as the product is sprayed on the plantation. It reaches the population through wind, rain, and groundwater, distributing the agrochemical among individuals.<sup>2</sup> Thus, representing the need of constant monitoring of air, soil, water, food and biochemical level, which can be primarily detected and exposed.<sup>15</sup>

The quilombola community Médio Itacuruçá is located in the city of Abaetetuba in the state of Pará/Brazil and is located in the territory of Dendê monoculture implantation, where individuals are constantly exposed to Organophosphate pesticides.

According to this context, the objective of the present study was to evaluate adult individuals with Metabolic Syndrome and their respective dosages of Serum and Plasma Cholinesterases, which are used as bioindicators of environmental exposure to Organophosphate pesticides in the quilombola

communities of Médio Itacuruçá (Abaetetuba) in the state from Pará. Exalting the importance of studies that clarify the real correlation between MS and agrochemicals usage, what corroborates the development of actions aimed at human health.

## II. METHOD

The study was carried out in the Middle Itacuruçá Community, in the city of Abaetetuba at (01° 43' 04" S 48° 52' 58" W) located in the northeastern mesoregion of the state and belonging to the Cametá microregion. Because of its far from the main city location, the population suffers from lackage of optimized services, including medical and educational care<sup>17</sup>

The economic activity of this traditional population was based on the açaí berry management, which is used to the tiles and bricks production, the cultivation of brazilian arrowroot and other foods. With the introduction of palm oil cultivation, this pattern was replaced, and today its economic activity is based on family agriculture and oil palm monoculture, establishing a strong epidemiological link between occupational and environmental exposure in the region.<sup>4</sup>

The project was evaluated and approved by the Ethics Committee for Research with Human Beings (CEP) of the Instituto Evandro Chagas- Opinion 2,658,533 and CAAE: 80180617.1.0000.0019; preserving the essential and necessary terms for the good ethical conduct of research with human beings.

Adults both sexes, inhabitants of the quilombola community of Médio-Itacuruçá were included, in summary giving 115 cases. Those under 18 years of age, and those whose biological material was not collected or founded incomplete in the analysis were not included.

While describing the clinical and epidemiological profile of the population, the following parameters were used: age, gender, education (illiterate, incompleted/completed primary education, incompleted/completed secondary education and higher education), BMI (Body Mass Index-Kg/m<sup>2</sup>), supply of water (Public network, Amazon wells, river water, and others), water treatment (chlorination, filtration, boiling or none), occupational exposure to pesticides, knowledge about pesticides, as well as recognizing their possible harm to health; and presence of symptoms of acute intoxication to organophosphates.

The diagnosis of Metabolic Syndrome (MS) was established according to the Joint Interim Statement protocol, which emphasizes the presence of 3 of the following evaluation criteria, simultaneously. 1) increased

triglycerides  $\geq 150$  mg/dL or usage of drugs to treat hypertriglyceridemia; 2) increased glucose  $\geq 100$  mg/dL during fasting blood sugar test or usage of diabetes medication; 3) Decreased HDL  $< 40$  mg/dL (male) or  $< 50$  mg/dL (female) or usage of drugs to treat low HDL; 4) increased blood pressure to systolic values  $\geq 130$  mmHg and/or diastolic values  $\geq 85$  mmHg, or the usage of antihypertensive medication; 5) increased waist measurement  $> 90$  cm for men and  $> 80$  cm for women, using figures suggested for Latin America. The presence of MS defined the division of individuals to the research group, while its absence to the control group.

Exposure to organophosphates was evaluated by considering following laboratory measurement of blood cholinesterases: red blood cells-acetylcholinesterase (AChE) and butyrylcholinesterase (BChE), according to the Modified Ellman method, performed at the Chromatography Laboratory of the Environment Section (SEAMB) from the Evandro Chagas Institute. AChE values between 2.6 and 4.1 IU/mL and BChE values between 1.5 and 3.5 IU/mL were considered within the normal range.

The information obtained from the medical records of individuals with MS was organized in Excel spreadsheets, version 2010, and analyzed using the Epi info program, version 2007, for the preparation of descriptive statistics and a scientific product. The definitive p-value of variables was calculated using two different tests: Fisher's test and Mann-Whitney U test. All statistical tests considered probability (p-value) significant  $\leq 0.05$ . The 95 percent confidence interval was also obtained in variables.

### III. RESULTS AND DISCUSSION

While observing the epidemiological profile of the community of 115 quilombola adults from Médio Itacuruçá (TABLE 1), it was clarified that more than half (52.8%) of the population is male. Regarding education, it was observed that most adults in the community (49.5%) did not complete elementary school. This fact refers to the large vulnerability that is present in the population<sup>5</sup>.

Regarding knowledge about pesticides (TABLE 2), 67.5% of the population claims not to have it, however, 80.4% that they are conscious that its usage can cause damage to health. Similar situation was found by Riccò (2018) who affirmed that most participants knew that pesticides can lead to health damage connected to occupation (85.0%) and inhabitants who live nearby to the plantations (76.5%), that their usage can cause potentially acute lethal poisoning (90.0%) and chronic injury (71.2%). In addition, eleven of the 115 adults (9.5%) reported having symptoms of acute intoxication.

A set of metabolic alterations characterizes Metabolic Syndrome (MS), usually associated with dyslipidemia, insulin resistance and glucose intolerance, changes in blood pressure and central obesity identified by increased waist measurement<sup>7</sup>. As a matter of absence of specific criteria that are needed to determine MS in a quilombola population, the general criteria referring to the Latin American population were used in that research<sup>8</sup>.

Among the 115 adult patients living in the rural area in Abaetetuba (TABLE 3), 33% (38 individuals) presented Metabolic Syndrome, 23 of them were male and 15 were female. In analysis of the prevalence of MS in the Brazilian population, it was discovered that 38.4% of them are MS carriers<sup>9</sup>. In quilombola populations, the value represents 25.8% of adult individuals, in a study by Mussi (2019). In Do Monte (2019) the percentage with MS, obtained according to the criteria of the International Diabetes Federation, was 37.1%. Therefore, in the population of Médio-Itacuruçá community, average values corresponding to the studies were found.

It is important to emphasize that the literature points out divergences regarding the association of MS with sociodemographic, behavioral, environmental, biological factors, and comorbidities, making it difficult to adequately screen and cope with its main predisposing factors<sup>11</sup>. In addition, differences in the prevalence of MS in epidemiological and socially similar populations are explained by the differences between the criteria established for the diagnosis.<sup>8</sup>

The p-value defined by the Mann-Whitney U test (TABLE 3) was calculated, demonstrating a p-value lower than 0.001 in: weight, BMI, waist measurement, systolic and diastolic blood pressure, glucose, triglycerides, HDL. Therefore, very strong evidence was obtained against the null hypothesis in these variables.

The BMI of healthy individuals was 26.44 kg/m<sup>2</sup> (95%CI: 25.1-27.7), while those with MS were 32.54 kg/m<sup>2</sup> (95%CI: 30.2-34.8). Therefore, the research is in consensus to the literature regarding metabolic syndrome in the adult population, as described in Luo (2020) who affirm that adults with MS had an average BMI of 33.24kg/m<sup>2</sup>, while those without MS had an average of 26.42kg/m<sup>2</sup>.

Regarding the values found for Plasma Cholinesterase, the average value of 3.60 IU/mL (3.01-4.19) was obtained in the MS group, and 3.94 IU/mL in the control group (3.49-4.40). The Mann-Whitney U test was also performed to define the p-value, observing a result of 0.381, showing there is no sufficiency evidence that points to the connection between BChE levels and MS appearing. Erythrocyte cholinesterase levels were 6.92 IU/mL (5.49-8.36) in the research group and 6.94 IU/mL (6.21-7.66) in

the control group, obtaining p-value by the Mann-Whitney U test of 0.974, indicating, as in the BChE, low evidence against the null hypothesis, that is, the association between AChE and MS.

According to the results detailed above, in the present study, acetylcholinesterase values did not change with the presence of MS in quilombola patients, thus, the connection between these variables was not observed because there was no statistical significance. Such data are in disagreement with the most recent studies, such as the study carried out by Luo<sup>12</sup>(2020) who collected urine samples with organophosphate metabolites, which were positively associated with high chances of the prevalence of MS, as well as its individual factors - waist measurement, blood pressure, blood glucose, triglycerides and HDL - particularly in male gender.

#### IV. CONCLUSION

The population of the Médio Itacuruça is in a situation of social vulnerability mainly because of undereducated society. In addition, it was observed that a third are classified as having Metabolic Syndrome, reflecting the importance of health measures aimed at reducing this comorbidity, which is linked to cardiovascular morbidity and mortality.

Despite the continuous environmental exposure in which the quilombola community is inserted, the chemical dosage of biomarkers indicative of intoxication was not found to be significant. Regarding the association between MS and the usage of agrochemicals, there was no significant statistical evidence which affirmed the correlation between modification of acetylcholinesterase values with the presence of MS in quilombola inhabitants, which may be associated with the period of collecting the analyzed material and to the spraying period in the region.

The outcome of other larger, more significant population-based studies suggested metabolic dysfunctions caused by exposure to organophosphates and their impact on human health, in addition to the need for frequent monitoring of the population's contact with pesticides by the Environmental Health Surveillance Program.

#### REFERENCES

- [1] Nahum JS, Dos Santos CB. **Agricultura familiar e dendeicultura no município de Moju, na Amazônia paraense**. Cuadernos de Geografía: Revista Colombiana de Geografía, v. 27, p. 50-66; 2018.
- [2] Agência de Defesa Agropecuária do Estado do Pará (ADEPARÁ). Relatório de Atividades Técnicas. Belém, 2013.
- [3] World Health Organization (WHO). **Safer access to pesticides: experiences from community interventions**. Geneva, 2016.
- [4] Instituto Brasileiro de Geografia e Estatística. **Estimativas populacionais para os municípios e para as Unidades da Federação brasileiros; 2015**.
- [5] Mussi RFF, Petróski EL. **Síndrome metabólica e fatores associados em quilombolas baianos**. Brasil. Ciência & Saúde Coletiva, v. 24, p. 2481-2490, 2019.
- [6] Riccò M, Vezzosi L, Gualerzi G. **Health and safety of pesticide applicators in a high income agricultural setting: a knowledge, attitude, practice, and toxicity study from North-Eastern Italy**. Journal of preventive medicine and hygiene, v. 59, n. 3; 2018.
- [7] Wang J, Zhu Y, Cai L, Jing J, Chen Y, Mai J, et al. **Metabolic syndrome and its associated early-life factors in children and adolescents: a cross-sectional study in Guangzhou, China**. Public health nutrition, v. 19, n. 7, p. 1147-1154; 2016.
- [8] López-Jaramillo P, Sánchez RA, Diaz M, Cobos L, Bryce A, Parra-Carrillo JZ, et al. **Consenso latino-americano de hipertensão em pacientes com diabetes tipo 2 e síndrome metabólica**. Arquivos Brasileiros de Endocrinologia & Metabologia, v. 58, n. 3, p. 205-225, 2014.
- [9] Oliveira LVA, Santos BNSD, Machado IE, Malta DC, Velasquez-Melendez G, Frelisbino-Mendes MS. **Prevalência da Síndrome Metabólica e seus componentes na população adulta brasileira**. Ciência & Saúde Coletiva, v. 25, pag 4269-4280; 2020.
- [10] Do Monte IP, França SL, De Vasconcelos RNO, Dos Santos Vieira JR. **Comparação entre quatro diferentes critérios de diagnóstico de síndrome metabólica em indivíduos do Arquipélago do Marajó (Pará, Brasil)**. Revista Da Associação Brasileira De Nutrição-RASBRAN, v. 10, n. 1, p. 96-102; 2019.
- [11] Luisi C, Figueiredo FWDS, Sousa LVDA, Quaresma FRP, Maciel EDS, Adami F, et al. **Prevalence of and Factors Associated with Metabolic Syndrome in Afro-Descendant Communities in a Situation of Vulnerability in Northern Brazil: A Cross-Sectional Study**. Metabolic syndrome and related disorders, v. 17, n. 4, p. 204- 209, 2019.
- [12] Luo K, Zhang R, Aimuzi R, Wang Y, Nian M, Zhang J. **Exposure to organophosphate esters and metabolic syndrome in adults**. Environment International, v. 143; 2020.



- [13] Lira Neto JC et al. **Prevalence of Metabolic Syndrome in individuals with Type 2 Diabetes Mellitus**. Revista brasileira de enfermagem, v. 70, n. 2, p. 265-270, 2017. ISSN 00347167.
- [14] Ramires EKNM, Menezes RCE, Longo-Silva G, Santos TG, Marinho PM, Silveira JAC. **Prevalência e Fatores Associados com a Síndrome Metabólica na População Adulta Brasileira: Pesquisa Nacional de Saúde - 2013**. *Arq Bras Cardiol* 2018; 110(5):455-466.
- [15] Carneiro FF, Rigotto RM, Augusto LGS, Búrigo AC. **Dossiê ABRASCO: um alerta sobre os impactos dos agrotóxicos na saúde**. Rio de Janeiro/São Paulo: Expressão Popular; 2015.
- [16] BRASIL, MINISTÉRIO DA SAÚDE. **Proposta Estadual de Vigilância em Saúde a Populações Expostas a Agrotóxicos**. Setembro 2013. Disponível em . Acesso em 30 de jan. 2019.
- [17] Da Costa Cardoso MB; Hage SM. **No remanso do contexto ribeirinho quilombola da Amazônia**. Revista Margens Interdisciplinar, v. 8, n. 10, p. 109-126, 2014.

## ANEXOS

*Table 01 – Clinical-epidemiological data of a sample of 115 individuals from the community of Médio Itacuruçá in the municipality of Abaetetuba, Pará, Brazil.*

| <b>Variables</b>                |                                           |
|---------------------------------|-------------------------------------------|
| <b>Age (Average [CI 95%])</b>   | <b>46,16 [42,9-49,4]</b>                  |
| <b>Gender (%)</b>               |                                           |
| Feminine                        | <b>68 (47,2)</b>                          |
| Male                            | <b>76 (52,8)</b>                          |
| <b>Education level (%)</b>      |                                           |
| Illiterate                      | <b>14 (12,2)</b>                          |
| Incompleted Primary Education   | <b>57 (49,5)</b>                          |
| Completed Primary Education     | <b>05 (4,3)</b>                           |
| Incompleted Secondary Education | <b>11 (9,5)</b>                           |
| Completed Secondary Education   | <b>27 (23,5)</b>                          |
| Higher Education                | <b>0 (0)</b>                              |
| <b>Weight (Average [IC95%])</b> | <b>72,9 kg [69,4-76,3]</b>                |
| <b>Height (Average [IC95%])</b> | <b>1,60 m [1,58-1,61]</b>                 |
| <b>BMI (Average [IC95%])</b>    | <b>28,45 kg/m<sup>2</sup> [27,2-29,6]</b> |

**BMI – Body Mass Index.**

**Source: Author's collection.**

Table 02 - Data related to exposure to pesticides in a sample of 115 individuals from the community of Médio Itacuruçá in the municipality of Abaetetuba, Pará, Brazil.

| Variables                                                                    |            |
|------------------------------------------------------------------------------|------------|
| <b>Knowledge about pesticides (%)</b>                                        |            |
| Yes                                                                          | 37 (32,5)  |
| No                                                                           | 77 (67,5)  |
| <b>Recognizes the possibility of pesticides causing damage to health (%)</b> |            |
| Yes                                                                          | 78 (80,4)  |
| No                                                                           | 19 (19,6)  |
| <b>Occupational Exposure to Pesticides (%)</b>                               |            |
| Yes                                                                          | 12 (10,5)  |
| No                                                                           | 102 (89,5) |
| <b>Symptoms of acute intoxication (%)</b>                                    |            |
| Yes                                                                          | 11 (9,5)   |
| No                                                                           | 104 (90,5) |

Source: Author's collection.

Table 03 - Statistical analysis between groups with metabolic syndrome (Case) and without metabolic syndrome (Control) for the sample population of rural residents in the municipality of Abaetetuba, Pará, Brazil.

| Variableness*             | Controle<br>(n = 77) | Caso<br>(n = 38)   | p                   |
|---------------------------|----------------------|--------------------|---------------------|
| Age (CI95%)               | 43,0 (39,2-46,8)     | 52,88 (47,0-58,7)  | <0,001 <sup>b</sup> |
| <b>Gender (%)</b>         |                      |                    |                     |
| Feminine                  | 48 (62,3%)           | 23 (60,5%)         | 1,00 <sup>a</sup>   |
| Male                      | 29 (37,6%)           | 15 (39,5%)         |                     |
| Weight (CI95%)            | 67,47 (63,9-71,0)    | 84,4 (77,8-91,0)   | <0,001 <sup>b</sup> |
| Height (CI95%)            | 1,59 (1,57-1,61)     | 1,61 (1,57-1,65)   | 0,093 <sup>b</sup>  |
| BMI (CI95%)               | 26,44 (25,1-27,7)    | 32,54 (30,2-34,8)  | <0,001 <sup>b</sup> |
| Waist measurement (IC95%) | 88,4 (84,3-91,6)     | 103,9 (98,7-109,1) | <0,001 <sup>b</sup> |

Table 03 - Statistical analysis between groups with metabolic syndrome (Case) and without metabolic syndrome (Control) for the sample population of rural residents in the municipality of Abaetetuba, Pará, Brazil.

| Variables*                          | Controle<br>(n = 77) | Caso<br>(n = 38)    | p                   |
|-------------------------------------|----------------------|---------------------|---------------------|
| Age (CI95%)                         | 43,0 (39,2-46,8)     | 52,88 (47,0-58,7)   | <0,001 <sup>b</sup> |
| Gender (%)                          |                      |                     |                     |
| Systolic Blood Pressure (IC95%)     | 124,65 (121,2-128,0) | 137,0 (131,3-142,6) | <0,001 <sup>b</sup> |
| Diastolic Blood Pressure(IC95%)     | 80,0 (77,0-82,9)     | 85,7 (82,3-89,2)    | <0,001 <sup>b</sup> |
| Glucose [mg/dL] (IC95%)             | 79,0 (75,0-83,0)     | 99,9 (86,1-113,7)   | <0,001 <sup>b</sup> |
| Triglycerides [mg/dL] (IC95%)       | 99,3 (89,1-107,5)    | 201,2 (171,5-230,8) | <0,001 <sup>b</sup> |
| LDL colesterol [mg/dL] (IC95%)      | 122,3 (114,5-130,0)  | 123,3 (112,5-134,6) | 0,141 <sup>b</sup>  |
| HDL colesterol [mg/dL] (IC95%)      | 45,7 (43,3-48,0)     | 32,4 (29,1-35,8)    | <0,001 <sup>b</sup> |
| Colinesterase Plasmática (IC95%)    | 3,94 (3,49-4,40)     | 3,60 (3,01-4,19)    | 0,381 <sup>b</sup>  |
| Colinesterase Eritrocitária (IC95%) | 6,94 (6,21-7,66)     | 6,92 (5,49-8,36)    | 0,974 <sup>b</sup>  |

\*: Quantitative variables are represented by the sample mean and 95% confidence interval (95%CI) and qualitative variables are represented by the absolute and relative frequency for each category; AChE – Acetylcholinesterase; a: p-value defined by Fisher's exact test; b: p-value defined by the Mann-Whitney U test.

Source: Author's collection.

## Territorial Identity: Challenges and perspectives in the quilombola communities of Gurugi and Mituaçu

## Identidade Territorial: Desafios e perspectivas nas comunidades quilombolas do Gurugi e Mituaçu

Marcley da Luz Marques<sup>1</sup>, Ângelo Giuseppe Chaves Alves<sup>2</sup>, Júlia Figueredo Benzaquen<sup>3</sup>,  
Horasa Maria Lima da Silva Andrade<sup>4</sup>, Wagner Lins Lira<sup>5</sup>

<sup>1</sup>Mestra em Sistemas Agroindustriais. Doutoranda em Agroecologia e Desenvolvimento Territorial. UFRPE. E-mail: marcleymarques@gmail.com

<sup>2</sup>Doutor em Ecologia e Recursos Naturais. Professor Permanente do Programa de Pós-Graduação em Agroecologia e Desenvolvimento Territorial. UFRPE. E-mail: angelo.alves@ufrpe.br

<sup>3</sup>Doutora em Pós-colonialismos e Cidadania Global pela Universidade de Coimbra. Professora colaboradora do Programa de Pós-Graduação em Agroecologia e Desenvolvimento Territorial. UFRPE. E-mail: julia.benzaquen@ufrpe.br

<sup>4</sup>Doutora em Etnobiologia e Conservação da Natureza. Professora Permanente do Programa de Pós-Graduação em Agroecologia e Desenvolvimento Territorial. UFRPE. E-mail: horasaa@gmail.com

<sup>5</sup>Doutor em Antropologia. Professor Permanente do Programa de Pós-Graduação em Agroecologia e Desenvolvimento Territorial. UFRPE. E-mail: wagnerip79@gmail.com

Received: 16 Aug 2022,

Received in revised form: 10 Sep 2022,

Accepted: 14 Sep 2022,

Available online: 19 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Ethnic Territories. Traditional People. Quilombola Communities. South coast of Paraíba*

**.Palavras-chave**— *Territórios Étnicos. Povos Tradicionais. Comunidades Quilombola. Litoral Sul da Paraíba.*

**Abstract**— *The research presents a study involving some challenges and conflicts inherent to the quilombola territories of the South Coast of Paraíba. In this sense, we observe, not only here, but throughout the National Territory, the emergence of inequalities, the lack of social assistance, environmental problems and the sluggishness around the processes of recognition and titling of the remaining quilombo territories. In this way, we seek to dialogue with the theoretical contributions - available on the platforms: Periódicos Capes and Google Scholar - about the territorial identity of the quilombola communities of Gurugi and Mituaçu, located in the South Coast of Paraíba - municipality of Conde - as well as the expectations aimed at the ethnic strengthening of these communities. According to the material consulted - three articles published in scientific journals-, we found that the quilombolas in question develop strategies so that their voices are heard and their rights guaranteed, above all, mobilizing for a broader and collective understanding of their quilombola identities. , since such territories have already gone through the due processes of recognition by the State, however, they still need to establish themselves ethnically as quilombola peoples.*

**Resumo**— *A pesquisa apresenta um estudo envolvendo alguns desafios e conflitos inerentes aos territórios quilombolas do Litoral Sul da Paraíba. Neste sentido, observamos, não apenas aqui, mas em todo o Território Nacional, a emergência de desigualdades, a falta de assistência social,*

*problemas ambientais e a morosidade em torno dos processos de reconhecimento e titulação dos territórios remanescentes de quilombo. Dessa forma, buscamos dialogar com os aportes teóricos - disponíveis nas plataformas: Periódicos Capes e no Google Acadêmico - acerca da identidade territorial das comunidades quilombolas do Gurugi e Mituaçu, localizados no Litoral Sul da Paraíba - município do Conde - como também as expectativas voltadas para o fortalecimento étnico destas comunidades. De acordo com o material consultado - três artigos publicados em revistas científicas- , detectamos que os quilombolas em questão desenvolvem estratégias para que as suas vozes sejam ouvidas e os seus direitos garantidos, sobretudo, mobilizando-se para compreensão ampliada e coletiva de suas identidades quilombolas, uma vez que tais territórios já passaram pelos devidos processos de reconhecimento por parte do Estado, todavia ainda precisam se firmar etnicamente enquanto povos quilombolas.*

## I. INTRODUÇÃO

Territórios étnicos conhecidos no Brasil como quilombos foram categorizados historicamente enquanto lugares de proteção, resistência, enfrentamento e acolhimento dos povos negros, que fugiram dos processos de escravização, sobretudo, espaços de expressão das lutas contra as opressões (Arruti, 2008; Leite, 2008). Com o tempo, tornaram-se territórios de representação e pertencimento de parcela significativa do povo negro, sendo necessário reafirmar a importância dos territórios como parte de suas histórias, uma vez que seus ancestrais reproduziram os ensinamentos e deram significado aos lugares escolhidos para vivência e resistência (Bispo, 2015).

Em contrapartida, a Constituição Federal de 1988, define o lugar como 'territórios remanescentes de quilombo', ou seja, não leva em consideração o sentimento de pertencimento, por isso é um conceito em disputa, porque segundo Bispo (2015), o território é considerado constitucionalmente como propriedade e não como lugar de relações comunitárias.

Leite (2000) afirma que a posse do território quilombola é um direito, pois o lugar exerce uma relação com uma herança histórica, na perspectiva da reciprocidade, em que as pessoas dialogam com as memórias e estabelecem um modo de vida coletivo. Porém, a burocracia estatal - principalmente nos tempos atuais - vem dificultando os processos de reconhecimento, demarcação e titulação dos territórios quilombolas. Essa morosidade é um dos grandes problemas para as comunidades tradicionais (Arruti, 2008).

Sendo assim, nos perguntamos quais seriam os problemas causados pela falta da titulação dos territórios quilombolas de Gurugi e Mituaçu e os direcionamentos frente aos problemas? A partir dessa indagação, a nossa

pesquisa busca refletir sobre os aportes teóricos presentes em produções científicas encontradas nas plataformas: Periódicos Capes e Google Acadêmico, visando entender como as comunidades em questão vêm enfrentando os desafios na perspectiva da coletividade.

Esses territórios quilombolas estão localizados na zona rural do município do Conde, na Mesorregião da Mata Paraibana. As comunidades ficam próximas ao Rio Jacoca, na margem que as conectam com Paripe e com o Gurugi; e por outro, pelo Rio Gramame, na fronteira entre João Pessoa e o Conde.

Sendo assim, para prosseguimento de nosso estudo, percorremos interdisciplinarmente nos campos científicos do Direito, da Sociologia, da História, da Geografia e da Antropologia, uma vez o acesso às obras consultadas, que tratam pontualmente da ausência de titulação dos territórios étnicos e outras questões que assolam as comunidades de Gurugi e Mituaçu, seja devido à falta de assistência social, trabalho e, principalmente, os problemas ambientais, ao passo que o setor industrial vem exercendo práticas de degradação, emitindo poluentes no Rio Gramame, bem como o descarte de entulho e o perene desmatamento da Mata Atlântica.

## II. IDENTIDADES CULTURAIS E RELAÇÕES TERRITORIAIS

O conceito de cultura discutido pela sociedade eurocêntrica tem um direcionamento hegemônico, buscando estabelecer um padrão único para os demais povos (Laraia, 2001). Quando agrupamentos humanos não apresentam características semelhantes aos da perspectiva da "humanidade ocidental", os conflitos e as violências são emergentes (Laraia, 2001). Seguindo essa lógica, a ordem ocidental estabelece a predisposição de fazer de sua cultura

a ideal frente à mediação de comportamentos, ideias, atitudes, crenças e concepções sob o viés do etnocentrismo, de modo que:

A nossa herança cultural, desenvolvida através de inúmeras gerações, sempre nos condicionou a reagir depreciativamente em relação ao comportamento daqueles que agem fora dos padrões aceitos pela maioria da comunidade (Laraia, 2001, p.67).

Inicialmente, de forma errônea, sob o viés determinista biológico e geográfico, entretanto, os cientistas sociais, primordialmente os antropólogos, trouxeram abordagens diferentes, pois compreendiam que nem a biologia e nem a geografia seriam condições definidoras para demarcação e compreensão das culturas humanas, tidas como complexos sistemas de significado inerentes à vivência social (Geertz, 1989).

Nestes termos, não se pode afirmar que no Brasil - tampouco em nenhuma outra parte do mundo (Silva et al., 2000) - possa existir apenas uma única cultura, uma vez que há diferentes povos, logo cada comunidade tem uma identidade cultural, que a difere das outras.

A sociedade ocidental tende a desconsiderar as relações culturais que fogem à compreensão etnocêntrica, posto que não compreendem as culturas tradicionais, logo as diversidades não são reconhecidas, nem respeitadas (Laraia, 2001). Para Toledo e Barrera-Bassols (2015), o entendimento de cultura está atrelado à diversidade, nas relações que vamos construindo com os grupos, os lugares e a natureza.

Se o *Homo sapiens* conseguiu permanecer, colonizando e expandindo a sua presença na Terra, é porque foi capaz de reconhecer e aproveitar os elementos e processos do mundo natural, um universo que encerra uma característica essencial: a diversidade. Essa habilidade se deve à manutenção de uma memória individual e coletiva, que conseguiu se estender pelas diferentes configurações societárias que formaram a espécie humana. Esse traço evolutivamente vantajoso da espécie humana tem sido limitado, ignorado, esquecido ou tacitamente negado com o advento da Modernidade, que constituiu uma era cada vez mais orientada pela vida instantânea e pela perda da capacidade de recordar (Toledo & Barrera-Bassols, 2015, p. 27-28).

Dessa forma, de acordo com Toledo e Barrera-Bassols (2015):

Assim como as populações humanas, as linguagens se diversificaram e evoluíram com o passar do tempo, de forma que suas semelhanças e diferenças também evidenciam as relações que

se estabeleceram entre os diversos povos (Toledo & Barrera-Bassols, 2015, p.32).

Destarte, os aspectos sociais são fundamentais para saber diferenciar uma cultura, visto que, não só os elementos naturais, mas as relações, a incorporação de costumes, valores e ideias são elementos que formulam uma identidade cultural. Nesse ínterim, a definição de cultura está relacionada a percepção, a ideologia de uma comunidade na compreensão de mundo, não é necessariamente sobre ela, mas como ela vê o outro, porque, quando se fala na compreensão de cultura como vê o mundo, é saber respeitar as diversas culturas, compreender que não são iguais, inferiores a sua, mas uma maneira diferente de compreensão de mundo (Geertz, 1997).

Erroneamente, a perspectiva de considerar a cultura ocidental como modelo tem caráter negacionista, justamente, por desmerecer as histórias, as ancestralidades e os saberes-fazer dos povos tradicionais (Bispo, 2015).

Conflitos de imposição cultural também costumam ocorrer dentro de uma mesma sociedade, mesmo porque, a visão colonialista impera, principalmente, na insistência de definição de padrões e valores sociais (Walsh, 2009). É imprescindível a compreensão de que as culturas se complementam nas suas diversidades, ao passo que enriquecem o discurso político-social e, conseqüentemente, promovem ações de interação e dialogicidade para atender as diversas especificidades (Walsh, 2009). Dessa forma, o exercício da interculturalidade estabelece relações mais inclusivas e dialógicas, posto que:

Como conceito e prática, processo e projeto, a interculturalidade significa – em sua forma mais geral – o contato e o intercâmbio entre culturas em termos equitativos; em termos iguais. Esse contato e troca não deve ser pensado simplesmente em termos étnicos, mas a partir do relacionamento permanente, comunicação e aprendizado entre pessoas, grupos, diferentes saberes, valores, tradições, lógicas e racionalidades, visando gerar, construir e fomentar o respeito mútuo e o pleno desenvolvimento das capacidades de indivíduos e grupos, acima de suas diferenças culturais e sociais. Em si, a interculturalidade tenta romper com a história hegemônica de uma cultura dominante e de outras subordinadas e, assim, forma, reforçar identidades tradicionalmente excluídas para construir, tanto na vida cotidiana quanto nas instituições sociais, uma coexistência

de respeito e legitimidade entre todos os grupos da sociedade (Walsh, 2009, p.41, tradução nossa).

A identidade é, portanto, uma questão de pertencimento, ou seja, fenômeno emergente quando o Ser Humano é educado a se identificar com a cultura e as tradições de um determinado grupo social, aprendendo, desde muito cedo, os códigos, símbolos, crenças, ideias e formas de se relacionar consigo, com os outros e com o mundo, de modo a participar dos processos sociais (Haesbaert, 2004).

Os territórios étnicos, por seu turno, estão intrinsecamente associados às culturas e às identidades, pois, de acordo com Marques (2015), traduzem uma construção histórica, visto que a ancestralidade, ou seja, a origem carregada de uma simbologia de pertencimento é fundamental para as culturas.

(...) a dimensão conceitual de território: nela se incluem não só a terra diretamente ocupada no momento específico da titulação, mas todos os espaços que fazem parte de seus usos, costumes e tradições e/ou que possuem os recursos ambientais necessários à sua manutenção e às reminiscências históricas que permitam perpetuar sua memória (Arruti, 2008, p. 23).

Haesbaert (2004) ressalta que não há como dissociar os territórios de seus povos, porque, ali foi e é onde os agrupamentos mantêm relações com a natureza e continuidade da sua expressividade. Então, compreendemos os conceitos de território, cultura e identidade em sua convergência frente à organização cultural, política e social dos povos tradicionais.

Para Brito (2015), a comunidade compreende o território como uma extensão da vida, vai além de uma marcação de fronteiras, mas, por outro lado, para o Estado-nação são justamente as fronteiras que determinam o território de um povo, dando visibilidade às relações de poder. Nesse sentido, o Estado brasileiro faz uso de um documento jurídico para tal reconhecimento, como se fosse o detentor de uma realidade e ainda se coloca na posição de não reconhecer e/ou relocar, ou seja, desterritorializar comunidades, sem levar em consideração suas histórias e vínculos com os territórios (Bispo, 2015).

Portanto, o debate sobre o território no Brasil aponta para o embate entre o lugar – dimensão local – e o global – dimensões regional e mundial. E este embate se dá de forma contraditória: ora o território local favorece as pessoas que vivem nele, seu cotidiano, ora o território se sujeita aos ordenamentos que vêm de fora (Schneider & Tartaruga, 2004, p.103)

Quando empreendemos estudos sobre comunidades tradicionais, os territórios representam marcos importantes para conhecermos as culturas e as identidades, mesmo porque os lugares influenciam nos estilos de vida, nas crenças, nas organizações sociais, enfim, não há como compreendermos as dinâmicas dos povos tradicionais sem observarmos as conexões nutridas entre os territórios étnicos e seus habitantes (Schneider & Tartaruga, 2004).

As experiências tecidas nesses lugares não são deslocadas ou dissociadas das estruturas sociais, pois são nesses espaços que as relações são efetivadas no cotidiano. De acordo com Schneider e Tartaruga (2004, v. 23, p. 106): “o lugar encerra, dessa forma, o espaço da vivência e da convivência, e possui como ponto de referência o cotidiano – imprescindível para a compreensão da sociedade”.

Face aos argumentos apresentados, temos em vista que a identidade é fundamental para compreendermos as relações dos povos tradicionais com o Estado e a sociedade, estes últimos devem promover o respeito à diversidade enquanto fator determinante para o exercício da cidadania em prol da dignidade humana (Marques, 2015).

Nesse contexto, a compreensão mais ampla pode ser descrita também na biointeração, conforme indicado por Bispo (2005), visto que, as comunidades tradicionais estabelecem uma relação com o território, por meio do cultivo, compartilhamento e distribuição dos trabalhos, com isso, reverberando que o lugar não os pertencem, mas os povos que pertencem ao território, sendo assim, reforça a luta pela estrutura circular, coletiva e plural.

Em síntese, essa discussão precisa ser expandida para que o Estado e a sociedade majoritária entendam os anseios dos grupos minoritários. Segundo Bispo (2015), faz-se essencial compreender o território enquanto um ser personificado, que representa a cultura de cada comunidade tradicional, agregando valor à vida humana.

### III. METODOLOGIA

No presente estudo adotamos uma metodologia de abordagem qualitativa, que, conforme Goldenberg (2004, p. 50) indica: “a representatividade dos dados na pesquisa (...) está relacionada à sua capacidade de possibilitar a compreensão do significado e a ‘descrição densa’ dos fenômenos estudados em seus contextos e não à sua expressividade numérica”. Nesse sentido, a pesquisa trata-se de um estudo que busca compreender a dinâmica dos territórios étnicos e as pautas inerentes aos povos quilombolas de Gurugi e Mituaçu.

A partir dessa configuração, realizamos uma pesquisa bibliográfica inspirada no “método descritivo”, justamente, por entendermos que ao realizarmos tal descrição, contribuimos para compreensão sobre a relevância do território frente ao fortalecimento das culturas e das identidades quilombolas locais.

Dessa forma, fizemos um levantamento bibliográfico, baseando-se em referenciais teóricos e publicações científicas elencadas nas plataformas Periódicos Capes e Google Acadêmico- em um recorte temporal abarcando os anos de 2010 a 2022- utilizando os seguintes descritores: “território quilombola” e “comunidade quilombola do Conde”. Neste percurso, encontramos, ao todo, 30 trabalhos que tratam das comunidades remanescentes do quilombo situadas no município do Conde-PB.

Como critério de escolha, estabelecemos duas etapas. A primeira foi a seleção de apenas textos publicados em revistas, sendo sete textos com esse perfil. Para a segunda etapa, delimitou a leitura dos textos para sabermos se o estudo contemplava as questões de desafios, dificuldades nos territórios, sobretudo, como as comunidades quilombolas enfrentam coletivamente os problemas encontrados. Por este ângulo, apenas três textos enquadraram-se nos critérios de seleção, sendo os seguintes:

1. “Território de vida e de trabalho: Luta pela terra na Comunidade Quilombola de Mituaçu – PB”. Artigo publicado no periódico: Brazilian Journal of Development, v.6, n.1, no ano de 2020, por Débora Louise Filgueira, trazendo como objetivo geral o de investigar o processo de construção da territorialidade étnica e da luta pela regularização fundiária do território da Comunidade Quilombola de Mituaçu – PB.

2. “QUANDO A DESTERRITORIALIZAÇÃO VEM DO RIO: A POLUIÇÃO DO RIO GRAMAME NA COMUNIDADE QUILOMBOLA DE MITUAÇU, PB”. Artigo publicado na Vivência Revista de Antropologia, v.1, n.53, no ano de 2019, por Patrícia dos Santos Pinheiro e Aline Maria Pinto da Paixão, tendo o objetivo geral de analisar as ressignificações e adaptações do território, diante do cenário de poluição do Rio Gramame.

3. “DOS TERRITÓRIOS DE REFORMA AGRÁRIA À TERRITORIALIZAÇÃO QUILOMBOLA: O CASO DA COMUNIDADE NEGRA DE GURUGI, PARAÍBA”. Artigo publicado na Revista Pegada, v.11, n.2, no ano de 2010, por Karolina dos Santos Monteiro e Maria Franco Garcia, tendo por objetivo geral o de analisar o processo que deu origem ao reconhecimento da Comunidade Negra de Gurugi como terra quilombola.

Para tratamento dos dados, optamos por uma análise interpretativa - tal qual aludida por Moita Lopes (1994) e Walsham (1993) - com a finalidade de compreendermos a dinâmica dos territórios quilombolas em questão, justamente, com o propósito de entendermos como os mesmos enfrentam as dificuldades para resistir aos problemas causados pelas ações externas, que afetam negativamente a vida das comunidades.

#### IV. RESULTADOS E DISCUSSÃO

Para melhor compreensão, apresentamos o Quadro 01, trazendo uma síntese das informações metodológicas trazidas pelas três pesquisas elencadas.

*Quadro 1- Síntese dos procedimentos metodológicos desenvolvidos pelos estudos analisados*

| Nº | Participantes            | Território | Metodologia                                                                                                    |
|----|--------------------------|------------|----------------------------------------------------------------------------------------------------------------|
| 1  | Mora-dores do território | Mituaçu    | Abordagem qualitativa, cultural e humanística baseada na revisão bibliográfica, documental e pesquisa de campo |
| 2  | Mora-dores do território | Mituaçu    | Trata-se de uma pesquisa bibliográfica e de campo                                                              |
| 3  | Não especificado         | Gurugi     | Bibliográfica, documental e de campo                                                                           |

Fonte: elaborado pelos autores a partir dos dados da pesquisa.

As três produções, diga-se de passagem, elaboradas por autoras e coautoras, se complementam, mesmo porque discorrem sobre os povos quilombolas do Litoral Sul da Paraíba. Quanto à história de formação dos territórios de Mituaçu e de Gurugi encontramos relações em comum às duas comunidades, uma vez que, de acordo com Filgueira (2020, p. 397): “a chegada de três irmãs escravizadas conhecidas por Ii, Kaká e Maria Felipe e Maria Croata (ou Toquarta) que possuíam, segundo os moradores, muito dinheiro e ouro”.

A partir desse pressuposto, a autora Filgueira (2020) afirma que cada irmã foi para um lugar e que mais tarde, tais lugares tornaram-se os territórios de Mituaçu, Gurugi e Ipiranga. Destaca-se que o território de Mituaçu



foi formado dentro das terras indígenas<sup>1</sup> pertencentes aos Tabajara, próximo ao Rio Gramame. Ela ressalta a relação de proximidade entre indígenas e quilombolas, inclusive, o próprio nome da comunidade Mituaçu significa “ave grande” na língua indígena.

Monteiro e Garcia (2010), por sua vez, desenvolveram sua pesquisa no território de Gurugi, que, por sua vez, também pertencia às terras indígenas Tabajara. Contudo, devido aos processos de despovoamento e desterritorialização, os Tabajara foram expulsos da localidade (Monteiro & Garcia, 2010). Neste contexto, também estavam os povos negros que, como resistência, formaram pequenos lotes, todavia o Estado tenha ficado com uma boa concentração das terras que foram arrendadas e vendidas.

As autoras das três pesquisas elencadas desenvolveram trabalhos de campo, discutindo os diversos problemas encontrados nas comunidades de Gurugi e Mituaçu, principalmente, abordando as dificuldades diante da obtenção dos documentos voltados à titulação dos territórios étnicos, de modo que o Quadro 02 busca sintetizar algumas das informações obtidas durante suas pesquisas de campo.

Quadro 2- Principais resultados dos estudos analisados

| Nº | Temáticas abordadas na pesquisa                                                                          | Desafios no território                                                                                                                            | Perspectivas no território                                                                                          |
|----|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| 1  | Processos de embranqueamento da população, racismo ambiental, perspectiva decolonial e direitos humanos. | Poluição das águas do Rio Gramame pelas indústrias e a morosidade para titulação do território, causado também por titulação individual de lotes. | Políticas públicas para assegurar os direitos dos quilombolas, assim como a demarcação/regularização do território. |
| 2  | Racismo ambiental e desterritorialização.                                                                | Poluição das águas do Rio Gramame pelas indústrias.                                                                                               | Mitigação das fontes de poluição.                                                                                   |
| 3  | Termo                                                                                                    | Preocupação                                                                                                                                       | Direitos                                                                                                            |

<sup>1</sup> De acordo com o Glossário Etimológico Tupi/Guarani, escrito por Clerot (2010, p. 450-451), Tabajara significa: “Nação Indígena que habitava no litoral, no Estado da Paraíba até os limites meridionais da Ilha de Itamaracá no Estado de Pernambuco. Taba-yára – os aldeões, os donos das aldeias; de Taba– aldeia, + yára – senhor, aquele que domina. Outros interpretam tobai-guára – o fronteiro oposto; o indivíduo fronteiro”.

|  |                                                                       |                                                                                                                       |                                     |
|--|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------|
|  | remanescente de quilombo; e conceitos de território/territorialidade. | com a preservação do território, falta de programas sociais, falta de moradia e novo processo de disputa territorial. | territoriais a partir da titulação. |
|--|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------|

Fonte: elaborado pelos autores a partir dos dados da pesquisa.

Diante das informações trazidas pelo Quadro 02, identificamos que as pesquisas trazem uma abordagem interdisciplinar nos campos do Direito, da Sociologia, da História, da Geografia e da Antropologia, pois buscam explicar os desafios destas comunidades quilombolas, seja em defesa dos seus territórios a partir do reconhecimento destes diante da titulação, seja por meio da conservação ambiental.

As autoras Filgueira (2020), Pinheiro e Paixão (2019), por seu turno, explicam que os problemas ambientais, tais quais a poluição do Rio Gramame e o desmatamento da Mata Atlântica na comunidade de Mituaçu são alicerçados pelo racismo ambiental. Ou seja, encontramos de forma acentuada o descaso, a injustiça com a natureza por meio de práticas de degradação, desmatamento e poluição.

Ainda, nesse contexto, verifica-se a desigualdade social, quanto à falta de renda, moradia precária, dificuldade de acesso aos sistemas de saúde e educação. De acordo com as autoras, o racismo ambiental faz-se bastante presente na vida destas comunidades, primordialmente, quando há o descarte de resíduos e rejeitos nas proximidades dos territórios étnicos, uma vez que tais atitudes revelam:

(...) o desprezo pelo espaço comum e pelo meio ambiente se confunde com o desprezo pelas pessoas e comunidades. Os vazamentos e acidentes na indústria petrolífera e química, a morte de rios, lagos e baías, as doenças e mortes causadas pelo uso de agrotóxicos e outros poluentes, a expulsão das comunidades tradicionais pela destruição dos seus locais de vida e trabalho, tudo isso, e muito mais, configura uma situação constante de injustiça socioambiental no Brasil (Herculano, 2008, p. 5).

Nessa perspectiva, Filgueira (2020) discute o preconceito racial como prática propulsora da sociedade majoritária, indo na contramão - e ferindo severamente - os

preceitos da Constituição Federal (1988), que prescreve a igualdade de direitos, sobretudo, combatendo juridicamente toda e qualquer forma de descriminalização e preconceito diante do enfrentamento das práticas que afetam a condição e a dignidade humanas.

Sabemos que, estruturalmente, a sociedade majoritária ocidental - especialmente a sociedade brasileira (Bispo, 2015) - se organiza a partir do etnocentrismo, tendo por base o eurocentrismo, de modo que estimula diversas formas de opressão e violências, tendo como base perspectivas racistas, dentre as quais a lógica do racismo ambiental, mesmo porque excluem historicamente do processo civilizador os agrupamentos étnicos, classificando-os enquanto pertencentes ao nível inferior da humanidade, quando comparados à sociedade majoritária (Herculano, 2008). Consequentemente, essa mesma sociedade tende a negligenciar os territórios étnicos lançados à própria sorte e permanecendo sem o devido acesso aos direitos básicos promotores de cidadania e dignidade.

Nestes termos, a sociedade brasileira buscou, a ainda busca, nos ideais do embranqueamento e da miscigenação formas de negar a vida e a etnicidade dos povos negros, tal qual demonstrado por Filgueira (2020), posto que tais ideais excludentes e formadores da identidade nacional: “tinham como ponto de partida o fato de que, dada a realidade do processo de miscigenação na história brasileira, os descendentes de negros passariam a ficar cada vez mais brancos através das gerações” (Filgueira, 2020, p. 388).

Lembramos que embranqueamento e miscigenação - ancorados na lógica eugenista (Munanga, 2008) - foram e continuam sendo formas violentas da sociedade nacional de propagar a visão da homogeneização dos povos, pois busca enquadrar os grupos étnicos em um padrão de cultura e identidade que lhes é estranho, portanto, tais movimentos excludentes tendem ao enfraquecimento e desestabilização das comunidades negras no intuito de apagar suas histórias e memórias diante do não reconhecimento da diversidade (Munanga, 2008).

Como forma de resistência, detectamos as potencialidades das perspectivas decoloniais - e por que não dizer contracoloniais? (Pinto & Mignolo, 2015) -, quando procuram desarticular as visões colonialistas que subestimam e marginalizam os grupos étnicos. Por este ângulo a decolonialidade:

(...) abrange não apenas os movimentos de transformação das ex-colônias europeias em estados-nações independentes - descolonização -, como também os esforços de desligamento ou

desengajamento subjetivo, epistêmico, econômico e político em face do projeto de dominação ocidental, esforços que antecederam tais movimentos de descolonização (Pinto & Mignolo, 2015, p.384).

Dessa forma, é preciso desprender-se teórica, fenomenológica e epistemologicamente das concepções discriminatórias, compreendendo as vidas dos agrupamentos étnicos a partir das suas potencialidades, vivências, memórias, histórias e experiências, visto que é preciso compreender as estratégias inerentes aos processos de luta, resistência e existência, além do intrínseco valor e importância dos territórios para as comunidades quilombolas (Almeida, 2013). Nesse percurso, os Direitos Humanos assumem papel crucial em defesa dos grupos étnicos na busca por políticas públicas, que garantam o pleno exercício da cidadania frente à proteção integral da condição humana (Reis, 2012).

Sendo assim, é que se torna essencial compreender os territórios étnicos quilombolas para além do acesso ao direito à terra, pois:

(...) o quilombo passa paulatinamente a condensar, a integrar diversas noções de direito que abrangem não só o direito a terra mas todos os demais; quando esse vai do território às manifestações artísticas; quando o direito quilombola quer dizer educação, água, luz, saneamento, saúde, todos os direitos sociais até então negados a essas populações; quando o direito vai do campo à cidade, do individual ao coletivo; e, principalmente, quando o quilombo como direito confronta projetos e modelos de desenvolvimento, questiona certas formas de ser e viver, certos usos dos recursos naturais, seus usufrutos, o parentesco, a herança, as representações políticas e muito mais; quando o quilombo deixa de ser exclusivamente o direito à terra para ser a expressão de uma pauta de mudanças que, para serem instauradas, precisam de um procedimento de desnaturalização dos direitos anteriores: de propriedade, dos saberes supostos sobre a história, dos direitos baseados nas concepções de público e privado, entre tantos outros (Leite, 2008, p. 975).

A comunidade de Mituaçu, como já afirmamos, vem passando por agressivos processos de desterritorialização ocasionados pela poluição no Rio Gramame, diga-se de passagem, uma ação predatória contra o meio ambiente, que atinge diretamente os agrupamentos próximos. De acordo com Pinheiro e Paixão (2019), as pessoas da localidade estabeleceram

historicamente laços afetivos e econômicos com o rio degradado, uma vez que representa uma extensão da identidade territorial quilombola, até porque o Gramame lhes garante o sustento, além de representar espaço de lazer e manutenção da vida na comunidade, ao passo em que fornece a água necessária à produção de alimentos e aos afazeres domésticos. Por este prisma, para os quilombolas de Mituaçu:

O Rio Gramame protege a comunidade e traz sustento a tantas famílias, no entanto, vem sendo alvo de longo processo de deterioração. Além da retirada de água para irrigação de plantios diversos, como mencionado nos relatos, as relações entre as práticas sociais e culturais estabelecidas pela comunidade a partir deste curso d'água e de seus manguezais têm sido prejudicadas, ao longo do tempo, por poluição industrial, agrícola e urbana que incidem diretamente no seu território e levaram muitos a buscarem empregos fora da comunidade, até mesmo nas indústrias que acabam por poluir o rio (Pinheiro & Paixão, 2019, p. 27).

Diegues (2001) afirma que as populações mais pobres, que moram nas periferias e nas áreas rurais, são as mais impactadas pelas conseqüentes crises socioambientais geradas pela degradação dos recursos naturais e, conseqüentemente, são lançadas às margens da sociedade, vivendo em precárias condições de vida estimuladas pela discriminação racial.

Fora isso, a comunidade de Mituaçu ainda não possui autonomia em relação ao seu território, tendo em vista a ausência da titulação fundiária, que compete ao Estado nacional, de modo que as dificuldades encontradas localmente vão, desde a falta de profissionais para fazer as visitas e sistematizar as informações devidas, aos desafios encontrados dentro do próprio território. Para Filgueira (2020, p.400): “(...) a existência de títulos individuais dentro da comunidade termina por criar/fomentar divisões e conflitos internos dentro da Comunidade Quilombola, o que acaba por prejudicar a lógica de utilização do espaço físico coletivo na comunidade”.

De acordo com Monteiro e Garcia (2010), essa mesma circunstância aparece como um dos entraves para a autonomia do território do Gurugi, pois o conflito interno entre os quilombolas foi agravado diante da divisão estabelecida internamente entre Gurugi I e Gurugi II, na medida em que, anteriormente, estavam assentados em duas fazendas. Após muitas lutas e reivindicações conseguiram os títulos individuais dos lotes.

Ocorre que após o reconhecimento da área como território remanescente de quilombo, os quilombolas de Gurugi perceberam que poderiam perder o acesso às ações sociais direcionadas aos grupos étnicos, mesmo porque, quando há o reconhecimento do espaço enquanto território quilombola, sabemos que não pode haver nenhum tipo de divisão ou posse individual de terras, tendo em vista a compreensão do Estado - em seus preceitos constitucionais - que afirma ser um território coletivo, diga-se de passagem, onde todos os membros são responsáveis pela administração e usufruto, de forma que o que desenvolvem é partilhado coletivamente (Monteiro & Garcia, 2010). Sendo assim, os conflitos são iminentes.

Após o reconhecimento quilombola moradores de Gurugi II passaram a não mais aceitar a sua terra como quilombola, essa recusa deveu-se a notificação pelo INCRA de que a delimitação do território acarretaria uma anulação dos títulos individuais das famílias assentadas e que a terra passaria a ser comunal o que significava que nenhum membro da comunidade poderia vender arrendar ou praticar qualquer tipo de comercialização com a terra. Os moradores de Gurugi II temiam a nova situação no qual o seu território seria coletivo, uma vez que já haviam lutado, tanto pela posse da terra com os proprietários legais como também para que os títulos individuais dos lotes fossem concedidos. Tinham o receio também de perder os programas governamentais concedidos aos assentamentos, já que com a territorialização quilombola correriam o risco de não mais serem beneficiados com esses programas (Monteiro & Garcia, 2010, p.166).

Mesmo diante de tantos entraves, às comunidades quilombolas Gurugi e Mituaçu reconhecem a importância dos territórios, até porque são lugares de representação identitária e cultural, onde imprimem suas histórias, memórias e ancestralidades, portanto, consideram-os enquanto extensões de suas vidas.

Os moradores de Mituaçu, embora não tenham suas terras demarcadas e regularizadas, reivindicam e reafirmam sua identidade quilombola cotidianamente, resistindo, tanto no passado quanto no presente, na busca por uma vida digna no seu território de vida e de trabalho, por meio de identidades que se (re) constroem cotidianamente por meio de suas relações históricas com a terra ancestral (Filgueira, 2020, p. 401).

As autoras Pinheiro e Paixão (2019) também destacam a relação do Rio Gramame com a comunidade de Mituaçu, pois perceberam nos relatos dos quilombolas que:

O rio se constitui ora como uma entidade, que provê sustento e que todos devem respeitar, ora como um território coletivo, aberto para que todos possam pescar. Não há cercas, mas sim regras sobre o uso coletivo, que, quando são quebradas, causam descontentamento nos demais (Pinheiro & Paixão, 2019, p. 21).

Sobre o território do Gurugi, Monteiro e Garcia (2010, p. 167) indicam que:

Embora a autoafirmação quilombola seja a opinião da maioria dos moradores jovens, não se constitui numa unanimidade dentro da comunidade, cuja posição contrária tanto em Gurugi I quanto em Gurugi II é mais forte entre a população mais velha que vivenciou um violento processo de luta pela terra e temem a nova forma de apropriação de seu território, mesmo com a possibilidade de que com a delimitação quilombola sejam anexadas as terras perdidas com o processo de desapropriação, que atualmente estão ocupadas por plantações de cana-de-açúcar e pela construção de condomínios.

Nessa perspectiva, o território de Gurugi está nessa dualidade ora se aceita como quilombola ora como assentado faz-se necessário que os quilombolas entendam a sua história enquanto povo negro a partir do percurso histórico dos seus ancestrais, pois, como já afirmamos, a identidade é autoafirmação, figurando uma questão de pertencimento coletivo (Haesbaert, 2004).

A convivência no território de Gurugi I e II aproximou as culturas dos povos quilombolas, assentados e agricultores rurais que ali vivem, conseqüentemente o diálogo entre culturas contribui para o entendimento que a cultura é dinâmica, conforme indicado por Laraia (2001, p.50): "(...)podemos agora afirmar que existem dois tipos de mudança cultural: uma que é interna, resultante da dinâmica do próprio sistema cultural, e uma segunda que é o resultado do contato de um sistema cultural com um outro".

De acordo com a pesquisa de Monteiro e Garcia (2010), os quilombolas de Gurugi precisam discutir enquanto comunidade, na perspectiva da coletividade, a partir da realidade, ou seja, se essa aproxima de povos tradicionais ou de povos assentados e assim buscar as melhorias para o seu território.

Compreendemos que os territórios Gurugi e Mituaçu passam por sérios problemas, pois faltam condições básicas para sobrevivência, terra para plantar, conservação da natureza e a documentação de regularização territorial. Mesmo com a posse desse documento, ainda é incerta a resolução dos problemas,

porque podem sofrer o processo de desterritorialização, visto que as composições hegemônicas reforçam o Estado a agir na perspectiva colonialista, capitalista, etnocêntrica e eurocêntrica (Bispo, 2015).

Para Leite (2000), precisamos compreender as comunidades étnicas, especialmente quilombolas, a partir das suas experiências, sobretudo, o sentimento de pertencimento, sabendo que o conceito de território quilombola é um conceito em disputa, mas é fundamental, termos um olhar que as culturas, identidades e povos fazem parte da diversidade.

## V. CONSIDERAÇÕES FINAIS

A partir dos resultados e discussões apresentadas, compreendemos que o processo de luta dos povos quilombolas perdura, pois buscam o direito ao território, assim como acesso aos serviços sociais por uma vida digna e exercício pleno da cidadania, por meio da educação, saúde, moradia, terra para o plantio, recursos financeiros, conservação da natureza entre outras ações.

Nesse sentido, é imperativo o respeito às culturas e identidades que permeiam suas crenças e valores, contudo a sociedade majoritária ainda exclui, marginaliza e fomenta ações que vão de encontro ao estilo de vida dos quilombolas.

Logo, os conflitos são iminentes pela morosidade na regularização do território, assim como as práticas de poluição no Rio Gramame e degradação da Mata Atlântica causadas pelo sistema industrial.

Além desses desafios, as comunidades quilombolas de Gurugi e Mituaçu passam por conflitos internos porque antes esses territórios eram configurados como assentamentos. Sendo assim, alguns quilombolas compraram lotes individuais, mas o Estado nacional só reconhece como território quilombola e conseqüentemente entrega a titulação quando tem o sentido de ser um território de todos, ou seja, um lugar de pertencimento coletivo.

Diante dos desafios, faz-se necessário às pessoas desses territórios se encontrarem enquanto grupo, decidirem o melhor para seu povo e reivindicar pelos seus direitos, pois quando estamos unidos pelo mesmo propósito as ações coletivas fluem e o território permanece forte e torna-se um lugar de representação identitária.

## REFERÊNCIAS

- [1] Almeida, A. W. B. de. (2013). "Prefácio: mobilizações étnicas não-tardias". In: BANAL, Alberto e FORTES, Maria Ester Pereira (orgs.). *Quilombos da Paraíba: a realidade de*

- hoje e os desafios para o futuro. João Pessoa: Imprell Gráfica e Editora.
- [2] Arruti, J. M. (2008). “Quilombos”. In: *Raça: Perspectivas Antropológicas*. [org. Osmundo Pinho]. ABA / Ed. Unicamp / EDUFBA, 01- 33. <https://files.ufgd.edu.br/arquivos/arquivos/78/NEAB/ARRUTI-%20Jose.%20Quilombos.pdf>
- [3] Bispo, A. dos S. (2015). *Colonização, quilombos – modos e significado*. Universidade de Brasília; CNPq, Brasília.
- [4] Brasil. (2004). *Constituição da República Federativa do Brasil*: Texto constitucional promulgado em 5 de outubro de 1988. Brasília: Senado Federal, Subsecretaria de Edições Técnicas.
- [5] Clerot, L. F. R. (2010). *Glossário etimológico dos termos geográficos, botânicos, zoológicos, históricos e folclóricos de origem Tupi/Guarani, incorporados ao idioma nacional*. Brasília: Senado Federal.
- [6] Diegues, A. C. (2001). O papel das ciências sociais na análise das questões ambientais e a globalização. In: Diegues A. C. (ed.). *Ecologia humana e planejamento costeiro*. São Paulo, NUPAUB-USP, 21-37. <https://nupaub.fflch.usp.br/sites/nupaub.fflch.usp.br/files/color/global2.pdf>
- [7] Filgueira, D. L. (2020). Território de vida e de trabalho: Luta pela terra na Comunidade Quilombola de Mituaçu–PB. *Revista Brazilian Journal of Development*, Curitiba, 6, 1, (1), 385-403. Disponível em: <https://www.brazilianjournals.com/index.php/BRJD/article/view/5852/5258>. Acesso em: 16 mai. 2022.
- [8] Geertz, C. (1989). *A interpretação das culturas*. Rio de Janeiro: Editora ITC.
- [9] Geertz, C. (1997). *O saber local: novos ensaios em antropologia interpretativa*. Petrópolis: Editora Vozes.
- [10] Goldenberg, M. (2004). *A arte de pesquisar: como fazer pesquisa qualitativa em ciências sociais*. Rio de Janeiro: Record.
- [11] Haesbaert, R. (2004). O Mito da Desterritorialização: do “fim dos territórios” à multiterritorialidade. Rio de Janeiro: Bertrand Brasil.
- [12] Herculano, S. (2008). O Clamor por Justiça Ambiental e Contra o Racismo Ambiental. *INTERFACEHS – Revista de Gestão Integrada em Saúde do Trabalho e Meio Ambiente*, 3, 1, (1), 1-20, Disponível em: [http://www.interfacehs.sp.senac.br/BR/artigos.asp?ed=6&cod\\_artigo=113](http://www.interfacehs.sp.senac.br/BR/artigos.asp?ed=6&cod_artigo=113) Acesso em: 17 mai. 2022.
- [13] Laraia, R. de B. (2001). *Cultura: um conceito antropológico*. Rio de Janeiro: Jorge Zahar Editor. Disponível em: <https://bit.ly/2OtiJr1>
- [14] Leite, I. B. (2000). Os Quilombos no Brasil: questões conceituais e normativas. Florianópolis: NEAD, 2000. *Etnográfica*, 4 (2), 333-354. Disponível em <http://www.nead.org.br/index.php?acao=artigo&id=21> Acesso em: 17 mai. 2022.
- [15] Leite, I. B. (2008). O Projeto Político Quilombola: desafios, conquistas e impasses atuais. UFSC. *Estudos Feministas*, Florianópolis, 16, 3, 965-977. Disponível em: <https://www.scielo.br/j/ref/a/PkRZPC6gwHRkLMMKkPxCvyd/?format=pdf&lang=pt> Acesso em: 17 maio 2022.
- [16] Marques, A. C. N. (2015). *Fronteira étnica: Tabajara e Comunidades Negras no processo de territorialização do Litoral Sul Paraibano*, 350 f. [Tese Doutorado em Geografia, Universidade Federal de Sergipe]. [http://plone.ufpb.br/gestar/contents/documentos/publicacoes/teses/amanda\\_christinne\\_n\\_marques.pdf/view](http://plone.ufpb.br/gestar/contents/documentos/publicacoes/teses/amanda_christinne_n_marques.pdf/view)
- [17] Moita Lopes, L. P. da. (1994). *Pesquisa interpretativista em linguística aplicada: a linguagem como condição e solução*. delta, são Paulo, 10, 2, 329-383. [file:///C:/Users/HP/Downloads/45412-Texto%20do%20artigo-129939-1-10-20191011%20\(1\).pdf](file:///C:/Users/HP/Downloads/45412-Texto%20do%20artigo-129939-1-10-20191011%20(1).pdf)
- [18] Monteiro, K. dos S. & Garcia, M. (2010). DOS TERRITÓRIOS DE REFORMA AGRÁRIA À TERRITORIALIZAÇÃO QUILOMBOLA: O CASO DA COMUNIDADE NEGRA DE GURUGI, PARAÍBA. *Pegada- Revista de Geografia do Trabalho*. 11, 2, 148-171. Disponível em: <https://revista.fct.unesp.br/index.php/pegada/article/view/1310> Acesso em: 16 mai. 2022.
- [19] Munanga, K. (2008). *Rediscutindo a mestiçagem no Brasil: identidade nacional versus identidade negra*. Belo Horizonte: Autêntica.
- [20] Pinheiro, P. dos S. & Paixão, A. M. P. da. (2019). QUANDO A DESTERRITORIALIZAÇÃO VEM DO RIO: A POLUIÇÃO DO RIO GRAMAME NA COMUNIDADE QUILOMBOLA DE MITUAÇU, PB. Vivência 53. *Revista de Antropologia*, 1, 53, 15-34. Disponível em: <https://periodicos.ufrn.br/vivencia/article/view/20599> Acesso em: 16 mai. 2022.
- [21] Pinto, J. R. de S. & Mignolo, W. (2015). A modernidade é de fato universal? Reemergência, desocidentalização e opção decolonial. *Civitas- Revista de Ciências Sociais*, Porto Alegre, 15, 3, 381-402. Disponível em: <https://revistaseletronicas.pucrs.br/ojs/index.php/civitas/article/view/20580> Acesso em: 17 mai. 2022.
- [22] Reis, R. R. (2012). O direito à terra como um direito humano: a luta pela reforma agrária e o movimento de direitos humanos no Brasil. *Lua Nova Revista de Cultura e Política*, São Paulo, 86, 89-122. Disponível em: <https://www.scielo.br/j/ln/a/ZHct3GQN5bWGLcvzvTMmk4n/?lang=pt>
- [23] Schneider, S. & Tartaruga, I. G. P. (2004). Território e Abordagem Territorial: das referências cognitivas aos aportes aplicados à análise dos processos sociais rurais. *Raízes (UFPB)*, Campina Grande, 23, 01 e 02, 99-116. Disponível em: <https://bit.ly/3toG3oC>
- [24] Silva, T. T. da., Hall, S. & Woodward, K. (2000). *Identidade e diferença: a perspectiva dos estudos culturais*. Petrópolis, RJ: Vozes, 2, 73-102. Disponível em: <http://bit.do/fTEPo>
- [25] Toledo, V. M & Barrera-Bassols, N. (2015). *A memória biocultural: a importância ecológica dos saberes tradicionais*, São Paulo: Expressão Popular.
- [26] Walsham, G. (1993). *Interpreting information systems in organisations*. West Sussex: John Wiley&Sons.
- [27] Walsh, C. (2009). *INTERCULTURALIDAD, ESTADO, SOCIEDAD LUCHAS (DE)COLONIALES DE NUESTRA ÉPOCA*. Quito: Abya-Yala.

# Detecting Anemia Based on Palm Images using Convolutional Neural Network

Ahmad Saiful Rizal<sup>1</sup>, Alfian Futuhul Hadi<sup>2</sup>, Sudarko<sup>3</sup>, Supangat<sup>4</sup>

<sup>1</sup>Department of Mathematics, Faculty of Mathematics and Natural Sciences, Jember University, Indonesia  
Email: [ahmadsaifulrizal13@gmail.com](mailto:ahmadsaifulrizal13@gmail.com)

<sup>2</sup>Department of Mathematics, Faculty of Mathematics and Natural Sciences, Jember University, Indonesia  
Email: [afhadi@unej.ac.id](mailto:afhadi@unej.ac.id)

<sup>3</sup>Department of Chemistry, Faculty of Mathematics and Natural Sciences, Jember University, Indonesia  
Email: [darko@unej.ac.id](mailto:darko@unej.ac.id)

<sup>4</sup>Department of Pharmacology, Faculty of Medicine, Jember University, Indonesia  
Email: [drsupangat@unej.ac.id](mailto:drsupangat@unej.ac.id)

Received: 15 Aug 2022,

Received in revised form: 05 Sep 2022,

Accepted: 11 Sep 2022,

Available online: 17 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— Classification, Clustering,  
Convolutional Neural Network,  
Hemoglobin, Image Processing.

**Abstract**— Hemoglobin is a protein in the blood that conveys oxygen from the lungs to the body's tissues. Hemoglobin levels under the normal limit cause anemia. Hemoglobin estimation is generally utilizing a needle to take the patient's blood as a sample and afterward testing it at the chemicals laboratory. This technique has a shortcoming, specifically, it is less proficient because it requires a few hours. Likewise, it needs to hurt the patient's skin with a hypodermic needle. In this study, we will discuss the Convolutional Neural Network (CNN) in classifying hemoglobin levels based on palm images. Hemoglobin levels are partitioned into two classes, to be anemia and non-anemia. The image size utilized is 500×375 pixels with the number of Red, Green, and Blue (RGB) channels. The data utilized in this study were images of the patient's palm. The first important phase in this research was data retrieval, which went on with preprocessing data, then the data is clustered into two clusters using a random state, then at that point, each cluster will be classified using the CNN algorithm.

The best results are obtained by the value of accuracy reached 96.43% with a precision score of 93.75% achieved, recall of 100%, and specificity of 92.31% for cluster 1 in random state 1, and the similar random state for cluster 2 is obtained the value of accuracy reached 96.43% with a precision score of 93.33%, recall of 100%, and specificity of 92.86% were achieved this way.

## I. INTRODUCTION

Machine Learning (ML) is a modeling technique that can recognize patterns in data automatically without human assistance. ML enables the analysis of massive quantities of data [1]. Algorithms in machine learning can predict based on the given dataset. Machine learning in the medical sector can be utilized for breast cancer classification [2], pneumonia detection based on chest X-

Ray images [3], classify Covid-19 contamination [4], early diagnosis of Coronavirus impacted patients [5], myocardial infarction detection [6], recognizing cardiovascular disease from mammograms [7], brain tumor detection [8], and dermatologist level classification of skin cancer [9]. There is additionally related research, for example, Ozturk et al. [10] have detected covid-19 automatically using raw chest X-ray images for binary

classification (Covid-19 cases vs Normal) and multiclass classification (Covid-19, Normal and Pneumonia). Rajpurkar et al. [11] presented radiologist-level pneumonia detection on chest X-rays, containing more than 100000 frontal view X-ray images with fourteen diseases. Talo et al. [12] designed a convolutional neural network for brain disorder classification. Comelli et al. [13] employed deep learning for lung segmentation on high-resolution computerized tomography images.

The model of machine learning can make a prediction based on current observations. The results of the prediction will be compared to the actual data that has been tested to measure the exactness of the model. Machine learning can make a model for image recognition. One of the algorithms is Convolutional Neural Network (CNN). CNN is one of the deep neural networks that apply a model based on an Artificial Neural Network (ANN) with multi-layers consisting of two or more hidden layers. ANN has the principle of imitating the brain process in the visual cortex with its main components being neuron cells and synapses. The model of the deep neural network can be trained utilizing existing data and ANN structures [14].

Hemoglobin is an important component in red blood cells. The main capability of hemoglobin is responsible for carrying oxygen and carbon dioxide in the body [15]. The lack of hemoglobin level can cause anemia, while hemoglobin conditions above the normal limit can cause polycythemia. Anemia is a decrease in the concentration of red blood cells that are circulating or the concentration of hemoglobin which hinders the most common way of transporting oxygen [16]. One of the clinical symptoms that are many times found in anemia patients is pale skin and conjunctiva. Therefore, paramedics frequently check the fingertips and conjunctiva to determine the condition of anemia patients [17]. The normal level for hemoglobin in the blood is as given: women 12-16 g/ 100 ml blood, men 14-18 g/ 100 ml blood, and newborns 14-20 g/ 100 ml blood [18].

Hemoglobin measurements are generally carried out using a hypodermic needle to take the patient's blood as samples and keep on testing at the chemicals laboratory. Their hemoglobin levels will be recognized after a few hours. Symptoms of anemia and non-anemia should be visible based on hemoglobin levels. This method is less efficient because it requires a long process and causes pain to patients. It is also considered less kindly for certain individuals since it should hurt the patient's skin with a hypodermic needle, especially in infants, elderly patients, and other vulnerable groups.

In this study, we will detect anemia and non-anemia based on palm images using a Convolutional Neural Network (CNN) to give development to patients without utilizing a hypodermic needle. This algorithm is used with the expectation of having high accuracy. By using the accuracy of the model, the detection of anemia and non-anemia should be possible only with a palm image.

## II. METHOD

### 2.1 Image Processing

An image might be characterized as a two-dimensional function that contains a set of pixels. Every pixel is represented by two integers to indicate its area in the image field, while to show the brightness of the pixels, it frequently utilizes a value of 8 bits, and that implies there are  $2^8$  or 256 degrees of gray with the interval  $[0, 255]$ , where 0 is considered black, 255 represents white and all intermediate values between 0 and 255 are shades of gray varying from black to white or gray level. A digital image is an image that can be processed directly using a personal computer. Digital image size  $M \times N$  is represented with matrix size  $M$  rows and  $N$  columns :

$$f(x,y) = \begin{bmatrix} f(0,0) & f(0,1) & \dots & f(0,N-1) \\ f(1,0) & f(1,1) & \dots & f(1,N-1) \\ \vdots & \vdots & \ddots & \vdots \\ f(M-1,0) & f(M-1,1) & \dots & f(M-1,N-1) \end{bmatrix}$$

Indexes of  $x$  and  $y$  are utilized to denote the rows and columns. The  $x$ -index moves down and the  $y$ -index moves right. The origin is  $f(0,0)$  which is located in the top-left corner and finishes in  $f(M-1, N-1)$ . It intends to show the area of pixels [19].

### 2.2 Convolutional Neural Network (CNN)

CNN is an improvement of the Multi-Layer Perceptron (MLP) and the most recent technique for processing two-dimensional data. CNN is a deep learning algorithm because of its network depth and is widely applied to image data. CNN consists of an input layer, output layer, and hidden layer. Hidden layers generally contain convolutional layers, pooling layers, and fully connected layers [20].

#### 2.2.1 Convolutional Layer

The convolutional layer is the core of CNN, most of the computation is finished in this layer. The convolutional layer in the CNN architecture generally uses more than one filter. The filter as a feature detector, convolved with an image input, thereby producing the convolved feature by using a stride until all receptive fields are covered [21]. The convolution process can be illustrated in Fig 1.

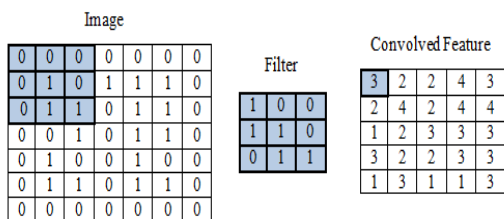


Fig 1: Convolution process

The convolution operation is the sum of products of the elements that are located at the same position of two matrices.

2.2.2 Pooling Layer

The pooling layer can keep up the size of data during the convolution process, by doing downsampling. In this layer, we can represent data to be smaller, easier to manage, and simple to control overfitting. The pooling system that is normally utilized is max pooling, which chooses the maximum value in a specific area [22]. The pooling system is shown in Fig 2.

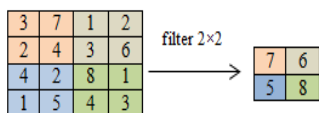


Fig 2: Max pooling operation

2.2.3 Activation Function

The activation function is a function to initiate neurons and its process should be possible after the convolutional or pooling process [23]. There are three activation functions:

*Sigmoid* function, the output of this function is dependably in the range 0 and 1. The disadvantage of the sigmoid is that the gradient tends to be small or zero when the dataset is too small or large. This causes the network to refuse to learn further or learning is drastically slow. This function is used for classification problems.

*Tanh* function, the output has a range between -1 and 1. This function tends to learn slowly but is slightly faster or quite stronger for *Tanh* than *sigmoid*. This is used for machine learning classification.

*ReLU* function, the output value of this function will be 0 if the input value is negative, if the input value is positive then the resulting output is the activation value itself. The advantage of this function, it is more computationally efficient and converges faster because it's linear than *sigmoid* and *Tanh*, meaning it overcomes the weakness of *sigmoid* and *Tanh*.

2.2.4 Fully Connected Layer

In this layer, every neuron has a full connection to all activations in the previous layer. Each neuron in the

convolution layer should be changed into one-dimensional data with the goal that the data can be classified linearly. The fully connected layer can be implemented at the end of the network.

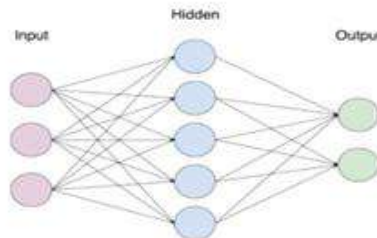


Fig 3: Fully connected layer

Overall, this is a Convolutional Neural Network model for image classification, consisting of convolutional layers, pooling layers, fully connected layers, and output layers [24]

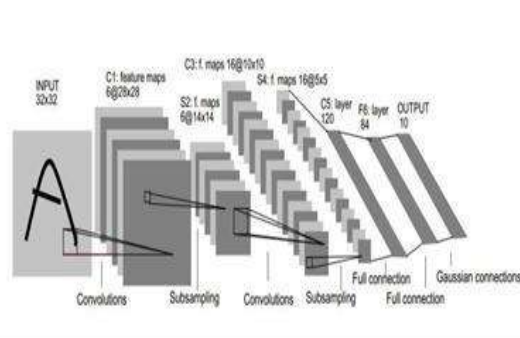


Fig 4: CNN Architecture

2.3 Performance Evaluation

The confusion matrix is a two-dimensional matrix that describes the performance of the model on the test data. Each column of it represents the predicted class and each row represents the actual class. In the confusion matrix, there is a true negative (TN) indicating a correct prediction for a negative class, false negative (FN) implying that the actual data is positive but predicted to be negative. True positive (TP) shows the correct prediction for the positive class, while false positive (FP) is the actual negative data but is predicted to be positive. From the results of the confusion matrix, it may be utilized to calculate the value of accuracy, recall, specificity, and precision [25].

2.3.1 Accuracy

Accuracy is a comparison between correct value prediction and general data. It describes how precisely the model can predict accurately.



$$Accuracy = \frac{TP + TN}{TP + FP + TN + FN} \quad (1)$$

### 2.3.2 Recall

Recall or sensitivity (True Positive Rate) is the correlation of a true positive prediction with the general positive actual data.

$$Recall = \frac{TP}{TP + FN} \quad (2)$$

### 2.3.3 Specificity

Specificity (True Negative Rate) is the proportion of true negative prediction with the general negative actual data.

$$Specificity = \frac{TN}{TN + FP} \quad (3)$$

### 2.3.4 Precision

Precision is the ratio of positive correct predictions with the general positive predicted data.

$$Precision = \frac{TP}{TP + FP} \quad (4)$$

## 2.4 Data

The data used in this study were images of patients' palms obtained directly from Soebandi General Hospital, Jember Regency, Indonesia. Data retrieval was taken using an android camera with the right health protocol. The research population was patients in the hospital. Every image and label embedded is to be utilized as a dataset. The image data obtained 193 images. The patients have tested their hemoglobin levels in the clinical laboratory. In the image data, 57 patients with anemia (25 men and 32 women) because hemoglobin level is under the normal limit, and 136 patients with non-anemia (73 men and 63 women). The examples of image data are shown in Fig 5.



Fig 5: Image Data

This research was finished with systematic steps, the architecture can be shown in Fig 6.

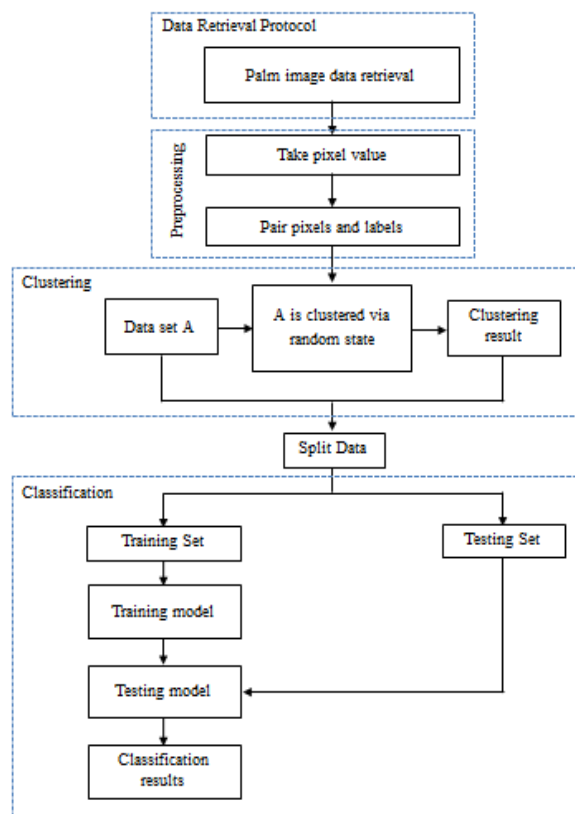


Fig 6: Research Framework

First, data retrieval was done by applying the right health protocol. Data that has been got will be preprocessed. The image will be taken its pixel values so the machine can analyze the pattern of pixel values. Next stage, these pixels will be matched with its label. This step needs a balancing strategy to adjust samples for classification cases.

After that, data was clustered into two clusters via a random state. Cluster results were separated into a training set (80%) and a testing set (20%). Data is fit to be applied to a current model. This study uses the CNN model. The model is trained using the accessible training set. This training process goes through several repetitions. In one repetition, the model will learn the pattern of all training data so it can do a decent prediction. This model is hoped to have high accuracy and low loss. In this process, the model will check the accuracy value of validation data. Then, the process has not been completed. Sometimes necessary to change parameters to get the accuracy of a decent model.

Testing model is a truly important part of machine learning since it aims to test the model that has been made, so classification results are obtained. Likewise, its result is evaluated by the standard goodness of fit predictive models with machine learning by analyzing accuracy, precision, recall, and specificity.

There is also a hyperparameter, that can be adjusted and plans to control the model improvement. Different hyperparameter values can affect model training. The next phase is the hyperparameters used in the training process. Epochs, the number of times to iterate over the dataset. Batch size is the quantity of sample data that should be visible to the model each time. Learning rate, the amount to update the model parameters at each batch. A small value of learning rate will make the training process run slowly.

In this study, we use Python programming on the web application also known as Google Colab. Its official site is [www.colab.research.google.com](http://www.colab.research.google.com). The Google Colab has various libraries including NumPy, Pandas, TensorFlow, Matplotlib, etc. It additionally gives storage media connected to google drive. In this research, we use the processor Graphics Processing Unit (GPU) because it has more cores so it's able to do parallel computing and is suitable for image processing [26].

**III. RESULTS**

In the classification results, there are 2 classes namely anemia and non-anemia. The testing model uses 28 images on each cluster for the different random states. Here are the results of the testing model that has been done:

Table 1: Classification results for Cluster 1

| RS | loss | Accuracy | Precision | Recall | Specificity |
|----|------|----------|-----------|--------|-------------|
| 0  | 2.26 | 78.57    | 84.62     | 73.33  | 84.62       |
| 1  | 0.26 | 96.43    | 93.75     | 100    | 92.31       |
| 2  | 0.18 | 92.86    | 92.86     | 92.86  | 92.86       |
| 3  | 0.03 | 96.43    | 91.67     | 100    | 94.12       |
| 4  | 1.39 | 71.43    | 60.00     | 81.82  | 64.71       |
| 5  | 0.54 | 89.29    | 93.33     | 87.50  | 91.67       |
| 6  | 0.65 | 89.29    | 83.33     | 90.91  | 88.24       |
| 7  | 0.17 | 96.43    | 90.00     | 100    | 94.74       |
| 8  | 0.39 | 82.14    | 80.95     | 94.44  | 60.00       |
| 9  | 0.99 | 89.29    | 93.33     | 87.50  | 91.67       |

RS: Random state

Based on the test results above, this indicates that the model can classify anemia well. The value of accuracy reaches 96.43%, it is called excellent classification. Meanwhile, the testing model for Cluster 2 is shown in Table 2.

Table 2: Classification results for Cluster 2

| RS | loss | Accuracy | Precision | Recall | Specificity |
|----|------|----------|-----------|--------|-------------|
| 0  | 1.27 | 89.29    | 91.67     | 84.62  | 93.33       |
| 1  | 0.11 | 96.43    | 93.33     | 100    | 92.86       |
| 2  | 1.01 | 85.71    | 84.62     | 84.62  | 86.67       |
| 3  | 1.31 | 89.29    | 92.86     | 86.67  | 92.31       |
| 4  | 0.61 | 92.86    | 88.24     | 100    | 84.62       |
| 5  | 0.17 | 92.86    | 85.71     | 100    | 87.50       |
| 6  | 0.87 | 92.86    | 92.86     | 92.86  | 92.86       |
| 7  | 1.22 | 82.14    | 87.50     | 82.35  | 81.82       |
| 8  | 0.82 | 82.14    | 88.89     | 84.21  | 77.78       |
| 9  | 0.72 | 89.29    | 100       | 76.92  | 100         |

In model optimization, a loss and an optimizer are needed to train the model. The best model of training data is Cluster 1 in random state 1. Meanwhile, for Cluster 2 in random state 1 as well, as shown in Fig 7.

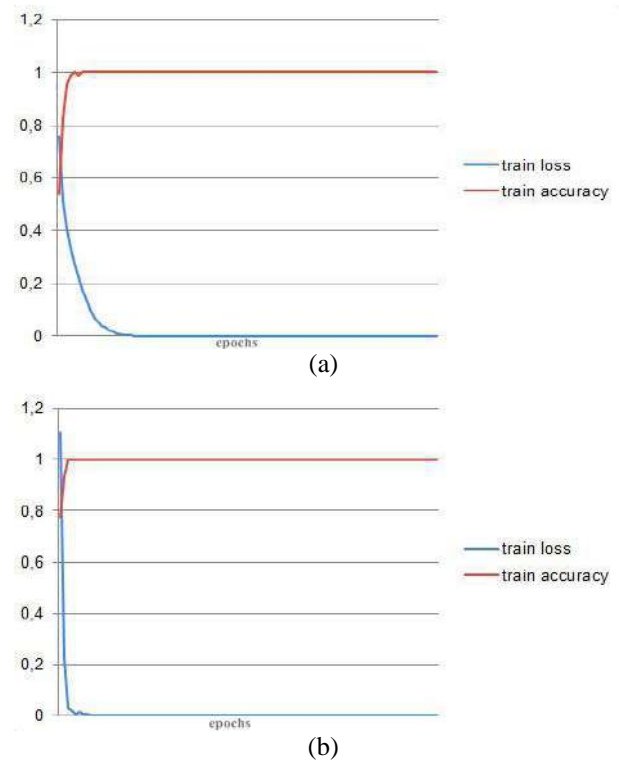


Fig 7: The best model training of all random states (a) Cluster 1; (b) Cluster 2

A confusion matrix is also needed to evaluate the performance of the model. It is utilized to show how the model when making predictions, not only provides information about the errors made by the model but also

the types of errors made. The best result confusion matrix is shown in Fig 8.

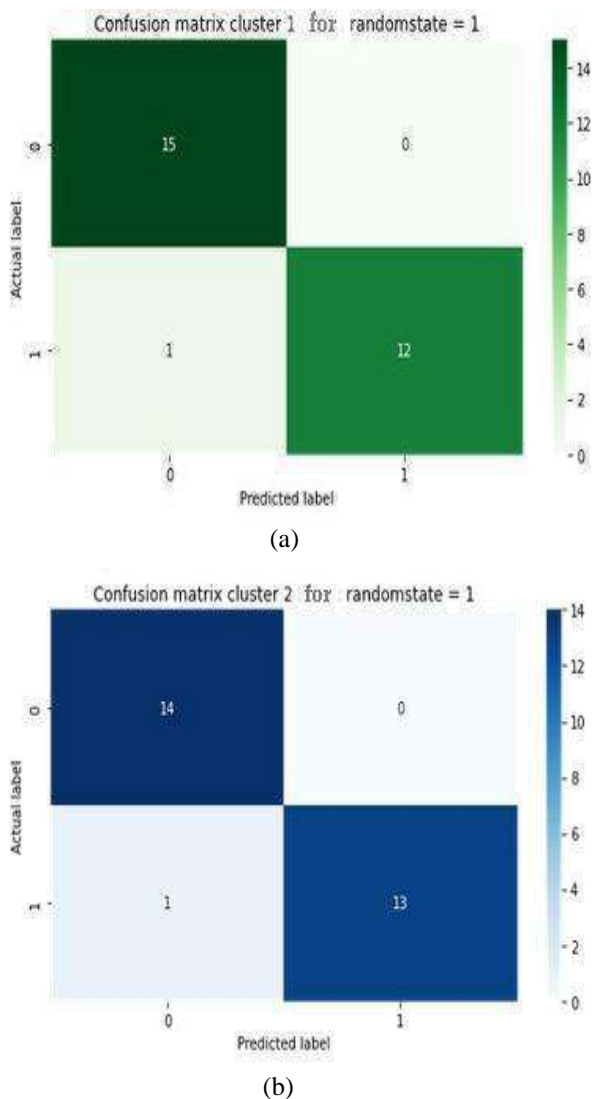


Fig 8: The best result testing of all random states  
(a) Cluster 1; (b) Cluster 2

Detailed classification results for the random state in ranges 0 and 9 are shown in Table 3 and Table 4 :

Table 3: Classification results for the random state in ranges 0 and 9 for Cluster 1

| Random State | TP | FN | FP | TN |
|--------------|----|----|----|----|
| 0            | 11 | 4  | 2  | 11 |
| 1            | 15 | 0  | 1  | 12 |
| 2            | 13 | 1  | 1  | 13 |

|   |    |   |   |    |
|---|----|---|---|----|
| 3 | 11 | 0 | 1 | 16 |
| 4 | 9  | 2 | 6 | 11 |
| 5 | 14 | 2 | 1 | 11 |
| 6 | 10 | 1 | 2 | 15 |
| 7 | 9  | 0 | 1 | 18 |
| 8 | 17 | 1 | 4 | 6  |
| 9 | 14 | 2 | 1 | 11 |

TP: True Positive; FP: False Positive

FN: False Negative; TN: True Negative

Table 4: Classification results for the random state in ranges 0 and 9 for Cluster 2

| Random State | TP | FN | FP | TN |
|--------------|----|----|----|----|
| 0            | 11 | 2  | 1  | 14 |
| 1            | 14 | 0  | 1  | 13 |
| 2            | 11 | 2  | 2  | 13 |
| 3            | 13 | 2  | 1  | 12 |
| 4            | 15 | 0  | 2  | 11 |
| 5            | 12 | 0  | 2  | 14 |
| 6            | 13 | 1  | 1  | 13 |
| 7            | 14 | 3  | 2  | 9  |
| 8            | 16 | 3  | 2  | 7  |
| 9            | 10 | 3  | 0  | 15 |

#### IV. DISCUSSION

The loss function will measure the level of dissimilarity of predicted data to the target data. To calculate the loss value, we make a prediction using the given input data sample and compare it with the actual label value. The lower the loss value, the more accurate the prediction model. The loss function used in this study is BinaryCrossEntropy. The loss value of the testing data for each random state is shown in Table 1 and Table 2.

Optimization is the process of adjusting model parameters to reduce model errors in every step of the training process. Optimization aims to do a fitting process between training data and target data, also avoiding overfitting. It occurs because the model is too focused on training data and the performance of the model will be bad when tested with other data.

In Fig 7, the loss function of the model represented that Cluster 2 converged faster than Cluster 1. For Cluster 2, loss value reached 0,0065 in 5 epochs. While Cluster 1 for the same loss value needs 17 epochs.

Based on the results of testing accuracy in Table 1, the model produces the highest accuracy 96.43%, meaning that it can recognize the images very well. The lowest accuracy is 71.43% however still includes fair classification. While for Table 2, the highest accuracy was 96.43% achieved. The lowest accuracy is 82.14%.

As shown in Fig 8, anemia is symbolized by 0, and non-anemia is represented by 1. The best result is Cluster 1 in random state 1, and so does Cluster 2. In Cluster 1, the model detected 15 patients with anemia as having anemia, and 12 out of 13 patients with non-anemia as having non-anemia. However, the model can't detect one patient, the model classifies it as anemia even though the patient is non-anemia. While Cluster 2, the model can classify well but there is 1 patient as False Positive, which means is detected as anemia even though the actual is non-anemia. 14 patients True positive, the model predicts patients with anemia as having anemia. True negative consists of 13 patients with non-anemia and the model predict correctly as having non-anemia.

From Table 3, the model of Cluster 1 in random state-0 has classified 11 out of 15 patients with anemia as having anemia, 11 out of 13 non-anemia patients as non-anemia; it misclassified 4 anemia patients as having non-anemia, and 2 non-anemia patients as having anemia. In random state-1, the model misidentified one patient with non-anemia as having anemia. In random state-2, there is 1 patient as a false positive and 1 patient as a false negative. In random state-3, CNN detected 11 patients as anemia, 16 patients with non-anemia are detected correctly as non-anemia, and it misclassified 1 patient with non-anemia as having anemia. In random state-4, the model can't predict 8 patients correctly. In random state-5, CNN has classified 14 out of 16 patients with anemia as having anemia, and 11 out of 12 non-anemia patients as non-anemia. In random state-6, one patient was a false negative, and two patients are false positive. In random state-7, the model detected one patient as anemia even though the actual is non-anemia. In random state-8, CNN has classified 17 out of 18 patients with anemia as having anemia, and 6 out of 10 non-anemia patients as non-anemia. In random state-9, the model predict 2 patients as non-anemia but the actual is anemia, also it misidentified 1 patient non-anemia as having anemia.

From Table 4, the model in random state-0 misclassified 3 patients. In random state-1, only one patient is detected as a false positive. In random state-2, CNN has predicted 11 out of 13 patients with anemia as having anemia, and 13 out of 15 non-anemia patients as non-anemia. In random state-3, there are 2 patients as false negative and 1 patient as false positive. In random state-4,

the model detected 11 out of 13 non-anemia patients as non-anemia, and it detected 15 patients as anemia correctly. In random state-5, the model misclassified 2 patients with non-anemia as having anemia. In random state-6, CNN can't predict one patient with anemia and one patient with non-anemia. In random state-7, there are 3 patients as false negative and 2 patients as false positive. In random state-8, the model detected 16 out of 19 patients with anemia as having anemia, and 7 out of 9 non-anemia patients as non-anemia. In random state-9, CNN misidentified 3 patients with anemia as having non-anemia.

There is some information about Cluster 1 and Cluster 2 in Fig 8. Cluster 1 in random state 1, the average age of patients is 47.54 years. The minimum and maximum ages of them are 14 years and 70 years. The average hematocrit level of them is 32,69. While for cluster 2 in random state 1, the minimum and maximum ages of patients are 18 years and 79 years, with the average age of them being 41,23 years. Their average hematocrit level is 33,55.

Different random state values will cause the members of each cluster to be different as well. If the image resolution is too large and there are many random states, it will cause an error in the training process. Google Colab only provides 12GB of free RAM. The error is basically because out of memory on Google Colab. The session crashed after using all available RAM

## V. CONCLUSION

The utilization of CNN is reliable enough to detect anemia, and also possibly be applied in the medical sector. This is proven by the results of accuracy of 96.43% with a loss value is 0.03 for Cluster 1, and a loss value of 0.11 for Cluster 2. Model testing gets maximum results, meaning that the model can detect categories in all experiments that were done. The results of low accuracy are due to the palm image features that are tested having many similarities with other palm image features so the model misclassified the palms.

The best result for Cluster 1 is random state 1, and so does Cluster 2. The average hematocrit level for Cluster 1 in random state 1 is 32.69 with the average age of patients being 47,54 years. While for cluster 2 random state 1, the average hematocrit level is 33.55 with the average age of patients being 41,23 years.

## ACKNOWLEDGEMENTS

We would like to thank Soebandi General Hospital has provided the patient's palm image data. We also tank to all

members of the Research Group between the Faculty of Mathematics and Natural Sciences, and Faculty of Medicine, Jember University, Indonesia

## REFERENCES

- [1] E. Ghanbari and S. Najafzadeh, "Machine Learning," *Mach. Learn. Big Data Concepts, Algorithms, Tools Appl.*, vol. 8, no.04, pp. 155–207, 2020, doi: 10.1002/9781119654834.ch7
- [2] Y. Fang, J. Zhao, L. Hu, X. Ying, Y. Pan, and X. Wang, "Image classification toward breast cancer using deeply-learned quality features," *J. Vis. Commun. Image Represent.*, vol. 64, p. 102609, 2019, doi: 10.1016/j.jvcir.2019.102609.
- [3] D. S. Kermany et al., "Identifying Medical Diagnoses and Treatable Diseases by Image-Based Deep Learning," *Cell*, vol. 172, no. 5, pp. 1122–1131.e9, 2018, doi: 10.1016/j.cell.2018.02.010.
- [4] C. Ouchicha, O. Ammor, and M. Meknassi, "CVDNet: A novel deep learning architecture for detection of coronavirus (Covid-19) from chest x-ray images," *Chaos, Solitons and Fractals*, vol. 140, no. January, p. 110245, 2020, doi: 10.1016/j.chaos.2020.110245.
- [5] D. Dansana et al., "Early diagnosis of COVID-19-affected patients based on X-ray and computed tomography images using deep learning algorithm," *Soft Comput.*, vol. 0123456789, 2020, doi: 10.1007/s00500-020-05275-y.
- [6] M. Hammad, M. H. Alkinani, B. B. Gupta, and A. A. Abd El-Latif, "Myocardial infarction detection based on deep neural network on imbalanced data," *Multimed. Syst.*, 2021, doi: 10.1007/s00530-020-00728-8.
- [7] J. Wang et al., "Detecting Cardiovascular Disease from Mammograms with Deep Learning," *IEEE Trans Med Imaging*, vol. 36, no. 5, pp. 1172–1181, 2017, doi: 10.1109/TMI.2017.2655486.Detecting.
- [8] S. Deepak and P. M. Ameer, "Brain tumor classification using deep CNN features via transfer learning," *Comput. Biol. Med.*, vol. 111, no. March, p. 103345, 2019, doi: 10.1016/j.compbimed.2019.103345.
- [9] A. Esteva et al., "Dermatologist-level classification of skin cancer with deep neural networks," *Nature*, vol. 542, no. 7639, pp. 115–118, 2017, doi: 10.1038/nature21056.
- [10] T. Ozturk, M. Talo, E. Azra, U. Baran, and O. Yildirim, "Automated detection of COVID-19 cases using deep neural networks with X-ray images," *Comput. Biol. Med.*, vol. 121, no. January, 2020.
- [11] P. Rajpurkar et al., "CheXNet: Radiologist-Level Pneumonia Detection on Chest X-Rays with Deep Learning," pp. 3–9, 2017, [Online]. Available: <http://arxiv.org/abs/1711.05225>
- [12] M. Talo, O. Yildirim, U. B. Baloglu, G. Aydin, and U. R. Acharya, "Convolutional neural networks for multi-class brain disease detection using MRI images," *Comput. Med. Imaging Graph.*, vol. 78, p. 101673, 2019, doi: 10.1016/j.compmedimag.2019.101673.
- [13] A. Comelli et al., "Lung Segmentation on High-Resolution Computerized Tomography Images Using Deep Learning: A Preliminary Step for Radiomics Studies," *J. Imaging*, vol. 6, no. 11, pp. 1–14, 2020, doi: 10.3390/jimaging6110125.
- [14] P. Kim, *MATLAB Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence*. Apress, 2017. doi: 10.1007/978-1-4842-2845-6.
- [15] C. Thomas and A. B. Lumb, "Physiology of haemoglobin," *Contin. Educ. Anaesthesia, Crit. Care Pain*, vol. 12, no. 5, pp. 251–256, 2012, doi: 10.1093/bjaceaccp/mks025.
- [16] C. M. Chaparro and P. S. Suchdev, "Anemia epidemiology, pathophysiology, and etiology in low- and middle-income countries," *Ann. N. Y. Acad. Sci.*, vol. 1450, no. 1, pp. 15–31, 2019, doi: 10.1111/nyas.14092.
- [17] B. Santra, D. P. Mukherjee, and D. Chakrabarti, "A non-invasive approach for estimation of hemoglobin analyzing blood flow in palm," *Proc. - Int. Symp. Biomed. Imaging*, vol. 1, pp. 1100–1103, 2017, doi: 10.1109/ISBI.2017.7950708.
- [18] V. P. Kharkar and V. R. Ratnaparkhe, "Hemoglobin Estimation Methods: A Review of Clinical, Sensor and Image Processing Methods," *Int. J. Eng. Res. Technol.*, vol. 2, no. 1, pp. 1–7, 2013.
- [19] R. C. Gonzalez and R. E. Woods, *4TH EDITION Digital image processing*. New York: Pearson, 2018.
- [20] Suyanto, *Machine Learning Tingkat Dasar dan Lanjut*. Bandung: Informatika, 2018.
- [21] R. Jain, N. Jain, A. Aggarwal, and D. J. Hemanth, "Convolutional neural network based Alzheimer's disease classification from magnetic resonance brain images," *Cogn. Syst. Res.*, vol. 57, pp. 147–159, 2019, doi: 10.1016/j.cogsys.2018.12.015.
- [22] K. U. Ahamed et al., "A deep learning approach using effective preprocessing techniques to detect COVID-19 from chest CT-scan and X-ray images," *Comput. Biol. Med.*, vol. 139, no. October, p. 105014, 2021, doi: 10.1016/j.compbimed.2021.105014.
- [23] F. Giannakas, C. Troussas, I. Voyiatzis, and C. Sgouropoulou, "A deep learning classification framework for early prediction of team-based academic performance," *Appl. Soft Comput.*, vol. 106, p. 107355, 2021, doi: 10.1016/j.asoc.2021.107355.
- [24] F. Sultana, A. Sufian, and P. Dutta, "Advancements in image classification using convolutional neural network," *Proc. - 2018 4th IEEE Int. Conf. Res. Comput. Intell. Commun. Networks, ICRCICN 2018*, pp. 122–129, 2018, doi: 10.1109/ICRCICN.2018.8718718.
- [25] A. Newaz, N. Ahmed, and F. Shahriyar Haq, "Survival prediction of heart failure patients using machine learning techniques," *Informatics Med. Unlocked*, vol. 26, no. August, p. 100772, 2021, doi: 10.1016/j.imu.2021.100772.
- [26] L. Pan, L. Gu, and J. Xu, "Implementation of medical image segmentation in CUDA," *5th Int. Conf. Inf. Technol. Appl. Biomed. ITAB 2008 conjunction with 2nd Int. Symp. Summer Sch. Biomed. Heal. Eng. IS3BHE 2008*, pp. 82–85, 2008, doi: 10.1109/ITAB.2008.4570542.

## The difficulties of implementing palliative care

Mariângela Ferraz Rodrigues Araújo<sup>1</sup>, Ana Paula Saldanha Santos<sup>1</sup>, Andressa Jordânia Alves de Amorim<sup>1</sup>, Francielly Aparecida Lemos Walder<sup>1</sup>, Ivan Paoletti Pisani<sup>1</sup>, Thalyta Eduarda de Menezes Gouvea<sup>1</sup>, Bruna Rafaela Gomes de Sousa Oliveira<sup>1</sup>, Pamela Nery do Lago<sup>2</sup>, Simone Aparecida de Souza Freitas<sup>2</sup>, Luciana Moreira Batista<sup>2</sup>, Danielle Cristina de Oliveira Silva Saturnino<sup>2</sup>, Luciana de Moraes Lisboa<sup>2</sup>, Aline da Silva Fernandes<sup>2</sup>, Diva Maria de Oliveira<sup>2</sup>, Carolina Costa Pinto<sup>2</sup>, Elessandra Antônia Santos de Rezende<sup>2</sup>, Nicolle Silva de Menezes<sup>2</sup>, Ana Paula Caetano Pereira<sup>2</sup>, Ronaldo Gomes Rodrigues<sup>2</sup>, Fabíola Fontes Padovani<sup>2</sup>, Laiana Otto da Costa<sup>2</sup>, Raquel Resende Cabral de Castro e Silva<sup>2</sup>, Ângelo Aparecido Ninditi<sup>2</sup>, João Eduardo Pinho<sup>2</sup>, Maria Emília Lúcio Duarte<sup>2</sup>, Darlan dos Santos Damásio Silva<sup>3</sup>, Juliane Guerra Golfetto<sup>4</sup>, Leticia do Nascimento<sup>4</sup>, Rita de Cássia Almeida Sales<sup>5</sup>, Kiwisunny Galvão Franzoi<sup>5</sup>, Hirlla Karla de Amorim<sup>5</sup>, Kelly Monte Santo Fontes<sup>6</sup>, Rafaela Bezerra Gama Guimarães<sup>6</sup>, Fabiana Nascimento Silva<sup>6</sup>, Marcelo Dangllys Duarte Fernandes<sup>6</sup>, Lisyanne Pinheiro Costa Silva<sup>6</sup>, Hilma Keylla de Amorim<sup>7</sup>, Tatiana Lamounier Silva<sup>8</sup>, Leonardo Oliveira Silva<sup>9</sup>, Michelly Angelina Lazzari da Silva<sup>9</sup>, Edma Nogueira da Silva<sup>10</sup>, Ana Patrícia da Cruz<sup>11</sup>, Tatiana Alves Costa<sup>11</sup>, Raiane Almeida Silva<sup>12</sup>, Ana Luiza Loiola Santos<sup>13</sup>, Juliana Grazielle Lobato Alexandre<sup>14</sup>, Fernando Henrique da Silva Costa<sup>15</sup>, Eugênio Barros Bortoluzi<sup>15</sup>, Maria Ivanilde de Andrade<sup>16</sup>, Daniel da Silva Costa Lazzari<sup>17</sup>, Claudiomiro da Silva Alonso<sup>18</sup>, Daniele Estéfany de Souza Pires Silva<sup>18</sup>, Andrea de Sousa Quintela<sup>19</sup>

<sup>1</sup>University Center UNA Bom Despacho, Bom Despacho, Brazil.

<sup>2</sup>Clinical Hospital of the Federal University of Minas Gerais, Belo Horizonte, Brazil.

<sup>3</sup>Professor Alberto Antunes University Hospital of the Federal University of Alagoas, Maceió, Brazil.

<sup>4</sup>University Hospital of the Federal University of Santa Maria, Santa Maria, Brazil.

<sup>5</sup>Clinical Hospital of the Federal University of Pernambuco, Recife, Brazil.

<sup>6</sup>University Hospital of the Federal University of Sergipe, Aracaju, Brazil.

<sup>7</sup>Professor Alberto Antunes University Hospital of the Federal University of Alagoas, Maceió, Brazil.

<sup>8</sup>Clinical Hospital of the Federal University of Triângulo Mineiro, Uberaba, Brazil.

<sup>9</sup>University Hospital of the Federal University of Grande Dourados, Dourados, Brazil.

<sup>10</sup>University Hospital of the Federal University of Juiz de Fora, Juiz de Fora, Brazil.

<sup>11</sup>Maria Aparecida Pedrossian University Hospital, Federal University of Mato Grosso do Sul, Campo Grande, Brazil.

<sup>12</sup>Dr. Washington Antônio de Barros Teaching Hospital, Federal University of Vale do São Francisco, Petrolina, Brazil.

<sup>13</sup>Clinical Hospital of the Federal University of Uberlândia, Uberlândia, Brazil.

<sup>14</sup>Sofia Feldman Hospital, Belo Horizonte, Brazil.

<sup>15</sup>Faculty of Applied Social Sciences, Campina Grande, Brazil.

<sup>16</sup>Lagoa Santa City Hall, Lagoa Santa, Brazil.

<sup>17</sup>University of Grande Dourados, Dourados, Brazil.

<sup>18</sup>Minas Gerais Military Police Hospital, Belo Horizonte, Brazil.

<sup>19</sup>Walter Cantídio University Hospital of the Federal University of Ceará, Fortaleza, Brazil.

Received: 08 Aug 2022,

Received in revised form: 04 Sep 2022,

Accepted: 12 Sep 2022,

Available online: 21 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords— Palliative Care, Intensive Care, Physical Therapy. Terminal Patient.**

**Abstract**—Palliative Joint Care (PC) is a set of palpable care practices that aim to prevent patients from increasing patients with diseases or a more advanced stage according to their disease. Care is provided by a multidisciplinary team, composed of nurses, nutritionists, nutritionists, doctors, whose purpose is to relieve autonomy, making what has one and the patient possible to prepare the death in their own way. The study aims to analyze the importance through qualitative data and what are the difficulties for the implementation of palliative care in the Adult Intensive Care Unit (ICU). It consists of a literature review, through a bibliographic survey, with an exploratory and relative approach, not on the physiotherapeutic performance in palliative care within the same Intensive Care (ICU) system, and how the environment among professionals is seen and graphic care multidisciplinary teams within hospitals. Realizing the importance of palliative care for critically ill patients, endorsing the phases of the patient's importance, was possible, in addition to the importance in this process. The prioritization of the patient's well-being in an intensive environment is always the focus of the treatment from the initial point, until its delivery, always maximizing its intention, psychological and physical health in a global way, where all the professionals involved are of paramount importance. with responsibility.

## I. INTRODUCTION

The World Health Organization (WHO) defines palliative care as active and comprehensive actions provided to patients with progressive and irreversible disease, becoming necessary from the moment that all therapeutic possibilities for the cure of the sick person are exhausted [1].

The increase in the world population has resulted in important aspects in the health sector, especially due to the growing population of elderly people, increasing the prevalence of chronic non-communicable diseases (NCDs), cancer, diabetes and chronic respiratory and cardiovascular diseases, impacting the volume of admission to the Intensive Care Unit (ICU). The ICU is a place where technology is used to save life or improve the patient's functional status. When dealing with terminal patients, there is a great need to establish limits between the best possible quality of life and the prolongation of dying [2].

Given this scenario, palliative care emerges, which seek to establish an adequate treatment program, with a multiprofessional and interdisciplinary approach, with the objective of relieving suffering, relieving pain and other physical, psychological and spiritual symptoms, with a view to making that the patient feels comfortable, and that their family members participate in this disease process with less anguish [3].

The importance of the performance of the multidisciplinary team considering its actions within the intensive unit, there is health promotion through integrated care, its approach is essential so that the patient's comfort is prioritized, establishing pillars of trust and effective communication, reducing the stress related to the bereavement of family members and later outlining decisive interventions in palliative treatment [4].

Physiotherapy presents a set of therapeutic resources that integrate both palliative care, acting in the improvement of symptoms, as well as in the patient's quality of life. It also contributes through manual therapy methods, stretching, passive and active exercises, joint mobilizations, positioning, breathing exercises and bronchial hygiene techniques, oxygen support and mechanical ventilation when necessary. In this way, the professional acts to complement the palliative approach in order to obtain, within their professional reach, the care that the patient needs [5].

ICUs are seen as units for patients with unfavorable prognoses and, in most cases, with no prospect of survival, with the purpose of bringing together recoverable patients, technology and human resources capable of care and constant observation in the same physical environment [6].

Technological and scientific advances allowed the prolongation of life and, mainly, the reversal of impairments without prognosis. More sophisticated devices such as respirators, monitors, equipment for

medication and other supports and the need for space in large hospitals have increased the stereotype of cold and inhumane units, full of machines where only scientific reasoning would fit, with the disease being above the human being itself. [6].

In recent years, ICUs have become a concentration not only of critical patients and advanced technology, but also with an experienced team with skills and competences [7], who seek to provide comfort to the patient and, for their family, the understanding of the mourning, making them understand that death is a natural process of life [8]. Therefore, we justify the importance of finding in the literature answers to our guiding question: What makes the implementation of palliative care in the ICU difficult?

Therefore, this research aims to analyze through qualitative data, what are the difficulties for the implementation of palliative care in the ICU.

## II. METHODOLOGY

The present study consists of a literature review, through a scientific bibliographic survey, with an exploratory and relative, non-systematic approach, on the physiotherapeutic performance in palliative care within the ICU environment. The search for theoretical reference was carried out through searches of articles available on the following platforms: Scientific Electronic Library Online (SCIELO), Google Scholar, Pedro and PubMed.

To search the databases, a combination of descriptors was used: palliative care, intensive care, physical therapy and terminal patients, in the following databases: Lilacs, VHL (Virtual Health Library), SciELO and PubMed. The texts were analyzed and selected in a reflective way, in order to obtain accurate information.

The inclusion criteria were: articles that contain information related to the chosen topic and be available online for free from 2016 to 2021, in Portuguese. All those published before 2016 and other literature review articles were excluded.

The research consists of a total of seven selected studies, as shown in the following flowchart:

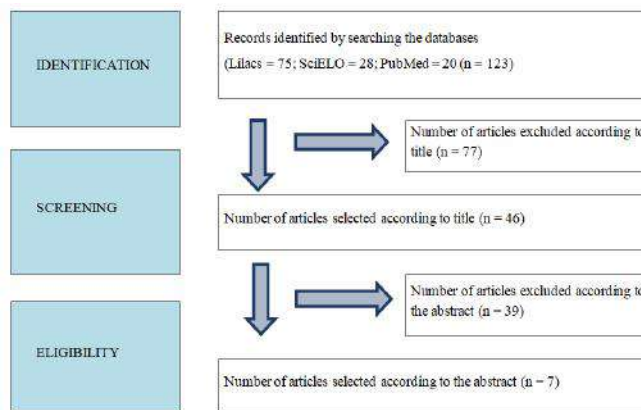


Fig.1: flowchart of the search process for scientific articles.

## III. RESULTS

In the process of bibliographic survey, in relation to the theme adopted in this study, it was possible to identify the importance of palliative care in terminally ill patients. It is worth mentioning that the search on Palliative care, Intensive care, Lilacs, VHL, SciELO and PubMed platforms allowed the selection of 7 scientific productions.

The studies were analyzed and selected carefully, and the articles were carefully read so that they were classified in the table according to the year, author, title, methodology and results:

Table 1. Representation of selected articles.

| AUTHOR/YEAR | TITLE                                                                                                               | METHODOLOGY                                                                                                                                                                                                                                                                                                                                                                                                                          | RESULTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mazutti [9] | Limitation of Advanced Life Support in patients admitted to an intensive care unit with integrated palliative care. | Retrospective cohort study, which included patients over 18 years of age enrolled in the palliative care program of the intensive care unit of Hospital Paulistano, from May 1, 2011 to January 31, 2014. Limitations of Advanced Life Support analyzed were: do not resuscitate order, mechanical ventilation, hemodialysis and vasoactive drug. For quantitative variables, measures of central tendency were calculated. The Chi- | According to the study, 3.487 patients were admitted to the intensive care unit, 342 of whom were included in the palliative care program. It was observed that, after entering the palliative care program, it took a median of 2 (1 - 4) days for death in the intensive care unit and 4 (2 - 11) days for in-hospital death. Most of the limitations of Advanced Life Support (42.7%) occurred on the first day of hospitalization. Cardiopulmonary resuscitation (96.8%) and ventilatory support (73.6%) were the most adopted limitations. |



|              |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              |                                                                                   | Square test was used to compare characteristics of patients with or without Advanced Life Support limitations and the Wilcoxon test to compare the length of stay after Advanced Life Support. For statistical significance, the confidence interval and $p \leq 0.05$ were considered.                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Lima [2]     | Palliative care in intensive care: the perspective of the multiprofessional team. | This is a qualitative study, in which 21 health professionals working in the ICU of a public hospital in the Federal District participated. The instruments used were: socio-demographic questionnaire and semi-structured interview. The interviews were submitted to Bardin's content analysis.                                                                                             | The results indicated four thematic axes, the most frequent categories being: 1) Thematic axis "PC Concept": without prognosis (n = 15) and quality of life (n = 14); 2) "Factors that favor PC": PC demand (n = 3) and technological resources (n = 2); 3) "Factors that make PC difficult": communication problems (n = 11) and lack of knowledge (n = 6); 4) "Suggestions for the implementation of PC": training (n = 13) and improvements in communication (n = 4); and CP protocol (n = 3).                                                                                                                                                                                                                                                                                                                  |
| Pires [10]   | End-of-life comfort in intensive care: perception of the multidisciplinary team.  | Qualitative, descriptive and exploratory study, carried out with 50 professionals from the health team of an Intensive Care Unit of a private hospital in Bahia. A socio-demographic questionnaire and a semi-structured interview were used to collect data, which were analyzed using the thematic content analysis technique and discussed in the light of the Pacific End of Life Theory. | According to authors, there was a predominance of women (72%) and young adults (age range from 30 to 45 years with 70%), with a mean age of 37.5 years. As for specialization, 56% have it in the ICU and none in the PC. Although all participants stated that they had already provided assistance to terminally ill patients, only 32% had approached the topic at graduation, with nurses standing out, 53.8%. Based on the identification of the basic needs of PC patients in the ICU, the participants directed care towards the concepts of the Peaceful End of Life Theory (PTVP), prioritizing the promotion of comfort. Three categories emerged: 1. Relieving pain to promote comfort; 2. Comfort to achieve peace, dignity and respect and 3. Approaching loved ones and faith as a comfort strategy. |
| Maingué [11] | Bioethical discussion about the patient in end-of-life care.                      | This is a quantitative research carried out in two hospitals in Paraná, between March and May 2018, with a sample of 45 members of a multidisciplinary team.                                                                                                                                                                                                                                  | In the study, it was found that the interviewees were concerned about respecting autonomy, protecting dignity and preserving the quality of life of patients and families through shared decision-making. However, the tendency of therapeutic obstinacy to fulfill the professional duty showed the need for more discussions and training in palliative care to minimize ethical conflicts.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Marques [12] | Palliative care: speech of physiotherapists working in ICU.                       | Exploratory research of a qualitative nature, carried out by 11 physiotherapists from the ICU of a University Hospital in the city of João Pessoa-PB. For data collection, a form containing questions relevant to the content of the study was used. The empirical material was analyzed using                                                                                               | Among the professionals who participated in the research, there was a predominance of females, totaling 8 professionals. As for the training time, most of the physical therapists interviewed have between 10 and 15 years of training, corresponding to 8 professionals, which is the shortest training time found in the interviewed sample. This fact characterizes a certain maturity regarding the                                                                                                                                                                                                                                                                                                                                                                                                           |

|              |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              |                                                                                                           | the Collective Subject Discourse (CSD) technique.                                                                                                                                                                                                                                                                                                | professional practice of physiotherapy. Regarding the length of time working in the ICU, most of them have worked as an intensivist for between 10 and 15 years, and only 3 of the participants have worked in the ICU for less than 3 years. With regard to postgraduate courses, 5 participants have postgraduate degrees at a specialization level, 4 are masters and 2 are doctors. From the analysis of the empirical material, 6 central ideas emerged. These will be presented with the respective DSC.                                                                                                                                                                                                                                                                                                                                                                |
| Barbosa [13] | Experiences in the intensive care unit: the multidisciplinary team's view of patients in palliative care. | Descriptive study, with a qualitative approach, carried out with 15 health professionals from the ICU of a University Hospital who underwent a semi-structured interview.                                                                                                                                                                        | The study pointed to a survey with a total of 15 health professionals working in the ICU of that hospital, being 5 nurses, 3 nursing technicians, 3 physiotherapists, 2 doctors, 1 pharmacist and 1 nutritionist. The predominant sex of the participants was female, with 9 (66.6%) professionals; professionals with higher education totaled 12 (80%), while 3 (20%) were mid-level professionals. Participants aged between 25 and 30 years predominated, with 5 (33.3%) participants; 6 (40%) participants reported having between 11 and 15 years of professional experience. Regarding professional qualification, participants with a postgraduate degree in the area of intensive care predominated, with 7 (53.3%) participants. From the speeches of the participants, 3 categories emerged, which will be presented below.                                        |
| Perão [14]   | Social representations of comfort for relatives of patients in palliative care in intensive care.         | Descriptive, qualitative study, theoretical framework adopted by social representations. Participants were 30 family members of patients hospitalized in an intensive care unit, in palliative care. Data were collected through individual semi-structured interviews, organized and analyzed using the Collective Subject Discourse technique. | In view of the survey results, the family members interviewed were between 25 and 75 years old, and most were female (n=19;63.3%). Regarding the degree of kinship, children (n=9; 30%) stood out, followed by husbands (n=6; 20%) and wives (n=6; 20%) and the others were partners, mother, sister, brother and father (n=9; 30%). Regarding the level of education, family members with complete elementary school stood out (n=10; 33.3%) and in the same number completed high school (n=10;33.3%). Only 1 family member reported having completed high school (n=01;3.3%). Regarding religion, family members were Catholic (n=18; 60%), evangelical (n=9; 30%) or had another religion (n=03; 10%). Most of the interviewees were employed, and some family members had another experience of a relative hospitalized under palliative therapy in an ICU (n=07;23.3%). |

Source: survey data (2021).

#### IV. DISCUSSION

In the study by Mazzutti, carried out in the ICU of Hospital Paulistano in the city of São Paulo, cohort studies were used as an evaluation tool, useful in the identification of risk and prognostic factors, in the follow-up regarding the impact of diagnostic and therapeutic interventions. It was observed that the applied study prioritizes the contribution of palliative care in the intensive care unit to the practice of orthonasia, inserting patients from the palliative care program admitted to the ICU of this hospital. This is due to the subsistence of qualitative and quantitative questioning in the estimative index and incidence in the limitation of advanced life support in critically ill patients. From the analysis of the results through the cohort study, it can be seen that there was a fundamental contribution to the understanding related to the contribution of palliative care in intensive care to the practice of orthonasia [9], which corroborates the article by the author Lima [15], where he states that palliative care in the face of the published study is effective in guaranteeing respect for a dignified death according to Human Rights, bioethics and medical ethics, in which he expresses the importance of progress related to the express regulation of orthonasia, where, only through this process, all professionals inserted in the palliative scope will be able to exercise their offices with legal certainty.

According to a study by Lima, carried out at a public hospital in the Federal District, with 21 health professionals, the socio-demographic questionnaire and semi-structured interview were used as an evaluation instrument, where an increase in the demand for PC was observed, and that the technologies are considered important and indispensable tools in an ICU, to promote a better quality in the final comfort [15]. It is noticed that there is little knowledge of the multidisciplinary team together with the lack of resources, both physical and human, hindering the advancement of PC within the ICU [1]. Comparing with the study by Silva, carried out in the city of Recife, we were able to analyze that there are several factors that contribute to the difficulty of effectively implementing palliative care, including the lack of practical contact during graduation, lack of protocols made by the institution, failure to communication between the team, and, at the end of the study, the professionals themselves admit to having little knowledge about PC, which requires more information [16].

The study by Pires, carried out in a private hospital in Salvador, with 50 health professionals, used the same evaluation process as the aforementioned study. In this study, it was possible to observe that, even in the case of a private hospital, the lack of knowledge of professionals in relation to PC has become an obstacle, but when identifying a patient in need of palliative care, they put

into practice interventions to relieve pain, promoting comfort to achieve peace, dignity, respect, and putting an end to the approximation of family members, which will also bring comfort to the patient [10]. The study by the author Ascensão, 2013, reinforces that palliative care should be for the prevention and relief of suffering, in addition to the importance of family support to the patient, which in this process makes all the difference, which brings more safety and comfort to the patient because be someone you trust [3].

The study by Maingué [11], carried out in two hospitals in Paraná, between March and May 2018, with the participation of 45 members of a multiprofessional team, showed that technical advances in ICU health care have increased the capacity of the science in prolonging life, replacing the patient's vital functions with technology. This added value to medical practice, but changed the way illness and death are interpreted. It is difficult to accept finitude, even for health professionals, who often exploit disproportionate measures to increase the end of life, prolonging suffering. It is the use of non-recommended practices instead of palliative actions, opposing the natural model of death [11]. When we compare with the study by the author Borges [17], we can observe that, with the growth of studies and technology, together with the space that palliative care has been gaining, it is possible to bring greater comfort to patients at the end of their lives and more information on how family members can help in this process [17].

According to the study by Marques, carried out in the ICU of a university hospital in João Pessoa, through a qualitative exploratory research using a form for data collection carried out with 11 physical therapists, it was possible to observe that the physical therapy team has knowledge on the subject, but the lack of resources in the hospital, makes the implementation of PC difficult [12], this difficulty was also reported in the study by Pereira, highlighting the scarcity of specific protocols and training that facilitate the implementation of PC and that is not always available by the hospital [18].

In a study carried out by Barbosa, with the objective of analyzing the view of health professionals, facing the patient with no therapeutic possibility in the ICU, of a University Hospital in the state of Rio de Janeiro, with the participation of 15 health professionals working in the ICU, it was evidenced through a questionnaire of semi-structured interviews with an elaborate script of open questions, that the participants highlighted the suffering of the patient and the family, which, in most cases, is intensified along the course of the disease, mainly in the ICU, due to the use of resources and efforts considered unnecessary. Reinforcing the importance and the need for

qualification of the multiprofessional team in the face of the palliative care process and the terminality process [13], they corroborate the study by Silva, who mentions that it is necessary to develop a national policy that supports the terminal critical patient care, the continuing education of professionals and the creation of care protocols to promote the comfort of the patient during the final phase of life and that of his family [19].

In the study by Perão, carried out at the Hospital de Florianópolis, being a descriptive and qualitative study, it is observed that this was aimed at sampling palliative care and understanding the family comfort concomitant with the patient and its variables, prioritizing their health on a global scale, observing questionable points in some intensive care units about the priority of family integration as an integral part of palliative care, later on, there is a distance between the multiprofessional team and the family. It was noticed the importance of care and the family and the patient in the intensive unit related to palliative care, which are defined by actions that improve the quality of life so that, the greater the palliative occurrence performed by the multiprofessional team, the greater the approximation the same with the patient and his/her relatives and the better the effectiveness of the treatment [14]. This study corroborates the findings of Pegaroro, which highlights the patient in intensive palliative care with limited life support and their life prospects, and the analysis of professional activities related to their normally performed tasks, where the need was recognized. to plan criteria for the care of these patients and the importance of palliative care. The observed results were the withdrawn position of the professionals, in terms of providing a dignified death without suffering for inpatients, and it is important for the institutions to plan to provide critical analysis and reflection on the process of palliative care, in the case of a more attentive observation. of the entire multidisciplinary team to avoid such retraction and lack of professional positioning [20].

Based on the above, it was possible to perceive the importance of palliative care for patients in critical, terminal stages, highlighting pain relief, dignity and respect, in addition to the importance of the family in this process. It is clear that most of the articles reviewed, both in private hospitals and in public hospitals, mostly found the lack of knowledge and communication of the multidisciplinary team, together with the lack of protocols, hindering the implementation and quality of palliative care in the units. intensive care unit, which requires greater guidance and training for hospital staff.

## V. CONCLUSION

In view of the aspects addressed in the study, it is clear that, with the implementation of the patient in the PC, it is possible to improve the quality of life, relieve pain and provide the patient with a dignified death. The family plays a fundamental role in this process, showing significant effectiveness when there is a rapprochement between itself and the patient, offering them greater comfort and safety, thus increasing the effectiveness of the treatment.

However, it is noted that, even with technological advances, there is still difficulty in implementing palliative care, as hospitals that have excellent infrastructure for this implementation have a team with little knowledge and ineffective communication, while hospitals with qualified professionals and with the necessary understanding, does not have the proper infrastructure to put their skills into practice.

This study shows us the importance of communication between the multidisciplinary team in the hospital environment. Academically, it is important to continue studying the subject addressed, so that the professional obtains a better knowledge about palliative care, leading to dignity, respect and quality of life not only for the patient, but also for the family.

## REFERENCES

- [1] World Health Organization. (2021). Who Definition of palliative care. Retrieved from <https://www.who.int/health-topics/palliative-care>.
- [2] Lima, A. S. S., Nogueira, G. S. & Werneck-Leite, C. D. S. (2019). Cuidados paliativos em terapia intensiva: a ótica da equipe multiprofissional. *Rev. SBPH*, 22, 91-106. Retrieved from [http://pepsic.bvsalud.org/scielo.php?script=sci\\_arttext&pid=S1516-08582019000100006](http://pepsic.bvsalud.org/scielo.php?script=sci_arttext&pid=S1516-08582019000100006).
- [3] Ascensão, D. S. (2013). Burnout nos enfermeiros em cuidados paliativos. Relatório de Prática Clínica [Mestrado em Cuidados Paliativos]. Instituto Politécnico de Castelo Branco, Portugal. Retrieved from <https://repositorio.ipcb.pt/handle/10400.11/2220>.
- [4] Nascimento, L. C., Fonseca, I. A. C. (2021). Cuidados paliativos na assistência domiciliar: a vivência de uma equipe multidisciplinar. *Revista Eletrônica Acervo Saúde*, 13 (6), e8117. Retrieved from <https://doi.org/10.25248/reas.e8117>.
- [5] Resende, J. M. D. (2012). Fisioterapia nos cuidados paliativos oncológicos - Aspectos Gerais. Simpósio de Cuidados Paliativos Para os Hospitais Federais do Rio de Janeiro. Retrieved from [http://bvsm.s.saude.gov.br/bvs/publicacoes/inca/Fisioterapia\\_nos\\_cuidados\\_paliativos.pdf](http://bvsm.s.saude.gov.br/bvs/publicacoes/inca/Fisioterapia_nos_cuidados_paliativos.pdf).
- [6] Ribeiro, C. G., Silva, C. V. N.S. & Miranda, M. M. (2005). O paciente crítico em uma unidade de terapia intensiva: uma revisão da literatura. *Rev. Min. Enf*, 9(4), 371-377.

- Retrieved from <https://cdn.publisher.gn1.link/reme.org.br/pdf/v9n4a14.pdf>.
- [7] Nozawa, E., Sarmento, G. J. V., Veja, J. M., Costa, D., Silva, J. E. P. & Feltrim, M. I. Z. (2008). Perfil de fisioterapeutas brasileiros que atuam em unidades de terapia intensiva. *Fisioter. Pesqui.*, 15 (2). Retrieved from <https://www.scielo.br/j/fp/a/WDsNsLgrsPWCKDNhLPcnrSf/?lang=pt>.
- [8] Brasil (Ministério da Saúde). 2004. Programa Nacional de Cuidados Paliativos. Direção Geral de Saúde: Conselho Nacional de Oncologia. Brasília. Retrieved from <http://1nj5ms2lli5hdgbe3mm7ms5-wpengine.netdna-ssl.com/files/2015/08/Programa-Nacional-de-Cuidados-Paliativos.pdf>.
- [9] Mazzutti, S. R., Nascimento, A. F. & Fumis, R. R. L. (2016). Limitação de Suporte Avançado de Vida em pacientes admitidos em unidade de terapia intensiva com cuidados paliativos integrados. *Rev. Bras. de Terapia Intensiva*, 28 (03). Retrieved from <https://www.scielo.br/j/rbti/a/yyFvhfwbQ6PNZq5T54bBs6B/?lang=en>.
- [10] Pires, I. B., Menezes, T. M. O., Cerqueira, B. B., Albuquerque, R. S., Moura, H. C. G. B., Freitas, R. A., Santos, A. L. S. & Oliveira, E. S. (2020). Conforto no final de vida na terapia intensiva: percepção da equipe multiprofissional. *Acta Paulista de Enfermagem*, 33, eAPE20190148. Retrieved from [http://www.revenf.bvs.br/scielo.php?script=sci\\_arttext&pid=S0103-21002020000100436&lng=pt&nrm=iso](http://www.revenf.bvs.br/scielo.php?script=sci_arttext&pid=S0103-21002020000100436&lng=pt&nrm=iso).
- [11] Maingué, P. C. P. M., Sganzerla, A., Guirro, U. B. P. & Perini, C. C. (2020). Discussão bioética sobre o paciente em cuidados de fim de vida. *Revista Bioética*, 28, 135-146. Retrieved from <https://www.scielo.br/j/bioet/a/QBc3qsn7WSNN37rC99DZJQD/?lang=pt>.
- [12] Marques, C. C. O, Pessoa, J. C. S., Nóbrega, I. R. A. P., Farias, R. C., Favero, A. B. L. & Andrade, F. L. J. P. (2020). Cuidados Paliativos: Discurso de Fisioterapeutas que Atuam em Unidade de Terapia Intensiva. *Rev Fun Care Online* 12, 1241-1246. Retrieved from [http://seer.unirio.br/cuidadofundamental/article/view/9446/pdf\\_1](http://seer.unirio.br/cuidadofundamental/article/view/9446/pdf_1).
- [13] Barbosa, A. P. M., Santo, F. H. E., Hipólito, R. L., Silveira, I. A. & Silva, R. C. (2021). Vivências do CTI: Visão da Equipe Multiprofissional Frente ao Paciente em Cuidados Paliativos. *Enfermagem em Foco*, 10 (4) 161-166. Retrieved from <http://revista.cofen.gov.br/index.php/enfermagem/article/view/2990/966>.
- [14] Perão, O. F., Nascimento, E., Padilha, M., Lazzari, D. D., Hermida, P. & Kersten, M. (2021). Social representations of comfort for patients' family members in palliative care in intensive care. *Rev Gaucha Enferm.*, 26 (42), e20190434. Retrieved from <https://pubmed.ncbi.nlm.nih.gov/33656163/>.
- [15] Lima, C. A. S. (2015). Ortotanásia, cuidados paliativos e direitos humanos. *Rev Soc Bras Clin Med.*, 13 (1), 14-7. Retrieved from <http://files.bvs.br/upload/S/1679-1010/2015/v13n1/a4762.pdf>.
- [16] Silva, G. M., Cavalcante, E. R., Souza, V. M. S., Lima, K. M. O., Cavalcanti, B. K. C. & Silva, S. S. C. (2017). Análise do conhecimento da equipe multidisciplinar em uma unidade de terapia intensiva à cerca dos cuidados paliativos. *Rev Saúde-UNG-Ser.*, 11 (1), 39. Retrieved from <http://revistas.ung.br/index.php/saude/article/view/3125>.
- [17] Borges, M. M. & Santos Junior, R. (2014). A comunicação na transição para os cuidados paliativos: artigo de revisão. *Rev. bras. educ. med.*, 38 (2). Retrieved from <https://www.scielo.br/j/rbem/a/kwFkVRhDzdWqNdpXzQ7zHqR/?lang=pt>.
- [18] Pereira, C. P., Bellinati, N. V. C. & Silva, B. F. (2021). Fragilidades e potencialidades da equipe multiprofissional no desenvolvimento dos cuidados paliativos em Unidade de Terapia Intensiva. *Research, Society and Development*, 10 (9), e22210917989. Retrieved from <https://rsdjournal.org/index.php/rsd/article/view/17989>.
- [19] Silva, C. F., Souza, D. M., Pedreira, L. C, Santos, M. R & Faustino, T. N. (2013). Concepções da equipe multiprofissional sobre a implementação dos cuidados paliativos na unidade de terapia intensiva. *Ciênc. saúde coletiva*, 18 (9). Retrieved from <https://www.scielo.br/j/csc/a/Yzg37SkczWT8KZ5MRDQDZbF/?lang=pt>.
- [20] Pegaroro, M. M. O. & Paganini, M. C. (2019). Cuidados paliativos e limitação de suporte de vida em terapia intensiva. *Rev. Bioét.*, 27 (4). Retrieved from <https://www.scielo.br/j/bioet/a/yHcNtCvdcw6wQp8rPRKrQjK/?lang=pt>.

# Antiulcer, analgesic and hepatoprotective activities of hydroalcoholic root extract of *Jurinea Dolomiaea Boiss* against carbon tetrachloride induced hepatopathy in rats

Mushtaq Ahmad Bhat<sup>\*1</sup>, Fairooz Ahmad Khan<sup>2</sup>, Quazi Saifuddin<sup>2</sup>, Dr.H.C.Kataria<sup>1</sup>

<sup>1</sup>Department of Chemistry, Govt. Geetanjali Girl's (Autonomous) P.G. College, Berasiya road Bhopal – 462038, Madhya Pradesh, India

<sup>2</sup>Department of Chemistry, Maulana Azad College of Arts Science and Commerce, Aurangabad –431001, Maharashtra, India  
mushtaqbhat24434@gmail.com<sup>1</sup>, fairoozch13@gmail.com<sup>2</sup>, kaazisaif@gmail.com<sup>3</sup>, h-c kataria@yahoo.com<sup>4</sup>

Received: 19 Aug 2022,

Received in revised form: 08 Sep 2022,

Accepted: 13 Sep 2022,

Available online: 20 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Antiulcer activity, Analgesic activity, hepatoprotective activity, Jurinea dolomiaea roots, CCl4, SGOT, SGPT, ALP, total bilirubin, histopathology.*

**Abstract**— *The plant Jurinea Dolomiaea Boiss belonging to family Astraceae traditionally used in Ayurvedic system as antidiabetic, antioxidant, antibacterial, antitumor and also used in liver disorders. In this study, water and hydroalcoholic root extracts of Jurinea dolomiaea boiss was studied for antiulcer, analgesic and hepatoprotective properties against carbon tetrachloride induced hepatotoxicity in albino wistar rats. Hydroalcoholic extract of Jurinea dolomiaea root (100mg/kg and 200mg/kg p.o) were administered to the experimental rats for seven days. The hepatoprotective activity of hydroalcoholic extract of Jurinea dolomiaea roots were evaluated by estimation of SGOT, SGPT, ALP and total bilirubin. Histopathology of the liver was also studied. In the hydroalcoholic extract of Jurinea dolomiaea roots treated animals, the toxic effect of carbon tetrachloride was controlled significantly by restoration of the increased levels of SGOT, SGPT, ALP and total bilirubin as compare to the toxicant control. The hydroalcoholic extract of roots of Jurinea dolomiaea showed significant hepatoprotective activity.*

## I. INTRODUCTION

Lipid peroxidation is an important detorate reaction in food during storage and processing. It not only causes a loss in food quality but also be associated with some diseases such as carcinogenesis, mutagenesis, ageing, and arteriosclerosis [1]. The role of active oxygen and free radicals in tissue damage in such diseases, are becoming increasingly recognized [2]. Cancer, emphysema, cirrhosis, arteriosclerosis, and arthritis have all been correlated with oxidative damage. Recently, various Phytochemicals and their effects on health, especially the suppression of active oxygen species by natural antioxidants from teas, spices and herbs, have been intensively studied [3]. However, they are suspected of being responsible for liver damage and carcinogenesis in laboratory animals [4, 5]. *Jurinea dolomiaea* roots are used to treat stomachache in Indian

folk medicine [6]. In addition, the root is used to treat rheumatic pain and for colds and cough [7] and is used against liver insufficiency [8].

The liver regulates many important metabolic functions. Hepatic injury is associated with distortion of these metabolic functions [9]. Additionally, it is the key organ of metabolism and excretion, thus it is continuously and variedly exposed to xenobiotics because of its strategic placement in the body. The toxins absorbed from the intestinal tract go first to the liver resulting in a variety of liver ailments. Thus liver ailments remain one of the serious health problems. Modern medicines have little to offer for alleviation of hepatic diseases and it is chiefly the plant based preparations which are employed for their treatment of liver disorders. But there are not much drugs available

for the treatment of liver disorders [10,11]. Therefore, many folk remedies from plant origin are evaluated for its possible antioxidant and hepatoprotective effects against different chemical-induced liver damage in experimental animals. CCl<sub>4</sub>-induced hepatotoxicity model is frequently used for the investigation of hepatoprotective effects of drugs and plant extracts [12,13].

Roots of *Jurinea dolomiaea* Boiss (Astraceae) are effective in bilious affections as emetic and purgative. Roots are administered internally in leprosy, piles, jaundice. It is active as galactoguge; it is also applied round the eye orbit for night blindness. Root juice is rubbed to soles in burning of the feet and used in liver complaint of childrens.

## II. MATERIALS AND METHODS

### 2.1 Plant material

The plants from which the substances under study were isolated and are traditionally used for the treatment of ulcers, analgesic and liver are the roots of *Jurinea dolomiaea* Boiss. The plant material was collected in the state of Jammu and Kashmir. Plant material was collected from Himalayan region of upper Danchigam and in south Kashmir about 38- 45 meters above the sea level. The plant was identified taxonomically and authenticated at the Herbarium, Department of Botany, and Kashmir University. Plant was washed thoroughly 2 - 3 times with running tap water and then with sterile water followed by shade-dried, powdered and used for extraction.

### 2.2 Antiulcer activity

Forty albino male rats with a weight of 180–210g were used for the experiment. The rats were fed with standard laboratory before the experiment. The laboratory was windowless with automatic temperature (25 ± 1°C) and lighting controls (14h light/10h dark). Rats were divided into five equal groups (n = 8) and housed in cages. Twenty-four hours before the experiment, the rats were fasted and allowed access to water and libitum.

Anti-ulcerogenic effect of water extract of root was investigated by using the ethanol-induced ulcer model [14]. On the day of the experiment, groups 1, 2 and 3 were injected with 10mg/kg water extract of root, while group 4 was injected with 20mg/kg famotidine and group 5 with saline solution. All of drugs were administered intraperitoneally in 0.5ml vehicle. Following a 30-min-period, all the animals were given 1ml of ethanol (70%) by oral gavages. After one hour the animals were sacrificed by decapitation. The stomach of each was removed, opened and washed with saline solution. For the measurement of the gross gastric mucous, freshly excised

stomach was laid flat and the mucous were traced on clear acetate paper. Gross mucosal lesions were recognized as haemorrhage or linear breaks (erosions) with damage to the mucosal surface. The area of stomach and gross lesions were approximately calculated by planimetry using a simple magnifier. The results were translated to the term of “total ulcer area/total gastric area” and these were expressed as an ulcer index percentage (%).

### 2.3. Writhing test

All experiments were performed on no-fasted male and female albino Swiss mice weighing 30–38kg. Animals were divided into five equal groups of 6 each. Animals were pretreated with 50, 100 and 200mg/kg doses of water extract of root and 200mg/kg dose of metamizol as reference drug. Control animals received an equal volume of 0.9% NaCl in distilled water. Drugs and saline were given 60min before acetic acid injection. Writhing test was determined according to the method [15]. Writhing was induced by 10mg/kg of intraperitoneally acetic acid (0.6%) injection. Ten millimetres after acetic acid injection, the mice were placed in a transparent box and the number of writhes was counted for period of 10min. Writhing movement was accepted as contraction of the abdominal muscles accompanied by stretching of the hind limbs. Antinociceptive effect was expressed as the reduction of the number of writhing between control and pretreated mice.

$$\text{Percentage reduction of the number of writhing (\%)} = \left[ \frac{A_0 - A_1}{A_0} \right] \times 100$$

Where  $A_0$  was the number of writhing of the control, and  $A_1$  was the number of writhing of pretreatment with water extract of root [16].

### 2.4 Hepatoprotective activity

Wistar albino rats (150-200 g) of either sex were procured from Pharmacy Department of Barkatullah University Bhopal and was used for study. The animals were kept in polypropylene cages and were fed with standard pelleted feed and water ad libitum. The study has got the approval from the Institutional Animal Ethical Committee (IAEC) of Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA).

Analytical Laboratory grade chemicals, solvents were used for the studies, which were procured from s. d. fine and span diagnostic Ltd.

Experimental Animals were divided into five groups, each group containing six animals Group I (normal control) received distilled water for 7 days. Group II (induction control) received CCl<sub>4</sub> 1ml/kg, i. p. 1:1

dilution with coconut oil [17] on 5th day. Group III received liver tonic (5ml/kg, p.o.) for 7 days and CCl<sub>4</sub> induction on 5th day. Groups IV-V, received hydroalcoholic extract of roots (100mg/kg and 200mg/kg p.o) for 7th days and CCl<sub>4</sub> induction on 5th day. On the 8th day, the animals were sacrificed under ether anesthesia, blood and liver samples were collected. The blood was allowed to clot for 30 min; serum was separated by centrifuging and was used for biochemical estimations For histopathological study, liver tissue was quickly removed after autopsy and fixed in 10% formo saline.

The activities of serum glutamate pyruvate transaminase (SGPT) and serum glutamate oxaloacetate transaminase (SGOT) were assessed by the method of Reitman and Frankel. Estimation of serum ALP and serum bilirubin (Jendrassik Groff method) were also carried out to assess the acute hepatic damage caused by CCl<sub>4</sub>.

### 2.5. Statistical analysis

Experimental results concerning this study were mean± S.D. of three parallel measurements. Analysis of variance was performed by ANOVA procedures. Significant differences between means were determined by Duncan's multiple range tests. P values <0.05 were regarded as significant and P values <0.01 very significant.

## III. RESULTS AND DISCUSSION

### 3.1. Effects on acute gastric mucosal lesions induced by ethanol

Ulcer indices (UI) are shown in Table 1. Per-oral administration of 70% ethanol produced multiple mucosal lesions in the rat stomach. Pre-treatment with Water extract of root and famotidine were found to inhibit the ethanol-induced gastric mucosal injury in rats. Preventive effects of 50, 100 and 200mg/kg water extract of root were in a dose-dependent manner (percent inhibitions were 67.7, 61.1 and 77.8, respectively, compared to control) and there was a statistically significance between the effects of used water extract of root doses (P<0.005). Famotidine also significantly inhibited the ethanol-induced gastric lesion (percent decrease was 34.4, compared to ethanol). There were significant differences between all concentrations of water extract of root effects and famotidine effect (P<0.001).

Table 1. The effects of different doses of water extract of root and famotidine on the ethanol induced gastric mucosal injury. Results are expressed by Mean ± S.E.M.

| S.No | Groups               | Ulcer index (%) (mean±S.E.M.) | Percent decrease of gastric mucosal injury (%) |
|------|----------------------|-------------------------------|------------------------------------------------|
| 1    | Control              | 6.70 ± 0.68                   | –                                              |
| 2    | Famotidin 20 (mg/kg) | 4.41 ± 0.24*                  | 34.4                                           |
| 3    | WER (50mg/kg)        | 2.20 ± 0.15*                  | 67.7                                           |
| 4    | WER(100mg/kg)        | 2.65 ± 0.26*                  | 61.1                                           |
| 5    | WER (200mg/kg)       | 1.56 ± 0.61*                  | 77.8                                           |

### 3.2. Analgesic effect

Writhing numbers are shown in Table 2. Pretreatment with WER and metamizol were found to inhibit the acetic acid-induced writhing in mice. Inhibitor effects of 50, 100 and 200mg/kg WER were in a dose-dependent manner and significant (percent decrease, compare to control: 62.1, 70.4 and 89.2%, respectively). As seen in Table 2, metamizol also inhibited the acetic acid-induced writhing significantly (P<0.01) (decrease compare to control: 39.4%).

Table 2. Effects of different doses of water extract of root and metamizol on acetic acid-induced writhing in mice. Results are expressed by Mean ± S.E.M.

| S.No | Groups               | Writhing number (mean±S.E.M.) | Percent decrease of acetic acid-induced writhing in mice (%) |
|------|----------------------|-------------------------------|--------------------------------------------------------------|
| 1    | Control              | 25.3 ± 2.3                    | –                                                            |
| 2    | Metamizol (200mg/kg) | 16.3 ± 2.6*                   | 40.5                                                         |
| 3    | WER (25mg/kg)        | 8.5 ± 3.8*                    | 63.4                                                         |
| 4    | WER(50mg/kg)         | 3.8 ± 2.9*                    | 72.1                                                         |
| 5    | WER (100mg/kg)       | 9.5 ± 1.4*                    | 90.3                                                         |

### 3.3. Hepatoprotective Activity



The hepatic injury induced by CCl<sub>4</sub> caused significant rise in marker enzymes SGOT, SGPT, ALP and total bilirubin. The serum enzymes like SGOT, SGPT, ALP and total bilirubin of treated animals were significantly reduced ( $p < 0.01$ ) by seven days pretreatment of hydroalcoholic extract of roots of

*Jurinea dolomiaea* at two dose levels 100mg/kg and 200mg/kg, when compared with CCl<sub>4</sub> treated control (group II). From the result it is clear that the drugs show dose dependent activity. The effects on serum marker enzymes and total bilirubin are shown in Table 3.

Table No. 3: Effect of Hydroalcoholic Extract of *Jurinea dolomiaea* Boiss root on Serum Enzymes and Total Billirubin.

Results are expressed as mean  $\pm$  SD.

| Groups                                                                                    | SGOT IU/L         | SGPT IU/L        | Alkaline phosphatase (U/L) | Total Billirubin mg/dl |
|-------------------------------------------------------------------------------------------|-------------------|------------------|----------------------------|------------------------|
| Group I (Normal control)                                                                  | 57.37 $\pm$ 2.53  | 39.65 $\pm$ 6.4  | 167.33 $\pm$ 5.15          | 0.95 $\pm$ 0.16        |
| Group II (CCl <sub>4</sub> treated control)                                               | 166.36 $\pm$ 4.20 | 109.34 $\pm$ 7.5 | 298.50 $\pm$ 1.36          | 1.86 $\pm$ 0.28        |
| Group III (CCl <sub>4</sub> + Liver Tonic )                                               | 62.58 $\pm$ 3.88  | 57.50 $\pm$ 5.55 | 208.33 $\pm$ 4.49          | 0.86 $\pm$ 0.12        |
| Group IV (CCl <sub>4</sub> + hydroalcoholic extract of <i>J.dolomiaea</i> roots 100mg/kg) | 70.66 $\pm$ 3.89  | 52.54 $\pm$ 4.28 | 197.53 $\pm$ 6.55          | 0.95 $\pm$ 0.15        |
| Group V (CCl <sub>4</sub> + hydroalcoholic extract of <i>J.dolomiaea</i> roots 200mg/kg)  | 64.36 $\pm$ 3.99  | 59.50 $\pm$ 6.59 | 190.55 $\pm$ 4.45          | 0.89 $\pm$ 0.20        |

#### Light Microscopic Examination

Carbon tetrachloride (CCl<sub>4</sub>) cause marked damage of rat hepatocytes in the form of fatty degeneration, cytoplasmic vacuolation, focal and confluent hepatocellular necrosis and portal tract fibrosis with endothelial swelling and disruption ( Fig 2). Pretreatment with hydroalcoholic extract of *Jurinea dolomiaea* root at two dose level markedly attenuated the CCl<sub>4</sub> induced histopathological changes in rat liver (fig. 4 and 5).

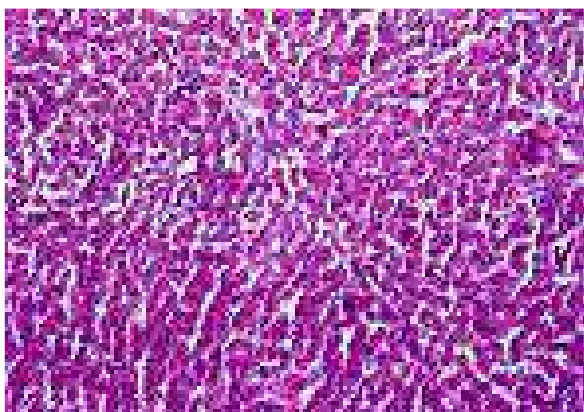


Fig.1 Control

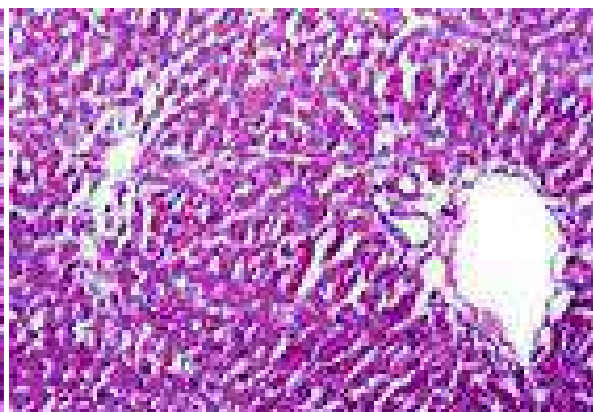


Fig.2 Toxicant

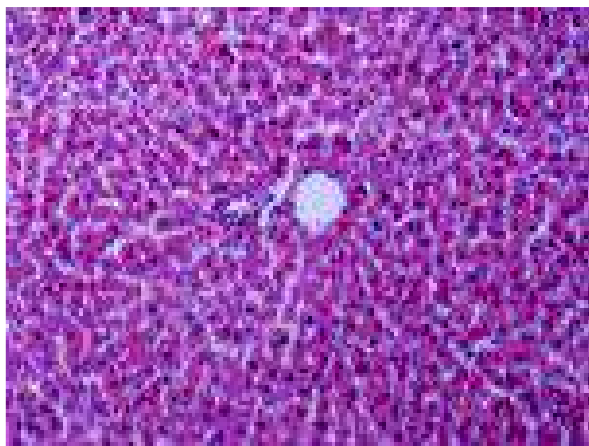
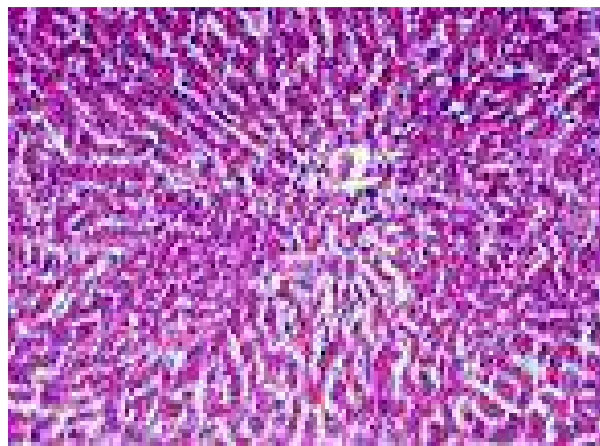
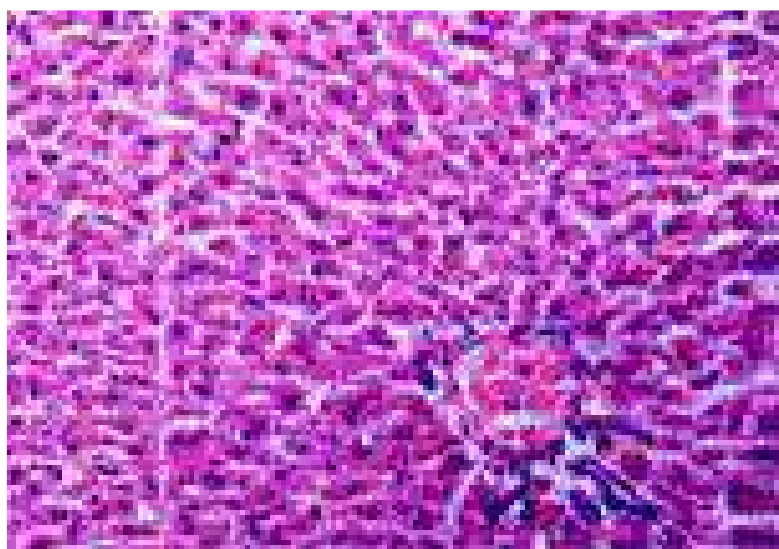


Fig.3 Standard

Fig.4 H. E. of *J dolomiaea* roots (100mg/kg)Fig.5 H. E. of *J dolomiaea* roots (200mg/kg)

#### IV. DISCUSSION

The roots of plant was reported as anti-inflammatory and antirheumatic effects [18, 19], acute diuretic, natriuretic and hypertensive effects [20], cardiovascular effects [21] and stimulation of proliferation of human lymphocytes [22]. The effects of the roots are also used in the therapy of prostatic hyperplasia [23, 24, 25]. Moreover, this plant has been used in the traditional therapy of hypertension [26]. On the basis of the results of this study, it is clearly indicated that water extract of roots has a powerful effect on antiulcer activity against ethanol-induced ulcerogenesis and analgesic effect on acetic acid-induced stretching and it can be used for therapy of ulcerogenesis and gastric mucosal injury. Since the changes associated with CCl<sub>4</sub>-induced liver damage are similar to that of acute viral hepatitis[27]. The hepatotoxicity induced by CCl<sub>4</sub> is due to its metabolite CCl<sub>3</sub>•, a free radical that alkylates cellular proteins and other

macromolecules with a simultaneous attack on lipids, in the presence of oxygen, to produce lipid peroxides, leading to liver damage[28]. Amino transferases are present in high concentration in liver linking carbohydrate and amino acid metabolism. Alanine amino transferase and aspartate amino transferase are well known diagnostic indicators of liver disease. In cases of liver damage with hepatocellular lesions and parenchymal cell necrosis, these marker enzymes are released from the damaged tissues into the blood stream[29]. Alkaline phosphatase is a membrane bound enzyme and its elevations in plasma indicate membrane disruption in the organ. The level of this enzyme increases in cholestasis[30]. Hepatotoxicity is characterized by cirrhotic liver condition which increases the bilirubin release[31]. The total bilirubin were found to increase in the hepatotoxic animals[32] and were significantly reduced in groups of

hydroalcoholic root extract of *Jurinea dolomiaea* administered rats as compared to that of toxicant rats. The effect was more pronounced with these extracts, this might be due to the higher contents of flavonoids. It is due to the reducing accumulation of toxic CCl<sub>3</sub> derived metabolites, which may contribute to the changes in the rough endoplasmic reticulum and the disturbance of protein metabolism in liver.

Comparative histopathological study of the liver from different groups of rats corroborated the hepatoprotective efficacy of hydroalcoholic root extract of *Jurinea dolomiaea* (fig. 1 to 5). Various pathological changes like steatosis, centrilobular necrosis and vacuolization seen in group II (toxicant rats) is due to oxidative damage by free radical generation. These pathological changes were prevented to moderate extent in both test groups. This might be due to presence of flavonoids and ascorbic acid.

## V. CONCLUSION

On the basis of the results of this study, it is clearly indicated that water extract of root has a powerful antiulcer, analgesic and hepatoprotective activity in pharmaceutical industry. Some studies have revealed that the antioxidants melatonin and carotene potentiate the antinociceptive responses. It was indicated that vitamin E has beneficial effects in improvement of rheumatic disease, intermittent claudication or angina pectoris. Thus the water extract of root has effective antiulcer activity against ethanol-induced ulcerogenesis and analgesic effect on acetic acid-induced stretching and it can be used for therapy of ulcerogenesis and gastric mucosal injury. The activities of the enzymes i.e. total bilirubin were found to increase in the hepatotoxic animals and were significantly reduced in groups of hydroalcoholic extract of roots of *Jurinea dolomiaea* administered rats as compared to that of toxicant rats.

## ACKNOWLEDGEMENTS

The authors acknowledge Department of Chemistry, Govt. Geetanjali Girl's (Autonomous) P.G. College, Berasiya road Bhopal – 462038, Madhya Pradesh (India), Pharmacy Department of Barkatullah University Bhopal Madhya Pradesh (India), and Department of Chemistry, Maulana Azad College of Arts, Science & Commerce, Aurangabad Maharashtra (India) for providing necessary facilities during the study.

## REFERENCES

- [1] Yagi, K., 1987. Lipid peroxides and human disease. *Chemistry and Physics of Lipids* 45, 337–341.
- [2] Halliwell, B., Gutteridge, J.M.C., 1985. *Free Radicals in Biology and Medicine*. Oxford University Press, Oxford, UK.
- [3] Ho, C.T., Ferraro, T., Chen, Q., Rosen, R.T., 1994. Phytochemical in teas and rosemary and their cancer-preventive properties. In: Ho, C.T., Osawa, T., Huang, M.T., Rosen, R.T. (Eds.), *Food Phytochemicals for Cancer Prevention. II. Tea, Spices and Herbs*. ACS Symposium Series 547, American Chemical Society, Washington, DC, pp. 2–9.
- [4] Grice, H.C., 1986. Safety evaluation of butylated hydroxyl toluene (BHT) in the liver, lung and gastrointestinal tract. *Food Chemistry and Toxicology* 24, 1127–1130.
- [5] Wichi, H.P., 1988. Enhanced tumour development by butylated hydroxyanisole (BHA) from the prospective of effect on forestomach and oesophageal squamous epithelium. *Food Chemistry and Toxicology* 26, 717–723.
- [6] Yesilada, E., Sezik, E., Honda, G., Takaishi, Y., Takeda, Y., Tanaka, T., 2001. Traditional medicine in Turkey X. Folk medicine in Central Anatolia. *Journal of Ethnopharmacology* 75, 95–115.
- [7] Sezik, E., Yesilada, F., Tabata, M., Honda, G., Takaishi, Y., Fujita, T., Tanaka, T., Takeda, Y., 1997. Traditional medicine in Turkey VIII. Folk medicine in East Anatolia Erzurum Erzincan Ağrı, Kars, Iğdır provinces. *Economic Botany* 51, 195–211.
- [8] Yesilada, E., Honda, G., Sezik, E., Tabata, M., Goto, K., Ikeshiro, Y., 1993. Traditional medicine in Turkey IV. Folk medicine in the Mediterranean subdivision. *Journal of Ethnopharmacology* 39, 31–38.
- [9] Wolf, P.L. Biochemical diagnosis of liver diseases. *Indian Journal of Clinical Biochemistry* 1999. 14, 59–90.
- [10] Karan, M., Vasisht, K., Handa, S.S. Antihepatotoxic activity of *Swertia chirata* on carbon tetrachloride induced hepatotoxicity in rats. *Phytotherapy Research*. 1999. 13, 24–30.
- [11] Chatterjee, T.K., *Medicinal Plants with Hepatoprotective Properties*. Herbal Options. Books and Applied Allied (P) Ltd., Calcutta, 2000. 143.
- [12] Rubinstein, D. Epinephrine release and liver glycogen levels after carbon tetrachloride administration. *American Journal of Physiology*, 1962. 203, 1033–1037.
- [13] Suja, S.R., Latha, P.G., Pushpangadan, P., Rajasekharan, S., Aphrodisiac property of *Helminthostachys zeylanica* in mice. *Journal of Tropical Medicinal Plants* 2002. 3, 191–195. 6.
- [14] Büyükköroğlu, M.E., Taysi, S., Polat, F., Göçer, F., 2002. Mechanism of the beneficial effects of dantrolene sodium on the ethanol-induced acute gastric mucosal injury in rats. *Pharmacological Research* 45, 421–424.
- [15] Zakaria, M.N.M., Zathakrishnan, R., Chen, H.B., Kamil, M., Algisri, A.N., Chan, K., Al-attas, A., 2001. Antinociceptive and antiinflammatory properties of *Carraluma arabica*. *Journal of Ethnopharmacology* 76, 155–158.
- [16] Gülçin, I., Büyükköroğlu, M.F., Oktay, M., Küfrevioğlu, Ö.İ., 2003d. Antioxidant and analgesic activities of

- turpentine of *Pinus nigra* arn. subsp. *palisiana* (Lamb.) Holmboe. *Journal of Ethnopharmacology* 86, 51–58.
- [17] Lin, C.C., Yen, M.H., Lo, T.S., Lin, J.M., Evaluation of the hepatoprotective and antioxidant activity of *Boehmeria nivea* var. *nivea* and *B. nivea* var. *tenacissima*. *J. Ethnopharmacol.* 1998, 60, 9–17.
- [18] Obertreis, B., Giller, K., Teucher, T., Behnke, B., Schmitz, H., 1996. Anti-inflammatory effect of *Urtica dioica* folia extract in comparison to caffeic malic acid. *Arzneimittel Forschung Research* 46, 52–56.
- [19] Riehemann, K., Behnke, B., Schulze-Osthof, K., 1999. Plant extracts from stinging nettle (*Urtica dioica*), an antirheumatic remedy, inhibit the proinflammatory transcription factor NF- $\kappa$ B. *FEBS Letters* 442, 89–94.
- [20] Tahri, A., Yamani, S., Legssyer, A., Aziz, M., Mekhfi, H., Bnouham, M., Ziyat, A., 2000. Acute diuretic, natriuretic and hypotensive effects of a continuous perfusion of aqueous extract of *Urtica dioica* in the rat. *Journal of Ethnopharmacology* 73, 95–100.
- [21] LaraTestai<sup>a</sup>SilvioChericoni<sup>b</sup>VincenzoCalderone<sup>a</sup>GiuliaNenci oni<sup>b</sup>PaolaNieri<sup>a</sup>IvanoMorelli<sup>b</sup>EnricaMartinotti<sup>a</sup> (2002). Cardiovascular effects of *Urtica dioica* L. (Urticaceae) roots extracts: in vitro and in vivo pharmacological studies. *Journal of Ethnopharmacology* .pp105-109.
- [22] Wagner, H., Willer, F., Kreher, B., 1989. Biologically active compounds from the aqueous extract of *Urtica dioica*. *Planta Medica* 55, 452–454.
- [23] Krzeski, T., Kazon, M., Borkowski, A., Kuczera, J., 1993. Combined extracts of *Urtica dioica* and *Pygeum africanum* in the treatment of benign hyperplasia: double-blind comparison of two doses. *Clinical Therapy* 6, 1011–1020.
- [24] Hiramoto, T., Homma, M., Oka, K., 1994. Effect of stinging nettle extracts and their steroidal components on the Na<sup>+</sup>,K<sup>+</sup>-ATPase of the benign prostatic hyperplasia. *Planta Medica* 60, 30–33.
- [25] Lichius, J.J., Muth, C., 1997. The inhibiting effect of *Urtica dioica* root extracts on experimentally induced prostatic hyperplasia in the mouse. *Planta Medica* 63, 307–310.
- [26] Ziyat, A., Legssyer, A., Mekhfi, H., Dassouli, A., Serhrouchni, M., Benjelloun, W., 1997. Phytotherapy of hypertension and diabetes in oriental Morocco. *Journal of Ethnopharmacology* 58, 45–54.
- [27] Suja, S.R., Latha, P.G., Pushpangadan, P., Rajasekharan, S., Evaluation of hepatoprotective effects of *Helminthostachys Zeylanica* (L.) Hook against carbon tetrachloride induced liver damage in Wistar rats. *J. Ethnopharmacol.* 2004, 92, 61–66.
- [28] Bishayee, A., Sarkar, A., Chatterjee, M., The hepatoprotective activity of Carrot (*Daucus carota* L) against carbon tetrachloride intoxication in mouse liver. *J. Ethnopharmacol.* 1995, 47, 69–74.
- [29] Sethumadhavan, S., Theruvathil, S.,Rangaswamy, A., Hepatoprotective activity of chitosan against isoniazid and rifampicin-induced toxicity in experimental rats *European J. Pharmacol.* Xx, 2007 , xxx-xxx.
- [30] Sanmugopriya, E., Venkataraman,S., Studies on hepatoprotective and antioxidant actions of *Strychnos potatorum* Linn. Seeds on CCl<sub>4</sub>-induced acute hepatic injury in experimental rats *J. Ethnopharmacol.*, 2006. (105). 154-160.
- [31] Man-Fung, Y., Takanobu, K., Masashi, M., Annie On-On, C., John, C.H.Y., He-Jun, Y., Am. Clinical outcome and virologic profiles of severe hepatitis B exacerbation due to YMDD mutations. *J. Hepatol.* 2003, (39)850–855.
- [32] Deepa, P.R., Varalakshmi, P., Protective effect of low molecular weight heparin on oxidative injury and cellular abnormalities in Adriamycin induced cardiac and hepatic toxicity. *Chem. Biol. Interact.* 2003, (146), 201–210.

# Affirmative actions for people inserted in the socio-territorial space of the countryside in the Bachelor's Degree in Agroecology at UFRPE

## Ações afirmativas para pessoas inseridas no espaço socioterritorial do campo no Curso de Bacharelado em Agroecologia da UFRPE

Pamela Karina de Melo Gois<sup>1</sup>, Ângelo Giuseppe Chaves Alves<sup>2</sup>, Wagner Lins Lira<sup>3</sup>

<sup>1</sup>Mestre em Sistemas Agroindustriais. Doutoranda em Agroecologia e Desenvolvimento Territorial. UFRPE

<sup>2</sup>Doutor em Ecologia e Recursos Naturais. Professor Permanente do Programa de Pós-Graduação em Agroecologia e Desenvolvimento Territorial. UFRPE

<sup>3</sup>Doutor em Antropologia. Professor Permanente do Programa de Pós-Graduação em Agroecologia e Desenvolvimento Territorial. UFRPE

Received: 20 Aug 2022,

Received in revised form: 12 Sep 2022,

Accepted: 18 Sep 2022,

Available online: 22 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** *Quotas. Higher Education. Rural students. Reservation of vacancies.*

**Palavras-chave—** *Cotas. Ensino Superior. Estudantes Rurais. Reserva de vagas.*

**Abstract—** *Affirmative action policies for access to higher education in Brazil has been, in recent decades, a theme widely discussed by the agendas of social movements, because the struggle for the democratization of access to Higher Education, linked to the perspective of social justice, demands actions and policies aimed at minorities historically excluded from society and, as a result, higher education levels. Therefore, this article aims to describe and analyze the affirmative action policy - which guarantees the access and permanence of people inserted in the socioterritorial space of the field - directed to the Bachelor's Degree in Agroecology at UFRPE. For this, we developed a case study anchored in the historical-organizational perspective, based empirically on documentary research. The results reveal that, of the 40 annual vacancies offered by the Course, most of it is reserved for rural students and that, as much as it is a recent affirmative action, starting in 2019, this is promising in the inclusion of peasant subjects in higher education, in a context beyond insertion, but for interdisciplinary, joint and participatory construction from theory and practice, respecting the knowledge-making of the rural environment and committed to peasant experiences.*

**Resumo—** *As políticas de ações afirmativas para o acesso ao Ensino Superior no Brasil têm sido, nas últimas décadas, temática bastante discutida pelas pautas dos movimentos sociais, pois a luta pela democratização do acesso à Educação Superior, atrelada à perspectiva da justiça social, demanda do Estado Brasileiro ações e políticas voltadas às minorias historicamente excluídas da sociedade e, conseqüentemente, dos níveis superiores de ensino. Diante disso, o presente artigo tem por*

*finalidade descrever e analisar a política de ação afirmativa - que garante o acesso e a permanência das pessoas inseridas no espaço socioterritorial do campo - direcionada ao Curso de Bacharelado em Agroecologia da UFRPE. Para isso, desenvolvemos um estudo de caso ancorado na perspectiva histórico-organizacional, tendo como base empírica a pesquisa documental. Os resultados revelam que, das 40 vagas anuais oferecidas pelo Curso, grande parte é reservada para estudantes rurais e que, por mais que seja uma ação afirmativa recente, com início em 2019, esta apresenta-se promissora na inclusão dos sujeitos camponeses no Ensino Superior, num contexto para além da inserção, mas para construção interdisciplinar, conjunta e participativa a partir da teoria e prática, respeitando os saberes-fazer do meio rural e comprometida com experiências camponesas.*

## I. INTRODUÇÃO

Visando à democratização do acesso ao Ensino Superior e à justiça social, no ano de 2012 entrou em vigor a Lei nº 12.771/12, chamada de Lei de Cotas, que representa uma Lei Federal, que trata das ações afirmativas para o ingresso nas Universidades e Instituições Federais de sujeitos inseridos em classes sociais subalternizadas, primordialmente, em torno da raça e da etnia (Brasil, 2012a).

Historicamente podemos afirmar que a primeira atitude jurídica e legislativa brasileira em torno das ações afirmativas na educação pública para pessoas do campo surgiu em 1968, com a Lei nº 5.465/68, que reservava 50% das vagas oferecidas pelos estabelecimentos de Ensino Médio agrícola e Escolas Superiores de Agricultura e Veterinária, mantidos pela União, a candidatos agricultores ou seus filhos, que residiam em áreas rurais e 30% aos agricultores ou seus filhos residentes em cidades ou vilas que não ofereciam o Ensino Médio em escolas públicas (Brasil, 1968).

Segundo Santos (2020, p. 23), esta é considerada “[...] como a primeira lei de cotas do Brasil”, a qual foi apelidada de “Lei do Boi”, por privilegiar os membros da elite rural brasileira ao favorecer ainda mais as classes abastadas, pois dava privilégios a quem já os detinha, os proprietários de terras rurais (Magalhães, 2015; Castro, 2016; Santos, 2020). Somente 17 anos após a sua promulgação, a Lei do Boi foi revogada pela Lei nº 7.423/85 (Brasil, 1985).

Entre os anos de 1985 e 2012, no âmbito federal, não houve legislação para regulamentar as políticas de ações afirmativas nas Universidades Federais, apenas iniciativas de projetos de lei, como o Projeto de Lei de nº 73/1999 (Brasil, 1999), o Projeto de Lei de nº 3.627/2004 (Brasil, 2004) e o Projeto de Lei de nº 3.913/2008 (Brasil, 2008). Contudo, antes da vigência de uma lei federal, muitas Universidades já vinham aplicando políticas de

ações afirmativas através de Leis Estaduais e resoluções dos Conselhos Universitários enquanto instâncias autônomas e deliberativas (Passos & Gomes, 2014; Silva & Lage, 2011). Segundo levantamento de Daflon et al. (2013), já havia, em 2012, 70 Universidades Públicas (estaduais e federais) adotando programas de ação afirmativa.

Em 29 de agosto de 2012 foi sancionada a Lei 12.711/12, que instituiu a reserva de 50% das vagas oferecidas por Instituições Federais de Educação Superior e de Ensino Técnico, de Nível Médio, aos estudantes de escolas públicas. Dessas, 50% das vagas devem ser reservadas aos estudantes oriundos de famílias com renda de até 1,5 salário-mínimo per capita (Brasil, 2012a).

A Lei determina ainda que essas vagas deverão ser preenchidas, por curso e turno, por sujeitos autodeclarados pretos, pardos e indígenas, mas também por pessoas com deficiência, em proporção ao total de vagas no mínimo igual à proporção respectiva de pretos, pardos, indígenas e pessoas com deficiência na população da Unidade da Federação, onde está instalada a Instituição (Brasil, 2012a)

Porém, além dos beneficiários obrigatórios (estudantes de escolas públicas, de baixa renda, que sejam pretos, pardos, indígenas e/ou pessoas com deficiência), a Portaria Normativa nº 18/2012 do MEC regulamenta a Lei de Cotas, de modo que apresenta a possibilidade das Universidades Públicas, a partir de suas realidades, instituírem outras modalidades de reserva de vagas, criando novos beneficiários de cotas, chamados de “beneficiários institucionais” (Brasil, 2012b).

As cotas institucionais permitem que as Instituições Federais de Educação Superior possam estipular ações afirmativas a partir dos contextos sociais locais, onde observa-se a existência de outros agrupamentos com visíveis desvantagens de acesso à Educação Superior. Castro (2016, p. 56) afirma que: “as

iniciativas do Estado, em adotar medidas que resultem na inclusão dos alunos de baixa renda, pretos, pardos e indígenas, têm contribuído para o aumento do número de cidadãos com o diploma superior”. Assim, as iniciativas das Instituições Federais de Ensino, por meio da inclusão e permanência dos sujeitos através das cotas, vêm favorecendo as minorias marginalizadas historicamente, de modo que possam ter condições de concluir os seus estudos e aperfeiçoamentos.

Mesmo antes da Lei nº 12.771/12, existiam no país alguns beneficiários contemplados por cotas nas Universidades, dentre eles: estudantes de escola pública, baixa renda, pretos e pardos, indígenas, quilombolas, moradores dos interiores dos Estados, pessoas com deficiência, professores da rede pública e assentados da reforma agrária (Silva & Lage, 2011).

Em se tratando dos assentados da reforma agrária, grupo contemplado pelo trabalho de Gois (2018), que, ao pesquisar sobre cotas em Universidades reservadas aos estudantes dos meios rurais, encontrou reserva de vagas para pronafianos (beneficiários do Programa Nacional de Fortalecimento da Agricultura Familiar), assentados da reforma agrária e empregados rurais.

Porém, foram encontradas nas análises de Gois (2018) apenas três instituições em todo Brasil, que utilizavam-se deste tipo específico de cotas: o Instituto Federal da Paraíba, o Instituto Federal do Sudeste de Minas Gerais e o Instituto Federal do Tocantins.

Visando a salvaguarda da dignidade da pessoa humana de camponeses é imperioso a garantia dos direitos humanos de forma justa e equitativa, dentre eles o direito à educação, que é um direito social previsto no artigo 6º da Constituição Federal (Brasil, 1988). A educação está regulamentada no Capítulo III da Carta Magna, artigos 205 ao 214. Conforme o artigo 205: “educação, direito de todos e dever do Estado e da Família, será promovida e incentivada com a colaboração da sociedade, visando ao pleno desenvolvimento da pessoa, seu preparo para o exercício da cidadania e sua qualificação para o trabalho” (Brasil, 1988).

Neste sentido, segundo Gois (2018, p. 15): “tornam-se urgentes medidas que corrijam as desigualdades de acesso e de manutenção do contingente de alunos de áreas rurais nas Universidades brasileiras”. Cabe destacar que as discussões e ações em torno de políticas específicas para o campo sempre foram pautadas em óticas assistencialistas e clientelistas, que pouco ajudam na resolução dos problemas historicamente acumulados (Souza, 2019). Ainda assim, quando existe alguma política voltada para a população rural, esta é pouco divulgada e minimamente implantada.

O Decreto nº 7.352/10 conceitua as populações do campo como: os agricultores familiares, os extrativistas, os pescadores artesanais, os ribeirinhos, os assentados e acampados da reforma agrária, os trabalhadores assalariados rurais, os quilombolas, os caiçaras, os povos da floresta, os caboclos e outros que produzam suas condições materiais de existência a partir do trabalho no meio rural (Brasil, 2010).

Assim, as pessoas ligadas ao espaço socioterritorial do campo formam um “grupo social que se organiza para desenvolver uma determinada ação em defesa de seus interesses, em possíveis enfrentamentos e conflitos, com objetivo de transformação da realidade” (Fernandes, 2005, p. 279). Por seu turno, movimentos socioterritoriais são: “sociais, territoriais e culturais, simultaneamente, tendo em vista que a luta pelo território pressupõe uma luta cultural e contra hegemônica produzindo e reproduzindo territorialidades também de contra ordem” (Reis, et al., 2019, p. 261).

Diante disso, percebe-se a necessidade de estudos que visem contextualizar a política de cotas de acesso ao Ensino Superior para estudantes rurais, contribuindo com sua divulgação e expansão. Nesse sentido, o presente texto visa, a partir da iniciativa da Universidade Federal Rural de Pernambuco (UFRPE), descrever e analisar a política de ação afirmativa voltada para o acesso no Curso de Bacharelado em Agroecologia de pessoas ligadas diretamente ao espaço socioterritorial do campo.

## II. REFERENCIAL TEÓRICO

A Constituição Federal de 1988 consagra em seu art. 1º, inciso II a cidadania como um dos fundamentos da República Federativa do Brasil. Tão importante a sua importância nos direitos e obrigações previstos na Carta Magna, ficando conhecida como a Constituição Cidadã (Brasil, 1988). Porém, para que ocorra o exercício pleno da cidadania é necessário que a dignidade da pessoa humana, fundamento previsto no inciso III do mesmo artigo supracitado, seja respeitada (Brasil, 1988). Para isso, deve ser assegurado o “mínimo existencial”, isto é, as condições mínimas de existência, entre elas, a educação, a saúde, a alimentação, o trabalho, a moradia, o transporte, o lazer, etc. Tratam-se dos direitos sociais, elencados no artigo 6º (Brasil, 1988).

Para a efetivação dos direitos sociais, segundo Lima (2009, p. 285): “mostra-se necessário que o Poder Executivo promova a elaboração e cumprimento das correspondentes políticas públicas, traçando estratégias de atuação na busca da efetivação de tais direitos”. Neste mesmo sentido, Borges (2018, p. 16) afirma que: “o direito à educação pública depende, para a sua efetivação, da

atuação dos Poderes Executivo e Legislativo, tratando-se de um direito que contém uma eficácia específica em relação à eficácia dos direitos individuais, pois sua fruição é distinta”.

Neves et al. (2015, p. 937) conceituam as políticas públicas como: “ações, metas e planos do governo estruturados nas esferas federal, estadual e municipal, que visam à melhoria das condições gerais de vida dos membros de uma sociedade e o interesse público”.

As políticas públicas, segundo Magalhães e Silva (2013, p. 03):

representam uma forma de regulação ou intervenção na sociedade, estruturando-se e materializando-se como fruto de interesses sociais organizados que se expressam por movimentos articulados, por vezes, concomitantes e interdependentes, constituídos de ações em forma de respostas, mais ou menos institucionalizadas, a situações consideradas problemáticas, materializadas por programas, projetos e serviços.

Assim, elas são fruto de lutas de diferentes sujeitos sociais, decorrentes da organização, mobilização e pressão de setores historicamente excluídos/marginalizados para que o Estado crie mecanismos para enfrentar suas problemáticas. Neste sentido, Costa (2013, p. 37) afirma que: “no século XX, a ampliação dos Direitos Humanos e fundamentais permitiu que vários movimentos sociais caracterizassem seu engajamento como uma busca pela concretização de direitos sociais que já faziam parte do próprio ordenamento jurídico”.

Como exemplo de políticas públicas, Lima (2009, p. 287) cita: “diretrizes para a elaboração de uma política nacional de integração; definição de regras de acessibilidade no âmbito dos espaços público e privado; e o estabelecimento de ações afirmativas”.

As ações afirmativas apresentam variadas designações como: política de cotas, reserva de vagas, ação compensatória, políticas de preferência, políticas de permanência, discriminação positiva, etc. (Magalhães & Silva, 2013). Porém, independente da conceituação, elas têm sido criadas, segundo Lima (2009, p. 268): “como resposta do Estado às demandas que emergem da sociedade e do seu próprio interior numa tentativa de minorar as desigualdades tão crescentes no país. Ou seja, elas são expressão do compromisso público de atuação do Estado numa determinada área”.

No mesmo sentido, Magalhães e Silva (2013, p. 05) conceituam as ações afirmativas como:

medidas especiais e temporárias, tomadas ou determinadas pelo Estado, espontânea ou compulsoriamente, com o objetivo de eliminar desigualdades historicamente acumuladas, garantindo a igualdade e oportunidades de tratamento, bem como visando compensar as perdas provocadas pela discriminação/marginalização, decorrentes de motivos raciais, étnicos, religiosos, de gênero e outros. Buscam reparar danos sócio-históricos sofridos pela população negra e outros grupos minoritários ao longo da construção da nação brasileira, no sentido de mitigar os perversos efeitos acumulados em virtude das discriminações e omissões ocorridas no passado e presente.

Para John Rawls, segundo Lima (2019, p. 46), no conceito de ações afirmativas, o “Estado perfaz ações de promoção social de igualdade a partir de políticas públicas para assegurar (afirmar) direitos dos grupos marginalizados ou carentes”. Entre as medidas qualificadas como ações afirmativas, Castro (2016, p. 34) cita: “determinação de metas ou cotas mínimas de participação na mídia, na política e outros âmbitos, reparações financeiras, políticas de valorização identitária, etc”. Portanto, discussões sobre as políticas afirmativas vão além das cotas, esta é apenas a ação afirmativa mais conhecida.

Como visto acima, a educação é um direito social, representando um dos alicerces para o pleno exercício da cidadania, sendo competência do Estado – competência comum da União, dos Estados, do Distrito Federal e dos Municípios – proporcionar os meios de acesso a este bem considerado fundamental (Brasil, 1988), assim como combater todo e qualquer tipo de preconceito e ou discriminação que dificulte este acesso. Dever constitucionalmente reforçado pelos artigos:

Art. 205. A educação, direito de todos e dever do Estado e da família, será promovida e incentivada com a colaboração da sociedade, visando ao pleno desenvolvimento da pessoa, seu preparo para o exercício da cidadania e sua qualificação para o trabalho.

Art. 206. O ensino será ministrado com base nos seguintes princípios:

- I - igualdade de condições para o acesso e permanência na escola;
- IV - gratuidade do ensino público em estabelecimentos oficiais;
- VII - garantia de padrão de qualidade.



Art. 208. O dever do Estado com a educação será efetivado mediante a garantia de:

V - acesso aos níveis mais elevados do ensino, da pesquisa e da criação artística, segundo a capacidade de cada um. (Brasil, 1988)

Assim, as Universidades Públicas deveriam ter sido criadas para satisfazer as promessas da Constituição Federal, sendo a Educação Superior, segundo Borges (2018, p. 70): “direito fundamental, inalienável, protegido e garantido pelo Estado”. Porém, historicamente, sabemos da existência de uma elitização do ensino público superior, haja vista que grupos subalternizados não têm acesso a tal nível de ensino, justamente, por apresentarem condições desiguais de vida, que reverberam na qualidade do ensino básico e, por seu turno, na dificuldade de competição por uma vaga na Universidade, dentre os quais destacam-se as pessoas de baixa renda, as pessoas com deficiência, além dos negros, pardos e indígenas (Castro, 2016).

Enquanto a Educação Básica é obrigatória e gratuita, segundo artigo 208, I da CF (Brasil, 1988), “o acesso à Educação Superior é baseado no mérito (art. 208, V), reafirmando-se o princípio contido na Declaração Universal dos Direitos Humanos (art. 26, I), dependendo da ‘capacidade de cada um’ (art. 208, V, CF/88)” (Borges, 2018, p. 77).

A gerência da Educação Básica pública, no decorrer dos anos, fez com que as chances do indivíduo desprovido economicamente de cursar o Ensino Superior em uma Universidade Pública fossem reduzidas, criando um grande obstáculo e impedindo-o de cursar um ensino de qualidade. A pessoa que possuía condições financeiras favoráveis tinha privilégios, por financiar a rede privada de educação, que oferece um acompanhamento ao aluno em prol de desenvolver todo seu potencial de aprendizado. As Universidades Públicas são ocupadas por indivíduos provenientes das classes mais favorecidas (Castro, 2016, p. 88).

Diante desta realidade, Magalhães e Silva (2013, p. 8) afirmam que: “as ações afirmativas devem permitir melhor acesso aos grupos minoritários às escolas públicas básicas e superiores, representando uma possibilidade de autonomização e emancipação humana”.

Com este intuito, a Lei de Cotas foi se aprimorando e permitindo que outros grupos pudessem gozar desta ação afirmativa de acesso ao Ensino Superior. Primeiramente, com os beneficiários obrigatórios (os estudantes oriundos de famílias com renda igual ou inferior a 1,5 salário-mínimo per capita, os pretos, pardos, indígenas, que tenham cursado integralmente o Ensino

Médio em escolas públicas) (Brasil, 2012a). Benefício que estendeu-se às pessoas com deficiência, em 2016, através da Lei nº 13.409 (Brasil, 2016). Como também, a partir da Portaria Normativa nº 18/2012 do MEC, com a possibilidade das Universidades Públicas contemplarem outros beneficiários de reserva de vagas, os chamados beneficiários institucionais:

Art. 12 - As instituições federais de ensino poderão, por meio de políticas específicas de ações afirmativas, instituir reservas de vagas:

I - suplementares, mediante o acréscimo de vagas reservadas aos números mínimos referidos no art. 10; e

II - de outra modalidade, mediante a estipulação de vagas específicas para atender a outras ações afirmativas. (Brasil, 2012b)

Assim, diante da visível desvantagem de acesso ao Ensino Superior, percebe-se a importância da criação e reserva de vagas a outras minorias não contempladas pela Lei de Cotas.

### III. METODOLOGIA

Foi realizado um estudo de caso numa perspectiva histórico-organizacional, onde se pretendeu investigar a política de ação afirmativa - voltada para pessoas inseridas no espaço socioterritorial do campo - para entrada no Curso de Bacharelado em Agroecologia da UFRPE. Segundo Lara e Molina (2011, p. 126), a perspectiva histórico-organizacional ocorre quando: “o interesse do pesquisador recai sobre a vida de uma instituição. A unidade pode ser uma escola, uma universidade, um clube etc”. Já para Graham (2010, p. 25), o estudo de caso:

consiste na triangulação de pessoas, eventos e circunstâncias. Apresentando em forma de história um tema relacionado a uma política pública acompanhada por informações contextuais e de fundo. É uma forma estruturada para compartilhar experiências, revelar desafios e oportunidades com as quais uma organização se depara e comunica lições aprendidas e práticas pioneiras que podem auxiliar outras em situações similares.

Vendo a necessidade de se entender o contexto histórico envolto da instituição das cotas para entrada nas Universidades Públicas e sua trajetória para vários beneficiários até chegarmos ao entendimento dos estudantes rurais como beneficiários institucionais, esta pesquisa utilizou o método histórico, uma vez que:

(...) quando a questão de pesquisa remete à análise e compreensão da trajetória de um determinado fenômeno, pode ser empregado o método histórico. Com este método, busca-se compreender as “origens” ou as “raízes” de um determinado fenômeno, o que permite explicar o motivo pelo qual o mesmo se desenvolveu, ao longo do tempo, de um modo específico (Mazucato, 2018, p. 58).

O instrumento utilizado para o levantamento dos dados deu-se a partir da pesquisa documental, posto que consultamos o Projeto Político Pedagógico do Curso (PPC) cedido pela Coordenação do Bacharelado em Agroecologia, identificando as bases teóricas, a organização curricular, a proposta metodológica e as estratégias pedagógicas de estruturação do Curso.

Segundo Veiga (2003a), o Projeto Político Pedagógico de um Curso define as bases e as diretrizes a partir dos pressupostos epistemológicos, filosófico-sociológico e didático-metodológicos. Como também apresenta “as finalidades da instituição, a sua estrutura organizacional, o currículo, o tempo de formação dos alunos, o processo de decisão, as relações de trabalho e a avaliação” (Veiga, 2003b, p. 22).

Também acessamos outras fontes de informações, a exemplo dos editais dos processos seletivos para ingresso no curso, das leis, jurisprudência, entre outros, a fim de compreendermos os fundamentos jurídicos, o funcionamento, a seleção de discentes e os determinantes sociais para a efetivação da política de ação afirmativa na instituição.

#### IV. RESULTADOS E DISCUSSÃO

O curso de Bacharelado em Agroecologia da Universidade Rural de Pernambuco (UFRPE), lotado fisicamente no Departamento de Educação, na Sede em Dois Irmãos, Rua Manoel de Medeiros, S/N – Dois Irmãos, Recife – PE, foi estipulado no ano de 2019, possuindo carga horária total de 4.140 horas, fornecendo anualmente 40 vagas de ingresso no Curso. Sua modalidade é presencial, porém tem o diferencial de priorizar as pessoas ligadas ao espaço sociocultural do campo. Por isso, os discentes estudam em “regime de alternância”, que considera os diferentes espaços de aprendizagem e a necessidade de preparar o/a futuro/a profissional-educador/a para transformar sua própria realidade (UFRPE, 2019).

O regime de alternância surge para superar “as contradições do sistema educacional de reprodução das desigualdades sociais, a hegemonia econômica e

intelectual das elites, a valorização do modo de vida da cidade sobre o campo e a concepção bancária em detrimento da educação libertadora” (SARDO, 2013, p. 41). Diante destas peculiaridades, o Curso tem funcionamento modular e caráter interdisciplinar, visando formar profissionais a partir de uma abordagem holística e sistêmica, superando a visão reducionista da natureza, das relações sociais e da própria educação (UFRPE, 2019).

Assim, a Universidade representa apenas um dos espaços de ensino-aprendizagem, pois as atividades realizadas nas comunidades onde vivem apresentam-se como ponto de partida e chegada, enraizando a aprendizagem, e dando sentido e significado ao conhecimento (UFRPE, 2019). Diante deste regime de alternância, o Curso apresenta integralização distinta das desenhadas pela Resolução nº 2 de 18 de Junho de 2007, da Câmara do Ensino Superior do CNE (Brasil, 2007a), pois o tempo pedagógico fora da Universidade é considerado como parte do currículo escolar.

Segundo o Projeto Pedagógico do Curso de Bacharelado em Agroecologia:

A opção pelo regime da alternância está diretamente relacionada ao objetivo do Curso de contribuir para a construção de sociedades ecologicamente sustentáveis. Daí emerge a necessidade de valorização da cultura local e da história de vida do estudante, corresponsabilizando-o pelo futuro de sua comunidade, dando concretude ao objetivo da Universidade de transformar a sociedade. Também está associada à necessidade de integrar a relação estudo-trabalho, especialmente para os/as estudantes do campo. A cultura do trabalho familiar rural sente dificuldade em dialogar com a lógica do sistema de ensino tradicional, porque este impõe que os filhos desses grupos saiam de casa por muito tempo, deixando o trabalho familiar. Com o regime de alternância, o/a estudante estabelece um diálogo entre o estudo e o trabalho familiar, além de contextualizar o processo de ensino-aprendizagem. Assim, as/os jovens estudam sem prejuízo da produção familiar, além de construir habilidades técnicas e levar inovações tecnológicas para ao voltar (UFRPE, 2019, p. 43).

Este regime de formação em alternância permite uma educação problematizadora e libertadora, em consonância com educação popular, que segundo Freire (2005, p. 80), “(...) é problematizadora, de caráter autenticamente reflexivo, implica um constante ato de desvelamento da realidade (...) quando mais se

problematizam os educandos, como seres do mundo e com o mundo, tanto mais se sentirão desafiados”.

Assim, a implantação da alternância em um Curso Superior já é, por si, uma transformação do paradigma dominante na formação universitária, tendo em vista que a educação popular: “está apoiada em uma filosofia da práxis educacional entendida como um processo político-pedagógico centrado no ser humano como sujeito histórico transformador, que se constitui socialmente nas relações com os outros seres humanos e com o mundo” (UFRPE, 2019, p. 48).

Como visto, as pessoas ligadas ao espaço sociocultural do campo são grupos prioritários desse Curso, que compreendem: os/as agricultores/as familiares e camponeses/as, assentados/as da reforma agrária, aquicultores/as e pescadores/as de base familiar, comunidades tradicionais em geral, como extrativistas, quilombolas, indígenas etc., em acordo com a Lei da Agricultura Familiar (Lei nº 11.326, de 2006), bem como lideranças e técnicos, que atuam com os movimentos sociais do campo.

O processo seletivo adotado pelo Curso é o de edital, realizado em uma única etapa, utilizando a média aritmética das cinco provas do Exame Nacional do Ensino Médio (ENEM), do ano escolhido dentre as últimas cinco edições do exame.

As 40 vagas anuais são distribuídas entre os cotistas previstos na Lei de Cotas (Lei nº 12.711/2012), compreendendo a reserva de 50% de vagas para alunos/as que tenham cursado integralmente o Ensino Médio em escolas públicas, subdivididas de acordo com critérios de renda, autodeclaração de raça/etnia e portadores de deficiência (Brasil, 2012; Brasil, 2016). As pessoas inseridas no espaço socioterritorial do campo são contempladas, em observância ao Projeto Pedagógico do Curso de Bacharelado em Agroecologia, aprovado e instituído pela Resolução nº 228/2018 CEPE/UFRPE (UFRPE, 2018), além das vagas para a ampla concorrência.

Desde 2019 ocorreram três processos seletivos para preenchimento de vagas, para os semestres de 2019.2, 2021.2 e 2022.2, com distribuição de vagas conforme a Tabela 01:

Tabela 1- Distribuição das vagas no curso de Bacharelado em Agroecologia da UFRPE entre 2019-2022

| Vagas              | 2019  | 2021  | 2022     |
|--------------------|-------|-------|----------|
| Ampla concorrência | 2(5%) | 2(5%) | 20*(50%) |
| Cotas              |       |       |          |

|                                                    |           |           |          |
|----------------------------------------------------|-----------|-----------|----------|
| obrigatórias (Lei de cotas)                        | 8(20%)    | 8(20%)    | 20*(50%) |
| Cota institucional (espaço sociocultural do campo) | 15(37,5%) | 15(37,5%) | -        |
| Cota institucional + Cotas obrigatórias            | 15(37,5%) | 15(37,5%) | -        |
| Total                                              | 40        | 40        | 40       |

Fonte: Os autores.

(\*) bônus de 30% no cômputo geral para pessoas ligadas ao espaço sociocultural do campo.

Em 2019 e 2021, a ação afirmativa utilizada foi do tipo reserva de vaga, já em 2022 foi do tipo bônus. Segundo Silva e Lage (2011), existem 3 modalidades de ações afirmativas: reserva de vagas, que é o estabelecendo de uma porcentagem ou uma quantidade fixa de vagas do total de vagas oferecido; o bônus, que é o acréscimo de pontos ou notas no vestibular tradicional para um dado segmento; e o acréscimo de vagas, que é a criação de novas vagas, contemplando um determinado grupo.

Portanto, nos dois primeiros anos de uso das ações afirmativas, o Curso de Bacharelado em Agroecologia classificou os inscritos por ordem decrescente do resultado da média aritmética das cinco provas que compõem o ENEM, respeitando a distribuição de vagas, de acordo com a opção de cotas. Já em 2022, os/as inscritos/as ligados/as diretamente ao espaço socioterritorial do campo receberam um bônus de 30% no cômputo geral da nota do ENEM, de acordo com os seguintes critérios: ser agricultor/a familiar, ou dependente, de acordo com o que preconiza a Lei nº 11.326, de 24 de julho de 2006; ser empregado/a rural ou dependente; ser assentado/a da Reforma Agrária ou dependente; ou pertencer a povo ou comunidade tradicional, de acordo com o que define o Decreto nº 6.040, de 07 de fevereiro de 2007.

Tal possibilidade de mudança de modalidade de ingresso específica está prevista no PPC do Curso, em que o corpo docente, em conjunto com os discentes, gestores e parceiros/as da sociedade civil organizada e movimentos sociais podem construir novas propostas de política de ação afirmativa, que busquem sanar as eventuais lacunas ,

para que se estabeleça um modelo de ingresso na Universidade Pública, que atenda verdadeiramente o compromisso de construção de uma sociedade e educação democráticas (UFRPE, 2019).

As ações afirmativas empregadas pelo Curso de Bacharelado em Agroecologia da UFRPE diferem das encontradas por Gois (2018) no Instituto Federal da Paraíba (IFPB), Instituto Federal do Sudeste de Minas Gerais (IFSEMG) e Instituto Federal do Tocantins (IFTO), os quais utilizavam apenas a modalidade de reservas de vagas e possuíam poucas vagas para estes cotistas, respectivamente, 6,6%, 5% e 5% das vagas totais em cada curso ofertado com cotas.

Já na UFRPE correspondiam a 70% das vagas em 2019 e 2021, e em 2022 com o bônus de 30% na nota há a possibilidade de 100% dos ingressantes serem pessoas ligadas ao espaço sociocultural do campo. Além disso, o rol de beneficiários institucionais empregado pelo Curso de Bacharelado em Agroecologia da UFRPE é mais amplo, pois além de pronafianos, assentados da reforma agrária e empregados rurais, este acrescenta os povos e comunidades tradicionais, que, de acordo com a definição do Decreto nº 6.040/2007 são:

grupos culturalmente diferenciados e que se reconhecem como tais, que possuem formas próprias de organização social, que ocupam e usam territórios e recursos naturais como condição para sua reprodução cultural, social, religiosa, ancestral e econômica, utilizando conhecimentos, inovações e práticas gerados e transmitidos pela tradição (Brasil, 2007b).

Deste modo, há uma ampliação conceitual do que Gois et al. (2019) definiram como beneficiários de cotas rurais no Ensino Superior público, quais sejam: filhos de famílias pronafianas, de assentados da reforma agrária e de empregados rurais. Assim, entre os cotistas rurais acrescentam-se os povos ou comunidades tradicionais. Ampliação importante, tendo em vista a função social e constitucional da Universidade comprometida com a democratização do Ensino Superior e a universalização do seu acesso.

## V- CONSIDERAÇÕES FINAIS

Por mais que a implementação de ações afirmativas para pessoas ligadas diretamente ao espaço socioterritorial do campo no Curso de Bacharelado em Agroecologia da UFRPE seja recente, com início em 2019, percebe-se como uma iniciativa promissora na inclusão dos sujeitos camponeses no Ensino Superior, num contexto para além da inserção, mas para construção

interdisciplinar, conjunta e participativa a partir da teoria e prática, respeitando os saberes-fazeres do meio rural e comprometida com as experiências camponesas. A utilização da pedagogia da alternância faz com que a realidade social dos discentes seja ponto de partida e chegada, enraizando a aprendizagem e dando sentido e significado ao conhecimento construído.

Além disso, é notório que tal iniciativa privilegia um número expressivo de discentes, muito além das outras instituições que possuem cotas para estudantes rurais. Porém, seria importante que tais ações afirmativas fossem ampliadas para os demais cursos da UFRPE, para que haja maior dialogicidade entre o campo e as outras áreas de conhecimento.

Como característica das políticas públicas, espera-se que esta ação afirmativa seja reavaliada periodicamente, a fim de se apurar os benefícios efetivos de acesso às pessoas do campo no Curso de Bacharelado em Agroecologia e se a mudança na modalidade para bônus de 30% foi uma estratégia mais favorável aos estudantes rurais.

Por fim, a temática abordada neste estudo anseia levantar debate sobre o tema, colaborando dessa forma, com futuros trabalhos que tratem de ações afirmativas para estudantes do meio rural e almejam contribuir com a escassa literatura científica ao auxiliar na ampliação da divulgação de outras experiências de Universidades e Institutos Federais na implantação de cotas institucionais e, mais precisamente, de cotas para estudantes rurais.

## REFERÊNCIAS

- [1] Borges, M. C. A. (2018). *A educação como um direito fundamental, um bem público e um serviço comercializável*. EDUEPB.
- [2] Brasil. (1999). *Projeto de Lei de nº 73 de 1999*. Dispõe sobre o ingresso nas universidades federais e estaduais e dá outras providências. [https://www.camara.leg.br/proposicoesWeb/prop\\_mostrarintegra?codteor=339847&filename=SBT+2+CE+%3D%3E+PL+73/1999](https://www.camara.leg.br/proposicoesWeb/prop_mostrarintegra?codteor=339847&filename=SBT+2+CE+%3D%3E+PL+73/1999).
- [3] Brasil. (2004). *Projeto de Lei nº 3.627 de 2004*. Institui Sistema Especial de Reserva de Vagas para estudantes egressos de escolas públicas, em especial negros e indígenas, nas instituições públicas federais de educação superior e dá outras providências. [https://www.camara.leg.br/proposicoesWeb/prop\\_mostrarintegra?jsessionid=node014nhlc4gx1di1h515h1m5qf8811922264.node0?codteor=223523&filename=PL+3627/2004](https://www.camara.leg.br/proposicoesWeb/prop_mostrarintegra?jsessionid=node014nhlc4gx1di1h515h1m5qf8811922264.node0?codteor=223523&filename=PL+3627/2004).
- [4] Brasil. (2008) Câmara dos Deputados. *Projeto de Lei de nº 3.913 de 2008*. Institui o sistema de reserva de vagas para estudantes egressos de escolas públicas nas instituições federais de educação superior, profissional e tecnológica.

- [https://www.camara.leg.br/proposicoesWeb/prop\\_mostrarnegra?codteor=593172&filename=PL+3913/2008](https://www.camara.leg.br/proposicoesWeb/prop_mostrarnegra?codteor=593172&filename=PL+3913/2008).
- [5] Brasil. (1988). *Constituição da República Federativa do Brasil, de 5 de outubro de 1988* (44) Saraiva.
- [6] Brasil. (2010). *Decreto nº 7.352 de 4 de novembro de 2010*. Dispõe sobre a política de educação do campo e o Programa Nacional de Educação na Reforma Agrária - PRONERA. <http://portal.mec.gov.br/docman/marco-2012-pdf/10199-8-decreto-7352-de4-de-novembro-de-2010/file>.
- [6] Brasil. (1968). *Lei nº 5.465 de 03 de julho de 1968*. Dispõe sobre o preenchimento de vagas nos estabelecimentos de ensino agrícola. [http://www.planalto.gov.br/ccivil\\_03/leis/1950-1969/L5465.htm](http://www.planalto.gov.br/ccivil_03/leis/1950-1969/L5465.htm). Acesso em: 27 mai. 2022.
- [7] Brasil. (1995). *Lei nº 7.423 de 17 de dezembro de 1985*. Revoga a Lei nº 5.465, de 3 de julho de 1968, que “dispõe sobre o preenchimento de vagas nos estabelecimentos de ensino agrícola”, bem como sua legislação complementar. [http://www.planalto.gov.br/ccivil\\_03/leis/1980-1988/L7423.htm](http://www.planalto.gov.br/ccivil_03/leis/1980-1988/L7423.htm).
- [8] Brasil. (2012a). *Lei nº 12.711 de 29 de agosto de 2012*. Dispõe sobre o ingresso nas universidades federais e nas instituições federais de ensino técnico de nível médio e dá outras providências. [http://www.planalto.gov.br/ccivil\\_03/\\_ato2011-2014/2012/lei/112711.htm](http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/112711.htm). Acesso em: 27 mai. 2022.
- [9] Brasil. (2016). *Lei nº 13.409 de 28 de dezembro de 2016*. Altera a Lei no 12.711, de 29 de agosto de 2012, para dispor sobre a reserva de vagas para pessoas com deficiência nos cursos técnico de nível médio e superior das instituições federais de ensino. [http://www.planalto.gov.br/ccivil\\_03/\\_ato2015-2018/2016/lei/L13409.htm](http://www.planalto.gov.br/ccivil_03/_ato2015-2018/2016/lei/L13409.htm).
- [10] Brasil. (2007). *Resolução nº 2 de 18 de Junho de 2007*. Dispõe sobre carga horária mínima e procedimentos relativos à integralização e duração dos cursos de graduação, bacharelados, na modalidade presencial. [http://portal.mec.gov.br/cne/arquivos/pdf/2007/rces002\\_07.pdf](http://portal.mec.gov.br/cne/arquivos/pdf/2007/rces002_07.pdf).
- [11] Brasil. (2012b). *Portaria Normativa do Ministério da Educação nº 18 de 11 de outubro de 2012*. Dispõe sobre a implementação das reservas de vagas em instituições federais de ensino de que tratam a Lei n. 12.711, de 29 de agosto de 2012, e o Decreto n. 7.824, de 11 de outubro de 2012. [http://portal.mec.gov.br/cotas/docs/portaria\\_18.pdf](http://portal.mec.gov.br/cotas/docs/portaria_18.pdf).
- [12] Brasil. (2007). *Decreto nº 6.040, de 07 de fevereiro de 2007*. Institui a Política Nacional de Desenvolvimento Sustentável dos Povos e Comunidades Tradicionais. [http://www.planalto.gov.br/ccivil\\_03/\\_ato2007-2010/2007/decreto/d6040.htm](http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2007/decreto/d6040.htm).
- [13] Castro, F. G. (2016). *Política de cotas no Instituto Federal de Educação, Ciência e Tecnologia do Tocantins - Campus Gurupi: reflexos da lei nº 12.711, de 29 de agosto de 2012*. [Dissertação de Mestrado Profissional em Gestão de Políticas Públicas, Universidade Federal do Tocantins]. <http://repositorio.uft.edu.br/handle/11612/275>.
- [14] Costa, A. A. (2013). Judiciário e interpretação: entre Direito e Política. *Pensar: Revista de Ciências Jurídicas (Unifor)*, 18, 9-46. <https://doi.org/10.5020/23172150.2012.9-46>.
- [15] Daflon, V. T., Feres Júnior, J. & Campos, L. A. (2013) Ações afirmativas raciais no ensino superior público brasileiro: um panorama analítico. *Cadernos de Pesquisa*, 43, 148, 302-327. <https://www.scielo.br/pdf/cp/v43n148/15>.
- [16] Fernandes, B. M. (2012) Movimentos socioterritoriais e movimentos socioespaciais: Contribuição teórica para uma leitura geográfica dos movimentos sociais. *OSAL: Observatorio Social de América Latina*, 6, 16. <http://biblioteca.clacso.edu.ar/clacso/osal/20110312111042/34MFernandes.pdf>.
- [17] Freire, P. (2005) *Pedagogia do oprimido* (42). Paz e Terra.
- [18] Gois, P. K. M. (2018). *Cotas para pronafricanos, assentados da reforma agrária e empregados rurais no ensino superior público: um panorama analítico*. [Dissertação de Mestrado Profissional em Sistemas Agroindustriais, Universidade Federal de Campina Grande]. <http://dspace.sti.ufcg.edu.br:8080/jspui/handle/riufcg/4404>.
- [19] Gois, P. K. M., Pereira Júnior, E. B., Ximenes, J. M. (2019). Cotas rurais no ensino superior público: um panorama analítico. *Revista Verde*, 14, 3, 464-469. <https://doi.org/100.18378/rvads.v14i3.5891>
- [20] Graham, A. (2010). *Como escrever e usar estudo de caso para ensino e aprendizagem no setor público*. ENAP. [https://repositorio.enap.gov.br/bitstream/1515/1/estudosde\\_caso.pdf](https://repositorio.enap.gov.br/bitstream/1515/1/estudosde_caso.pdf).
- [21] Lara, A. M. B. & Molina, A. A. (2011) Pesquisa Qualitativa: apontamentos, conceitos e tipologias. In: Cêzar de Alencar Arnaut de Toledo; Maria Teresa Claro Gonzaga. (Org.). *Metodologia e Técnicas de Pesquisa nas Áreas de Ciências Humanas* (1). EEduem.
- [22] Lima, N. O. (2019). *10 lições sobre Rawls*. Vozes.
- [23] Lima, V. B. O. (2009). Ações afirmativas: instrumentos de efetivação do princípio da igualdade e do princípio da dignidade da pessoa humana. *Revista PGM - Procuradoria Geral do Município de Fortaleza*, 17, 271-294. <http://revista.pgm.fortaleza.ce.gov.br/index.php/revista1/article/view/297>.
- [24] Magalhães, A. C. M & Silva, M. J. A. (2013). Políticas públicas em educação, ações afirmativas e mudanças sociais: lutas por equidade e cidadania. *Anais V FIPED*, 1. [http://www.editorarealize.com.br/revistas/fiped/trabalhos/Trabalho\\_Comunicacao\\_oral\\_idinscrito\\_97\\_bbbb4d76c7fc4386502eeabb4a4502c1.pdf](http://www.editorarealize.com.br/revistas/fiped/trabalhos/Trabalho_Comunicacao_oral_idinscrito_97_bbbb4d76c7fc4386502eeabb4a4502c1.pdf).
- [25] Magalhães, W. L. A. (2015). *"lei do boi" como estratégia da burguesia rural: o caso da Universidade Federal Rural do Rio de Janeiro (1968-1985)*. [Dissertação de Mestrado em História, Universidade Federal Rural do Rio de Janeiro]. <https://tede.ufrj.br/jspui/bitstream/jspui/1770/2/2015%20-%20Wallace%20Lucas%20Magalhaes.pdf>.
- [26] Mazucato, T. (2018). *Metodologia da pesquisa e do trabalho científico*. FUNEPE.
- [27] Neves, R. L. R., Golin, C. H, Lira, L. C, Sampaio, T. M. V & Assumpção, L. O. T. (2015). Políticas públicas para minorias étnico-raciais, mulheres e juventude: notas introdutórias sobre as áreas de esporte e lazer. *Pensar a*

- prática*, 18, 4, 937-948.  
<https://doi.org/10.5216/rpp.v18i4.34689>.
- [28] Passos, G. O & Gomes, M. B. (2014). A instituição da reserva de vagas na universidade pública brasileira: os meandros da formulação de uma política. *Ensaio: aval. pol. públ. Educ.*, 22(85), 1091-1114.  
<https://www.scielo.br/j/ensaio/a/n66QB9GQFSmfVjw6dYdLT9S/?lang=pt&format=pdf>.
- [29] Reis H. H. S., Sobreiro Filho, J. & Rabelo, E. V. (2019). Território, movimentos socioterritoriais e Educação do Campo. *Caminhos De Geografia*, 20(69), 253–265.  
<https://doi.org/10.14393/RCG206941199>
- [30] Santos, C. L. (2020). *Autodeclarar-se, uma análise sobre o acesso à universidade por meio de ações afirmativas na UFF*. [Trabalho de Conclusão de Curso da Graduação em Sistemas de Informação, Universidade Federal Fluminense] [https://app.uff.br/riuff/bitstream/handle/1/22479/Monografia%20de%20Caio%20Lima\\_final\\_REVISADO.pdf?sequence=1&isAllowed=y](https://app.uff.br/riuff/bitstream/handle/1/22479/Monografia%20de%20Caio%20Lima_final_REVISADO.pdf?sequence=1&isAllowed=y).
- [31] Sardo, P. M. L. (2013). *A pedagogia da alternância no bacharelado em agronomia com ênfase em agroecologia e sistemas rurais sustentáveis (ProNERA/UFSCar): o campo e a universidade como territórios educativos*. [Dissertação de Mestrado em Agroecologia e Desenvolvimento Rural, Universidade Federal de São Carlos]. <https://repositorio.ufscar.br/bitstream/handle/ufscar/164/5655.pdf?sequence=1&isAllowed=y>.
- [32] Silva, I. G & Laje, T. (2011). *Direito social à educação: acesso ao ensino superior – o debate sobre as políticas de ações afirmativas nas Universidades Públicas Brasileiras*. PUC.
- [33] UFRPE. (2019). *Projeto Pedagógico do Curso de Bacharelado em Agroecologia*. <http://www.preg.ufrpe.br/sites/ww4.depaacademicos.ufrpe.br/files/PPC%20Bacharelado%20em%20Agroecologia%20SEDE%202019.pdf>.
- [34] UFRPE. (2018). *Resolução CEPE nº 228/2018*. Aprova Projeto Pedagógico e a criação do Curso de Bacharelado em Agroecologia, Campesinato e Educação Popular da Universidade Federal Rural de Pernambuco.
- [35] Veiga, I. P. A. (2003a). Perspectivas para reflexão em torno do projeto político-pedagógico. In: VEIGA, I. P.A; RESENDE, L. M. G. (Orgs.). *Escola: espaço do projeto político pedagógico* (7). Papirus.
- [36] Veiga, I. P. A. (2003b). Projeto político pedagógico da escola: uma construção coletiva. In: VEIGA, I. P. A (Org). *Projeto político pedagógico da escola: uma construção possível* (16). Papirus.

# The green fair as an instrument of autonomy for family farmers in agroecological transition in the municipality of Paripiranga-Ba, Brazil: A case study

## A feira verde como instrumento de autonomia de agricultores familiares em transição agroecológica no município de Paripiranga-Ba, Brasil: Um estudo de caso

Carlos Allan Pereira dos Santos<sup>1</sup>, Horasa Maria Lima da Silva Andrade<sup>2</sup>, Luciano Pires de Andrade<sup>3</sup>

<sup>1,2</sup>Universidade Federal Rural de Pernambuco, Brasil

<sup>3</sup>Universidade Federal do Agreste de Pernambuco, Brasil

Received: 22 Aug 2022,

Received in revised form: 12 Sep 2022,

Accepted: 18 Sep 2022,

Available online: 22 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Solidarity economy, Empowerment, Agroecological fairs, Agroecological transition.*

**Palavras-chave**— *Economia solidária, Empoderamento, Feiras agroecológica, Transição agroecológica.*

**Abstract**— *The agroecological transition process is complex and requires preparation of all involved, from the changes in the production system to the moment of commercialization. This moment is crucial for the socioeconomic development of the participating producers. Agroecological markets play an important role in the agroecological transition process and in the empowerment of farmers involved in this process. The objective of this paper is to reflect, based on a case study, about the role of the green fair as a socioeconomic development tool for family farmers in agroecological transition in the municipality of Paripiranga-Ba, Brasil. From the study developed, it was realized that there is a need for further studies with the participating producers, but it was already possible to realize that the green fair has enabled productive diversification in a region where grain monocultures predominate.*

**Resumo**— *O processo de transição agroecológica é complexo e requer preparo de todos envolvidos desde as mudanças no sistema produtivo até o momento da comercialização. Este momento é crucial para o desenvolvimento socioeconômico dos produtores participantes. As feiras agroecológicas desempenham papel importante no processo de transição agroecológica e de empoderamento dos agricultores envolvidos neste processo. O objetivo deste texto é refletir, a partir de um estudo de caso, sobre o papel da feira verde ferramenta de desenvolvimento socioeconômico de agricultores familiares em transição agroecológica no município de Paripiranga-Ba, Brasil. A partir do estudo desenvolvido percebeu-se que há necessidade de aprofundamento dos estudos com os produtores participantes, mas já foi possível perceber que a feira verde possibilitou a diversificação produtiva em uma região onde predomina o monocultivo de grãos.*

## I. INTRODUÇÃO

A modernização da agricultura, evidenciada após a Revolução Verde, com a utilização massiva de fertilizantes sintéticos e práticas de manejo focadas no aumento da produção associada às exigências de consumo, que determinam a uniformização das culturas, resultou em degradação química, física e biológica de solos, perda de biodiversidade e por consequência perda de identidade dos territórios resultou em implicações socioeconômicas das comunidades envolvidas nesse processo, em especial os Agricultores Familiares (Balestro & Sauer, 2013).

A crise sanitária instalada em função da pandemia da COVID-19, soma-se, portanto, às demais crises que já vínhamos enfrentando no mundo, produto de um modelo industrial e de consumo altamente destrutivo e com consequências sem precedentes para a humanidade e a natureza. A agroecologia se apresenta como sendo o caminho para enfrentar esse sistema que gera doenças, desigualdades, violências, iniquidades, exploração de toda sorte e mortes. A partir da Agroecologia, enquanto Ciência, podemos investir na construção de um conhecimento que promova uma visão crítica e transformadora, pautada no princípio holístico de respeito à natureza (Bezerra, Sousa & Barros, 2020).

Produzir alimentos seguindo os preceitos agroecológicos vai além de não usar defensivos químicos na lavoura, pois a produção agroecológica é um conjunto de processos que visam produzir alimentos de forma sustentável. A Agroecologia sugere alternativas de produção sustentáveis com vistas à sustentabilidade ambiental, num pressuposto que não há necessidade de degradar para produzir e sim produzir com base na conservação do agroecossistema, em substituição às práticas predadoras aplicadas na agricultura convencional capitalista, que segue os preceitos da Revolução Verde (Leff, 2002).

A agroecologia recentemente ganhou espaço, por se apresentar como alternativa para produção de alimentos associado a um desenvolvimento rural menos com foco no uso sustentável das terras e do meio ambiente, em oposição ao modelo agropecuário inscrito no paradigma da agricultura moderna pregado pela Revolução Verde, que se baseia em práticas predatórias resultando em sérios impactos ambientais e sociais nos territórios (Balestro & Sauer, 2013).

A ascensão da agroecologia enquanto ciência acadêmica torna-se uma necessidade urgente para sustentar sua consolidação como modelo produtivo do campesinato. Para tanto há a necessidade de desenvolver no meio científico os saberes acumulados historicamente pela agricultura

camponesa e, para isso, a agroecologia precisa se compor como ciência legítima e autônoma frente a agronomia tradicional. (Troilo & Araújo, 2020).

Entende-se que a partir dos princípios agroecológicos, há um potencial técnico-científico capaz de estimular transformações no campo e na produção agrícola, assegurando a segurança alimentar e potencializar a sustentabilidade socioambiental e econômica nos diferentes agroecossistemas orientados por ações de ensino, pesquisa e extensão rural. (Caporal, Paulos & Costabeber, 2009).

A Agroecologia é a associação dos saberes tradicionais dos agricultores, levando em consideração os processos culturais, com os conhecimentos científicos, buscando o estabelecimento de estratégias de promoção do desenvolvimento rural sustentável. Compreende também uma análise crítica do modelo de agricultura desenvolvimentista que foca em resultados e desenvolvimento desordenado. (Caporal & Azevedo, 2011).

A agroecologia como ciência que valoriza o conhecimento tradicional na construção de modelo de produção agrícola sustentável tem como objeto também o empoderamento social do produtor e das comunidades agrícolas, a fim de que possam ser sujeitos ativos de suas próprias vidas e possam viver com dignidade e independência no campo, em harmonia com os recursos naturais e produzindo alimentos saudáveis. (Vanessa de Castro & Campos, 2020).

A agroecologia se mostra mais do que apenas a adoção de manejo sustentável dos recursos naturais, ela está articulada com as experiências dos produtores propondo uma produção heterogênea baseada nas culturas locais sendo um contraponto à agricultura convencional que utiliza os recursos de forma intensiva, voltada à produção e lucro. A agroecologia está fundamentada nas questões socioeconômicas dos produtores e nos aspectos ecológicos (Scheuer *et al.*, 2017).

Além de ciência, a agroecologia é movimento, quando busca outros processos civilizatórios entre sociedade/natureza baseados nos povos e comunidades tradicionais e oprimidos. Assim, podemos dizer que toda produção agroecologia é orgânica, mas nem toda produção orgânica é agroecológica. A agroecologia é uma ferramenta importante para autonomia dos povos, construção de valores ambientais e busca por outros modelos civilizacionais. As experiências agroecológicas manifestam-se em diferentes tipologias territoriais como



assentamentos de reforma agrária, quilombos, territórios indígenas etc (Costa *et al.*, 2021).

A agricultura convencional ao longo do último século se mostrou e tem se mostrado insustentável do ponto de vista socioambiental, o que abre espaço para o retorno de uma agricultura amparada nos saberes camponeses e práticas antes classificadas como atrasadas. Essa agricultura convencional é fruto da revolução verde que teve como base o uso excessivo de agrotóxicos e fertilizantes sintético, que por anos promoveu o esgotamento de solos e perda de biodiversidade (Rempel, Turatti & Dalmoro, 2021).

A Agenda 2030 da ONU engloba 17 Objetivos de Desenvolvimento Sustentável, os ODS, os quais, por sua vez, listam 169 metas, todas orientadas a traçar uma visão universal, integrada e transformadora para um mundo melhor. Destes, o segundo objetivo visa acabar com a fome, alcançar a segurança alimentar e melhoria da nutrição e promover a agricultura sustentável e este tem como uma das metas que até 2030, garantir sistemas sustentáveis de produção de alimentos e implementar práticas agrícolas resilientes, que aumentem a produtividade e a produção, que ajudem a manter os ecossistemas, que fortaleçam a capacidade de adaptação às alterações climáticas, às condições meteorológicas extremas, secas, inundações e outros desastres, e que melhorem progressivamente a qualidade da terra e do solo (ONU, 2017).

A agroecologia por proporcionar aos agricultores independência do sistema capitalista de produção e alimentos se apresenta como ferramenta de empoderamento socioeconômica dos mesmo que estão em processo de transição da agricultura convencional para uma agricultura agroecológica promotora do desenvolvimento sustentável, sendo, portanto, uma ferramenta para se concretizar os Objetivos de Desenvolvimento Sustentável (ODS) propostos pela Organização das Nações Unidas (Vanessa de Castro & Campos, 2020).

Fundada em experiências produtivas da agricultura ecológica e apoiada em horizontalidades, construídas por sujeitos que produzem alimentos, mas que se empenham também em valorizar toda forma de vida ao longo do processo produtivo, a agroecologia insere-se especialmente em circuitos curtos da economia, onde procura firmar-se em teias que articulam campo e cidade na construção da soberania alimentar (Pertile, 2021).

Este modelo de produção concilia produção agrícola com conservação dos recursos naturais e fortalecimento da agricultura, porém é um processo complexo baseado na

sinergia entre diferentes saberes, aplicando técnicas que valorizam o saber local com foco no fortalecimento da agricultura camponesa. A esse processo se nomina de transição agroecológica e busca a construção de novas práticas socioprodutivas que tenham como premissa a valorização de estratégias de desenvolvimento de agricultura sustentável (Piraux *et al.*, 2012).

Apesar da transição agroecológica ter como foco a valorização da cultura local, ela não pode ser entendida como um retrocesso ao passado, mas um caminho no sentido da construção do desenvolvimento sustentável, onde é levada em consideração todas as experiências, sejam positivas ou danosas à sociedade e ao meio ambiente, utilizando-as como ponto de partida para a construção de um futuro sustentável (Marin, 2009).

A transição agroecológica refere-se a um processo gradual de mudança na forma de manejo do agroecossistema, que envolve a passagem de um modelo agroquímico de produção, de alta dependência de insumos externos (fertilizantes e agrotóxicos) para outro modelo de agricultura que incorpore princípios, métodos e tecnologias de base ecológica. As mudanças podem ocorrer em vários níveis: começando pela redução no uso de insumos convencionais; passando para a substituição de práticas e insumos convencionais por técnicas e insumos alternativos; e por fim, pela remodelagem de toda a propriedade conforme os princípios agroecológicos, com elevado aproveitamento dos processos naturais e interações ecológicas (Michereff Filho *et al.*, 2013).

Os alimentos oriundos da produção agroecológica, apesar das reconhecidas vantagens tanto para o agroecossistema como para os consumidores, ainda tem um marketing muito inferior quando comparados à agricultura convencional, fato que em alguns casos dificulta sua comercialização. As feiras agroecológicas apresentam a vantagem de estabelecerem a conexão entre agricultores e consumidores, proporcionando a partir deste contato, o diálogo a respeito tanto da origem desses alimentos como do modo de vida dos produtores (Pinha & Almeida, 2018).

Mais do que instrumento de independência de intermediários, as feiras agroecológicas podem se constituir como uma ferramenta de protagonismo e empoderamento de agricultores familiares, uma vez que a não existência dos intermediários faz com que os próprios agricultores lidem com etapas de planejamento de produção, precificação e marketing. Além disso, proporciona aos mesmos a adoção de práticas de produção agroecológicas, ou seja, uma produção que prioriza o

respeito à natureza, não praticando ações que degradem o solo, água ou ar.

A agroecologia e a economia solidária se apresentam com mais força como alternativas realizáveis por parte dos sujeitos do campo e da cidade. Guardadas algumas diferenças em relação à dimensão organizativa desses sujeitos, ambos os movimentos se comunicam em boa parte das práticas, principalmente no que se refere aos processos de construção de mercados agroecológicos e solidários e às estratégias de garantir o Direito Humano à Alimentação de indivíduos e comunidades, tanto no campo como na cidade (Dubeux & Batista, 2017).

Os atores envolvidos nestes empreendimentos solidários visam não apenas uma oportunidade de negócio mas também e principalmente, um propósito a ser perseguido, que passa por uma modificação do modo de pensar e fazer agricultura, visando a produção de alimentos saudáveis a partir de práticas sustentáveis que geram impactos positivos social e ambientalmente (Nascimento *et al.*, 2018).

As feiras agroecológicas representam a iniciativa de estruturação de arranjos sociais com vistas à produção baseada nos princípios agroecológicos associado com a autonomia na comercialização, uma vez que nestas, a articulação com atravessadores é eliminada, fortalecendo assim o produtor familiar. Entretanto, não há um enquadramento institucional, formal e com controle, para que estas sejam consideradas orgânicas. Na prática, as denominações “agroecológica” e “orgânica” são dadas pelos atores que lideram a criação da feira – e tais fundadores podem ser órgãos ou grupo de entidades, grupo de produtores, a até mesmo pessoas físicas (Araújo; Lima & Macambira, 2015).

As feiras agroecológicas se constituem em uma das modalidades dos circuitos curtos de comercialização da Agricultura Familiar, principalmente para aqueles que estão em processo de transição agroecológica, já que estes necessitam de um espaço para comercializar seus produtos. Estas normalmente ocorrem em espaços públicos e com periodicidade. Caracterizam-se pela venda direta dos produtos gerados pela Agricultura Familiar aos consumidores, sem percorrer as cadeias produtivas da agroindústria convencional, ligadas à produção, manejo, processamento e distribuição dos alimentos nos grandes mercados consumidores. Esse fluxo direto faz com que os agricultores em transição não dependam de atravessadores para comercializar seus produtos e assim gerando renda e independência para estes (Caminhas, 2022).

Na sua maioria, os produtos comercializados nas feiras agroecológicas são oriundos de quintais produtivos, fato que otimiza a produção uma vez que não há grandes deslocamentos entre a residência e a unidade produtiva.

Os quintais são espaços adjacentes aos domicílios rurais onde as mesmas buscam sincronizar e expressar sentimentos e desejos de conforto ambiental, além de espaços da oferta de alimentos, paisagismos, estoque de material genético de origem vegetal e animal, com o alicerce do princípio da agrobiodiversidade, qual consistem da combinação de espécies agrícolas, medicinais, ornamentais e florestais, às vezes, integrado a criação de animais (Gomes, 2017).

A produção agroecológica brasileira é dominada pelas mulheres no campo e esse domínio é visualizado também nos processos de comercialização destes produtos, inclusive nas feiras agroecológicas. Esse movimento demonstra a força e empoderamento feminino no campo (Caminhas, 2022).

O debate a respeito do protagonismo da mulher rural se intensificou nos últimos anos a partir do reconhecimento por parte dos movimentos sociais, das mesmas como atrizes fundamentais na defesa da alimentação familiar assim como na preservação das práticas tradicionais (Strate & Costa, 2018).

Ainda que o papel das mulheres na agricultura de base agroecológica e na construção da sustentabilidade tenha ganhado destaque nos últimos anos, a discussão a respeito deste ainda é superficial (Santos *et al.*, 2020). A participação da mulher nos processos agroecológicos vai além da condição de cuidadora, compreende suas relações com a natureza e desenvolvimento social, para que exista consciência da necessária igualdade entre gêneros e, também, de respeito à natureza, em sua forma singular de preservação da vida e do sustento da humanidade. A partir desta discussão é necessário que haja a quebra da ideia do patriarcado que ainda é dominante no campo e tende a inferiorizar o papel feminino no mesmo. que inferioriza a participação feminina (Maciel 2015).

O objetivo deste texto é caracterizar e refletir sobre o papel da feira verde ferramenta de desenvolvimento socioeconômico de agricultores familiares em transição agroecológica no município de Paripiranga-Ba.

## II. MATERIAIS E MÉTODOS

O estudo foi desenvolvido no município de Paripiranga (Fig. 1), situado na região nordeste da Bahia, caracterizado por fazer parte do polígono das secas. De acordo com a classificação de Köppen, o clima do município é Aw, considerado como tropical, havendo um maior volume

pluviométrico durante o verão e menor no inverno. A estação quente permanece por 5,6 meses, de outubro a abril, com temperatura máxima média diária acima de 32 °C. O mês mais quente do ano em Paripiranga é janeiro, com a máxima de 33 °C e mínima de 21 °C, em média, com pluviosidade média anual em torno de 900 mm. A região é conhecida por sua vocação para a produção agrícola de grãos.

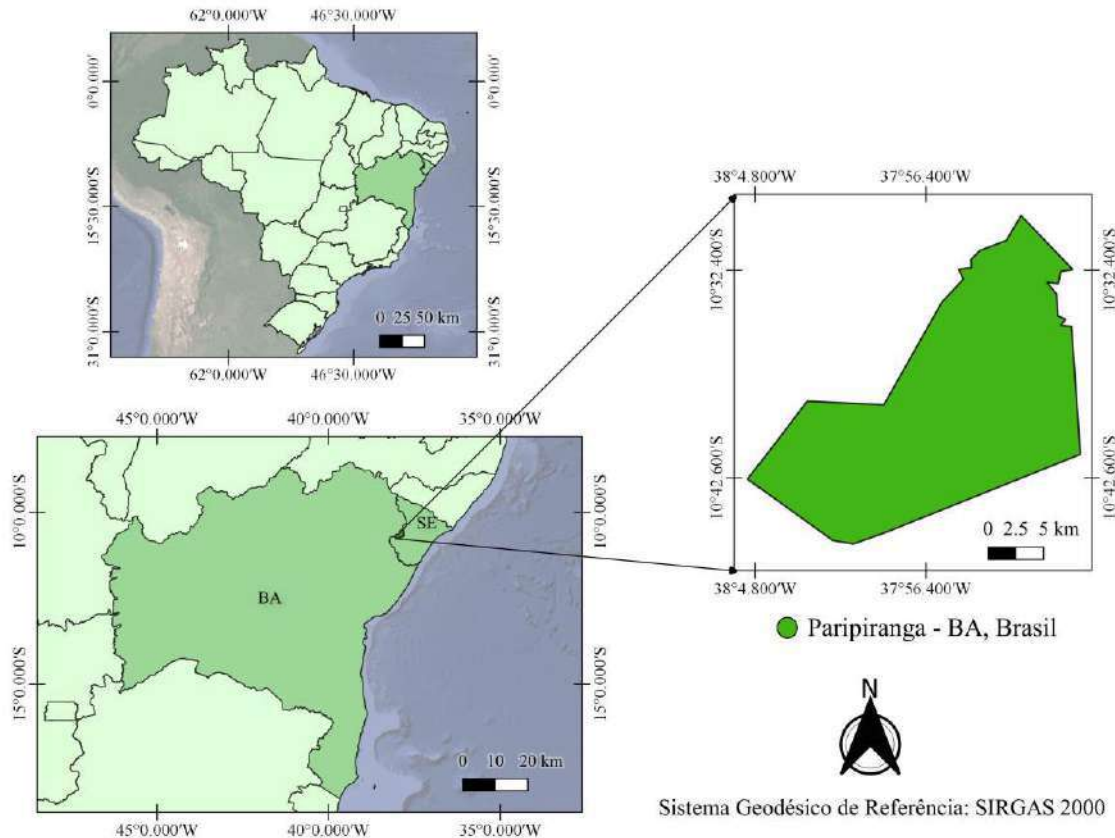


Fig. 1: Mapa de localização do município de Paripiranga-Ba, Brasil.

Participaram da pesquisa todos os integrantes da feira verde, num total de 30 agricultores familiares, inseridos em 10 povoados do entorno da sede municipal que compunham a feira agroecológica, denominada como “Feira Verde” do município. Estes produtores foram selecionados para participarem da feira por estarem em processo de transição agroecológica e eram acompanhados pelos técnicos da secretaria e por um grupo de extensão composto docentes e discentes do curso de Engenharia Agrônoma do Centro Universitário Ages, com sede no município.

A feira verde é um mecanismo de comercialização de produtos de agricultores familiares em transição agroecológica, idealizada pelo colegiado de Engenharia Agrônoma do Centro Universitário Ages em conjunto com a Secretaria Municipal de Agricultura e Meio Ambiente de Paripiranga. A feira é organizada e

mantida pela secretaria e ocorre semanalmente podendo ser considerada como uma ferramenta não apenas de comercialização, mas também de socialização entre os participantes e exposição cultural.

A metodologia adotada para coletar os dados que subsidiam o presente texto foi estudo de caso com agricultores do município de Paripiranga(BA), por meio do qual os mesmos foram obtidos através de observação não participativa. Estes eram produtores participantes regulares da feira verde de modo a nos permitir realizar um diagnóstico dos produtos comercializados por eles. Esta metodologia consiste de uma investigação empírica que pesquisa fenômenos dentro do seu contexto real, no qual o pesquisador não tem controle sobre eventos e variáveis e busca apreender a totalidade de uma situação, descrevendo, compreendendo e interpretando a complexidade de um caso concreto (Martins, 2008).

Como instrumento de coleta das informações foi adotada a observação participativa, por proporcionar uma relação de confiança entre os participantes da pesquisa e o pesquisador, possibilitando assim a melhor captação das relações que fazem parte do cotidiano dos trabalhos e que só podem ser observadas na realidade em que acontecem. Utilizou-se também como ferramenta de coleta de dados a entrevista com a finalidade de se obter dados referentes à diversidade de produtos comercializados. Após finalização da etapa de coleta, os dados foram tabulados e tratados para posterior discussão dos resultados.

A pesquisa é classificada como aplicada, de acordo com Silva e Menezes (2005) este tipo de pesquisa tem como objetivo gerar conhecimentos para aplicação prática e dirigidos à solução de problemas específicos. Envolve verdades e interesses locais. Quanto a abordagem é classificada como qualitativa.

Para Pinheiro *et al.* (2005), a pesquisa qualitativa caracteriza-se por um estudo analítico, não necessariamente estatístico, cujo propósito é identificar e analisar com maior grau de profundidade dados e informações não mensuráveis, sentimentos, sensações, percepções, pensamentos, intenções, comportamentos passados, expectativas futuras, experiências, vivências. Para esse objeto de estudo, a pesquisa qualitativa se propõe a entender, interpretar motivos e significados de um grupo de pessoas em relação a uma questão especificamente determinada. No que diz respeito aos objetivos a pesquisa é classificada como exploratória.

A pesquisa exploratória visa proporcionar maior familiaridade com o problema com intuito de torna-lo explícito ou de construir hipóteses. Envolve levantamento bibliográfico; entrevistas com pessoas que tiveram experiências práticas com o problema pesquisado; análise de exemplos que estimulem a compreensão. Assume, em geral, as formas de pesquisas bibliográficas e estudos de caso. (Matias-Pereira, 2016).

### III. RESULTADOS E DISCUSSÕES

Durante a investigação, três agricultores se desligaram da feira alegando dificuldades para se manter no processo. Foi possível constatar a comercialização de aproximadamente de 35 produtos entre frutas da estação, hortaliças, ovos, doces artesanais, comidas típicas, plantas ornamentais e laticínios, apresentando toda a diversidade produtiva dos participantes, demonstrando uma grande diversidade de produtos (Fig. 2), sendo todos típicos da região e produzidos de maneira sustentável, seguindo os princípios da agroecologia. Ao se considerar que o município é caracterizado pela produção em monocultivo do milho para produção de grãos com a finalidade de

alimentar a cadeia do agronegócio, a diversidade encontrada na feira é vista de maneira positiva uma vez que toda a produção é advinda de áreas produtivas do município, o que demonstra a força e resistência da agroecologia.



Fig. 2: A feira e sua diversidade.

A produção agroecológica tem como princípios como respeito e adequação da comercialização em relação a entressafra, sazonalidade de produção, variedades locais e ou regionais etc., ao contrário das grandes redes de varejo e o comércio convencional. Nas feiras agroecológicas são demonstrados a diversidade cultural da agricultura familiar e promovem a autonomia na comercialização e a venda direta aos consumidores, contribuindo de forma significativa para estimular mudanças internas nos sistemas produtivos, favorecendo o processo de conversão de agricultores familiares convencionais para a produção orgânica (Wergues & Simon, 2007).

A adoção do sistema produtivo da agricultura agroecológica merece destaque, pois se trata de uma das estratégias da agricultura familiar para a manutenção do espaço rural, sendo compreendido como espaço físico e também de particularidades como identidade e modo de viver no campo (Leal *et al.*, 2020).

A diversidade de produtos comercializados na feira reflete exatamente o que ocorre nas unidades de produção que no caso dos produtores em questão se caracterizam por serem quintais produtivos. Estes espaços têm como característica principal a diversificação da produção, onde num pequeno espaço o produtor é capaz de desenvolver diversos cultivos possibilitando um incremento de renda pois não depende apenas de uma cultura para comercialização (Fig. 3).

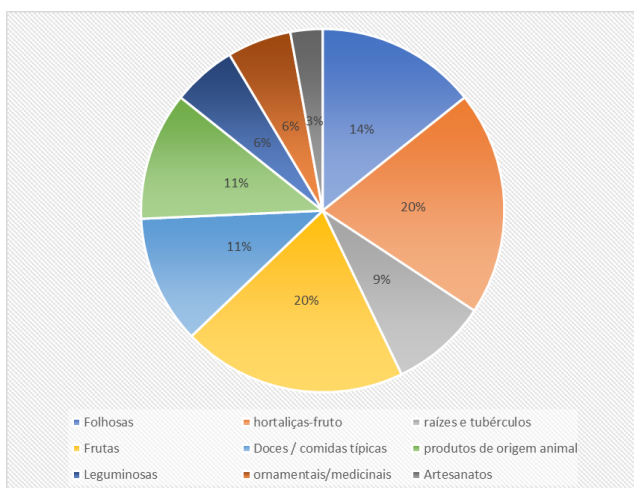


Fig. 3: Participação dos produtos na comercialização na feira agroecológica.

A diversidade de produtos na feira está relacionada diretamente com a dinâmica dos quintais produtivos, nos quais estes são produzidos. Nestes há uma multiplicidade de culturas sendo desenvolvidas, fato que os tornam sustentáveis. Tradicionalmente dominados pelas mulheres, estes espaços são característicos por apresentarem cultivos de fruteiras e hortaliças, além da criação de pequenos animais de produção (Santos & Brito, 2018).

A pluriatividade é uma característica recorrente entre os produtores familiares que participaram da feira verde, proporcionando diferentes fontes de renda, uma vez que além da diversidade produtiva há o incremento com os produtos não agrícolas como artesanatos, doces e comidas típicas. Esse fato resulta em ganho não só econômico, mas também social. A pluriatividade tem funcionado não somente como um fator positivo, mas também contribuído para a desclassificação de expressiva parcela das famílias de trabalhadores por conta própria da condição do que é legalmente considerado por “agricultura familiar” (Nascimento; Aquino & Delgrossi, 2021).

A pluriatividade serve, ainda, para mostrar a transição da própria função da agricultura que, além de produzir alimentos e gerar emprego, favorecendo o processo de acumulação de capital, se apresenta hoje como um setor plurifuncional, que não deve ser analisado apenas pela sua eficiência produtiva, mas também pela sua contribuição na preservação ambiental e na própria dinamização do espaço rural (Mattei, 2007).

A participação massiva de mulheres na constituição da feira foi outro fato identificado no trabalho, demonstrando assim o seu potencial como forma de empoderamento da mulher agricultora (Figura 04) fato que coloca em evidência o protagonismo feminino no campo.

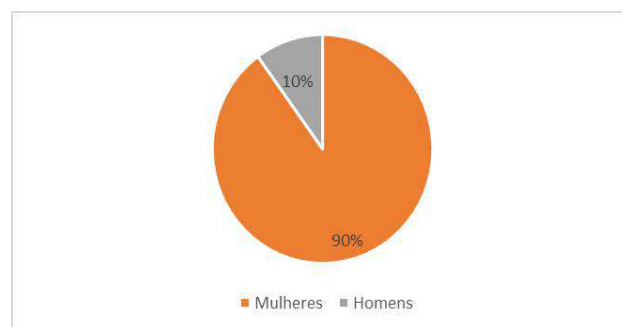


Fig. 4: Participação dos produtores por gênero.

A participação do gênero feminino nas feiras agroecológicas provoca a fidelização dos consumidores, assim como a associação entre os conceitos : qualidade de vida e alimentos saudáveis. A correlação destes conceitos com a participação das mulheres nas atividades de comercialização, distribuição e produção de alimentos agroecológicos e artesanais ligados à Economia Criativa, fazem das feiras um sucesso sociocultural e econômico. (Gomes et al., 2016).

Silva (2016) em seu trabalho, observou que a participação feminina nas atividades desenvolvidas seguindo os preceitos da agroecologia, sendo possível constatar que estas exercem papel protagonista nos processos, compreendendo que os mesmos contribuem diretamente para autonomia dos envolvidos além de contribuir para o desenvolvimento da comunidade e do meio ambiente.

As mulheres rurais no Brasil possuem histórica trajetória de lutas para conquistar o seu espaço e reconhecimento devidos. Estas resultaram na reivindicação por renda e o questionamento do homem como único representante da família, demandando a participação ativa das mulheres nos processos de produção e comercialização (Strate & Costa, 2018).

A discussão sobre as questões de gênero vem ganhando espaço na agroecologia, tendo sido afirmada como uma das diretrizes da Política Nacional de Agroecologia e Produção Orgânica (PNAPO), lançada pelo Governo Federal em agosto de 2012, contribuindo para a redução das desigualdades de gênero por meio de ações e programas que possivelmente aumentem a autonomia econômica das mulheres (Leal et al., 2020).

Os resultados observados ratificam a teoria que a feira verde é mais que um dispositivo de comercialização, se apresentando como meio de socialização entre os participantes, onde as trocas culturais são frequentes e a

participação feminina se caracteriza como dominante entre os agricultores participantes da mesma. Radünz *et al.* (2021) em seu estudo observaram que as feiras agroecológicas se mostram como ferramenta de envolvimento dos atores sociais e da comunidade, evidenciando a construção de um conhecimento coletivo e emancipador.

#### IV. CONSIDERAÇÕES FINAIS

A feira verde se apresentou não apenas como uma alternativa para comercialização dos produtos oriundos de áreas em transição agroecológica, mas também e talvez principalmente ela foi um instrumento de incentivo a adesão à transição agroecológica e instrumento de empoderamento dos produtores que optaram por ir contra ao sistema e num município onde o agronegócio do milho tem toda a força e incentivos, escolheram produzir alimentos de forma sustentável, valorizando a especificidade do território e cultura local.

A feira pode ser considerada um instrumento de resistência não só para os produtores mas também para o território, uma vez que os atores envolvidos neste processo apresentam uma consciência de manutenção das características locais e preservação do agroecossistema, valorizando as espécies presentes, trabalhando e planejando em função das dinâmicas naturais.

Apesar dos resultados encontrados indicarem que a feira verde possibilitou que os agricultores participantes comercializassem sua produção oriunda de áreas em transição agroecológica de forma direta aos consumidores, entende-se que há necessidade de trabalhos mais aprofundados para comprovar seu real papel como ferramenta de empoderamento deste grupo estudado. É notório que por meio desta, os quintais produtivos se tornaram mais do que um espaço para produção de subsistência, mas sim uma área de produção que possibilitou incremento na renda familiar. Assim é possível concluir que houve indícios que a feira verde funcionou como ferramenta que deu início ao processo de empoderamento dos seus participantes.

#### REFERENCES

- [1] Araújo, T. P., Lima, R. A., & Macambira, J. (2015). Feiras agroecológicas: institucionalidade, organização e importância para a composição da renda do agricultor familiar. *Fortaleza: Instituto de Desenvolvimento do trabalho: núcleo de economia solidária da Universidade Federal de Pernambuco*, 280. Perfect, T. J., & Schwartz, B. L. (Eds.) (2002). Applied metacognition Retrieved from <http://www.questia.com/read/107598848>
- [2] Balestro, M. V., & Sauer, S. (2013). A diversidade no rural, transição agroecológica e caminhos para a superação da Revolução Verde: introduzindo o debate. *Agroecologia e os desafios da Transição Agroecológica*, 2, 7-15.
- [3] Bezerra, I., da Paixão Sousa, R., & Barros, F. B. (2020). A pandemia da covid-19 e seus efeitos À saÃ°e e ao ambiente: a agroecologia como caminho. *Revista Brasileira de Agroecologia*, 15(4), 3-3. Blue, L. (2008, March 12). Is our happiness preordained? [Online exclusive]. Time. Retrieved from <http://www.time.com/time/health>
- [4] Caminhas, A. M. T. (2022). As Feiras Agroecológicas, a Segurança Alimentar e o Protagonismo Feminino nos Quintais Produtivos da Agricultura Familiar: A Contribuição para a Prática da Agenda 2030. *Brazilian Journal of Development*, 8(1), 4184-4200.
- [5] Caporal, F. R., & Azevedo, E. O. D. (2011). Princípios e perspectivas da agroecologia. *Instituto Federal de Educação, Ciência e Tecnologia do Paraná-Educação à Distância*.
- [6] Caporal, F. R., Paulus, G., & Castobebber, J. A. (2009). Agroecologia: uma ciência do campo da complexidade.
- [7] Costa, A. D., dos Santos, J. S., de Oliveira, R. D., & Folhes, R. T. (2021). A ATUAÇÃO DOS QUINTAIS PRODUTIVOS COMO R-EXISTÊNCIAS TERRITORIAIS. *Revista Tocantinense de Geografia*, 10(22), 181-201.
- [8] Dubeux, A., & Batista, M. P. (2017). Agroecologia e economia solidária: um diálogo necessário à consolidação do direito à soberania e segurança alimentar e nutricional. *REDES: Revista do Desenvolvimento Regional*, 22(2), 227-249.
- [9] Gomes, F. L. (2017). Quintais produtivos e resiliência alimentar nos espaços da reforma agrária. *Revista Craibeiras de Agroecologia*, 1(1).
- [10] Leal, L., Filipak, A., Duval, H., Ferraz, J. M., & Ferrante, V. L. (2020). Quintais produtivos como espaços da agroecologia desenvolvidos por mulheres rurais. *Perspectivas em Diálogo: revista de educação e sociedade*, 7(14), 31-54.
- [11] Leff, E. (2002). Agroecologia e saber ambiental. *Agroecologia e desenvolvimento rural sustentável*, 3(1), 36-51.
- [12] Maciel, L. B. O EMPODERAMENTO DA MULHER NO CONTEXTO AGROECOLÓGICO.
- [13] Marin, J. O. B. (2009). Agricultores familiares e os desafios da transição agroecológica. *Revista UFG*, 11(7), 38-45.
- [14] Martins, G. D. A. (2008). Estudo de caso. *São Paulo: Atlas*.
- [15] Mattei, L. (2007). A relevância da família como unidade de análise nos estudos sobre pluriatividade. *Revista de Economia e Sociologia Rural*, 45, 1055-1073.
- [16] Matias-Pereira, J. (2016). *Manual de metodologia da pesquisa científica*. Grupo Gen-Atlas.
- [17] Michereff Filho, M., Resende, F. V., Vidal, M. C., Guimaraes, J. A., de Moura, A. P., da SILVA, P. S., & Reyes, C. P. (2013). *Manejo de pragas em hortaliças durante a transição agroecológica*.
- [18] Nascimento, D. V. C., Silva, J. A., de Rezende Pinto, M., & Mesquita, M. C. (2018). Quando o orgânico se torna

- “rótulo”: discussões críticas sobre consumo e Agroecologia a partir de um empreendimento de Economia Solidária: When organic food becomes a "label": critical discussions about consumption and agroecology in a solidarity economy enterprise. *Estudos Sociedade e Agricultura*, 26(3), 608-629.
- [19] O.N.U. Organização das Nações Unidas. (2017). Objetivos de Desenvolvimento Sustentável. <https://brasil.un.org/pt-br/sdgs>
- [20] Pertile, N. (2021). Agroecologia e ODS. Possibilidades em construção na Bahia (Brasil). *de la crisis política*, 91.
- [21] Pinha, G. A., & Almeida, R. A. (2018). A contribuição das feiras agroecológicas na UFMS/campus II e no condomínio Don El Chall para a soberania alimentar em Três Lagoas/MS. *Revista Entre-Lugar*, 9(17), 118-135.
- [22] Piraux, M., Silveira, L., Diniz, P., & Duque, G. (2012). Transição agroecológica e inovação socioterritorial. *Estudos Sociedade e Agricultura*.
- [23] Radünz, A. L., Gilson, Í. K., de Vargas Lucas, R. R., Tonin, S. T., Andrioli, A. I., Radünz, M., ... & Burg, I. C. (2021). Feiras Agroecológicas e de Economia Solidária da UFFS: um relato de caso sobre o município de Chapecó/SC. *Revista Thema*, 19(2), 450-455.
- [24] Rempel, C., Turatti, L., & Dalmoro, M. (2021). Desafios da sustentabilidade. Ed. Univates
- [25] Vanessa de Castro, R. O. S. A., & de Souza CAMPOS, G. (2020). A AGROECOLOGIA COMO MECANISMO DE EFETIVAÇÃO DOS OBJETIVOS DE DESENVOLVIMENTO SUSTENTÁVEL NO BRASIL. *Revista Eletrônica da Faculdade de Direito de Franca*, 15(1), 321-340.
- [26] de Jesus SANTOS, C., de Arimatéia SILVA, J., & de Souza AMARAL, L. (2020). Protagonismo feminino na Agroecologia: estudo de caso em São Miguel do GOSTOSO/RN. *Cadernos de Agroecologia*, 15(3).
- [27] Santos, V. P., & de Brito, F. P. MULHERES E QUINTAIS PRODUTIVOS: DESAFIOS E ALTERNATIVAS DO USO DA ÁGUA PARA O CULTIVO DE ALIMENTOS. *Anais do VI e VII Seminários Bem Viver Indígena*, 133.
- [28] Scheuer, J. M., da Silva Neves, S. M. A., dos Santos Galvanin, E. A., & de Moura, A. P. (2017). Estrutura produtiva e a agroecologia: um estudo de caso na associação dos pequenos produtores da região do Alto Sant'Ana, Mato Grosso. *Revista Geográfica Acadêmica*, 11(2), 50-66.
- [29] Silva, F. R. F. (2016). Gênero, agroecologia e economia solidária: estudo de caso do grupo de mulheres do Acampamento Recanto da Natureza em Laranjeiras do Sul-PR. *Desenvolvimento e Meio Ambiente*, 39.
- [30] Silva, E. L., & Menezes, E. M. (2005). Metodologia da pesquisa e elaboração de dissertação. *UFSC, Florianópolis*, 4a. edição, 123.
- [31] Strate, M. F., & da Costa, S. M. (2018). Quintais produtivos: contribuição à segurança alimentar e ao desenvolvimento sustentável das mulheres rurais no RS-Brasil. *Brazilian Journal of Development*, 4(7), 3732-3744.
- [32] Troilo, G., & de Araújo, M. N. R. (2020). A EDUCAÇÃO EM AGROECOLOGIA E AS DISPUTAS DE CLASSE NO ENSINO SUPERIOR: ESTUDO DE CASO DE FORMAÇÕES PIONEIRAS INSTITUÍDAS EM UNIVERSIDADES PÚBLICAS BRASILEIRAS/Education in agroecology and class disputes in higher education: a case study of pioneer training instituted in Brazilian public universities/Educación en agroecología y disputas de clase en educación superior: un estudio de caso de capacitación pionera instituida en universidades públicas brasileñas. *REVISTA NERA*, (55), 294-321.
- [33] Wuerges, E. W., & Simon, Á. A. (2007). Feiras-Livres como uma forma de popularizar a produção e o consumo de hortifrutigranjeiros produzidos com base na agroecologia. *Revista Brasileira de Agroecologia*, 2(2).
- [34] Yin, R. K. (2015). *Estudo de Caso-: Planejamento e métodos*. Bookman editora.

## Sudowest Goiano Expansion and Agricultural Contracts as Strategic Instruments for Access to Land

### A Expansão Canavieira no Sudoeste Goiano e os Contratos Agrários como Instrumentos Estratégicos de Acesso à Terra

Sara Menezes Maia<sup>1</sup>, Warley Lopes Martins<sup>2</sup>, Liliane Vieira Martins Leal<sup>3</sup>,

<sup>1</sup>Graduada em Direito, pela Universidade Federal de Jataí - UFJ

<sup>2</sup>Mestrando em Direito do Agronegócio e Desenvolvimento pela Universidade de Rio Verde - Unirv

<sup>3</sup>Doutora em Direito em Ciências Ambientais e Professora do curso de Direito da Universidade Federal de Jataí - UFJ

Received: 19 Aug 2022,

Received in revised form: 14 Sep 2022,

Accepted: 19 Sep 2022,

Available online: 24 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>)

**Keywords—** Sugarcane Agroindustry.  
Sugarcane. Contracts. Agricultural  
Partnership.

**Palavras-chave—** Agroindústria canavieira.  
Cana-de-açúcar. Contratos. Parceria  
Agrícola.

**Abstract—** The state of Goiás stands out in the country's agricultural commodities export agenda. Thus, soy, corn and sorghum are evident in the state's agricultural production. However, it is observed that the monoculture of sugarcane has been occupying more and more the productive space, especially in the southwest region. Its insertion in agribusiness gained greater visibility from 2007, when it came to occupy the first place in the production ranking of the state of Goiás and the Midwest. Natural factors in the region, incentive policies and environmental issues played fundamental and determining roles in its increase. The road infrastructure also contributed significantly to the establishment of sugarcane mills and plantations in strategic locations for the logistics of production flow and for the reduction of transport costs. However, as most of the arable areas in the southwest of Goiás are already heavily occupied by the cultivation of soybeans and, in the off-season, corn, the cultivation of sugarcane advances to these areas and also to pasture. The logic of the system is evident, the areas already cultivated provide the reduction of production costs, being able to maximize the capital of the sugar and alcohol agroindustries. It is in this context that disputes between economic agents in the field of power arise. In this way, contractual law can serve both as an instrument for acquiring land and for controlling it. Therefore, the objectives of the research are presented: to analyze contractual instruments, specifically, contracts celebrated by the sugar and alcohol agribusinesses and rural producers and the possible conflicts arising from these relationships. The methodological approach is based on quantitative and qualitative assumptions, as a means of enabling a more holistic understanding of the object of study. Regarding the techniques, the research prioritized, mainly, the bibliographic and documentary, and the main sources of secondary data collection were databases of public and private



*institutions. The elementary sources for the analysis were contractual instruments of agricultural partnership signed between agro-industries, rural producers and landowners. As a consequence of the study, it was observed that the partnership contract, object of analysis, is configured as an instrument of access and maintenance of land tenure and that generally the grantor partner (land owner) has less negotiation power than the partner-granted (agribusiness), mainly due to the clauses provided. Thus, it was concluded that the agroindustry holds the power of information, which generates asymmetries in the contractual relationships established.*

**Resumo**— *O estado de Goiás destaca-se na pauta exportadora de commodities agrícolas do país. Assim, a soja, o milho e o sorgo são evidentes na produção agrícola do estado. Contudo, observa-se que a monocultura da cana-de-açúcar vem ocupando cada vez mais o espaço produtivo, sobretudo, na região sudoeste. A sua inserção no agronegócio ganhou maior visibilidade a partir de 2007, momento em que chegou a ocupar o primeiro lugar no ranking de produção do estado de Goiás e do Centrooeste. Fatores naturais da região, políticas de incentivo e questões ambientais tiveram papéis fundamentais e determinantes para o seu incremento. A infraestrutura viária, também, contribuiu significativamente para o estabelecimento das usinas e plantações de cana-de-açúcar em locais estratégicos para a logística de escoamento da produção e para a redução dos custos de transporte. Todavia, como a maior parte das áreas agricultáveis do Sudoeste goiano já são fortemente ocupadas pelo cultivo da soja e, na safrinha, do milho, a cultura da cana-de-açúcar avança para essas áreas e também para as de pastagem. A lógica do sistema é evidente, as áreas já cultivadas propiciam a redução dos custos de produção, podendo maximizar o capital das agroindústrias sucroalcooleiras. É nesse contexto que surgem as disputas entre os agentes econômicos no campo de poder. Desse modo, o direito contratual poderá servir tanto como instrumento de aquisição de terras, quanto de domínio sobre elas. Portanto, apresentam-se os objetivos da pesquisa: analisar instrumentos contratuais, especificamente, contratos celebrados pelas agroindústrias sucroalcooleiras e produtores rurais e os possíveis conflitos advindos dessas relações. A abordagem metodológica consubstancia-se nos pressupostos quantitativos e qualitativos, como meio de viabilizar uma compreensão mais holística do objeto de estudo. No que concerne às técnicas, a pesquisa priorizou, mormente, a bibliográfica e a documental, e as principais fontes de coleta de dados secundários foram bancos de dados de instituições públicas e privadas. As fontes elementares para a análise, foram instrumentos contratuais de parceria agrícola celebrados entre agroindústrias, produtores rurais e proprietários de terras. Como consectário do estudo, observou-se que o contrato de parceria, objeto de análise, configura-se como um instrumento de acesso e manutenção da posse da terra e que geralmente o parceiro-outorgante (proprietário da terra) possui menos poder de negociação que o parceiro-outorgado (agroindústria), em virtude, sobretudo, das cláusulas dispostas. Sendo assim, concluiu-se que a agroindústria detém o poder de informação, o que gera assimetrias nas relações contratuais estabelecidas.*

## I. INTRODUÇÃO

A expansão canavieira no Sudoeste goiano acentuou-se a partir de 2008. Contudo, a região já era fortemente ocupada por outras atividades da agropecuária. Sendo assim, o território passa a ser um campo de disputas entre os atores que representam o setor de grãos e as agroindústrias canavieiras instaladas na região (LEAL, 2015). Nesse condão, o direito surge como um instrumento para regulamentar as relações contratuais entre os proprietários de terras, produtores rurais e usinas sucroalcooleiras, seja como modo de acesso à terra, seja como ferramenta de domínio sobre ela.

Nesse sentido, as usinas e os produtores de cana, utilizam quatro tipos de contratos para terem acesso às terras ou à matéria-prima: o de fornecimento de matéria-prima, no qual a indústria recebe a cana-de-açúcar de produtores rurais (cana de parceiros); arrendamento rural, que consiste no aluguel da terra pela indústria, para ela mesma efetuar a produção (cana própria); compra e venda, quando a indústria adquire a terra, monopolizando todos os setores de produção, inclusive a propriedade (cana própria) (LEAL, 2015); e a parceria agrícola, que consiste na divisão de lucros e dividendos entre a agroindústria e o proprietário da terra (cana própria).

Todavia, observa-se que geralmente as partes não possuem a mesma força de poder e barganha nas relações contratuais, de modo que uma acaba se sobrepondo a outra por meio da inserção de cláusulas contratuais desfavoráveis impostas à parte mais frágil da relação. Esse desequilíbrio da relação contratual ocorre porque as agroindústrias sucroalcooleiras são detentoras de maior força de poderes decorrentes dos diversos tipos de capital (político, financeiro, tecnológico, organizacional e jurídico).

Assim, delineou-se como objetivo geral, compreender como o direito contratual atua nessas relações agroindustriais e os consequentes conflitos que emergem nesse campo de poder. Essa análise torna-se importante na medida em que destrincha as cláusulas dos contratos celebrados entre os proprietários de terras, agricultores e agroindústrias, possibilitando um entendimento mais aprofundado dessas pactuações.

A pesquisa consubstancia-se nas abordagens teórico-empírica, quantitativa e qualitativa da dinâmica sucroalcooleira no Sudoeste goiano, a partir do estudo do processo histórico-social da expansão canavieira em Goiás. Essa articulação possibilita a construção de uma percepção mais empírica para o estudo desenvolvido.

O desenvolvimento da pesquisa prioriza a combinação de técnicas bibliográficas e documentais, com levantamento de dados secundários disponibilizados em sites de órgãos públicos e privados. Assim como a análise de livros, teses, dissertações, artigos, entre outros.

Além da presente seção, o trabalho estrutura-se em mais outras quatro sessões. Na segunda seção, apresentam-se os aspectos da dinâmica sucroalcooleira no estado de Goiás e no Sudoeste goiano. Na terceira seção, será abordado as variáveis da cana-de-açúcar na região Sudoeste de Goiás, como: a expansão da área cultivada no decorrer dos anos, a produção e a produtividade da matéria-prima e de seus derivados, como o álcool e o açúcar, e as principais unidades sucroalcooleiras existentes na região. Por fim, na quarta seção, será realizada uma análise de como o direito contratual agrário é utilizado nas relações entre os proprietários de terras, as agroindústrias e os produtores rurais, bem como as disparidades de poderes que interferem diretamente no estabelecimento das cláusulas contratuais.

## II. EXPANSÃO CANAVIEIRA EM GOIÁS E NO SUDOESTE GOIANO

Atualmente, o estado de Goiás destaca-se como um dos maiores produtores canavieiros do Brasil. Isso advém da expansão da fronteira agrícola, definida como:

[...] um espaço onde ocorrem transformações sociais, econômicas e espaciais, com a inserção de novas relações de produção e de novos padrões tecnológicos, capazes de propiciar um desenvolvimento pautado na integração do capital agrícola ao industrial (LEAL, 2015, p. 24).

Assim, com as mudanças tecnológicas e com o desenvolvimento da agroindústria, ampliaram-se as áreas de produção agrícola. Somando a isso, a crise das jazidas de petróleo, a poluição ambiental causada pelos combustíveis fósseis e a demanda nacional e internacional por açúcar e álcool, levaram o estado a incentivar a ampliação da produção e a industrialização da cana-de-açúcar (SILVA; MIZIARA, 2011).

A modernização da agricultura, o relativo preço baixo das terras e os fatores naturais, como clima, fertilidade dos solos e topografia favorável ao processo de mecanização, despertaram o interesse dos agricultores de outras regiões do país pelo estado de Goiás que, até então, possuía por base uma economia pautada na pecuária e na agricultura familiar.

Dessa maneira, Goiás passa a ser incorporado ao processo dinâmico produtivo capitalista e empresarial do agronegócio, de forma mais efetiva. Além disso, o avanço tecnológico foi fundamental para viabilizar a correção dos solos ácidos do Cerrado, tornando- os aptos para o plantio.

Todos esses fatores contribuíram para a inserção do estado de Goiás na pauta nacional e internacional do agronegócio que culminou no processo de formação dos complexos agroindustriais (LEAL, 2015).

Portanto, para compreender melhor como a produção da cana-de-açúcar vem ganhando cada vez mais espaço na região de Goiás, passa-se a análise das suas principais variáveis.

### III. VARIÁVEIS DA CANA-DE-AÇÚCAR

#### 3.1 ÁREA CULTIVADA

Nos últimos anos, as terras do bioma do Cerrado vêm passando por um processo gradativo de aumento da exploração pela agricultura extensiva (LEAL, 2015), principalmente, pela plantação de soja, sorgo e milho. Ocorre que, com a expansão da cana-de-açúcar, o espaço produtivo passa a ser disputado pelos agentes da produção agropecuarista. Portanto, surge um confronto entre produtores de soja/milho e usinas sucroalcooleiras, aqueles para se manterem no espaço produtivo e esta para acessá-lo.

Desde o início do processo de expansão da cana-de-açúcar no Centro-Oeste brasileiro, as suas áreas de plantio ampliaram-se cada vez mais, com destaque para o estado de Goiás, em que:

[...] houve, para produção de cana-de-açúcar, entre 2000 e 2009, aumento de cerca de

372% em áreas, sendo que, para a soja, o incremento foi da ordem de 155%, para o mesmo período. O mesmo ocorre para a mesorregião sul goiano, onde o incremento de área, neste período, para a produção de cana-de-açúcar, foi da ordem de 432% e, para a soja, de 139%. Tais dados reafirmam a tese de que existem mudanças no padrão agrícola do Estado, as quais refletem sobre a dinâmica do espaço agrícola (SILVA; MIZIARA, 2011).

Em consonância com dados da Companhia Nacional de Abastecimento (Conab), a área total de cana-de-açúcar colhida em Goiás em 2018/2019, correspondeu a 917,1 mil hectares, sendo que em 2006/2007, esse valor era de 234,9 mil hectares (CONAB, 2018), ou seja, o espaço ampliou-se 4 vezes mais.

#### 3.2 PRODUÇÃO E PRODUTIVIDADE

Conforme coloca a Conab (2018), existem alguns fatores cruciais que cooperam com o crescimento da produção de cana-de-açúcar em Goiás, como: o clima tropical adequado ao plantio; o fotoperíodo, que ocorre quando a planta recebe a quantidade de luz solar necessária para o seu bom desenvolvimento; o relevo e a topografia, que contribuem para a mecanização das lavouras, o que reduz os custos e os impactos ambientais no solo.

À vista disso, o estado de Goiás vem adquirindo crescente amplitude nacional. É o que indica, com base na observação dos dados da tabela e dos gráficos abaixo.

Ainda, dentre as regiões goianas analisadas no ano de 2016, o Sudoeste de Goiás contava com quatro municípios dentre os dez maiores produtores de cana-de-açúcar do estado, sendo eles: Rio Verde (3.150.000 t), Jataí (2.880.000 t), Mineiros (2.808.000 t) e Santa Helena de Goiás (2.363.400 t). O que comprova a concentração de grande parte da produção canavieira do estado nessa localidade (IMB, 2020).

No que se refere a produção canavieira em Goiás, com base no relatório de 2018/2019, fornecido pela Companhia Nacional de Abastecimento, o total de toneladas de cana-de-açúcar produzidas nesses anos, correspondeu a 71.135,7 mil toneladas. Desse valor, 15.080,8 mil toneladas foram destinadas à produção de açúcar e 56.054,9 mil toneladas à de etanol. Desse modo, do total de cana-de-açúcar produzida em sua matéria bruta, 21% foram destinados à produção de açúcar, enquanto que

71% para etanol. Portanto, atualmente, a maior parte do plantio da cana é destinada à produção de álcool (CONAB, 2018).

### 3.3 UNIDADES SUCROALCOOLEIRAS

De acordo com dados atualizados disponibilizados pelo site de comunicação do setor sucroenergético Novacana, o estado de Goiás possui um total de 40 usinas produtoras de açúcar e etanol, ficando entre os três primeiros estados brasileiros que mais possuem indústrias canavieiras (NOVACANA, 2021b). Em primeiro lugar, São Paulo com 171 usinas, e, em segundo, Minas Gerais, com um total de 43 usinas (NOVACANA, 2021a).

Conforme o mapa das usinas/destilarias, fornecido pela União Nacional de Bioenergia (UDOP), dentre as 35 usinas ativas no estado de Goiás, 25 delas se concentram na mesorregião Sul Goiano e Sudoeste e sul goiano. Ou seja, mais de 70% das usinas produtoras de açúcar e etanol do estado se encontram nesta região.

Na região do Sudoeste Goiano, no ano de 2015, concentravam-se 17 usinas sucroalcooleiras. Todavia, segundo o site Novacana, atualmente, dessas usinas, constatou-se que apenas 11 estão em pleno funcionamento, são elas: Usina Santa Helena (Santa Helena de Goiás), Unidade Centroeste (Jataí), Unidade Decal (Rio Verde), Usina Serra do Caiapó (Montividiu), Usina Cambuí (Santa Helena de Goiás), Usina Floresta (Santo Antônio da Barra), Unidade Água Emendada (Perolândia), Unidade Morro Vermelho (Mineiros), Cerradinho Bio Cana (Chapadão do Céu), Neomille (Chapadão) e Usina Serranópolis (Serranópolis) (NOVACANA, 2021b).

## IV. O DIREITO CONTRATUAL NA PRODUÇÃO CANAVIEIRA

O Direito Agrário trata-se de um ramo da ciência jurídica que possui o próprio conjunto normativo e principiológico, tanto de direito público como de direito privado, cujo principal instituto normativo é a Lei Federal nº 4.504/1964, o Estatuto da Terra, e o Decreto nº 59.566/1966, que a regulamenta. Outro instituto legal de suma importância para o Direito Agrário é a Lei Federal nº 8.629/1993, a Lei Agrária.

Pardo Filho (2006, p. 22) conceitua o Direito Agrário como o “[...] conjunto de princípios e de normas que disciplinam as relações emergentes da atividade rural, com base na função social da terra”. A partir dessa perspectiva, nota-se que o seu objeto central é a terra e sua relação com o homem. Logo, compete a esse ramo do

direito, regulamentar as relações que se estabelecem entre o homem, o campo e a sociedade.

Os contratos agrários são regidos pelos princípios específicos:

a)- da função social da propriedade; b)- do progresso econômico e social do produtor rural; c)- do combate sistemático ao minifúndio e ao latifúndio; d)- do imposto territorial rural; e)- do fortalecimento da economia nacional, pelo aumento da produtividade; f)- do desenvolvimento do sentimento de liberdade (pela propriedade) e de igualdade (pela oferta de oportunidades concretas); g)- da implantação da justiça distributiva; h)- da eliminação das injustiças sociais no campo; i)- do povoamento da zona rural, de maneira ordenada; j)- do combate ao minifúndio; k)- do combate ao latifúndio; l)- do combate a qualquer tipo de propriedade rural ociosa, sendo aproveitável e cultivável; m)- do combate à exploração predatória ou incorreta da terra; e, n)- do combate aos mercenários da terra (PARDO FILHO, 2006, p. 142).

Além deles, também, são norteados pelos princípios gerais, aqueles que sobrevivem aos contratos comuns, são eles: autonomia das partes; consensualismo; obrigatoriedade; relatividade; probidade; boa-fé; e função social. Merecendo este último uma breve explanação, dada a sua importância no âmbito contratual.

Desse modo, o Estatuto da Terra, em seu art. 2º, assegura a todos a oportunidade de acesso à propriedade da terra, que deve ser condicionada pela sua função social. Assim, o § 1º elenca os requisitos necessários, são eles: o favorecimento do bem-estar dos proprietários e dos trabalhadores que atuam na terra, assim como de suas famílias; a produtividade; a conservação dos recursos naturais e a observação das leis trabalhistas (BRASIL, 1964).

De acordo com Leal (2015), o modo de acesso à terra, para o plantio da cana-de-açúcar, necessária à produção sucroalcooleira, pelas agroindústrias e pelos produtores rurais, geralmente ocorre por meio dos seguintes contratos agrários: o contrato de fornecimento de matéria-prima (cana de fornecedor), o de arrendamento rural (cana própria) o de compra e venda (cana própria) e o de parceria agrícola (cana própria).

Um estudo realizado por Gomes, Leal e Pereira (2020), a partir de dados da Federação da Agricultura e Pecuária de Goiás (Faeg), indicou que, do total de cana produzida no estado de Goiás em 2019, 86% foram cultivadas em áreas arrendadas ou de propriedade da usina. O mesmo estudo apontou que as áreas arrendadas para a produção de cana em Goiás no ano de 2019 correspondeu à 525.915 ha, enquanto as áreas de fornecedores de cana compreenderam à 157.700 ha. Esses dados corroboram pela preferência do arrendamento de terras em relação ao fornecimento de matéria-prima pelos produtores rurais.

Dessa forma, tais contratos “[...] configuram-se em ações estratégicas das empresas de acesso às terras com aptidão agrícola e com localização estratégica (próximas às unidades agroindustriais), para domínio e controle do campo econômico” (LEAL, 2015, p. 169).

Para uma melhor compreensão desse processo, apresenta-se uma análise do instrumento contratual mais utilizado pelas agroindústrias sucroalcooleiras e pelos produtores rurais de cana para a ocupação do espaço produtivo.

#### 4.1 PARCERIA AGRÍCOLA

A parceria agrícola é definida no art. 4º do Decreto nº 59.566/1966 como um:

[...] contrato agrário pelo qual uma pessoa se obriga a ceder à outra, por tempo determinado ou não, o uso específico de imóvel rural, de parte ou partes do mesmo, incluindo, ou não, benfeitorias, outros bens e ou facilidades, com o objetivo de nele ser exercida atividade de exploração agrícola, pecuária, agro-industrial, extrativa vegetal ou mista; e ou lhe entrega animais para cria, recria, invernagem, engorda ou extração de matérias primas de origem animal, mediante partilha de riscos do

caso fortuito e da força maior do empreendimento rural, e dos frutos, produtos ou lucros havidos nas proporções que estipularem, observados os limites percentuais da lei (BRASIL, 1966).

Na parceria agrícola, tanto o parceiro-outorgante (proprietário) quanto o parceiro-outorgado (usina ou produtor) terão parte nos lucros oriundos da atividade exploratória, cada qual com a sua porcentagem preestabelecida, e os riscos serão em comum entre eles.

Por meio de pesquisa empírica, consubstanciada em diálogos com advogados especialistas e atuantes na área do agronegócio do Sudoeste goiano, na cidade de Jataí, constatou-se que nessa região a maioria dos contratos celebrados, como instrumentos de acesso à terra, são os de parceria agrícola, em detrimento dos demais. Tanto é que, no dia 27 de agosto de 2021, foi realizada uma solicitação junto ao Cartório de Registro de Imóveis de Jataí-GO, para a busca de contratos celebrados de arrendamento rural, fornecimento de matéria-prima, e parceria agrícola, referentes à cana-de-açúcar, a partir do ano de 2007. Dos 33 documentos encontrados, todos eram de parceria agrícola.

Posteriormente, no dia 07 de janeiro de 2022, foi solicitada nova busca, agora em nome da Raízen Centroeste Açúcar e Álcool LTDA. Dos 26 documentos encontrados em nome da agroindústria, um era de arrendamento, um de fornecimento de produto, dois aditivos, sendo todos os outros 22 de parceria agrícola. Ou seja, de um total de 59 documentos de negociações que envolvem a cana-de-açúcar em Jataí-GO, 55 são de parceria. Desse modo, é possível afirmar categoricamente, que das pactuações realizadas por agroindústrias e produtores rurais com proprietários de terras, nesta cidade, para a plantação de cana, 90% delas correspondem a contratos de parceria.

Por conseguinte, na próxima seção, analisam-se como esses contratos se consolidam na prática, as disparidades de poderes existentes entre as partes e quais os possíveis conflitos advindos dessas relações contratuais, entre parceiro-outorgante (proprietário da terra) e parceiro-outorgado (agroindústrias canavieiras/produtores rurais).

## V. ANÁLISE DE CONTRATOS DE PARCERIA AGRÍCOLA

Foram coletados 4 contratos de parceria agrícola para a análise:

- i) Parceiro-outorgado: Raízen Centroeste Açúcar e Álcool LTDA (Jataí) e parceiro-outorgante: proprietário de terra (Jataí);
- ii) Parceiro-outorgado: Cerradinho Bioenergia S.A. (Chapadão do Céu) e parceiro-outorgante: proprietário de terra (Chapadão do Céu);
- iii) Parceiro-outorgado: produtor rural (Jataí) e parceiro-outorgante: proprietário de terra (Jataí);
- iv) Parceiro-outorgado: produtor rural (Jataí) e parceiro-outorgante: proprietário de terra (Jataí);

Além desses, também foi utilizado um de contrato de parceria, não assinado, disponibilizado por um escritório de advocacia de Jataí, especializado no agronegócio. Foi redigido conforme o disposto no Estatuto da Terra e auxiliou como modelo comparativo em relação aos demais documentos supracitados.

### 5.1 ÁREA CEDIDA PARA PLANTAÇÃO DA CANA-DE-AÇÚCAR

O primeiro ponto analisado trata-se do tamanho da área disponível para o cultivo, objeto do contrato, transcrito na tabela abaixo.

Tabela 1 - Tamanho das áreas pactuadas para plantio da cana-de-açúcar (ha)

| Contratos                        | Área em hectares (ha)                                         |
|----------------------------------|---------------------------------------------------------------|
| <i>Raízen</i>                    | 137,74 ha (cento e trinta e sete e setenta e quatro hectares) |
| <i>Cerradinho Bioenergia S.A</i> | 1.100,44 ha (um mil e cem hectares e quarenta e quatro ares)  |
| <i>Décio Luiz (agricultor)</i>   | 120 ha (cento e vinte hectares)                               |
| <i>Décio Luiz (agricultor)</i>   | 190,9 ha (cento e noventa hectares e nove ares)               |

Fonte: Contratos (2011, 2017, 2018 e 2019).

Nota-se que a usina Cerradinho obteve um contrato de parceria com um proprietário de terra que possui uma área de grande extensão na região de Chapadão do Céu. Enquanto que no município de Jataí as áreas dos contratos analisados são menores. Uma hipótese

é que nessa região ainda existe certa resistência quanto a plantação da cana-de-açúcar, uma vez que a cultura da soja já é fortemente consolidada.

Desse modo, a inserção de uma nova atividade agrícola no local pode simbolizar uma perda do espaço produtivo. Por isso que,

o setor de grãos, diretamente interessado na matéria-prima que abastece a agroindústria, manifesta-se contrário à expansão do setor sucroalcooleiro, temendo a ocupação das terras já apropriadas por ele e que são necessárias ao abastecimento da cadeia produtiva. Essas resistências são mecanismos estratégicos do setor, no sentido de inviabilizar a expansão de outra atividade produtiva na região (LEAL, 2015, p. 119).

Portanto, esse grupo de produtores de soja utilizam ações estratégicas, por meio de decisões políticas e econômicas, bem como de discussões sobre os impactos ambientais que a plantação de cana pode gerar no solo, para convencer os proprietários a não arrendarem suas terras para as usinas. Isso com o objetivo de se manterem no domínio das áreas produtivas (LEAL, 2015).

Nota-se também, que um dos principais fatores que cooperam para a resistência dos produtores à plantação da cana é a elevação dos preços das terras, assim confirmou a matéria publicada no Estadão, em 09/01/2011, intitulada “Produtores de soja boicotam cana em GO”:

Uma das razões para a rejeição dos produtores de grãos à cana em Jataí está no impacto da nova cultura nos preços para arrendamento de áreas de plantio. Para arrendar um hectare, o produtor de soja pagava em média o valor de 12 sacos do grão (cerca de R\$560). Já a Cosan [Raízen] chega a oferecer 18 sacos (em torno de R\$840) pela área. (PACHECO, 2011).

Nesse sentido, também foi o posicionamento de outro produtor rural da cidade de Jataí em matéria publicada no site Canal VG:

Em todas as regiões que a cana entrou a gente tem observado o domínio dela em toda a área e não é isso que a gente quer para a nossa região. A monocultura fica nas mãos de um ou de poucos, como é o caso das usinas. Põem três, quatro usinas no município, tomam conta do município e isso é ruim [...]. (ENTRA..., 2011).

No entanto, mesmo com essa resistência para o incremento da cana-de-açúcar nessa região, é notável que ela vem se consolidando. Desse modo, alguns produtores rurais, bem como proprietários de terras, atraídos pela vantagem econômica oferecida pelas agroindústrias, estão substituindo suas atividades agrícolas e pecuaristas pela produção canavieira.

## 5.2 PRAZO DE VIGÊNCIA DOS CONTRATOS

O próximo ponto analisado é o período de duração dos contratos, que geralmente são estabelecidos em ciclos, desde o início do plantio até o término, expresso na tabela a seguir.

Tabela 2 - Período de duração dos contratos

| Contratos                        | Prazo em anos                        |
|----------------------------------|--------------------------------------|
| <i>Raízen</i>                    | 11 anos + 1 ano (prorrogável) por 2x |
| <i>Cerradinho Bioenergia S.A</i> | 12 anos + 1 ano (prorrogável)        |
| <i>Produtor Rural</i>            | 12 anos + 1 ano (prorrogável) por 2x |
| <i>Produtor Rural</i>            | 12 anos + 1 ano (prorrogável) por 2x |

Fonte: Contratos (2011, 2017, 2018 e 2019).

Nota-se que geralmente os contratos de parceria são caracterizados por sua longevidade. Nos instrumentos analisados, observa-se que todos possuem em média um prazo de duração de 12 anos. É um período bastante extenso, no qual o proprietário vincula sua terra à produção canavieira. Esse fato ocorre em virtude do ciclo da cana-de-açúcar que, de acordo com a matéria “Aspectos do plantio da cana-de-açúcar”, publicada pelo site Novacana, tem um período de 6 (seis) anos.

Abaixo, será abordada a cláusula de prorrogação do prazo de vigência dos contratos. Portanto, seguem as informações obtidas na tabela abaixo.

Tabela 3 - Prorrogação do prazo do contrato

| Contratos                        | Cláusulas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Raízen</i>                    | “Fica concedida ao PARCEIRO AGRICULTOR a opção de, independentemente de qualquer formalidade, caso entenda que na área exista contingente de lavoura em condições de exploração economicamente viável, prorrogar o presente Contrato para abranger mais uma safra [...]. Havendo dita prorrogação e após ultimada a colheita do produto, fica concedida ao PARCEIRO AGRICULTOR a opção de, caso entenda que na área ainda exista contingente de cana-de-açúcar em condições de exploração economicamente viável, novamente prorrogar o referido Contrato por mais uma safra [...]” (CONTRATO..., 2011, p. 2) |
| <i>Cerradinho Bioenergia S.A</i> | “[...] podendo este prazo sofrer variação de um ano/safra caso a PARCEIRA AGRICULTORA, CONSTATE no curso do contrato de parceria viabilidade técnica e econômica de extração de mais de um (colheita) corte de cada ciclo.” (CONTRATO..., 2017, p. 2)                                                                                                                                                                                                                                                                                                                                                        |

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Produtor Rural</i>  | “Fica concedida ao PARCEIRO AGRICULTOR a opção de, independentemente de qualquer formalidade, caso entenda que na área exista contingente de lavoura em condições de exploração economicamente viável, prorrogar o presente Contrato para abranger mais uma safra [...]. Havendo dita prorrogação e após ultimada a colheita do produto, fica concedida ao PARCEIRO AGRICULTOR a opção de, caso entenda que na área ainda exista contingente de cana-de-açúcar em condições de exploração economicamente viável, novamente prorrogar o referido Contrato por mais uma safra [...]” (CONTRATO..., 2018, p. 3) |
| <i>Produtor Rural</i>  | “Fica concedida ao PARCEIRO AGRICULTOR a opção de, independentemente de qualquer formalidade, caso entenda que na área exista contingente de lavoura em condições de exploração economicamente viável, prorrogar o presente Contrato para abranger mais uma safra [...]. Havendo dita prorrogação e após ultimada a colheita do produto, fica concedida ao PARCEIRO AGRICULTOR a opção de, caso entenda que na área ainda exista contingente de cana-de-açúcar em condições de exploração economicamente viável, novamente prorrogar o referido Contrato por mais uma safra [...]” (CONTRATO..., 2019, p. 3) |
| <i>Contrato Modelo</i> | “O presente contrato terá vigência de ... (ano/s, meses) a começar no dia ... de ... de 20 ... e a terminar no dia ... de ... de 20..., podendo esse prazo ser prorrogado por convenção expressa entre as partes” (CONTRATO ..., 2021, p. 2).                                                                                                                                                                                                                                                                                                                                                                |

Fonte: Contratos (2011, 2017, 2018, 2019 e 2021).

A prorrogação do prazo em todos os contratos reais poderá ser feita unicamente pela vontade do parceiro-outorgado, enquanto no contrato modelo, somente quando houver acordo entre as partes. Naqueles, a cláusula ainda coloca que isso pode ocorrer independentemente de qualquer formalidade, ou seja, após o término do prazo, se o (a) agricultor (a) constatar que ainda é possível dar continuidade na produção, poderá desde já, sem a anuência do proprietário, prorrogar por mais uma safra.

O Decreto nº 59.566/1966, que regulamenta o Estatuto da Terra, estabelece que:

Art. 96. Na parceria agrícola, pecuária, agro-industrial e extrativa, observarse-ão os seguintes princípios:

VII - aplicam-se à parceria agrícola, pecuária, agropecuária, agro-industrial ou extrativa as normas pertinentes ao arrendamento rural [...];

Art. 95. Quanto ao arrendamento rural, observarse-ão os seguintes princípios:

I - os prazos de arrendamento terminarão sempre depois de ultimada a colheita, inclusive a de plantas forrageiras temporárias cultiváveis. No caso de retardamento da colheita por motivo de força maior, considerar-se-ão esses prazos prorrogados nas mesmas condições, até sua ultimação (BRASIL, 1966)

O artigo supracitado determina que, concluída a última colheita, encerra-se o prazo da parceria. Somente nos casos em que não for possível realizar a colheita, por força maior, é que será prorrogado. Contudo, nas cláusulas dos contratos reais analisados, é autorizada a prorrogação por mais um ano, mesmo após a ultimação da colheita, caso o parceiro-outorgado queira. O que desfavorece o consensualismo entre as partes, princípio essencial, que assegura o acordo das vontades nas pactuações.

### 5. 3 CULTIVO DE CULTURAS TEMPORÁRIAS

Quanto ao cultivo de culturas temporárias, a tabela infra, mostra o que os contratos analisados estipularam.



Tabela 4 – Culturas temporárias

| Contratos                        | Cláusulas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Raízen</i>                    | “[...] o PARCEIRO AGRICULTOR poderá desenvolver, no todo ou em parte da área, atividade agropecuária, lavoura de ciclo curto e similares, visando ao descanso e ao preparo do solo, à rotatividade da cultura, à incorporação de nitrogênio ao solo, à adubação verde, etc., não sendo cabível qualquer participação ou remuneração ao PARCEIRO OUTORGANTE [...]” (CONTRATO ..., 2011, p. 3)                                                                                                                                |
| <i>Cerradinho Bioenergia S.A</i> | “Se no curso deste contrato, a PARCEIRA AGRICULTORA optar pela implantação temporária de alguma cultura que favoreça as condições de solo para o cultivo da cana-de-açúcar [...], deverá arcar com as respectivas despesas, mas os frutos daí advindos não serão partilhados com o (s) PARCEIROS (S) OUTORGANTES (S) [...]” (CONTRATO... , 2017, p. 3)                                                                                                                                                                      |
| <i>Produtor Rural</i>            | “[...] o PARCEIRO AGRICULTOR poderá desenvolver, no todo ou em parte da área, atividade agropecuária, lavoura de ciclo curto e similares, visando ao descanso e ao preparo do solo, à rotatividade da cultura, à incorporação de nitrogênio ao solo, à adubação verde, etc., não sendo cabível qualquer participação ou remuneração ao PARCEIRO OUTORGANTE [...]” (CONTRATO ..., 2018, p. 5)                                                                                                                                |
| <i>Produtor Rural</i>            | “[...] o PARCEIRO AGRICULTOR poderá desenvolver, no todo ou em parte da área, atividade agropecuária, lavoura de ciclo curto e similares, visando ao descanso e ao preparo do solo, à rotatividade da cultura, à incorporação de nitrogênio ao solo, à adubação verde, etc., não sendo cabível qualquer participação ou remuneração ao PARCEIRO OUTORGANTE [...]” (CONTRATO ..., 2019, p. 5)                                                                                                                                |
| <i>Contrato Modelo</i>           | Caberá ao Parceiro Outorgante a quota de .....% (.....) na cultura de .....e.....% ( ) nas culturas temporárias, e no que mais produzir a área objeto deste contrato, que deverá ser entregue.....(local da entrega da colheita). A partilha efetuar-se-á (local e data), devendo o Parceiro Outorgado comunicar com antecedência o Parceiro Outorgante a data em que terá início a colheita, ficando facultado a este último acompanhar pessoalmente os trabalhos ou designar preposto para tanto (CONTRATO , 2021, p. 3). |

Fonte: Contratos (2011, 2017, 2018, 2019 e 2021).

Os dispositivos dos contratos analisados trazem uma ação de unilateralidade contratual, uma vez que dá ao Outorgado a autonomia de cultivar outras culturas temporárias sem ter que repartir os frutos advindos com o Outorgante, proprietário da terra. Por outro lado, o contrato modelo prevê a partilha dos frutos da cultura principal e também das temporárias. Além disso, faculta ao Outorgante o acompanhamento dos trabalhos executados

pela Outorgada, enquanto nos outros, essa atribuição fica restrita ao agricultor.

#### 5. 4 CESSÃO OU TRANSFERÊNCIA DO CONTRATO

A tabela abaixo mostra o que os contratos analisados estabeleceram em relação a cessão ou transferência do documento:

Tabela 5 - Autorização de cessão ou transferência

| Contratos                        | Cláusulas                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Raízen</i>                    | “O presente contrato não poderá ser cedido ou transferido a qualquer título ou forma por uma das partes contratantes, sem a expressa concordância da outra. O PARCEIRO OUTORGANTE autoriza a PARCEIRA AGRICULTORA, desde logo, a ceder o presente Contrato à empresa pertencente ao mesmo grupo econômico que o dela [...]” (CONTRATO ..., 2011, p. 3) |
| <i>Cerradinho Bioenergia S.A</i> | “A PARCEIRA AGRICULTORA poderá ceder e/ou transferir o presente contrato apenas para as empresas pertencentes ao mesmo grupo empresarial, em qualquer tempo, sem anuência do (s) PARCEIRO (S) OUTORGANTES (S) [...]” (CONTRATO ..., 2017, p. 4).                                                                                                       |
| <i>Produtor Rural</i>            | “O presente contrato não poderá ser cedido ou transferido a qualquer título ou forma por uma das partes contratantes, sem a expressa concordância da outra.” (CONTRATO ..., 2019, p. 5).                                                                                                                                                               |
| <i>Produtor Rural</i>            | “O presente contrato não poderá ser cedido ou transferido a qualquer título ou forma por uma das partes contratantes, sem a expressa concordância da outra.” (CONTRATO ..., 2018, p. 5).                                                                                                                                                               |
| <i>Contrato Modelo</i>           | “Ao Parceiro Outorgado é vedado, a qualquer título, a transferência ou cessão, parcial ou total, do presente contrato, salvo expressa anuência do Parceiro Outorgante” (CONTRATO ..., 2021, p. 12).                                                                                                                                                    |

Fonte: Contratos (2011, 2017, 2018, 2019 e 2021).

Nota-se que as agroindústrias estabelecem cláusulas no sentido de autorizar a cessão ou transferência do instrumento para outras empresas, sem a anuência do proprietário, isto é, desde que sejam do mesmo grupo econômico. Já no contrato modelo e nos celebrados pelo produtor rural, ficou veda a cessão e a transferência do contrato, a menos que as partes concordem.

Portanto, observa-se uma certa unilateralidade na tomada de decisão por parte das usinas, uma vez que o

outorgado não poderá ao tempo, decidir quanto a transferência ou não do documento pactuado para um terceiro, nos casos em que este for do mesmo grupo econômico da outorgada.

#### 5.5 PRESERVAÇÃO AMBIENTAL

No que se refere a preservação e responsabilização ambiental, a tabela expõe as cláusulas estabelecidas nos contratos em análise:

Tabela 6 - Responsabilização Ambiental

| Contratos                        | Cláusulas                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Raízen</i>                    | Não estabeleceu                                                                                                                                                                                                                                                                                                                           |
| <i>Cerradinho Bioenergia S.A</i> | “O Parceiro Outorgante declara que as áreas agricultáveis, incluindo as áreas de soqueira, encontram-se livres de quaisquer restrições ambientais e que não há pendências relativas a infrações ambientais [...], ficando a Parceira Agricultora autorizada a plantar cana-de-açúcar em toda a área cedida.” (CONTRATO ..., 2017, p. 11). |

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Produtor Rural</i>  | <p>“5.13. O PARCEIRO AGRICULTOR, no exercício das atividades que lhe compete, compromete-se a tomar todas as providências para que não venha a causar danos ao imóvel, às áreas de preservação permanente e de reservas legais nele existentes, sendo que na sua ocorrência, obriga-se a fazer as devidas reparações.</p> <p>5.14. O PARCEIRO AGRICULTOR, durante a vigência do presente contrato, deverá (I) respeitar todas as normas e leis ambientais, sejam elas federais, estaduais ou municipais; (II) fazer manutenção dos carregadores da área que estará sob sua posse; (III) tomar as providências necessárias no cuidado com a conservação do solo, especialmente quanto a confecção de curvas de nível, terraços e similares.” (CONTRATO ..., 2019, p. 7).</p>                                                                                                                                          |
| <i>Produtor Rural</i>  | <p>“5.13. O PARCEIRO AGRICULTOR, no exercício das atividades que lhe compete, compromete-se a tomar todas as providências para que não venha a causar danos ao imóvel, às áreas de preservação permanente e de reservas legais nele existentes, sendo que na sua ocorrência, obriga-se a fazer as devidas reparações.</p> <p>5.14. O PARCEIRO AGRICULTOR, durante a vigência do presente contrato, deverá (I) respeitar todas as normas e leis ambientais, sejam elas federais, estaduais ou municipais; (II) fazer manutenção dos carregadores da área que estará sob sua posse; (III) tomar as providências necessárias no cuidado com a conservação do solo, especialmente quanto a confecção de curvas de nível, terraços e similares.” (CONTRATO ..., 2018, p. 7 e 8).</p>                                                                                                                                      |
| <i>Contrato Modelo</i> | <p>“O Parceiro Outorgado se obriga a preservar as áreas de preservação permanente e de reserva legal da propriedade e impedir que terceiros causem danos àquelas que estiverem abrangidas na área objeto da parceria, respondendo civil, administrativa e criminalmente pelos danos ocorridos nas referidas áreas em decorrência de dolo ou culpa sua ou de seus familiares, empregados ou prepostos.</p> <p>Parágrafo único. Nenhuma alteração que afete direta ou indiretamente as áreas de preservação permanente ou de reserva legal, ou que implique na necessidade de licença ambiental, poderá ser executada pelo Parceiro Outorgado sem prévia concordância do Parceiro Outorgante e a devida permissão do órgão ambiental competente, arcando o Parceiro Outorgado com as sanções administrativas e com a responsabilidade civil em caso de descumprimento desta cláusula.” (CONTRATO ..., 2021, p. 4).</p> |

Fonte: Contratos (2011, 2017, 2018, 2019 e 2021).

Os contratos celebrados pelas agroindústrias, Raízen e Cerradinho, não preveram cláusulas de responsabilização e de preservação ambiental para elas. Pelo contrário, no caso da segunda, atribuiu essa obrigação ao outorgante, o proprietário da terra. O que demonstra que as usinas buscam ao máximo se eximirem das responsabilidades ambientais relativas ao espaço produtivo.

Em contraposição, o contrato modelo, direciona o cuidado de preservar as reservas legais e as áreas de preservação permanente àquele que irá utilizar a terra, o outorgado. Sendo totalmente coerente, na medida em que

será o agricultor ou a usina que irá aplicar a técnica do cultivo. Portanto, caberá a ele (a) o dever de cuidar do solo, para que não se deteriore, dos recursos hídricos, para que não se tornem escassos, da fauna e da flora existentes dentro das áreas de preservação ambiental.

#### 5. 6 PREVISÃO DE CAUSAS DE EXTINÇÃO E RESCISÃO

A previsão de causas de extinção e rescisão, são obrigatórias nos contratos agrários, assim como dispõem os arts. 26 a 34 do Decreto nº 59.566/1966. Portanto, a tabela abaixo mostra como os contratos dispuseram sobre.

Tabela 7 – Causas de extinção e rescisão

| Contratos                        | Cláusulas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Raízen</i>                    | “A inobservância no cumprimento de qualquer das cláusulas do presente contrato caracteriza infração e, assim, justa causa para a rescisão contratual, respondendo a parte culpada pela indenização cabível por perdas e danos à parte inocente [...]” (CONTRATO..., 2011, p. 4).                                                                                                                                                                                                                                           |
| <i>Cerradinho Bioenergia S.A</i> | Não estabeleceu                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>Produtor Rural</i>            | “A inobservância no cumprimento de qualquer das cláusulas do presente contrato caracteriza infração e, assim, justa causa para a rescisão contratual, respondendo a parte culpada pela indenização cabível por perdas e danos à parte inocente [...]” (CONTRATO..., 2018, p. 7).                                                                                                                                                                                                                                           |
| <i>Produtor Rural</i>            | “A inobservância no cumprimento de qualquer das cláusulas do presente contrato caracteriza infração e, assim, justa causa para a rescisão contratual, respondendo a parte culpada pela indenização cabível por perdas e danos à parte inocente [...]. No que tange à extinção e rescisão do presente contrato, observarse-á às disposições contidas no art. 13, V e art. 26 a 34, todos do Decreto 59.566/66, sem prejuízo das disposições expressamente contidas nas cláusulas contratuais.<br>(CONTRATO..., 2019, p. 8)” |
| <i>Contrato Modelo</i>           | “O presente contrato ficará rescindido nos seguintes casos: a) inadimplemento contratual por qualquer das partes;<br>b) inaptidão do Parceiro-Outorgado no trato do cultivo objeto deste contrato;<br>c) acontecimento natural que venha a danificar toda a lavoura.<br>(CONTRATO..., 2021, p. 3)”                                                                                                                                                                                                                         |

Fonte: Contratos (2011, 2017, 2018, 2019 e 2021).

Compulsando os contratos analisados, observa-se que o único contrato que deixou de estabelecer cláusula de rescisão e extinção do contrato, foi o celebrado pela empresa Cerradinho. Portanto, foi omissivo, o que pode acarretar num desequilíbrio na relação contratual, favorecendo a acumulação de poder por parte da usina e contrariando os princípios da autonomia da vontade das partes e da boa-fé objetiva. Além de estar em desacordo com o art. 96, inciso V, d, do Estatuto da Terra, que estabelece como um dos requisitos obrigatórios constar no contrato as formas de extinção ou rescisão do mesmo (BRASIL, 1964).

## VI. CONSIDERAÇÕES FINAIS

A partir da compreensão da dinâmica do setor sucroalcooleiro no estado de Goiás e principalmente, no Sudoeste goiano, constatou-se que a expansão canavieira avançou o território, ocupando áreas, prioritariamente, cultivadas por outras culturas, como as de pastagem e de soja, por exemplo. Essa constatação foi evidente, já que expandir as atividades produtivas para regiões cultivadas

por outras culturas reduzem os custos de produção e maximizam os lucros.

Contudo, a expansão para regiões não tradicionais ao cultivo da cana-de-açúcar, desencadeia um embate entre os setores produtivos para a ocupação do solo e do domínio sobre ele. Estas disputas são processos naturais de ocupação do espaço produtivo, já que é impossível, que em um mesmo local e ao mesmo tempo sejam realizadas atividades extensivas distintas.

Destarte, o direito contratual agrário manifesta-se como um mecanismo regulador das relações de acesso e de domínio das terras. Existem quatro tipos de contratos utilizados nesse processo: os de compra e venda, os de fornecimento de matéria-prima, os de arrendamento e os de parceria agrícola. Após o desenvolvimento da pesquisa, a análise dos dados permitiu inferir que, na região do Sudoeste goiano, o instrumento mais comum de acesso à terra é o contrato de parceria agrícola. Observou-se, ainda, que esse instrumento, na prática, muitas vezes, se caracteriza como contrato de arrendamento rural.

Os instrumentos contratuais analisados demonstraram que grande parte das cláusulas protege

apenas uma das partes em detrimento da outra, proporcionando um desequilíbrio na relação contratual. Nos casos analisados, observou-se que a agroindústria sucroalcooleira dispõe de poder econômico, político e social. Ou seja, as agroindústrias detêm o poder de barganha em decorrência das assimetrias de informações, que lhes possibilitam articular um conjunto diversificado de espécies de capital, que se expressam nos aspectos políticos, financeiros, tecnológicos, organizacionais e jurídicos.

Por outra via, os proprietários de terra, atraídos pelo retorno financeiro, acabam aceitando as condições impostas por ela, colocando-se em situação de subordinação e dependência na relação contratual.

Quanto aos contratos estabelecidos entre produtores rurais e proprietários de terra, nota-se que existe certa equiparidade no tocante às estipulações das cláusulas contratuais. Isso se deve ao fato desses agricultores não terem tanto poder simbólico quanto as agroindústrias. De modo que a relação entre eles e os proprietários de terras conseguem alcançar certo nível de equilíbrio contratual.

Portanto, é possível inferir, ainda que de forma holística, que as agroindústrias detêm maior concentração de poder do que os proprietários de terra, nas relações contratuais, uma vez que a maioria das cláusulas asseguram mais direitos e autonomia à elas em detrimento deles. Dessa forma, denota-se que assim como a maioria das relações contratuais não são compostas por partes com igualdade de poderes, as relações contratuais do setor sucroalcooleiro, não se divergem muito. Todavia, é possível que haja uma equiparação dos pactuantes, por meio das cláusulas contratuais, desde que elas se consolidem conforme as determinações e os princípios legais, protegendo assim, ambas as partes pactuantes.

## REFERÊNCIAS

- [1] BRASIL. Decreto nº 59.566, de 14 de novembro de 1966. Regulamenta as Seções I, II e III do Capítulo IV do Título III da Lei nº 4.504, de 30 de novembro de 1964, Estatuto da Terra, o Capítulo III da Lei nº 4.947, de 6 de abril de 1966, e dá outras providências. **Diário Oficial [da] União**, Brasília, DF, 17 nov. 1966. Disponível em: [http://www.planalto.gov.br/ccivil\\_03/decreto/antigos/d59566.htm](http://www.planalto.gov.br/ccivil_03/decreto/antigos/d59566.htm). Acesso em: 10 jul. 2022.
- [2] BRASIL. Lei nº 4.504, de 30 de novembro de 1964. Dispõe sobre o Estatuto da Terra, e dá outras providências. **Diário Oficial [da] União**, Brasília, DF, 30 nov. 1964. Disponível em: [http://www.planalto.gov.br/ccivil\\_03/leis/l4504.htm](http://www.planalto.gov.br/ccivil_03/leis/l4504.htm). Acesso em: 20 jul. 2022.
- [3] CONAB. Companhia Nacional de Abastecimento. **Acompanhamento da safra brasileira de cana-de-açúcar: Safra 2018/19**: primeiro levantamento: maio/2018. v. 5. n. 1. Brasília, DF, 2018. 1-62 p. Disponível em: <http://www.conab.gov.br>. Acesso em: 5 jul. 2022.
- [4] CONAB. Companhia Nacional de Abastecimento. **Série histórica das safras**. Safras 2006/07 a 2018/19. Brasília, DF, 2021. Disponível em: <https://www.conab.gov.br/infoagro/safras/serie-historica-das-safras>. Acesso em: 15 jul. 2022.
- [5] CONTRATO particular de parceria agrícola: celebrado entre parceiro outorgante [...] e parceiro outorgado (Cosan Centroeste S/A açúcar e álcool – Filial Jataí). **Contrato...** [documento impresso]. Jataí/GO, 11 mar. 2011.
- [6] CONTRATO particular de parceria agrícola: celebrado entre parceiro outorgante [...] e parceiro outorgado (Usina Cerradinho Bioenergia S/A). **Contrato...** [documento impresso]. Chapadão do Céu/Goiás, 5 jul. 2017.
- [7] CONTRATO particular de parceria agrícola: celebrado entre parceiro outorgante [...] e parceiro outorgado (Produtor Rural). **Contrato...** [documento impresso]. Jataí/GO, 12 dez. 2018.
- [8] CONTRATO particular de parceria agrícola: celebrado entre parceiro outorgante [...] e parceiro outorgado (Produtor Rural). **Contrato...** [documento impresso]. Jataí/GO, 23 ago. 2019.
- [9] CONTRATO modelo de parceria agrícola: modelo confeccionado de acordo com o Estatuto da Terra. **Contrato não assinado** [documento impresso]. Jataí/Goiás, 30 ago. 2021.
- [10] GOMES, Stephanye da Silva; LEAL, Liliane Vieira Martins; Pereira, Alexandre Ernesto de Almeida. Análise da expansão da indústria sucroalcooleira no Sudoeste goiano entre 2008 e 2018: impactos na ocupação do solo e estratégias de ação no campo de poder, integração vertical e concentração fundiária. In: MELLO, Roger Goulart; FREITAS, Patrícia Gonçalves (org.). **Meio ambiente: gestão, preservação e desenvolvimento sustentável**. Rio de Janeiro: e- Publicar, 2020. v. 2. cap. 13, p. 159176. E-book.
- [11] IMB. Instituto Mauro Borges de Estatísticas e Estudos Socioeconômicos. **Estatísticas municipais: séries históricas**. Goiânia, 2020. Disponível em: <https://www.imb.go.gov.br/estatisticas/sistemas-de-pesquisa/estat%20C3%ADsticas-municipais.html>. Acesso em: 15 jul. 2022.
- [12] LEAL, Liliane Vieira Martins. **Expansão sucroalcooleira e disputa pelo uso do solo no Sudoeste de Goiás**. 333 f. Tese (Doutorado). Universidade Federal de Goiás, Goiânia, 2015.
- [13] NOVACANA. **Aspectos do plantio da cana-de-açúcar**. Curitiba, 2021. Disponível em: <https://www.novacana.com/cana/aspectos-plantio-cana-de-acucar#:~:text=Seu%20ciclo%20produtivo%20C3%A9%2C%20em,tratos%20culturais%20e%20a%20colheita>. Acesso em: 10 jul. 2022.
- [14] NOVACANA. **As usinas de açúcar e etanol do Brasil**. Curitiba, 2021a. Disponível em: [https://www.novacana.com/usinas\\_brasil](https://www.novacana.com/usinas_brasil). Acesso em: 10 jul. 2022.

- [15] NOVACANA. **Usina de açúcar e álcool no estado**: Goiás. Curitiba, 2021b. Disponível em: [https://www.novacana.com/usinas\\_brasil/estados/goias?page=2](https://www.novacana.com/usinas_brasil/estados/goias?page=2). Acesso em: 22 jul. 2022.
- [16] PACHECO, Paula. Produtores de soja boicotam cana em GO. **Estadão**, São Paulo, 9 jan. 2011. Economia e Negócios. Disponível em: <http://www.estadao.com.br/noticias/impreso,produtores-de-soja-boicotam-cana-emgo,663814,0.htm>. Acesso em: 22 jul. 2022.
- [17] PARDO FILHO, Milton. **Direito agrário**: aspectos reais e obrigacionais. 2006. 279 f. Dissertação (Mestrado em Direito das Relações Sociais). Universidade Católica de São Paulo, São Paulo, 2006.
- [18] SILVA, Adriana Aparecida; MIZIARA, Fausto. **Avanço do setor sucroalcooleiro e expansão da fronteira agrícola em Goiás**. Pesquisa Agropecuária Tropical, Goiânia, v. 41, n. 3, jul./set. 2011. Disponível em: <https://www.scielo.br/pdf/pat/v41n3/a07v41n3.pdf>. Acesso em: 1 jul. 2022.
- [19] UDOP. União dos Produtores de Bioenergia. **Serviços-Usinas/Destilarias**. Estado: Goiás. Araçatuba, SP, 2021. Disponível em: [https://www.udop.com.br/index.php?item=m\\_apa\\_unidades](https://www.udop.com.br/index.php?item=m_apa_unidades). Acesso em: 1 jul 2022.

# People's Health Surveillance in the Construction of Coexistence with the Semi-Arid in Times of Pandemic COVID-19

Gislei Siqueira Knierim<sup>1</sup>, Gáudia Maria Costa Leite Pereira<sup>2</sup>, Luciano Pires de Andrade<sup>3</sup>, Ana Maria Dubeux Gervais<sup>4</sup>

<sup>1</sup>Master's degree in Public Health, doctoral candidate in the Postgraduate Programme of Agroecology and Territorial Development at the Federal Rural University of Pernambuco.

<sup>2</sup>Master's degree in Rural Extension, PhD candidate in Agroecology and Territorial Development, Universidade Federal Rural de Pernambuco.

<sup>3</sup>PhD in Ethnobiology and Nature Conservation and Professor at the Universidade Federal Rural de Pernambuco and Associate Professor at the Universidade Federal do Agreste de Pernambuco.

<sup>4</sup>PhD in Sociology. Co-Counselor, Collaborating Professor of the Postgraduate Programme of Agroecology and Territorial Development. Federal Rural University of Pernambuco.

Received: 22 Aug 2022,

Received in revised form: 13 Sep 2022,

Accepted: 19 Sep 2022,

Available online: 24 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** Training-action, Health practices, Covid-19, Semi-arid.

**Abstract—** The training-action process called "The Cycle of Meetings: Healthy and Sustainable Territories in the Brazilian Semi-Arid - Popular Health Surveillance in Times of Pandemic", was characterized as a training space organized by the Articulation of the Brazilian Semi-Arid (ASA) and the Health Environment Work Program (PSAT) of Fiocruz - Brasília in the period from August to September 2020 where it sought to encourage dialogue, the construction of knowledge, the strengthening of community relations with the Unified Health System (SUS) and build strategies to confront the Covid-19 health crisis in the territories of the Semi-Arid. The Cycles were organized in five virtual meetings and territorial actions between meetings. They were oriented towards the construction of new models of understanding and action in the face of the Covid-19 pandemic, in order to discuss how the adoption of theoretical and practical approaches can enable the action of the organizations that make up ASA in the territories to strengthen agroecological transition systems, appropriate technologies for access to water and food security for families in the Sertão. It resulted in the construction of guiding principles for health practices for the resumption of the activities of ASA organizations in the territories in times of pandemics.

## I. INTRODUCTION

Convivência com o semiárido<sup>1</sup> is a regional and sustainable political project adapted to the diversity and

singularities of the Brazilian semi-arid region, which breaks

<sup>1</sup> The Brazilian semi-arid region, also known as the Sertão, corresponds to approximately 12% of the Brazilian territory, with 1.03 million km<sup>2</sup>, where 1,262 municipalities are located and an average population of 27 million people. It has specific climatic

characteristics, with rainfall rates averaging 750mm/year, with irregular and scattered rains. But the Brazilian semi-arid is not only climate, vegetation, soil, sun and water. It is people, music, festivals, art, religion, politics, history. It is a social process. It cannot be understood from just one angle. It brings with it a cultural identity beyond climate and biome (P. C. G. da Silva et al., 2010).

with the paradigm of combating drought that has hitherto guided state policies and actions for the region. It is based on the perspective of recognising and valuing local experiences, the knowledge and practices of farmers and community social experiences involving access to water, the struggle for land, the strengthening of family farming, agro-ecology and contextualised education. It is a matter of a way of acting and thinking, other ways of living and being in the region, in a kind of "paradigmatic shift, from the view of denial of the ecological characteristics of the region, to an approach of acceptance" (Chacon, 2007, p. 34).

In this scenario, the work of the Articulation Network of the Semi-Arid (Rede de Articulação do Semiárido<sup>2</sup> - ASA) stands out. This network is made up of more than three thousand civil society organisations of different natures, which have been contributing to the construction of an integrating political proposal, articulated with discussions on the emergence of a new paradigm of sustainability for the Semi-Arid: Living with the Semi-Arid (Conti & Pontel, 2013).

The arrival of the Covid-19 pandemic in Brazil, in early 2020, imposed great challenges to the population, because it is a disease with high potential for transmissibility and high mortality, exposing in the most distinct territories the technical and political unpreparedness to face a phenomenon of such magnitude. Caused by a virus identified as belonging to the Coronavirus family, which came to be called SARS-COV 2, this virus causes a Severe Acute Respiratory Syndrome (SARS), affecting mainly the lungs, but with the potential to affect other organs. The disease caused by this new *Coronavirus* was named "*Coronavirus disease 2019*" (COVID-19) (Damasceno & Façanha, 2020).

Faced with this scenario, rural populations, historically neglected by public authorities, are now facing great difficulties.

---

<sup>2</sup> Created in 1999, ASA is articulated in ten Brazilian states with a semi-arid ecosystem: Alagoas, Bahia, Ceará, Maranhão, Minas Gerais, Paraíba, Piauí, Pernambuco, Rio Grande do Norte and Sergipe. ASA brings together about 1,200 organisations from the most diverse segments, such as churches, development and environmental NGOs, rural and urban workers' associations, community associations, trade unions and rural workers' federations that have been fighting for the social, economic, political and cultural development of the Brazilian semi-arid region. Its mission is to strengthen civil society in the construction of participatory processes for sustainable development and co-existence with the semi-arid region, based on cultural values and social justice (ASA, 2002, n/p).

In this sense, ASA's mission is to "strengthen civil society in the construction of participatory processes for sustainable development and co-existence with the semi-arid region, based on cultural values and social justice" (ASA, 2022, n/p).

Access to health services by the rural population faces several types of barriers: geographical, such as great distances from the service and road conditions; organizational, with difficulties in maintaining updated records by basic health care; political issues, among others. Some of the vulnerabilities in these territories are associated with the lack of sanitation (COSTA; SOUSA; et al, 2020, p.266).

Training in Popular Health Surveillance, in the context of Collective Health, can be strategic for the construction of coexistence with the semi-arid region at this time of the Covid-19 pandemic, as it generates a set of technical-scientific practices that modify not only the ways of feeling, acting think about the use of water, land and biodiversity in the semiarid, but also change habits, practices and attitudes, which strengthen the agroecological movement, the individual and collective health care practices, and the solidarity and democratic ways of relating to common goods.

The aim of this essay is to discuss the training in popular health surveillance carried out by ASA in partnership with the Oswaldo Cruz Foundation (Fiocruz), in the construction of health security strategies for the implementation of activities in the semi-arid territories in a context of the Covid-19 pandemic as a structuring axis in the Development of Healthy and Sustainable Territories in the Semi-arid.

This training process took place as a free course and was entitled "Cycle of Meetings: Healthy and Sustainable Territories in the Brazilian Semiarid - Popular Health Surveillance in Times of Pandemic", offered virtually between the months of August and September 2020 and sought to encourage dialogue, the construction of knowledge, from the exchanges between technical assistance groups and health professionals, strengthen relationships between communities and Primary Health Care<sup>3</sup> and build strategies to address the health emergency of Covid-19.

---

<sup>3</sup> Primary Health Care (PHC) is internationally known as a strategy to organize health care, which seeks, in a decentralized, continuous and systematized way, to meet most of the health needs of a population, integrating preventive and curative, individual and collective actions (Matta & Morosini, 2008, p. 44). In Brazil, PHC incorporates the principles of the Brazilian Health Reform of integrality and universality and is now called Basic Health Care (BHC).



The training process is geared towards building new models of understanding and action against the Covid-19 Pandemic and aims to discuss how the adoption of theoretical and practical approaches can enable the action of the organizations that make up ASA in the territories to strengthen agroecological transition systems, appropriate technologies for access to water and food security for families in the semi-arid region.

The essay presents the theoretical and epistemological bases of training, the methodological tools, and the political and pedagogical structure of the training-action process and its interfaces with agroecological transition systems and appropriate technologies for coping with the semi-arid region, reflecting on the repercussions for ASA and the communities linked to it.

### **Training to strengthen agroecological systems for coping with the semi-arid region in times of the Covid-19 pandemic**

The training-action process Healthy and Sustainable Territories in the Semi-Arid (TSSS): People's Health Surveillance in Times of Pandemic, sought on the one hand to train technicians and technicians from ASA's programs and health professionals in the Semi-Arid for field actions in times of pandemics and on the other, to respond to the demands of society, especially rural communities in the Brazilian semi-arid region that are in a situation of environmental, economic and social vulnerability. It also aims to favour the strengthening of individual, collective and public capacities, and to increase the efficiency and effectiveness of care practices as a result of the Covid-19 health emergency and of public policies aimed at family farming.

## **II. THEORETICAL AND EPISTEMOLOGICAL BASES**

To develop theoretically and conceptually the content related to, it is assumed that territory is a field of research and experimentation (Macerata et al., 2020). Therefore, it cannot be reduced to a geographical space only. Territory reflects multifactorial fields of relationships and meanings that integrate elements of biome, history, culture, social recognition, as well as food and nutrition sovereignty and security.

But territory is also the place of creativity, of the possibility of peoples' autonomy, of resistance, of the production of resilience, of re-territorialization that imposes on the world the "revenge" and the "return to territory" in the metaphor of Milton Santos (2006). The process of

shaping the new paradigm of living with the semi-arid region in conjunction with the production of a horizontal network of organizations and social movements that make up the ASA Network is an example of this possibility of meaning and social practice in the reconstruction and disputes over the meanings (territorialities) of territory.

The territory has been constituted as the basis on which the social determinations of the health-disease-care process produce transformative effects and, therefore, has also been a reference for the field of collective health. Thus, "it is not the territory itself that makes it the object of social analysis" (M. Santos, 2004, p. 138), but its uses and the experiences present there. In this sense, the healthy and sustainable life of a territory is expressed over time, in its environmental, cultural, economic, political and social dimensions, in a multiscale way, manifesting itself, therefore, within the global, regional and local development (Machado et al., 2017).

To the extent that territories result from social-natural constructions, it is possible to undertake actions for Healthy and Sustainable Development (Machado et al., 2017), understanding that the discussion of sustainable development starts from the rupture with other modes of development that led us, and lead us, to considerable social and ecological wear and tear at local, regional and international levels. Sustainable development is defined by the United Nations (UN) as that which meets the needs of the present without compromising the ability of future generations to meet their needs (UN, 1987)

Coexistence with the semi-arid region brings back and values the debate on sustainable development. The proposal of coexistence, loaded with various meanings and senses, expresses a change in the perception of the complexity of the territory and makes it possible to build or recover relationships of coexistence between human beings and nature, based on local knowledge and resources.

The development of the Semi-arid is closely linked to the introduction of a new mentality regarding its environmental characteristics and changes in practices and indiscriminate use of natural resources (Conti & Pontel, 2013, p. 27).

From this perspective, the principles of storing and conserving in order to live together emerge:

Storing water for human consumption, storing water for food production, storing food for people and animals, storing local seeds, conserving the caatinga

vegetation and its multiple creations and recreations of life (Baptista et al., 2021, p. 267).

In coexistence with the semi-arid region, Agroecology is characterised as a strategy of sustainability, capable of providing families in the semi-arid region with significant environmental, economic and social benefits and, in an equitable and sustainable way, feeding families.

Agroecology as a science seeks to apply the principles of ecology in agriculture, (Gliessman, 2015), supporting the strategies of families in designing and redesigning the management of their agroecosystems, so that they become more productive, sustainable and healthy. It also contributes to the struggle of farming families for autonomy, in the face of the logic imposed by the capitalist model of combating drought. According to Altieri

TO agroecology represents an inspiring example of a powerful systems approach and, at this time of the coronavirus pandemic, agroecology can help explore the links between agriculture and health by demonstrating that the way agriculture is practised can on the one hand promote health or, conversely, if it is poorly practised, as in industrial agriculture, can cause major health risks (Altieri & Nicholls, 2020, p. 2).

Social Technologies (STs) are healthily suited to the issue of access to water in semi-arid communities, given the fragility of water resources, the sustainable management of springs and the valorisation of the capture, storage and management of rainwater for appropriate production. STs have emerged on the national scene as a movement that stems from the experimentation of individuals in the territories, which is differentiated by the creative and organisational capacity of population segments to create alternatives to meet their needs or social demands.

In Brazil, its use has gained momentum since the Conference of the Parties to the United Nations Convention to Combat Desertification and Drought (COP3-Olinda, 1999), when the 1 Million Cisterns Programme (P1MC) was launched in line with the strengthening of ASA - a network of civil society organisations working to build coexistence with the semi-arid region. It is based on the idea that drought is a condition that can be mitigated through the articulation of local groups and the development of specific technologies (Adriano B. Costa & Dias, 2013).

Dagnino (2014), considers ST as a construction that comes from popular knowledge, being an open process (not prescriptive), which can be modified when replicated, according to the local needs of each community.

The ST can also be considered an alternative, inclusive, efficient, and aggregating tool because it is thought out and built in a participatory manner, involving popular knowledge present in each territory. According to Dagnino (2010), ST articulates two dimensions that are inseparable for the construction of a methodological approach to social inclusion: the conceptual dimension (theoretical-analytical) and the material dimension (of social intervention). In view of this, the protagonism of the community is fundamental in the construction of alternatives, considering popular knowledge to think of solutions applicable at the material level with a view to intervention in various local contexts.

The need to adopt technologies appropriate to the reality of the Semi-arid has been strongly emphasized by society's organizations and researchers who propose and experiment with alternatives for the development of this region (Ghislaine Duque, 2008, p. 137).

One of the characteristics pointed out is the development of technologies that provide harmonious co-existence between human beings and nature, taking advantage of the biodiversity of the caatinga with all its natural resources, thus contributing to the sustainability of the territory.

For farming families in the Sertão, access to water is fundamental in the current health crisis in Covid-19. Therefore, STs, such as rainwater catchment cisterns and household filters, are necessary not only to guarantee access to water for consumption and cleaning, but also for the autonomy and food and nutritional security of families and the community.

To analyse the health situations in the territories it is necessary to understand the process of social determination of health in a historically contextualised way, placing the factors of determination in the modes of production and reproduction of life and in the process of organisation of national states in the emancipatory perspective of Breilh, (2006), allows a broader understanding of popular surveillance in health.

When it comes to the concept of *popular surveillance* in surveillance, it is still under construction. Vicent Valla, (1998), for example, works with the perspective of citizen surveillance, based on the guidelines of popular education in health and participatory bio-research. Breilh, (2006), in turn, starts from the understanding that, in the capitalist mode of production, popular action needs to be emancipatory in order to recognize the subject as active, as owner of his life, as the owner of his history. These subjects include various individual and collective subjects, including collective, including the Academy.

Thus, the idea of popular surveillance in health emerges led by the Academy, in joint action with social movements, in an attempt to build the concept of militant research, where the actors define projects and processes collectively.

It is from this perspective that the idea of popular biosurveillance arises, which is in line with Breilh's (2006) understanding of critical epidemiology, which refers to the established power relations and the need to ensure surveillance that is not merely an instrument of state action, but one of transformation.

For this transformation to occur, it is necessary that the subjects actively participate in the process from the beginning; it is fundamental that the insertion of the subjects is guaranteed, so that their knowledge and ways of living are respected. The country people, the rural workers, the fishermen, the settlers, the quilombolas have a way of life, a knowledge that should be recognised, respected and incorporated, in such a way that surveillance also acts as an instrument of mediation and negotiation. Understanding that the relationship between capital and labour defines the process of reproduction of life and the organisation of society.

From this perspective, the popular surveillance in health adopts a dialogical form (singular, particular and general) which demands and requires protective and reparatory measures. Thus, it is necessary to start from a more general dimension. Currently, to address any environmental problem, health or of any nature, it is necessary to understand the social, political, economic, cultural context in which one lives, in its local and global dimensions, and taking into account their reverberations and replications in national states.

For Breilh, (2006), the dimensions of the general, the singular and the particular require actions that are both protective and reparative. In the singular, there are phenotypic and genotypic issues that will certainly interfere. Some

have genetic issues that favour certain processes of illness and this illnesses and this must be considered. There are also the particularities when considering the social solidarity networks established among the different groups, which, in turn, articulate themselves in a specific way with each other and with several governmental and non-governmental entities (Universities, NGOs, Health Departments). In the more general context, we must also observe the Public Policies in the sense of offering answers in the form of protective or reparatory actions.

According to Breilh, (2006), it is necessary to consider what he calls the "4 Ss" of life:

- ✓ SOVEREIGNTY: perspective of sustainability and sovereignty within the framework of the relationship between production and social reproduction;
- ✓ SOLIDARITY: how the networks and organised social subjects manage to establish some mechanism of protection and reparation, including in terms of guarantees from the State;
- ✓ SUSTAINABILITY: present in the territorial interventions to promote a Healthy and Sustainable Territory (TSS);
- ✓ HEALTH AND SECURITY: this is bio-security, or the State's social protection apparatus made available for the well-being of the subjects.

This is a perspective of popular health surveillance that is being built and has few experiences - some very significant in the current context of the Covid-19 Pandemic.

### III. POLITICAL-PEDAGOGICAL STRUCTURE OF THE TRAINING PROCESS

The Pedagogy of Alternating Cycle (PA) was the pedagogical path chosen for the construction of knowledge with the territories and in the organization of the Cycles of Meetings of the Formation Process and is considered one of the teaching-learning strategies most appropriate to the reality of life in the countryside (L. H. da Silva, 2007). Because through its methodology and contents contextualized in the life and reality of each territory, it is directly related to the need to promote greater integration between theory and practice, and is materialized in the alternation between moments of concentration - School Time (TE), and moments in the territory - Community Time (TC) (L. H. da Silva, 2007).

Training based on the AP is organised in two stages. The first is TE, which in this case was five remote

meetings, and is characterized by the time when the students remain part of their time in direct contact with the educational institution and have the opportunity to relate and dialogue directly with the educator and with the content constructed and validated by science. Furthermore, this time also encourages theoretical debate and the construction of connections with the different experiences in their territories, promoting critical reflection on relevant issues.

The transforming intervention occurs at the moment of the TC because that is when the students return to their territories with the purpose of carrying out a set of activities that were guided by the educators in the TE. For Silva,

Alternating cycle, as a pedagogical principle, more than the characteristic of repeated sequences, aims to develop in formation situations in which the school world is positioned in interaction with the surrounding world. Under this aspect, the idea of alternation is converted into a strategy of schooling that allows the young people who live in the countryside to combine schooling with the productive activities and tasks of the family unit, without being disconnected from the family and the culture of the field (L. H. da Silva, 2007, p. 105).

This pedagogical strategy of alternating cycle is based on the critical-historical line, for which it is not possible to understand the pedagogical process separate from the social process, that is, it is necessary to start from the links between education and society, objectified in the social practice of the students.

The Discussion Cycles were constituted as spaces of intersectoral connections between health, sanitation and food and nutritional security in the context of the pandemic. Technicians from the health, agrarian, education and social areas, farmers and traditional peoples were involved in these debates, enabling a dialogue on protection and care with the communities in the face of the problematization of the dynamics of spatial and temporal movement of the pandemic in relation to the paths of water and food, disseminating experiences of multiple health barriers in the

context of building networks of popular health surveillance actions for the promotion of healthy and sustainable territories in the semi-arid region.

The training process was developed in a cycle of five remote face-to-face meetings via the Zoom platform. Between one meeting and another, in the TC, there was group work to continue the reflections and orientations of the face-to-face time. The meetings were held once a week, every Thursday between 20 August and 17 September 2020, lasting four hours.

The class was organized into groups taking as criteria the heterogeneity of the subjects participating and a specific spatiality in the semi-arid territory, articulated to the work and life of all the members, thus allowing the groups to remain articulated throughout the training track. Therefore, five groups were formed, subdivided into ten subgroups, to hold debates and contextualized deepening on the themes and organization with the purpose of sharing the synthesis built. The subgroups had the presence of tutors to mediate and facilitate the debates, contribute to the guidance on the issues proposed for reflection, inform and facilitate the process based on the reality in the different territories.

The remote Face-to-Face Meetings were organised in three moments:

Moment 1: synthesis of the previous meeting and presentation of the group work, which is intended to reconnect the group and share what each person has experienced in their territories;

2nd Moment: Approach to a new theme, from the sharing and analysis of innovative and instigating experiences related to it, this moment seeks to theoretically deepen a new theme in dialogue with the groups' experience; and

3rd Moment: Debate in the plenary and group debate on the new theme, with the intention of making syntheses between what has been lived, scientific knowledge resulting in new constructions of knowledge and pointing out new needs.

The curricular proposal of the training was thematic, and each meeting was interwoven with the other by guided activities to be carried out in the Community time.

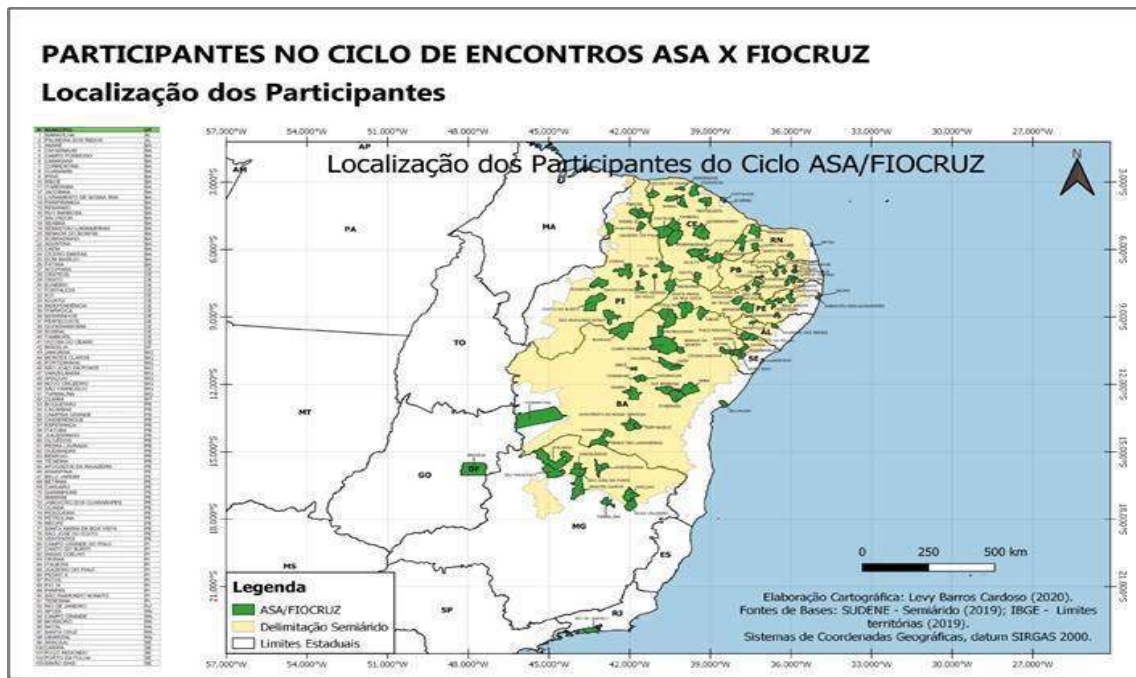


Fig.1 - Map of the location of the participants in the Cycle of Meetings: Territory, Healthy and Sustainable in the Brazilian Semi-Arid - Popular Health Surveillance in times of Pandemic.

**Source:** Booklet of the Cycle of Meetings: Territory, Healthy and Sustainable in the Brazilian Semi-Arid - Popular Health Surveillance in Times of Pandemic (ASA-FIOCRUZ, 2021).

Table 1 - Organisation of contents and route

| Theme                                                                                                                  | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>I - Resistance in the semi-arid region and socio-environmental and health context in times of pandemics.</i></b> | <p><i>Review of the journey of ASA Network, contextualization of coexistence with the semi-arid and challenges of the current pandemic.</i></p> <p><i>Health promotion in times of pandemic. Popular health surveillance. Health and Territory. Connection between the ways of people, water and food.</i></p> <p><i>Experience of one organisation's performance, in the field, in the pandemic.</i></p> <p><i>Visibilization of surveillance and health promotion experiences in communities. Health vision in the territories.</i></p> |
| <b><i>II - Water Paths in times of pandemic</i></b>                                                                    | <p><i>Experience in territories addressing water ways in communities/territories, considering available waters.</i></p> <p><i>Integration between Waterways and Multiple Health Barriers and People's Health Surveillance.</i></p>                                                                                                                                                                                                                                                                                                        |
| <b><i>III - Food security in times of pandemic</i></b>                                                                 | <p><i>Territorial experiences with productive backyards and seed banks.</i></p> <p><i>Health promotion and food and nutritional security. Food culture as an expression of good, of a harmonious relationship with life. Territory as a food heritage. Real food and nutrition. Food diasporas.</i></p>                                                                                                                                                                                                                                   |
| <b><i>VI - People's Health Surveillance</i></b>                                                                        | <p><i>The construction of Action and Connection Strategies in</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

|                                          |                                                                                                                                                                                                                                                                       |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Plans in times of Pandemic</b>        | <i>Popular Health Surveillance on a territorial basis.</i><br><i>Experience on Strategies for Action and Connection: the training of popular agents in health.</i><br><i>Synthesis and future connection for the construction of popular surveillance strategies.</i> |
| <b>V - Closing and Future Directions</b> | <i>Synthesis of the work produced collectively and outlining the way forward.</i>                                                                                                                                                                                     |

**Source:** Booklet of the Cycle of Meetings: Territory, Healthy and Sustainable in the Brazilian Semi-Arid - Popular Health Surveillance in Times of Pandemic (ASA-FIOCRUZ, 2021).

The work of the TC was guided by generating questions, questions that provoked discussion in the groups and the construction of knowledge, bringing the contents worked in the TE closer to the knowledge and practices developed in the territories.

Chart 2 - Guiding themes of the group work and collective construction of knowledge,

| <b>Meetings</b>    | <b>Generator Questions</b>                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Meeting I</b>   | <i>Where do the actions of the ASA/Brazilian Agricultural Research Company (EMBRAPA) programmes and health actions interrelate in the communities where we operate?</i><br><i>How do these interrelationships happen? Or why don't they happen?</i>                                                                                                                                                                               |
| <b>Meeting II</b>  | <i>What are the multiple health barriers that you recognise in your territory?</i><br><i>What actions already exist or can be carried out to contribute to the implementation of multiple sanitary barriers in the communities where we operate?</i><br><i>How can communities, from the waterways, build multiple health barriers?</i>                                                                                           |
| <b>Meeting III</b> | <i>How can the healthy eating pathway strengthen health barrier strategies?</i><br><i>How can families be strengthened for the production, circulation, distribution and access to healthy food in times of pandemic?</i><br><i>Considering the healthy food pathway and the water pathway, what are the other possibilities of construction and strengthening, associated with multiple health barriers, in the communities?</i> |
| <b>Meeting IV</b>  | <i>Based on the previous discussions and debates, how do we build procedures and territorial action strategies for Popular Health Surveillance?</i>                                                                                                                                                                                                                                                                               |
| <b>Meeting V</b>   | <i>Guidance for the production of institutional documents defining strategies for the return to the field, including a survey of all materials and Personal Protective Equipment (PPE) that will be needed for the return to the field.</i><br><i>In charge of ASA organizations.</i>                                                                                                                                             |

**Source:** Booklet of the Cycle of Meetings: Territory, Healthy and Sustainable in the Brazilian Semi-Arid - Popular Health Surveillance in Times of Pandemic (ASA-FIOCRUZ, 2021).

The cycle of meetings was attended by 238 people, including: ASA technicians and technicians, Community Health Agents from the municipalities in which ASA organizations operate, health professionals from EMBRAPA and the Oswaldo Cruz Foundation - Fiocruz, students from the Professional Master's Course in

Health, Environment and Work linked to the Postgraduate Program in Public Health at Fiocruz Brasília in partnership with the Postgraduate Program of the Aggeu Magalhães Institute IAM of Fiocruz - Pernambuco and representatives from civil society and governmental organizations. The presence of technicians and technicians from ASA and

Community Health Agents was more expressive. In relation to gender participation, the presence of women

(145) was greater than that of men (93). All participants were from the Brazilian semi-arid region.

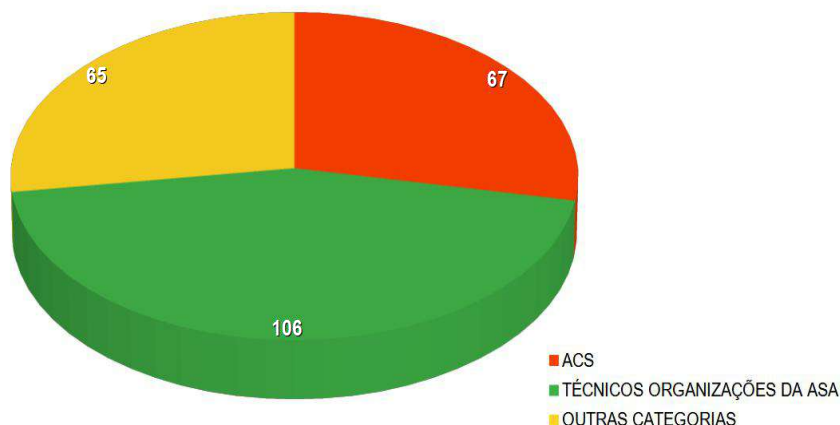


Fig.2 - Total Participants of the Cycle of Meetings: Territory, Healthy and Sustainable in the Brazilian Semi-Arid - Popular Health Surveillance in times of Pandemic.

**Source:** Booklet of the Cycle of Meetings: Territory, Healthy and Sustainable in the Brazilian Semi-Arid - Popular Health Surveillance in Times of Pandemic (ASA-FIOCRUZ, 2021).

#### IV. PEDAGOGICAL AND METHODOLOGICAL TOOLS FOR ACTION IN THE TERRITORIES IN THE CONTEXT OF A PANDEMIC TO STRENGTHEN AGROECOLOGICAL TRANSITION SYSTEMS AND FOOD SECURITY

From the systematisation of the work done in the groups, some guidelines were drawn up for the work to be done in the territories, showing that all the organisations, together with their technicians and technicians, should seek to reflect on the paths that each one will take to return to the communities, prioritising care for life and people. These strategies must take into account three fundamental elements: caring, affection and affection.

It was very evident in the working groups' reports of a political will, a commitment and a desire for the strategies for returning to the field to incorporate narratives of care, affection, affection, protection and the importance of communities, thus reaffirming the Pedagogy of Care<sup>4</sup> and contextualised education<sup>5</sup>.

<sup>4</sup> Pedagogy of Care: care as a political act, committed to the construction of a world capable of overcoming oppression, reducing inequalities, committed to a project of happiness and humanization.

<sup>5</sup> "Contextualised education in the semi-arid region - is characterised by an education that organises school contents in dialogue with the territory where it is inserted (geographical space, culture, identity and the specificities of the place) deconstructing stereotypes and stimulating the construction of a

The main guidelines resulting from the training cycle:

1. The actions to return to the field must start in the territories, the places where the actions are located must be the starting point to discover possible ways to carry out the activities, so the relationships between ASA and local leaders and Community Health Agents must be strengthened;
2. Actions must be collective, integrated, networked, integration with the municipality, with the state, with the world is needed in the construction of people's health;
3. The paths must be built from the significant and political recognition that there are several subjects involved, technicians, health agents and families, and that it is in the dialogue with the families that definitions will occur, because they are the subjects of the process and of the decisions;
4. Farmers are subjects of rights, so they have the right to technical assistance, to technical monitoring by organizations, and to the right to a dignified, quality life with health for themselves and for everyone. The technicians and technicians of the organizations, and health professionals,

new look on the semi-arid region, it is a process of re-signification and socio-spatial reorganisation" (KRAUS, 2015, p. 26).

have the task of creating the conditions and prospects for farmers to recover and assume their role as subjects of rights;

5. The pandemic is not only a health and hygiene issue, but a deeper issue, one of building new forms of sociability, new relationships with others, with the territory and with nature, a society without discrimination, more egalitarian.

In the guidance on sanitation practices some general guidelines were listed:

1. Health care measures must consider the different levels of action, whether individual or collective, with their respective singularities, considering the different ways of building and rebuilding life in the territories, observing the occupation of spaces, the use of territory, the availability, access to and management of water, food production, agro-biodiversity management practices, and the way and organisation of the farmers' work process;
2. It is necessary to organise and plan the times of the return to the field, considering the safety of both the technical teams of the organisations and the families:
  - a) make a previous contact with the family that will visit, informing about the visit, seeking information about health conditions, authorization for the visit, exchange information about the necessary care during and after the visit, agree on some safety procedures;
  - b) when making the first contact with the family, follow the previously agreed protocols;
  - c) During the visit and the activity to be zealous, to keep the pacts and be attentive to the process and to make a health record, beyond the agreed barriers, to observe how the feeding conditions are, the water management, the mental health of the family, the relationships between family members, the situation of the elderly, those who are part of risk groups, women. Leave guidelines on how to proceed after the visit;
  - d) and after the visit, make contact with the family to follow up and be attentive to any interurrences that may arise.
3. Reaffirm and redefine the sanitary barriers, adapting them to all the places where the family and the team circulate in the territory, whether in the home and its surroundings, in the areas of

cultivation, animal husbandry, agro-industry, cooperative, fairs, meetings, seeking to ensure the use of personal protective equipment and access to sanitizing inputs, water, soap, alcohol and bleach;

4. Promote the circulation, by virtual means, of educational and informative materials on the sanitary emergency situation, water management and the strengthening of agroecological transition processes underway on the farms;
5. Organise popular health surveillance strategies in the territories, involving young people, leaders, community caregivers, integrated with Community Health Agents and the Unified Health System.
6. The food security of the families, being strengthened and encouraged, the exchange and donation of seeds, agricultural and animal production, strengthening the agroecological transition processes as a defence of life and territory in the semi-arid region;
7. Water management in its various uses: for human and animal consumption, for personal and family hygiene, for food production, for sanitising work tools, for products purchased off the property, for transport, for public and private spaces.

## V. CONCLUDING REMARKS

This training process recognises that the health crisis in Covid19 aggravates the general picture of social vulnerability that affects rural areas, especially rural populations in the semi-arid region. But on the other hand, it is believed that the negative impacts of the virus in this region could have been much greater if it were not for the Strategies for Coexistence with the Semi-Arid.

These strategies seek to strengthen the use and management of traditional genetic resources, conservation of native seeds, ensuring food and nutritional security for farmers and consumers, improving the socioeconomic conditions of families and the use of natural resources, and are closely related to human health in its various dimensions.

The health crisis, in turn, has intensified the social isolation of communities that are already isolated due to the lack of communication systems and/or the precariousness of public services.

The rescue of species diversity, the search for food autonomy of families and agroecological practices become effective health barriers that contribute to the



construction of healthy and sustainable food systems in the health emergency and post-emergency.

The pandemic moment is a moment of exception, so the return to the field requires extraordinary measures that take into account the specificities of the territories, the sanitary crisis and the health of communities. The cycles, in turn, occurred at an opportune moment to address these redefinitions of procedures, on the one hand, as conceptual and methodological support; and on the other, to draw attention to an expanded conception of health, the protagonism of communities in health surveillance and care, relating it to practices of building Healthy and Sustainable Territories, strengthening coexistence with the Semi-Arid.

### REFERENCES

- [1] Altieri, M. A., & Nicholls, C. I. (2020). *La Agroecologia en tiempos del COVID-19*. CELIA. Universidade de California.
- [2] ASA-FIOCRUZ. (2021). *Territórios saudáveis e sustentáveis no Seminário Brasileiro: Vigilância Popular em Saúde em Tempos de Pandemia*. FIOCRUZ.
- [3] ASA. (2002). *Carta de Princípios*. ASABRASIL; Articulação do Semiárido (ASA). <https://www.asabrasil.org.br/images/UserFiles/File/CARTA-POLITICA-III-ENCONASA.pdf>
- [4] ASA. (2022). *Sobre nós - História*. ASABRASIL; Articulação do Semiárido (ASA). <https://www.asabrasil.org.br/sobre-nos/historia>
- [5] Baptista, N. de Q., Pires, A., & Barbosa, A. G. (2021). Convivência com o Semiárido. In A. P. Dias, A. de B. Stauffer, L. H. G. de Moura, & M. C. Vargas (Eds.), *Dicionário de Agroecologia e Educação* (pp. 265–270). Expressão Popular / FIOCRUZ.
- [6] Breilh, J. (2006). *Epidemiologia Crítica: Ciência Emancipadora e Interculturalidade*. FIOCRUZ.
- [7] Chacon, S. S. (2007). *O Sertanejo e o Caminho das Águas: Políticas Públicas, Modernidade e Sustentabilidade no Semi-árido*. Banco do Nordeste do Brasil.
- [8] Conti, I. L., & Pontel, E. (2013). Transição paradigmática na convivência com o Semiárido. In I. L. Conti & E. O. Schroeder (Eds.), *Convivência com o Semiárido Brasileiro: Autonomia e Protagonismo Social* (pp. 29–40). Editora IABS.
- [9] Costa, A. B., & Dias, R. de B. (2013). Políticas públicas e tecnologia social: algumas lições das experiências em desenvolvimento no Brasil. In Adriano Borges Costa (Ed.), *Tecnologia social e políticas públicas* (pp. 223–246). Instituto Pólis Fundação Banco do Brasil Gapi/Unicamp.
- [10] Costa, L. A. da, Sousa, R. B. de, & et al. (2020). Trabalho em tempos de Covid 19: orientações para a saúde e segurança dos trabalhadores e trabalhadoras do campo. In *Trabalho em tempos de Covid 19: orientações para a saúde e segurança* (p. 324). Imprensa universitária.
- [11] Dagnino, R. P. (2010). *Tecnologia social: ferramenta para construir outra sociedade*. Koedi.
- [12] Dagnino, R. P. (2014). *Tecnologia Social: contribuições conceituais e metodológicas*. EDUEPB. <https://doi.org/10.7476/9788578793272>
- [13] Damasceno, L. S., & Façanha, M. C. (2020). A doença causada por SARS-COV-2 (COVID-19). In *Trabalho em tempos de COVID: orientações para saúde e segurança* (pp. 148–162). Editora da Universidade Federal do Ceará - UFC.
- [14] Ghislaine, D. (2008). “Conviver com a seca”: contribuição da Articulação do Semi-Árido/ASA para o desenvolvimento sustentável. *Desenvolvimento e Meio Ambiente*, 17(Jan/Jun), 133–140.
- [15] Gliessman, S. R. (2015). *Agroecologia: Processos Ecológicos em Agricultura Sustentável* (2nd ed.). UFRGS Editora.
- [16] Macerata, I. M., Sade, C., & Ramos, J. F. C. (2020). Território na pesquisa, território da pesquisa: protagonismo do território na pesquisa-intervenção participativa. *Interface (Botucatu)*, 24, 1–14. <https://doi.org/10.1590/interface.190733>
- [17] Machado, J. M. H., Martins, W. de J., Souza, M. do S. de, Fenner, A. L. D., Silveira, M., & Machado, A. de A. (2017). Territórios saudáveis e sustentáveis: contribuição para saúde coletiva, desenvolvimento sustentável e governança territorial. *Com. Ciência Saúde*, 28(2), 243–249.
- [18] Matta, G. C., & Morosini, M. V. G. (2008). Atenção Primária à Saúde. In I. B. Pereira & J. C. F. Lima (Eds.), *Dicionário da Educação Profissional em Saúde* (2ª, pp. 44–50). EPSJV/Fiocruz.
- [19] ONU. (1987). *Relatório Brundtland: nosso futuro comum*. Comissão Mundial sobre o Meio Ambiente e Desenvolvimento - ONU.
- [20] Santos, M. (2004). *A natureza do Espaço*. EDUSP.
- [21] Santos, M. A. (2006). O papel ativo da geografia. Um manifesto. *Tamoios UFRJ*, 1(2), 1–6.
- [22] Silva, L. H. da. (2007). Educação do Campo e Pedagogia da Alternância: A experiência brasileira. *Sísifo / Revista de Ciências Da Educação*, 8(5), 105–112.
- [23] Silva, P. C. G. da, Moura, M. S. B. de, Kiill, L. H. P., Brito, L. T. de L., Pereira, L. A., Sá, I. B., Correia, R. C., Teixeira, A. H. de C., Cunha, T. J. F., & Guimarães-Filho, C. G. (2010). Caracterização do Semiárido brasileiro: fatores naturais e humanos. In I. B. Sá & P. C. G. da Silva (Eds.), *Semiárido brasileiro: pesquisa, desenvolvimento e inovação*. (pp. 18–48). Embrapa Semiárido.
- [24] Valla, V. V. (1998). Sobre participação popular: uma questão de perspectiva. *Cad. Saúde Pública*, 14(2), 7–18.

## Quality of Life of Diabetic patients with chronic wounds in Home Care

## Calidad de vida de los pacientes Diabéticos con heridas crónicas en la Atención Domiciliaria

Allan Bruno Alves de Sousa Santos<sup>1</sup>, Victória Maria Pontes Martins<sup>2</sup>, Jessica Andrade Limeira<sup>3</sup>, Saulo Leite de Paula<sup>4</sup>, Vítor Diego de Pontes Simões<sup>5</sup>, Jéssica Vieira Gomes dos Santos<sup>6</sup>, Bruno Eduardo de Menezes Pequeno<sup>7</sup>, João Miguel da Silva Sá<sup>8</sup>, Nayla Carvalho Rocha<sup>9</sup>, Karina de Souza Silva<sup>10</sup>, Tais Gomes Rosestolato<sup>11</sup>, Edvania do Nascimento Souza Santos<sup>12</sup>, Kely Ferreira da Cruz da Silva<sup>13</sup>, Amanda Gabriel Pimentel<sup>14</sup>, Daniel Àvila Silva Monteiro<sup>15</sup>, Andréia Santos de Carvalho Pinheiro<sup>16</sup>, Wallace da Silva de Paula<sup>17</sup>, Noenia Alves de Araújo<sup>18</sup>, Railany de Oliveira Santana<sup>19</sup>, Isabelly Raiane Silva dos Santos<sup>20</sup>, Rafaela Oliveira Santana Pinheiro<sup>21</sup>, Pamella Semiramys Silvestre da Silva<sup>22</sup>, Maria Cintia Alves Costa<sup>23</sup>, Maricélia Rubim da Silva<sup>24</sup>, Paloma Leal Nobre<sup>25</sup>, Rinária de Quadro Figueiredo Guedes<sup>26</sup>, Marcos Tadeu de Sá Machado<sup>27</sup>, Bárbara Pereira Gomes<sup>28</sup>

<sup>1</sup>Nursing. São Francisco Faculty of Education- FAESF.

<sup>2</sup>Nursing. Centro Universitário Inta - UNINTA (Sobral- CE).

<sup>3</sup>Nursing. Universidade Castelo Branco.

<sup>4</sup>Nutritionist. Federal University of Ceará (UFC).

<sup>5</sup>Nursing. Centro Universitário Augusto Motta.

<sup>6</sup>Nurse. Hospital da Mulher Mariska Ribeiro.

<sup>7</sup>Medical Clinic. Irmandade da Santa Casa de Misericórdia de São Paulo. E-mail: b.eduardomenezes@gmail.com<sup>7</sup>,

<sup>8</sup>Nursing. Centro universitário Santo Agostinho.

<sup>9</sup>Nursing. Institution: Faculdade Santo Agostinho - UNIFSA.

<sup>10</sup>Bachelor in nursing, graduate student in urgency, emergency and ICU, graduate student in oncology and obstetrics. University/institution: Brazilian University Center (UNIBRAS)

<sup>11</sup>Nursing. University Castelo Branco

<sup>12</sup>Nursing. UniBras Juazeiro (BA)

<sup>13</sup>Nursing. Universidade Gama Filho

<sup>14</sup>Neonatologist Nurse. Universidade Castelo Branco

<sup>15</sup>Nursing. Estácio de Alagoas College

<sup>16</sup>Nursing. Centro Universitário Santo Agostinho.

<sup>17</sup>Nursing. Clínica Cuidado Fundamental - Associated Nurses

<sup>18</sup>Nutritionist and Master in Collective Health. Universidade Estadual do Ceará.

<sup>19</sup>Nursing. Estácio de Juazeiro do Norte Medical School

<sup>20</sup>Master of Arts. Universidade Federal do Pará.

<sup>21</sup>Nursing. Estácio de Juazeiro do Norte Medical School - FMJ

<sup>22</sup>Nurse. Estácio de Alagoas College of Medicine.

<sup>23</sup>Nursing. Uninovafapi.

<sup>24</sup>Nursing. Centro Universitário Santo Agostinho- UNIFSA

<sup>25</sup>Biomedicine. Unifacid wyden University Center.

<sup>26</sup>Nursing. Centro universitário santo Agostinho (UNIFSA).

<sup>27</sup>Nursing. Estácio Teresina - CEUT.

<sup>28</sup>Nursing. Unifacid Wyden University Center.

Received: 25 Aug 2022,

Received in revised form: 15 Sep 2022,

Accepted: 20 Sep 2022,

Available online: 24 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Quality of life, Diabetes Mellitus, Chronic Wounds, Home Care.*

**Palabras clave**— *Calidad de vida, Diabetes Mellitus, Heridas Crónicas, Cuidados Domiciliarios.*

**Abstract**— *Chronic injuries are determining factors in the quality of life of diabetic patients, because besides causing physical weaknesses, they also affect the emotional and social aspects, providing the need to adapt to a new form of routine. The study aims to reflect about the relations between the presence of chronic lesions and the experience at home and to transcend a reflection related to family participation in the care of these patients. This is a study of the narrative literary review type, with a theoretical-reflexive aspect, of qualitative approach and exploratory bias, it was carried out through data obtained from the BDENF, LILACS via Virtual Health Library, and SciELO portal, using the descriptors combined with the Boolean operator And "Quality of life, Diabetes Mellitus, Chronic Wounds, Home Care". The following inclusion criteria were adopted for the studies in the search: articles published in scientific journals, books and book chapters, theses and dissertations in English, Spanish and Portuguese, related to the theme. Studies available in paid form were excluded. Fourteen studies were included. From the analysis, the following categories emerged: The presence of chronic injuries in diabetic patients in home care and its interference in their quality of life and the importance of the family in assisting diabetic patients with chronic wounds at home. Primary care through the family health strategy plays a key role, identifying diabetic patients with chronic wounds and susceptible to developing them, and thus, training their families and caregivers, always seeking to include family members in the care process, because it is proven that the family plays a key role in the implementation of care and health planning. Furthermore, the health education offered by family members and caregivers is little documented in the literature. In this perception, a need emerges for a greater number of scientific productions that focus on family action and home care, thus evidencing the importance of these publics.*

**Resumen**— *Las lesiones crónicas son determinantes en la calidad de vida de los pacientes diabéticos, porque además de causar debilidades físicas, también afectan a los aspectos emocionales y sociales, proporcionando la necesidad de adaptarse a una nueva forma de rutina. El estudio pretende reflexionar sobre las relaciones entre la presencia de lesiones crónicas y la vivencia en el hogar y trascender una reflexión relacionada con la participación familiar en el cuidado de estos pacientes. Se trata de un estudio del tipo revisión literaria narrativa, con aspecto teórico-reflexivo, de abordaje cualitativo y sesgo exploratorio, se realizó a través de datos obtenidos de la BDENF, LILACS a través de la Biblioteca Virtual de Salud, y del portal SciELO, utilizando los descriptores combinados con el operador booleano Y "Calidad de vida, Diabetes Mellitus, Heridas Crónicas, Atención Domiciliaria". Se adoptaron los siguientes criterios de inclusión para los estudios de la búsqueda: artículos publicados en revistas científicas, libros y capítulos de libros, tesis y disertaciones en inglés, español y portugués, relacionados con el tema. Se excluyeron los estudios disponibles en formato de pago. Se incluyeron 14 estudios. Del análisis surgieron las siguientes categorías: La presencia de lesiones crónicas en pacientes diabéticos en la atención domiciliaria y su interferencia en su calidad de vida y la importancia de la familia en la*

*asistencia a pacientes diabéticos con heridas crónicas en el domicilio. La atención primaria a través de la estrategia de salud familiar juega un papel fundamental, identificando a los pacientes diabéticos con heridas crónicas y susceptibles de desarrollarlas, y por lo tanto, capacitando a sus familiares y cuidadores, buscando siempre incluir a los miembros de la familia en el proceso de atención, ya que está comprobado que la familia juega un papel fundamental en la implementación de los cuidados y la planificación de la salud. Además, la educación sanitaria ofrecida por los familiares y cuidadores está poco documentada en la literatura. En esta percepción, surge la necesidad de un mayor número de producciones científicas que se centren en la acción de la familia y los cuidados en el hogar, evidenciando así la importancia de estos públicos.*

## I. INTRODUCTION

In Brazil, with the increase in life expectancy and consequently the increase in the senescence process, it is a worrisome factor in relation to the population of diabetic patients and, consequently, for the health system, since the aging process also causes the appearance of chronic diseases (Dantas et al, 2017).

Chronic lesions are conceptualized as lesions in skin tissues that are independent of size or shape, characterized by a delay in the physiological process of repair of tissue layers in a period of three months or more, the most common being: pressure injuries and ulcers of neuropathic and ischemic origin, occurring in greater proportion in patients with diabetes mellitus (Werdin et al, 2009).

Diabetes mellitus (DM) is a pathology characterized as a metabolic syndrome of multiple origin, which results from high rates of glucose in the bloodstream. The patient with DM, when not treated properly, has deficits related to circulatory and neuropathic aspects, thus providing the appearance of injuries and hindering the healing process, thus resulting in high rates of chronic injuries, directly affecting the quality of life of these publics (Armstrong, Boulton & Bus, 2017).

The term quality of life is described by the World Health Organization (WHO) as the perception that the individual has about his or her situation in the environment, encompassing all aspects of life, including social, environmental, cultural, economic and emotional aspects, i.e., it is the harmonic complexity between all these aforementioned factors. Thus, diabetic patients with chronic wounds have high rates of developing these deficits (Vieira & Araújo, 2018).

Chronic injuries are determining factors in the quality of life of diabetic patients, because besides causing physical weaknesses, they also affect the emotional and

social aspects, providing the need to adapt to a new form of routine, which implies the emergence of negative feelings such as sadness, fear, loneliness, anguish and anxiety, also making it impossible to perform activities of daily living at home (Joaquim et al, 2018).

Home care is a crucial factor in assisting patients with DM and chronic wounds, and it is essential to encourage self-care, because the feelings expressed at home interfere directly in the acceptance and adherence to pharmacological and non-pharmacological treatment, being essential the activities developed by health professionals in the field of home care, i.e. qualified listening and guidance not only to the patient, but also to all family members (Araújo et al., 2020).

Therefore, the relevance of the study emerges, which applies to the fact that the theme enables a critical reflection, based on scientific research, to achieve a description of the quality of life of diabetic patients with chronic wounds at home. Therefore, it aimed to reflect about the relationship between the presence of chronic wounds and the experience at home and transcend a reflection related to family participation in the care of these patients.

## II. METHODOLOGY

This is a study of the narrative literary review type, with a theoretical-reflexive aspect, qualitative approach and exploratory bias. The narrative review describes and discusses the development of a given theme, and allows readers to acquire knowledge about a given subject (Rother, 2007).

This research was conducted using data obtained from the bases, Database on Nursing (BDENF), American and Caribbean Literature on Health Sciences (LILACS) via the Virtual Health Library (VHL), and the portal of the Scientific Electronic Library Online (SciELO), using the

descriptors combined with the Boolean operator (And) "Quality of Life, Diabetes Mellitus, Chronic Wounds, Home Care".

The following inclusion criteria were adopted for the studies in the search: articles published in scientific journals, books and book chapters, theses and dissertations in English, Spanish and Portuguese, related to the theme. Studies available in paid form were excluded.

Fifteen studies were excluded for being off-topic in the databases, 8 duplicates, and 14 studies were included. No temporal clippings were used.

From the analysis, the following categories emerged. The presence of chronic wounds in diabetic patients in home care and their interference in quality of life and the importance of the family in the assistance to diabetic patients with chronic wounds in the home setting.

Since this is a reflective-theoretical review study, it was not submitted to the Research Ethics Committee (CEP), and the guarantee of ethical precepts in the construction of the study is reaffirmed.

### III. RESULTS AND DISCUSSION

#### **The presence of chronic lesions in diabetic patients in home care and their interference in the quality of life.**

In daily practice, there are several interferences related to the care of people with chronic injuries at home, and, consequently, affect the quality of life. In the research conducted by Figueiredo & Zuffi (2012), the families' economic condition, the lack of training of caregivers and primary care professionals, the lack of supplies for wound treatment and failures in the referral and counter-referral system contribute directly to the ineffectiveness of care and the worsening of these patients' clinical status.

Primary care, in this context, has a primordial role in the provision of home care, where due to the lack of population, it is necessary the multiprofessional performance together with the family. Health promotion contributes as the main action offered by health professionals, which culminates in significant improvement in the quality of life of diabetic patients with chronic wounds in the short, medium and long term (Bedin et al., 2014).

In the characterization of chronic injuries that relatively interfere with quality of life, a greater constancy is observed in some etiologies. According to Vieira et al.

(2017), it was found that pressure ulcers and neuropathic "diabetic foot" ulcers were more frequent, located mainly in the lower limbs, more specifically in the calcaneus and sacral region.

According to the evaluation of chronic injuries, it was observed that specificities that influence the worsening of the quality of life at home. According to the studies of Oliveira et al, (2019), the amount of exudate, foul odor, healing time, and pain are the main factors declining quality of life. Being the collagenase ointment and essential oils, the most used treatment at the home level of care.

Pain is a symptomatology present in almost all diabetic patients with chronic wounds, and can present itself in acute and chronic forms, and when not properly controlled, it interferes with the quality of life of these patients. The main aspects impaired are changes in mood, sleep, mobility, ambulation, and delaying the healing process (Brito et al., 2017).

However, there are factors that help increase the quality of life of diabetic patients with chronic wounds during home treatment. It was evidenced that there was a greater satisfaction when the clinical picture was related to the patient's faith and spirituality, and personal and family relationships were also another important factor in improving quality of life. Individuals present benefits related to emotional and psychological aspects, which becomes important in the treatment and rehabilitation process (Evangelista et al., 2012).

#### **The importance of the family in assisting diabetic patients with chronic wounds at home.**

It should be noted that living at home has an important impact on helping and stimulating the improvement of quality of life, but the lack of development of health-promoting actions to these home caregivers can negatively affect and culminate in the management of chronic wound care, thus leading to the occurrence of possible complications, such as non-adherence to treatment and the emergence of negative feelings like sadness and loneliness (Barros et al., 2016).

Currently, the action of caring for people with chronic wounds is assumed by their families and informal caregivers, and empowering actions related to the management of chronic injuries are increasingly necessary (Carvalho, Sadigursky, & Viana, 2006).

In this context, primary care, through the family health strategy, plays a key role in identifying diabetic patients with chronic wounds and susceptible to

developing them, and thus empowering their families and caregivers, always seeking to include family members in the care process, since it is proven that the family plays a key role in the implementation of health care and planning (Figueiredo & Zuffi, 2012).

In a manner directly related to family inclusion in care, it is essential for the treatment to encourage the development of patient autonomy by the family members. Family dependence is also a worrying factor in the reduction of the quality of life of these patients (Sousa et al., 2010).

In this sense, it is necessary to encourage self-care, an incentive that stems from a stable family relationship, in which the family and the health team play the role of influencers of self-care. Autonomy emerges as an alternative of care at home, generating as benefits, the reduction of complications related to the non-hygiene of the wound bed and a faster healing process (Piropo, 2012).

Thus, when properly trained, the family plays a key role in health education and prevention of complications. The preventive practices should not be limited to just knowledge exchange, but mainly there is to strengthen the interactions between the carrier of the injury, family members and health professionals. That is, even if the patient is aware of the educational process, it is essential to observe the facts during home life, and for this reason, family members play such an important role in this therapy (Domansky & Borges, 2014).

Therefore, in order to improve the quality of life of these patients in home care, it is necessary to take into account the family preparation, the environment in which the family is inserted, the support of family members and friends, the understanding of the needs of diabetic patients with chronic wounds, and the adaptation of these patients to this means of care.

#### IV. CONCLUSION

It was concluded that diabetic patients with chronic wounds in home treatment go through several difficulties that hinder the effectiveness of therapy, and it was proven that the chronic lesions are mostly developed in the lower limbs, and having their etiology related to diabetic neuropathies and pressure injuries in the sacral region.

In relation to quality of life, the research concluded that diabetic individuals with chronic lesions present a decrease related to environmental, emotional and physical aspects, being the amount of exudate, foul odor

and chronic pain the main debilitating factors of quality of life.

Moreover, health education offered by family members and caregivers is little documented in the literature, and its need is more frequently evidenced. Being primordial the understanding about caring, that is, the implementation of self-care.

In this perception, a need emerges for a greater number of scientific productions that focus on family action and home care, seeking to raise awareness and bring the importance that this public plays in the clinical improvement and quality of life of diabetic patients with chronic wounds at home.

#### REFERENCES

- [1] Armstrong, D. G., Boulton, A. J., & Bus, S. A. (2017). Diabetic foot ulcers and their recurrence. *New England Journal of Medicine*, 376(24), 2367-2375.
- [2] Barros, M. P. L., Ferreira, P. J. D. O., Maniva, S. J. C. D. F., & Holanda, R. E. (2016). Characterization of chronic wounds of a group of patients followed at home.
- [3] Bedin, L. F., Busanello, J., Sehnem, G. D., Silva, F. M. D., & Poll, M. A. (2014). Strategies to promote self-esteem, autonomy and self-care of people with chronic wounds. *Revista gaucha de enfermagem*, 35, 61-67.
- [4] Carvalho, E. S., Sadigursky, D., & Viana, R. (2006). The meaning of the wound for people who experience it. *Rev Estima*, 4(2), 26-32.
- [5] Dantas, R. F. D. B., Gouveia, B. D. L. A., Albuquerque, A. M. D., Torquato, I. M. B., Ferreira, J. D. A., & Oliveira, S. H. D. S. (2017). Characterization of chronic injuries in the elderly served in the family health strategy. *Rev. enferm. UFPE on line*, 1835-1841.
- [6] de Araújo, W. A., Assis, W. C., Vilela, A. B. A., de Oliveira Boery, R. N. S., Rodrigues, V. P., & Rocha, R. M. (2020). Meanings of living with chronic wound: a metasynthesis study. *Estima-Brazilian Journal of Enterostomal Therapy*, 18.
- [7] de Brito Vieira, C. P., Furtado, A. S., de Almeida, P. C. D., Luz, M. H. B. A., & Pereira, A. F. M. (2017). Prevalence and characterization of chronic wounds in elderly assisted in primary care. *Revista Baiana de Enfermagem*, 31(3).
- [8] De Brito, D. T. F., de Araújo Xavier, V. M., dos Santos, J. P., & Agra, G. (2017). Chronic ulcer pain: sociodemographic, clinical, and therapeutic profile of patients in the municipality of Cuité-PB. *Academus Scientific Journal of Health*, 2(2).
- [9] de Cássia Domansky, R., & Borges, E. L. (2014). Manual for skin injury prevention: evidence-based recommendations. Rubio Publishing House.
- [10] do Nascimento Piropo, T. G. (2012). Self-care of chronic venous ulcer sufferers in the home environment. *Revista Saúde. com*, 8(2), 2-11.
- [11] Evangelista, D. G., Magalhães, E. R. M., Moretão, D. I. C., Stival, M. M., & Lima, L. R. (2012). Impact of chronic

- wounds on the quality of life of users of the family health strategy. *Revista de Enfermagem do Centro-Oeste Mineiro*.
- [12] Figueiredo, M. L., & Zuffi, F. B. (2012). Care of venous ulcer patients: perception of Family Health Strategy nurses. *Enfermeria global*, 11(4).
- [13] Joaquim, F. L., Silva, R. M. C. R. A., Garcia-Caro, M. P., Cruz-Quintana, F., & Pereira, E. R. (2018). Impact of venous ulcers on patients' quality of life: integrative review. *Brazilian Journal of Nursing*, 71, 2021-2029.
- [14] Oliveira, A. C. D., Rocha, D. D. M., Bezerra, S. M. G., Andrade, E. M. L. R., Santos, A. M. R. D., & Nogueira, L. T. (2019). Quality of life of people with chronic wounds. *Acta Paulista of nursing*, 32, 194-201.
- [15] Rother, E. T. (2007). Systematic literature review X narrative review. *Acta Paulista de Enfermagem*, 20, v-vi.
- [16] Sousa, L. B. D., Torres, C. A., Pinheiro, P. N. D. C., & Pinheiro, A. K. B. (2010). Health education practices in Brazil: the performance of nursing. *Rev. enferm. UERJ*, 55-60.
- [17] Vieira, C. P. D. B., & Araújo, T. M. E. D. (2018). Prevalence and factors associated with chronic wounds in older adults in primary care. *Journal of the USP School of Nursing*, 52.
- [18] Werdin, F., Tennenhaus, M., Schaller, H. E., & Rennekampff, H. O. (2009). Evidence-based management strategies for treatment of chronic wounds. *Eplasty*, Nine.

## Landraces seeds: A study from the identification of the physiological quality of common bean

## Sementes crioulas: Uma estudo a partir da identificação da qualidade fisiológica de feijão comum

Rafael dos Santos Balbino<sup>1</sup>, Ana Maria Dubeux Gervais<sup>2</sup>, Luciano Pires de Andrade<sup>3</sup>, Horasa Maria Lima da Silva Andrade<sup>4</sup>

<sup>1,2,4</sup>Universidade Federal Rural de Pernambuco, Brasil

<sup>3</sup>Universidade Federal do Agreste de Pernambuco, Brasil

Received: 25 Aug 2022,

Received in revised form: 18 Sep 2022,

Accepted: 22 Sep 2022,

Available online: 27 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Alagoas, Germinação, Phaseolus vulgaris L., Produção campesina.*

**Abstract**— *Landraces seeds are important inputs for family farming as they represent, above all, the peasant force in the face of genetically modified plant species. In Alagoas, there is a great movement of peasant communities in the struggle for improvements regarding the cultivation and maintenance of Landraces seeds in the most diverse territories. Evidencing this struggle, and its importance, is fundamental. This study, in addition to aiming to bring to light the relevance of the theme for Alagoas peasant families, presents a diagnosis about the physiological quality of common bean Landraces seeds produced and stored in a seed bank in the Middle Sertão of the state. Bibliographic research was used for theoretical basis and germination and vigor tests were carried out to evaluate the quality of the seeds studied. The data were submitted to a statistical test to evaluate the results obtained. The seeds studied showed low levels of germination and vigor.*

**Resumo**— *As sementes crioulas são insumos importantes para a agricultura familiar pois representam, sobretudo, a força campesina frente às espécies vegetais modificadas geneticamente. Em Alagoas, é grande o movimento das comunidades campesinas na luta por melhorias no que concerne ao cultivo e manutenção das sementes crioulas nos mais diversos territórios. Evidenciar esta luta, e sua importância, é fundamental. Este estudo, além de objetivar trazer à tona a relevância do tema para as famílias campesinas alagoanas, apresenta um diagnóstico acerca da qualidade fisiológica de sementes crioulas de feijão comum produzidas e armazenadas em um banco de sementes no Médio Sertão do estado. Utilizou-se pesquisa bibliográfica para embasamento teórico e foram realizados testes de germinação e vigor para a avaliação da qualidade das sementes estudadas. Os dados foram submetidos à teste estatístico para avaliação dos resultados obtidos. As sementes estudadas apresentaram baixos níveis de germinação e vigor.*



## I. INTRODUÇÃO

Conservar e armazenar as sementes são práticas adotadas pelos agricultores ao longo dos anos. É comum o uso de sementes cultivadas, em diversos territórios, de geração em geração. Tal fato se dá pelo reconhecimento dos valores destas, sobretudo, quanto à sua adaptação às condições edafoclimáticas do lugar e das técnicas de cultivo empregadas por cada família (Santos et al., 2017; Lima, 2017).

Com o objetivo de assegurar a manutenção e a disponibilidade de sementes adaptadas às suas condições de cultivo, ao longo do tempo, muitos agricultores familiares vêm desenvolvendo estratégias baseadas nos seus conhecimentos sobre as variedades crioulas, sobretudo no que concerne às formas de armazenamento e manejo. Os Bancos Comunitários de Sementes surgem como estratégia para garantir tal manutenção e disponibilidade, além de representarem um mecanismo de seguridade para os agricultores com relação às suas sementes (Londres, 2014; Santos et al., 2017).

Pouco ainda se foi estudado sobre os Bancos Comunitários de Sementes e sua representação dentro das comunidades campesinas em Alagoas. Tampouco se é valorizado e fomentado sua manutenção e desenvolvimento de pesquisas que visem a melhoria destes dentro das comunidades rurais as quais estão inseridos.

Os Bancos Comunitários de Sementes, por representarem uma alternativa coletiva para assegurar a perpetuação das mais variadas espécies e tipos de sementes, tornam-se objeto de pesquisa importante e que deve ser estudado. Seja sob o ponto de vista técnico, com relação à manutenção da qualidade do produto ali depositado ao longo do tempo, seja sob o ponto de vista sociocultural.

Em Alagoas, a Lei Nº 6.903 de 3 de janeiro de 2008 (Alagoas, 2008) dispõe sobre a criação do Programa Estadual de Bancos Comunitários de Sementes. Tal lei reconhece a produção das sementes crioulas no estado, regulamenta políticas públicas de acesso a sementes para o plantio e comercialização, além de destinar recursos financeiros (seja próprio ou a partir de convênios) a fim de viabilizar o fortalecimento dos bancos comunitários de sementes no estado. Apesar de ser um grande avanço com relação ao tema ao disponibilizar algumas garantias aos produtores, essa Lei não é clara quanto a necessidade de manutenção e controle da qualidade destas sementes para a comercialização.

Outrossim, o advento da lei não garante ao agricultor um retorno quanto a manutenção dos bancos de sementes, nem tampouco disponibilidade efetiva de recursos

financeiros que possam garantir o desenvolvimento de ações de fortalecimento da produção.

O feijão comum (*Phaseolus vulgaris* L.) está presente nas refeições diárias dos brasileiros, sendo a principal fonte de proteína vegetal destes, e por isso, ocupa uma posição de destaque na agricultura brasileira, configurando-se como a quinta maior cultura de grãos produzida no Brasil (CONAB, 2022).

Em Alagoas a cultura do feijão comum é caracterizada por pequenas áreas de cultivo, o que a torna de grande importância socioeconômica. Sua produção é feita basicamente a partir de sementes crioulas, selecionadas e produzidas pelos próprios produtores locais e sem a adoção de tecnologias apropriadas. É forte a expansão e conservação de sementes crioulas de feijão comum em bancos comunitários de sementes, sobretudo no sertão.

É notória a necessidade acerca da coleta de dados que possam subsidiar, de forma científica, uma base relevante de informações que podem ser levadas ao conhecimento de todos, sobretudo dos governantes e da comunidade científica, para que assim, seja dada a real importância ao tema. Portanto, as questões que norteiam este trabalho procuram entender o quanto as sementes crioulas influenciam e representam para produção agrícola das famílias campesinas em Alagoas, assim como sobre a qualidade fisiológica das sementes armazenadas nos bancos de sementes de tais famílias.

Haja vista o exposto, este trabalho tem como objetivo apresentar a relevância das sementes crioulas para as famílias campesinas de Alagoas, bem como apresentar um diagnóstico acerca da qualidade de sementes crioulas de feijão comum produzidas em um banco de sementes do Médio Sertão alagoano.

## II. AS SEMENTES CRIOULAS EM ALAGOAS: PANORAMA GERAL

As sementes crioulas, ou da resistência como são conhecidas em Alagoas, são variedades desenvolvidas, adaptadas ou produzidas pela agricultura familiar, assentados da reforma agrária ou povos indígenas que ao longo de vários anos vêm sendo permanentemente adaptadas às formas de manejo dessas populações e aos seus locais de cultivo (Brasil, 2003). Tais sementes têm como importante característica a grande variabilidade genética, apresentarem-se adaptadas a sistemas produtivos de baixo uso de insumos externos, além de serem mais resistentes ao ataque de patógenos, uma vez que são mais adaptadas às condições locais (Catão, 2013; Londres, 2014).

Para Antonello et al. (2009), as variedades crioulas desempenham papel de relevante importância para agricultores familiares, tendo em vista a ampla utilização por estes em sua base alimentar, além de permitirem a manutenção das tradições, cultura e costumes das comunidades onde estão inseridas e, também, como fonte de renda.

Com o intuito de defender as sementes crioulas, camponeses do sertão alagoano têm travado uma luta no campo social e de território contra a ofensiva capital do campo. Capital este que, seguindo os preceitos dos países imperialistas, promove, segundo Oliveira (2012), a territorialização dos monopólios e a monopolização dos territórios em um processo dirigido, sobretudo, por empresas monopolistas do setor de grãos.

No semiárido alagoano, é crescente o avanço das sementes geneticamente modificadas. O fato é que o próprio governo do estado, por meio de suas políticas de compra e distribuição de sementes, representa um elemento fortalecedor deste processo (Lima, 2017).

De acordo com Roces (2011), as sementes geneticamente modificadas provêm da chamada Revolução Verde e sua promessa por soluções tecnológicas que pudessem suprir a falta de comida e a fome que ainda imperam atualmente. Segundo o mesmo autor, a Revolução Verde impulsionou o avanço da biotecnologia, o que ocasionou, dentre outras coisas, o processo de manipulação do DNA de sementes, surgindo, assim, cruzamentos genéticos que não seriam possíveis de forma orgânica na natureza.

Diante do exposto, em Alagoas, mais especificamente no semiárido, agricultores familiares, camponeses, organizados em cooperativas e associações, têm se esforçado bastante com o intuito de garantir a defesa das sementes crioulas. Sementes estas que dentro da realidade do semiárido, representam um elemento vital quando considerado o processo de disseminação camponesa.

Com a crescente adoção de sementes híbridas/transgênicas por parte do estado em seu programa de distribuição de sementes, é notória as crescentes lutas e resistência por parte dos camponeses em Alagoas, sobretudo frente ao avanço do capital monopolista. Não obstante, camponeses de Alagoas, sobretudo do sertão, têm promovido ações de visam a preservação das sementes crioulas no estado. Segundo Lima (2017), desde a década de 1980, muitos esforços estão sendo voltados para a construção de Bancos Comunitários de Sementes. Tais bancos são ações implementadas pelas comunidades rurais para que, de forma coletiva, haja a administração de reservas de sementes necessárias para semeadura e cultivo (Platero et al., 2013).

A partir de um trabalho que se deu início na década de 1980, se criou em Alagoas o primeiro Banco Comunitário de Sementes (BCS), em 1984, na cidade de Água Branca,

semiárido alagoano. Desde então as lutas em defesa destas sementes ganharam força, o que culminou, atualmente, em 89 bancos comunitários de sementes, localizados em 18 municípios do sertão alagoano (Lima, 2017).

Consoante ao objetivo da manutenção da conservação das sementes crioulas, os Bancos Comunitários de Sementes trazem um elemento de afeição entre os camponeses, o que estabelece, segundo Platero et al. (2013), uma relação de afetividade e união das comunidades que estes representam, pois podem levar a mudanças socioculturais que vão além da melhoria da qualidade de vida das famílias.

Em meio às lutas enredadas pelos camponeses no sertão alagoano, os métodos assumidos em defesa das sementes crioulas se colocam como um fato de extrema importância no cerne da resistência campesina, o que, segundo Paulino e Gomes (2015) se atrela “à tradição do campesinato, de reproduzir o conhecimento local, de produzir alimentos saudáveis e de minimizar a dependência das políticas governamentais”.

É fato que as sementes crioulas formam um conjunto de relações que transcendem o exercício de trabalho em o homem do campo e a terra. Consoante a isto estão as questões afetivas, históricas e culturais. Segundo García et al. (2011), as sementes crioulas referem-se a uma riqueza que existe e se reproduz graças ao modo campesino de produzir alimentos, tendo em vista que se tratam de sementes produzidas, melhoradas, guardadas e adaptadas aos diferentes climas e necessidades agrícolas.

A criação dos Bancos Comunitários de Sementes contribui para o desenvolvimento da solidariedade, além de garantir a autonomia e segurança alimentar. Mesmo com a ausência de políticas públicas que deixem forte a prática social da troca de sementes crioulas, e a falta do cumprimento da Lei Estadual 6903/2008 pelo estado, é notório o crescimento dos BCS's nos últimos anos no sertão de Alagoas. Este crescimento se deu, sobretudo, pela grande atuação de muitas organizações camponesas e movimentos socioterritoriais.

Haja vista o exposto, fica evidente a importância que as sementes crioulas desempenham para o desenvolvimento local no semiárido alagoano. Os Bancos Comunitários de Sementes desempenham papel fundamental para a manutenção da qualidade destas, uma vez que neles as sementes poderão ser mantidas e conservadas. Porém, não somente isto uma vez que os Bancos representam, também, um elo entre toda a comunidade. Fato este que

proporciona aos camponeses envolvidos muito mais que a manutenção das espécies ali guardadas, mas representam, sobretudo, uma maior qualidade de vida para toda a comunidade, além da manutenção da sua cultura e troca de saberes.

### III. AVALIAÇÃO DA QUALIDADE FISIOLÓGICA DAS SEMENTES ESTUDADAS

#### *Coleta das sementes e local de condução do experimento*

As sementes utilizadas neste estudo foram cedidas por um agricultor familiar, residente no município de Santana do Ipanema-AL, sertão alagoano. Tais sementes foram produzidas na região rural do mesmo município e encontravam-se armazenadas em garrafas (politereftalato de etileno) PET, em ambiente sem controle de temperatura e umidade. Segundo o agricultor, estavam nestas condições a cerca de um ano.

O agricultor cedeu amostras de dezenove diferentes variedades de feijão comum (*Phaseolus vulgaris* L.), designadas popularmente por: azuk (AZ), boi deitado (BD), beijo de moça (BM), bico de ouro (BO), catenga (CA), cavalo preto (CP), fígado de galinha (FG), fogo na serra (FS), favita (FV), jalo (JL), lajes (LA), leite (LT), mulatinho vagem roxa (MR), mulatão (MT), preto mulatinho vagem branca (PM), rosinha (RO), rim de porco (RP), riqueza (RQ) e rosado (RS).

O material coletado foi embalado, identificado e enviado para o Laboratório de Análise de Sementes da Embrapa Tabuleiros Costeiro, Unidade de Execução de Pesquisa e Desenvolvimento (UEP) em Rio Largo/AL para avaliação fisiológica. Foram realizados os testes descritos abaixo:

#### *Teor de umidade e peso de mil sementes*

Previamente às avaliações, foram separadas e eliminadas as sementes com defeitos visíveis, mal formadas e chochas. Determinou-se o teor de água das sementes de acordo com o método da estufa à 105 °C por 24 horas, conforme as Regras para Análise de Sementes (Brasil, 2009), com 2 repetições de 25 sementes para cada variedade.

Determinou-se o peso de mil sementes, tomando-se o peso de oito repetições de cem sementes e calculando-se a variância, o desvio padrão e o coeficiente de variação das pesagens conforme descrito em Brasil (2009). Tais mensurações foram realizadas com o auxílio de uma balança analítica com precisão de 0,0001g.

#### *Germinação e qualidade fisiológica*

O teste de germinação foi conduzido seguindo as recomendações de Brasil (2009). O experimento foi disposto em delineamento inteiramente casualizado, com dezenove tratamentos (variedades) e quatro repetições, sendo a parcela representada pelo rolo de papel contendo 50 sementes. As sementes foram previamente desinfetadas por imersão em solução de hipoclorito de sódio a 2%, por cinco minutos, seguida de lavagem em água corrente.

Em seguida, as sementes foram postas em papel de germinação tipo “germitest” umedecido com água destilada (2,5 vezes o peso do papel) de modo a formar rolos de papel (duas camadas abaixo das sementes e uma acima). Os rolos foram envoltos em sacos plásticos transparentes para diminuir a perda de água e encaminhados para acondicionamento em câmara de germinação tipo Mangelsdorf regulada à temperatura constante de 25 °C, com fotoperíodo constante.

Realizou-se contagem diária da germinação, com reumedecimento do substrato quando necessário, considerando germinadas as sementes que formaram plântulas normais, ou seja, aquelas com todas as suas estruturas essenciais (um par de folhas, hipocótilo, epicótilo e raiz primária). Assim, foram determinadas as porcentagens de germinação (primeira contagem e final, respectivamente ao 5° e 9° dia) e o tempo médio de germinação (TMG), conforme Labouriau (1983) e, o índice de velocidade de germinação (IVG), conforme Maguire, (1962).

As plântulas normais oriundas do teste de germinação foram submetidas a medições de comprimento da parte aérea e raiz com o auxílio de régua graduada (mm), efetuando em seguida o cálculo para obtenção da média de cada parcela. Todas as partes aéreas e todas as raízes de cada parcela foram colocadas em sacos de papel tipo kraft e levadas à estufa a 80 °C por 72 horas com posterior pesagem em balança analítica (0,0001 g) para determinação da massa seca. Em seguida efetuou-se a divisão pela quantidade de plântulas que haviam no saco de papel para determinação da massa por plântula. Foi ainda realizada a soma das partes (parte aérea + raiz) para compor o comprimento total e a massa seca total por plântula.

Realizou-se também, para avaliação do vigor, o teste de condutividade elétrica com quatro repetições de 25 sementes para cada variedade, pesadas e acondicionadas em copos plásticos descartáveis (300 mL) contendo 75 mL de água deionizada. Os copos foram acondicionados em câmara tipo B.O.D. à 25 °C por 24 horas. Decorrido o tempo de

embebição, a condutividade elétrica foi determinada com o auxílio de um condutivímetro de bancada. Os resultados foram expressos em  $\mu\text{S}/\text{cm}/\text{g}$  de sementes.

#### Análise estatística

Os dados obtidos foram submetidos à análise de variância (ANAVA) e teste de Scott-Knott a 5% de significância para comparação das médias. Os valores de germinação foram previamente transformados pelo sistema Box-Cox, sendo apresentados os dados originais. Para todas as análises foi utilizado o programa estatístico Sisvar® (FERREIRA, 2000).

#### IV. RESULTADOS DA ANÁLISE DA QUALIDADE FISIOLÓGICA DAS SEMENTES ESTUDADAS

A partir das análises em laboratório pôde-se constatar que o teor médio de água das sementes de feijão-fava apresentou uma variação de 3,75% entre a menor e a maior média (10,00 a 13,75%) para as diferentes variedades estudadas (Tabela 1). Bertolin et al. (2011), trabalhando com diferentes cultivares de feijão comum, observaram teores de água da ordem de 11,45 a 13,85%.

O teor de água inicial das sementes é fator importante para que se haja um padrão dos testes de avaliação da qualidade fisiológica. Ressalta-se que um teor elevado de água pode resultar em interferências no desempenho das sementes nos testes (Coimbra et al., 2007).

Marcos Filho et al. (1987) comentaram que quanto maior o teor de água das sementes, maiores serão os efeitos prejudiciais para testes de vigor, principalmente para a condutividade elétrica. Em relatos de AOSA (1983) observa-se que teores de água menores ou iguais a 10% e maiores ou iguais a 17% apresentam bastante influência nos resultados de condutividade elétrica, sendo necessário o ajuste da umidade das sementes para uma faixa de teor de água compreendida entre esses valores.

Alves e Lin (2003) encontraram resultados satisfatórios para germinação e vigor em sementes com teores de água em 11% para diferentes tipos de embalagens de armazenamento. Porém, em condições de armazenamento semelhantes aos encontrados para as sementes avaliadas neste trabalho, sugere-se um teor de água ideal para armazenamento na ordem 9% (Popinigis, 1985).

Para as diferentes variedades estudadas observou-se variação em relação ao comprimento, largura e espessura das sementes, variando de 6,981 a 15,832 mm, 3,942 a 7,618 mm e de 2,970 a 5,678 mm, respectivamente. Os valores encontrados para desvio padrão evidenciam diferentes tamanhos de sementes para o mesmo lote (tabela 1). Soares Jr et al. (2012), trabalhando com sementes crioulas de feijão comum verificaram que o comprimento,

largura e espessura das sementes variaram de 8,77 a 13,84 mm, 5,74 a 6,98 mm e de 4,29 a 5,39 mm, respectivamente, sendo as médias encontradas semelhantes para os dois trabalhos.

É interessante destacar que este resultado é um indicativo da qualidade das sementes, bem como nos permite gerar informações para calcular a densidade de semeadura (Brasil, 2009). Além de serem fundamentais para a definição da forma da semente e seu grau de achatamento (Puerta Romero, 1961).

Para o peso de 1000 sementes obteve-se uma variação de 338,93 g entre a menor e a maior média encontrada, sendo a menor 62,91 g e a maior 401,84 g, com valor médio de 231,05 g (tabela 1). Percebe-se uma considerável variação para esta variável, o que demonstra certa heterogeneidade entre as dimensões das sementes dos lotes em estudo. Em seus trabalhos com diferentes variedades comerciais de feijão comum, Mambrin et al. (2015) apresentaram valores médios de 231,30 g para o peso de 1000 sementes, com variações entre 201,79g (menor peso) e 313,00 g (maior peso), ou seja, variação média de 111,21 g, o que indica uma maior homogeneidade nos lotes estudados por estes autores.

De acordo com Coelho et al. (2007), diferentes condições ambientais pouco influenciam as variações nos valores de peso de mil sementes para cada variedade avaliada, sendo, portanto, tal característica, uma das principais na separação entre diferentes variedades de feijão. Porém, condições de altas temperaturas na época de reprodução da espécie podem afetar de forma negativa tal variável, havendo a manutenção do peso de mil sementes para variedades tolerantes a esta condição e decréscimo para os genótipos menos tolerantes (Hoffmann Junior et al., 2007).

Com relação à qualidade fisiológica, no que se refere à porcentagem de germinação, as variedades azuk, mulatão, preto mulatinho vagem branca e rim de porco foram as que apresentaram as maiores médias dentre as variedades crioulas aqui estudadas, não diferindo entre si ( $p \leq 0,05$ ), tendo valores iguais ou superiores a 97% de sementes germinadas (plântulas normais) (Tabela 2).

Segundo Brasil (2013), a germinação mínima para que um lote de sementes esteja apto para comercialização é 70% para sementes básicas e 80% para sementes certificadas (C1 e C2) ou não certificadas (S1 e S2) de primeira e segunda geração. Sendo assim, com exceção das variedades bico de ouro, favita e jalo, todas as variedades do lote estudado estariam aptas para a comercialização, se considerado apenas este teste, uma vez que atenderam às porcentagens mínimas exigidas legalmente.

Quanto ao teste de primeira contagem, as variedades azuk e mulatinho vagem roxa não diferiram entre si pelo teste de comparação de média ( $p \leq 0,05$ ), mas de todas as demais. Ainda neste mesmo teste, as variedades beijo de moça, catenga, cavalo preto, fígado de galinha, fogo na serra, jalo e lajes não apresentaram germinação até o momento da contagem, não sendo, portanto, incluídas no teste de comparação de médias para esta variável (Tabela 2).

Bertolin et al. (2011), em trabalho com variedades comerciais de feijão comum, encontraram resultados superiores e na ordem de 98,53 a 100% de germinação para o teste de primeira contagem, o que evidencia uma inferioridade, para esse teste de vigor, na qualidade das sementes aqui estudadas.

Na tabela 2 onde são observados os resultados médios do índice de velocidade de germinação (IVG) verifica-se que a variedade azuk apresentou o maior resultado (15,94), diferindo das demais no teste de comparação de média ( $p \leq 0,05$ ), sendo, portanto, a variedade com maior germinação média diária. Entretanto, Bertolin et al. (2011) encontraram valores na ordem de 19,50 a 20,00 para variedades comerciais, evidenciando, também, uma inferioridade para este teste de vigor nas sementes aqui estudadas.

Pôde-se observar que para o tempo médio de germinação (TMG) as variedades estudadas variaram na ordem de 3,18 dias para o menor e 8,5 dias para o maior tempo médio de germinação. A variedade azuk apresentou o menor resultado (3,18 dias), diferindo das demais no teste de comparação de média ( $p \leq 0,05$ ), sendo, por sua vez, a variedade que germinou mais rapidamente. Em trabalho com variedade comercial de feijão comum Souza et al. (2015) encontraram valores médios de 4 dias este teste, o que denota grande diferença para os resultados médios aqui encontrados.

Para o teste de condutividade elétrica, ainda na tabela 2, a variedade bico de ouro apresentou a maior média, ou seja, provavelmente sua estrutura interna estava consideravelmente danificada com relação às demais variedades estudadas. Os resultados deste teste corroboram com os resultados dos demais testes de vigor e germinação, uma vez que, mesmo para as variedades com menores leituras de condutividade elétrica os índices indicam baixos níveis de vigor, o que pode ser resultado de um processo de deterioração dessas sementes.

É importante ressaltar que as sementes utilizadas neste experimento encontravam-se armazenadas em garrafas PET's e apresentavam teores de água variando de 10,00 a 13,75% (tabela 1), porém, como já dito por Popinigis (1985), nestas condições de armazenamento o teor de água

ideal é na ordem de 9%, podendo isto ser uma possível causa que justifique tais resultados.

Com relação à avaliação das plântulas, os dados relativos ao comprimento da parte aérea apresentaram médias variando de 5,46 a 15,24 cm. Quanto às médias de comprimento de raiz, a variação esteve entre 5,60 a 13,16 cm e as médias de comprimento total (parte aérea + raiz) variaram de 10,05 a 26,83 cm. Puderam-se verificar os maiores valores para as médias da variedade bico de ouro, com 15,24 cm, 11,59 cm e 26,83 cm para comprimento da parte aérea, raiz e total, respectivamente (Tabela 3).

Para os dados de massa de matéria seca total as variações entre as médias das diferentes variedades foram da ordem de 0,0140 a 0,0978 g (fig. 1). A análise dos dados permitiu constatar que as variedades jalo e favita apresentaram a maiores médias com valores de 0,0978 e 0,0957 g para massa de matéria seca total, respectivamente. Esses resultados mostraram diferença significativa quando comparadas às demais variedades avaliadas ( $p \leq 0,05$ ).

A variedade azuk apresentou a menor média para esta variável (0,0140 g), diferindo isoladamente das demais. Em porcentagem, a diferença entre a menor e a maior média encontrada foi da ordem de 85,69% para massa da matéria seca total.

Souza et al. (2015), em trabalho com variedade comercial de feijão comum, observaram valores médios de 23,4 cm para comprimento de parte aérea e 12,9 cm para comprimento de raiz. Para massa de matéria seca total estes observaram valores médios de 0,85 g. Tais valores médios são bastante superiores aos encontrados neste estudo.

Além da baixa qualidade dos lotes estudados, o genótipo pode ter influenciado nos resultados apresentados para esta variável, uma vez que, sementes de diferentes tamanhos apresentam, conseqüentemente, diferentes quantidades de conteúdos de reserva, podendo isso corroborar com o desempenho germinativo (Marcos Filho, 2015). É interessante, também, ressaltar que cada variedade possui sua especificidade genética e, portanto, pode, por natureza, apresentar resultados específicos para cada uma.

Os estudos referentes ao potencial das sementes devem receber grande importância, uma vez que estes fatores são pontos determinantes à produção, armazenamento e comercialização da espécie (Nobre et al., 2012). Segundo Kappes et al. (2012), os efeitos danosos sobre a qualidade das sementes, em geral, são evidenciados pelo decréscimo na porcentagem de germinação, aumento de plântulas anormais e redução do vigor das mesmas. Portanto, o uso

de sementes de qualidade é parte fundamental para o estabelecimento adequado de uma lavoura.

Tais testes de vigor, consoante ao teste de germinação, possibilitam ao produtor uma aferição mais detalhada da qualidade dos lotes a serem utilizados na implantação da

cultura. Os resultados aqui apresentados demonstram uma qualidade pouco considerável em relação ao que se espera para os níveis de qualidade de semente que resultem no sucesso de uma lavoura quanto à produtividade.

Tabela 1: Médias de teor de água (TA) e peso de mil sementes (P 1000) de sementes de cultivares crioulas de feijão comum (*Phaseolus vulgaris L.*) produzidas no médio sertão alagoano.

| VARIEDADES                   | VARIÁVEIS |            |
|------------------------------|-----------|------------|
|                              | TA (%)    | P 1000 (g) |
| azuk                         | 11,17     | 62,91      |
| mulatinho vagem roxa         | 13,75     | 168,52     |
| bico de ouro                 | 13,33     | 207,70     |
| leite                        | 12,08     | 209,52     |
| mulatão                      | 12,06     | 210,81     |
| preto mulatinho vagem branca | 11,04     | 194,61     |
| riqueza                      | 11,39     | 207,74     |
| favita                       | 11,42     | 327,89     |
| boi deitado                  | 11,75     | 230,27     |
| rosinha                      | 11,36     | 218,95     |
| rim de porco                 | 10,77     | 213,74     |
| rosado                       | 11,75     | 173,55     |
| lajes                        | 10,98     | 178,78     |
| fogo na serra                | 11,59     | 298,70     |
| beijo de moça                | 11,45     | 401,84     |
| catenga                      | 11,88     | 262,37     |
| fígado de galinha            | 11,24     | 248,49     |
| cavalo preto                 | 10,61     | 318,69     |
| jalo                         | 10,00     | 254,92     |
| Média                        | 11,56     | 231,05     |

Fonte: Os autores.

Tabela 2: Valores médios de primeira contagem (PC), germinação (G), índice de velocidade de germinação (IVG), tempo médio de germinação (TMG) e teste de condutividade elétrica (CE) de sementes de cultivares crioulas de feijão comum (*Phaseolus vulgaris L.*) produzidas no médio sertão alagoano.

| VARIEDADES                   | VARIÁVEIS |   |                |     |            |    |      |   |        |   |
|------------------------------|-----------|---|----------------|-----|------------|----|------|---|--------|---|
|                              | 1ª C      |   | Germinação (%) | IVG | TMG (dias) | CE |      |   |        |   |
| azuk                         | 100,00    | a | 100,00         | a   | 15,94      | a  | 3,18 | a | 78,25  | d |
| mulatinho vagem roxa         | 76,00     | a | 82,50          | d   | 8,14       | b  | 5,08 | b | 71,37  | d |
| bico de ouro                 | 35,50     | b | 79,00          | d   | 6,99       | d  | 5,74 | c | 117,83 | a |
| leite                        | 33,50     | b | 88,00          | c   | 7,70       | c  | 5,80 | c | 103,60 | b |
| mulatão                      | 27,50     | b | 99,00          | a   | 7,70       | c  | 6,62 | e | 70,77  | d |
| preto mulatinho vagem branca | 27,00     | b | 97,50          | a   | 8,10       | b  | 6,17 | d | 82,47  | c |
| riqueza                      | 17,00     | c | 94,50          | b   | 7,33       | c  | 6,61 | e | 67,83  | e |
| favita                       | 14,50     | c | 79,00          | d   | 6,66       | d  | 5,99 | d | 64,77  | e |
| boi deitado                  | 10,00     | c | 81,00          | d   | 6,84       | d  | 6,00 | d | 65,53  | e |
| rosinha                      | 5,50      | d | 86,00          | c   | 6,34       | e  | 6,92 | f | 93,07  | c |
| rim de porco                 | 7,50      | d | 97,00          | a   | 7,40       | c  | 6,67 | e | 62,59  | e |
| rosado                       | 3,50      | d | 93,50          | b   | 6,64       | d  | 7,18 | f | 84,60  | c |
| lajes                        | *         |   | 92,00          | b   | 6,14       | e  | 7,64 | g | 79,38  | d |
| fogo na serra                | *         |   | 91,00          | b   | 5,64       | f  | 8,16 | h | 60,01  | e |
| beijo de moça                | *         |   | 89,00          | c   | 5,49       | f  | 8,12 | h | 74,03  | d |
| catenga                      | *         |   | 86,00          | c   | 5,78       | f  | 7,55 | g | 65,67  | e |
| fígado de galinha            | *         |   | 86,00          | c   | 5,74       | f  | 7,58 | g | 88,49  | c |
| cavalo preto                 | *         |   | 86,00          | c   | 5,09       | f  | 8,50 | i | 94,06  | c |
| jalo                         | *         |   | 79,00          | d   | 5,68       | f  | 6,98 | f | 88,22  | c |
| CV (%)                       | 14,44     |   | 14,21          |     | 5,79       |    | 2,84 |   | 9,72   |   |

Médias seguidas de mesma letra, na coluna, não diferem entre si pelo teste de Scott-Knott a 5% de probabilidade.

\* variedades não apresentaram germinação até o momento da contagem.

Fonte: Os autores.

Tabela 3: Valores médios, por plântulas, de comprimento da parte aérea (CPA/pl), raiz (CR/pl) e total (CP/pl) para diferentes cultivares crioulas de feijão comum (*Phaseolus vulgaris L.*) produzidas no médio sertão alagoano.

| VARIEDADES                   | VARIÁVEIS   |           |            |   |       |   |
|------------------------------|-------------|-----------|------------|---|-------|---|
|                              | CPA/pl (cm) | R/pl (cm) | CT/pl (cm) |   |       |   |
| azuk                         | 5,46        | f         | 10,05      | c | 10,05 | i |
| mulatinho vagem roxa         | 11,69       | c         | 11,19      | b | 22,88 | c |
| bico de ouro                 | 15,24       | a         | 11,59      | a | 26,83 | a |
| leite                        | 12,66       | c         | 11,28      | b | 23,93 | c |
| mulatão                      | 10,50       | d         | 10,02      | c | 20,52 | e |
| preto mulatinho vagem branca | 13,64       | b         | 9,29       | d | 22,93 | c |
| riqueza                      | 12,49       | c         | 9,33       | d | 21,82 | d |

|                   |       |   |       |   |       |   |
|-------------------|-------|---|-------|---|-------|---|
| favita            | 11,90 | c | 13,16 | a | 25,06 | b |
| boi deitado       | 12,26 | c | 12,32 | a | 24,58 | b |
| rosinha           | 10,58 | d | 9,04  | d | 19,62 | e |
| rim de porco      | 12,35 | c | 12,73 | a | 25,08 | b |
| rosado            | 11,79 | c | 8,56  | d | 20,35 | e |
| lajes             | 11,01 | d | 8,36  | d | 19,37 | e |
| fogo na serra     | 8,50  | e | 8,43  | d | 16,92 | f |
| beijo de moça     | 6,22  | f | 6,55  | e | 12,78 | h |
| catenga           | 11,78 | c | 9,71  | c | 21,49 | d |
| fígado de galinha | 7,81  | e | 6,63  | e | 14,44 | g |
| cavalo preto      | 7,87  | e | 5,60  | e | 13,47 | h |
| jalo              | 10,09 | d | 10,53 | c | 20,62 | e |
| CV (%)            | 5,52  |   | 7,97  |   | 5,05  |   |

Médias seguidas de mesma letra, na coluna, não diferem entre si pelo teste de Scott-Knott a 5% de probabilidade.

Fonte: Os autores.

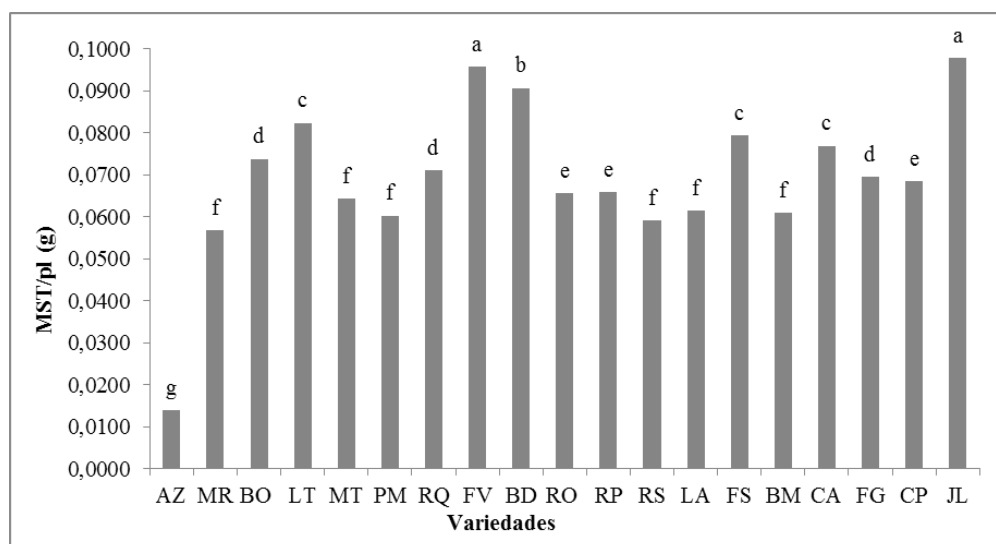


Fig. 1: Valores médios de massa da matéria seca total por plântulas de diferentes cultivares crioulas de feijão comum (*Phaseolus vulgaris* L.) produzidas no sertão alagoano (Santana do Ipanema, AL, 2016). azuk (AZ), mulatinho vagem roxa (MR), bico de ouro (BO), leite (LT), mulatão (MT), preto mulatinho vagem branca (PM), riqueza (RQ), favita (FV), boi deitado (BD), rosinha (RO), rim de porco (RP), rosado (RS), lajes (LA), fogo na serra (FS), beijo de moça (BM), catenga (CA), fígado de galinha (FG), cavalo preto (CP), Jalo (JL).

Médias seguidas de mesma letra, na coluna, não diferem entre si pelo teste de Scott-Knott a 5% de probabilidade. Coeficiente de variação (CV) apresentado é 5,62%.

Fonte: Os autores.

## V. CONSIDERAÇÕES FINAIS

As sementes crioulas desempenham papel importante para o desenvolvimento da agricultura familiar no estado de Alagoas, além de representar papel fundamental na produção de grãos local. A luta campesina é fator importante no que refere a manutenção das sementes crioulas no estado.

Os lotes estudados apresentam diferenças na capacidade germinativa e vigor das sementes. Considerando os padrões estabelecidos para as cultivares comerciais, os lotes das sementes das variedades crioulas estudadas encontram-se com baixos níveis de vigor e potencial de germinação, ou seja, baixa qualidade fisiológica.



Os resultados das análises fisiológicas das sementes apresentam dados preocupantes ao demonstrarem uma baixa qualidade destas. Tal fato, evidencia, sobretudo, as condições de manejo e armazenamento precários, sob o ponto de vista ideal, em que estas sementes deveriam ser armazenadas.

## REFERÊNCIAS

- [1] Advíncula, T. L. et al. (2015). Qualidade física e fisiológica de sementes de *Phaseolus lunatus* L. *Brasileira de Ciências Agrárias*, 10(3), 341-346.
- [2] Alagoas. Lei nº 6.903, de 3 de janeiro de 2008. Dispõe sobre a criação do Programa Estadual de Bancos Comunitários de Sementes e dá outras providências. *Diário Oficial do Estado de Alagoas*, Maceió, AL, 4 jan. 2008. Disponível em: [http://www.iteral.al.gov.br\\_legsilacao\\_lei\\_sementesalagoas.pdf](http://www.iteral.al.gov.br_legsilacao_lei_sementesalagoas.pdf). Acesso em: 16 out. 2020.
- [3] Alves, A. C. & Lin, H. S. (2003). Tipo de embalagem, umidade inicial e período de armazenamento em sementes de feijão. *Scientia Agraria*, 4(1-2), 21-26.
- [4] Antonello, L.M. et al. (2009). Influência do tipo de embalagem na qualidade fisiológica de sementes de milho crioulo. *Brasileira de Sementes*, 31(4), 75-86.
- [5] Association of Official Seed Analysts. (1983). *Seed vigor testing handbook*. East Lansing. 88p.
- [6] Bertolin, D. C., Sá, M. E., Moreira, E. R. (2011). Parâmetros do teste de envelhecimento acelerado para determinação do vigor de sementes de feijão. *Revista Brasileira de Sementes*, 33(1), 104-112.
- [7] Brasil. (2013). Ministério da Agricultura, Pecuária e Abastecimento. Padrões para a produção e comercialização de sementes de feijão (*Phaseolus vulgaris* L.). Anexo XI da Instrução Normativa nº 45, de 17 de setembro de 2013. Brasília: MAPA.
- [8] Brasil. (2009). Ministério da Agricultura, Pecuária e Abastecimento. Regras para Análise de Sementes. Brasília: MAPA.
- [9] Carbonell, S. A. M. et al. (2010). Tamanho de grão comercial em cultivares de feijoeiro. *Ciência Rural*, 40(10), 2067-2073.
- [10] Catão, H. C. R. M. et al. (2013). Incidência e viabilidade de sementes crioulas de milho naturalmente infestadas com fungos em pré e pós-armazenamento. *Ciência Rural*, 43(5), 764-770.
- [11] COELHO, C. M. M. et al. (2007). Diversidade genética em acessos de feijão (*Phaseolus vulgaris* L.). *Ciência Rural*, 37(5), 1241-1247.
- [12] Coimbra, R. A. (2007). Teste de germinação com acondicionamento dos rolos de papel em sacos plásticos. *Brasileira de Sementes*, 29(1), 92-97.
- [13] CONAB. (2022). Ministério da Agricultura, Pecuária e Abastecimento. Acompanhamento de safra brasileira grãos, Safra 2021/22 - Décimo levantamento. Disponível em: <https://www.conab.gov.br/info-agro/safras/graos/boletim-da-safra-de-graos>. Acesso em: 13 jul. 2022.
- [14] Ferreira, D. F. (2011). Sisvar: a computer statistical analysis system. *Ciência e Agrotecnologia* (UFLA), 35(6), 1039-1042.
- [15] García, A. C. et al. (2011). Prólogo. In: ROCES, Elena Álvarez-Buylla; GARCÍA, Areli Carreón; TELLO, Adelita San Vicente (Orgs.). *Haciendo milpa: la protección de las semillas y la agricultura campesina*. Ciudad de México: Universidad Nacional Autónoma de México.
- [16] Hoffmann Junior, L. et al. (2007). Resposta de cultivares de feijão à alta temperatura do ar no período reprodutivo. *Ciência Rural*, 37(6), 1543-1548.
- [17] KAPPES, C. (2012). Qualidade fisiológica de sementes e crescimento de plântulas de feijoeiro, em função de aplicações de paraquat em pré-colheita. *Pesquisa Agropecuária Tropical*, 42(1), 9-18.
- [18] Labouriau, L.G. *A germinação de sementes*. Washington: OEA, 1983. p. 174.
- [19] Lima, L. G. (2017). *Limites da política de compra e distribuição de sementes em Alagoas*. Disponível em: <http://asaalagoas.blogspot.com/2017/09/limites-da-politica-de-compra-e.html>. Acesso em: 12 de nov. 2020.
- [20] Londres, F. *As sementes da paixão e as políticas de distribuição de sementes na Paraíba*. Rio de Janeiro: AS-PTA, 2014. 83 p.
- [21] Maguire, J.D. (1962). Speed of germination aid in selection and evaluation for seedling emergence and vigor. *Crop Science*, 2(1), 176-177.
- [22] Mambrin, R. B. et al. (2015). Seleção de linhagens de feijão com base no padrão e na qualidade de sementes. *Caatinga*, 28(3), 147-156.
- [23] Marcos Filho, J. (2015). *Fisiologia de sementes de plantas cultivadas*. Londrina, PR: ABRATES. 659 p.
- [24] Marcos Filho, J., Cicero S. M. & Silva, W. R. (1987). *Avaliação da qualidade de sementes*. Piracicaba: FEALQ. 230p.
- [25] Nobre, D. A. C. et al. (2012). Qualidade física, fisiológica e morfológica externa de sementes de dez variedades de feijão-fava (*Phaseolus lunatus* L.). *Brasileira de Biociências*, 10(4), 425-429.
- [26] PATERNIANI, E., NASS, L.L. & SANTOS, M.X. (2000). *O valor dos recursos genéticos de milho para o Brasil: uma abordagem histórica da utilização do germoplasma*. In: UDRY, C.W.; DUARTE, W. (Org.) *Uma história brasileira do milho: o valor dos recursos genéticos*. Brasília: Paralelo 15. p.11-41.
- [27] PAULINO, J. S. & GOMES, R. A. (2015). Sementes da Paixão: agroecologia e resgate da tradição. *Economia e Sociologia Rural*, 53(3), 517- 528.
- [28] PLATERO, G. G. R. et al. (2013). *Bancos comunitarios de semillas criollas: una opción para la conservación de la agrobiodiversidad*. 1. Turrialba: CATIE.
- [29] POPINIGIS, F. *Fisiologia da semente*. Brasília: s.n., 1985. 289p.
- [30] PUERTA ROMERO, J. (1961). *Variedades de judias cultivadas en España*. Madrid: Ministério da Agricultura. 798 p. (Monografias, 11).
- [31] ROCES, E. A. (2011). Comunalidad: imprescindible para la sobrevivencia de la diversidad del maíz campesino. In:

ROCES, Elena Álvarez-Buylla; GARCÍA, Areli Carreón; TELLO, Adelita San Vicente (Orgs.). *Haciendo milpa: la protección de las semillas y la agricultura campesina*. Ciudad de México: Universidad Nacional Autónoma de México.

- [32] SANTOS, M. S. et al. (2017). Sementes crioulas: Sustentabilidade no Semiárido Paraibano. *Agrarian Academy*, 4(7), 404-418.
- [33] SOARES JR et al. (2012). Características físicas, químicas e sensoriais de feijões crioulos orgânico, cultivados na região de Goiânia-GO. *Verde de Agroecologia e Desenvolvimento Sustentável*, 7(3), 109-118.
- [34] SOUZA, J. M. et al. (2015). Qualidade fisiológica de sementes de feijão submetidas a águas residuárias em laboratório. *Brazilian Journal of Biosystems Engineering*, 9(2), 142-150.

## The Challenges of Interdisciplinarity in Graduate Graduation

Luciana Souza de Oliveira<sup>1</sup>, Lucia Marisy Souza Ribeiro de Oliveira<sup>2</sup>, Júlio Jose Torres dos Santos<sup>3</sup>, Andrea Araújo de Aquino<sup>4</sup>, Andrea Reis de Souza Ribeiro<sup>5</sup>, Valmir Nogueira de Souza<sup>6</sup>

<sup>1</sup>Engenheira Agrônoma. Mestra em Fruticultura. Doutora em Desenvolvimento Sócioambiental. Docente do IF Sertão Pernambucano. Docente do Mestrado em Extensão Rural da UNIVASF.

<sup>2</sup>Pedagoga. Mestra em Desenvolvimento Regional. Doutora em Desenvolvimento Sócioambiental. Docente permanente do Mestrado em Extensão Rural e do Doutorado em Agroecologia e Desenvolvimento Territorial da UNIVASF.

<sup>3</sup>Advogado. Mestre em Sociologia. Docente da Universidade do Estado da Bahia. Doutorando em Agroecologia e Desenvolvimento Territorial na UNIVASF.

<sup>4</sup>Assistente Social. Doutoranda em Agroecologia e Desenvolvimento Territorial.

<sup>5</sup>Administradora de Empresas. Especialista em Agricultura com Emissão de Baixo Carbono.

<sup>6</sup>Administrador de Empresas. Especialista em Agricultura com Emissão de Baixo Carbono. Graduando em Engenharia Agrônoma.

Received: 20 Aug 2022,

Received in revised form: 13 Sep 2022,

Accepted: 18 Sep 2022,

Available online: 29 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Interdisciplinarity, traditionality, content integration, postgraduate studies.*

**Palavras – Chave**— *Interdisciplinaridade, tradicionalidade, integração de conteúdos, pós-graduação.*

**Mots-clés**— *Interdisciplinarité, traditionalité, intégration de contenu, études supérieures.*

**Abstract**— *This article aims to raise discussions about interdisciplinarity, particularly in teacher education, in order to present a critical view of the need to develop interdisciplinary actions present in theoretical references and in official normative documents consulted that dialogue with the topic today. Through a bibliographic review, the importance of interdisciplinary training for teachers was brought to light, with the aim of deepening the different types of knowledge in higher education, more specifically in postgraduate courses in public universities, based on the assumption that interdisciplinarity is a concept under construction. The analytical approach of the information collected was qualitative and content analysis was used to interpret the speeches.*

**Resumo**— *O presente artigo tem como objetivo levantar discussões sobre a interdisciplinaridade, particularmente na formação docente, de modo a apresentar uma visão crítica sobre a necessidade de desenvolver ações interdisciplinares presentes nos referenciais teóricos e nos documentos oficiais normativos consultados que dialogam com o tema na atualidade. Por meio de revisão bibliográfica, foi trazida para reflexão a importância da formação interdisciplinar para os docentes, com o intuito de aprofundar os diferentes tipos de conhecimento no ensino superior, mais especificamente nos cursos de pós-graduação nas universidades públicas, partindo do pressuposto de que interdisciplinaridade é um conceito em construção. A abordagem analítica das informações coletadas foi qualitativa e utilizou-se a análise de conteúdo para interpretação dos discursos.*

**Resumée**— *Cet article vise à susciter des débats sur l'interdisciplinarité, notamment dans la formation des enseignants, afin de présenter un regard*

*critique sur la nécessité de développer des actions interdisciplinaires présentes dans les références théoriques et dans les documents normatifs officiels consultés qui dialoguent avec le sujet aujourd'hui. À travers une revue bibliographique, l'importance de la formation interdisciplinaire pour les enseignants a été mise en évidence, afin d'approfondir les différents types de connaissances dans l'enseignement supérieur, plus spécifiquement dans les cours de troisième cycle dans les universités publiques, en partant de l'hypothèse que l'interdisciplinarité est un concept en construction. L'approche analytique des informations recueillies a été qualitative et l'analyse de contenu a été utilisée pour interpréter les discours.*

## I. A LITTLE HISTORY: from disciplinarity to transdisciplinarity

The movement for interdisciplinarity in the teaching-learning process in educational institutions emerged in the mid-1960s in Europe as a reaction of teachers and students who, uncomfortable with the specialization and fragmentation of knowledge, defended a teaching connected with social reality, based on a curriculum that had as main objective the social transformation and the critical formation of the collective subject, autonomous and concerned with the problems of society.

From this perspective, the disciplines and their contents should integrate and interact with each other, to give meaning to what is taught and learned, considering that in today's world the priority function of the teacher is to help the student to think, to question, to read the reality of the world and build their own opinions, exploring with them other learning environments with other teachers from other areas and with non-academic professionals. This is called interdisciplinary behavior, idealized by the Frenchman Georges Gusdorf (1952).

On curriculum, an important contribution is made by Menezes and Araújo (2008:14), who approaches the theme in a contextualized way, where information related to regional and local issues that were obscured throughout history, come to have greater prominence, in the understanding that it is from the knowledge of the social, economic, political and cultural needs of each space, that it is possible to improve the situation of the people who live there.

Such views coincide with that of the National Curriculum Research Center – CENPEC – in stating that the university needs to “teach the contents and skills necessary for the individual's participation in society. [...] lead the student to understand the reality of which he is a part, situate himself in it, interpret it and contribute to its transformation” (CENPEC apud SILVA, 2018:44).

In Brazil, interdisciplinarity was first discussed in the 1970s by the researcher Hilton Japiassú (1976: 74-75), through his book “Interdisciplinarity and Pathology of Knowledge,” whose work indicated interdisciplinarity as a tool capable of overcoming the disciplinary boundaries, combat the fragmentation of knowledge and contribute to the solution of difficulties related to teaching and research. Subsequently, as his disciple, Ivani Fazenda (1979:39), began to stand out for the numerous productions on the subject, defining interdisciplinarity as “a relationship of reciprocity, of mutuality, a regime of co-ownership capable of enabling dialogue among those interested” For her, a work that is interdisciplinary requires an engaged team that can dialogue and contribute with information about the different contents of the disciplines and assumes a reciprocity between its participants, that is, it depends on attitudes of humility, openness, collaboration, solidarity, because:

- a) interdisciplinarity leads to an exercise of knowledge: asking and doubting;
- b) interdisciplinarity develops from the development of the disciplines themselves.

Another author who has dedicated herself to this discussion is Heloísa Lück (2008:14), in whose work “Interdisciplinary Pedagogy: theoretical-methodological foundations”, states that interdisciplinarity presupposes more than the interaction between two or more disciplines. She says:

(...)  
interdisciplinarity intends to overcome the fragmentation of knowledge and, for that, it needs an overall vision to establish coherence in the articulation of

knowledge (...) In fact, this awareness is not restricted to teaching. It manifests itself in multiple areas of human activity (LUCK, 2008:14).

From these considerations, it is easy to conclude that the University, in its graduate courses, needs to adopt a more dialogic posture between individuals and the various areas of knowledge, which increasingly demand interdisciplinary knowledge. More specialized knowledge has contributed a lot and still contributes to a better quality of life, but they need to advance in procedural innovations, transferring information from one area to another, generating new knowledge and thus, training professionals with holistic profiles.

CAPES, through the evaluation committee of its programs, unfavorably recommends those that present:

- proposals that show a simple juxtaposition of two or more areas of knowledge;
- a meeting of researchers who remain working in watertight compartments;
- curricular structure containing subjects that cover different subjects, in a

superficial and isolated way, evidencing an encyclopedic training (AVALAÇÃO, 2003; 2016;2017;2019).

On the contrary, according to the Multidisciplinary Committee (ASSESSMENT, 2019:4), an interdisciplinary program must:

- be characterized by an integrative proposal, with areas of concentration indicating the focused objectives;
- present a faculty with diversified disciplinary training, but consistent with the areas of concentration, lines or integrative research projects;
- present a curricular structure appropriate to the students' training, with subjects coherent with the areas of concentration, evidencing the construction of integrative lines of research;
- present a faculty with experience, competence and scientific productivity in their

respective disciplines of origin, with experience in multidisciplinary research,

while respecting the parameters of academic production in each of the areas.

As can be seen, interdisciplinarity does not reduce the importance of disciplinary knowledge, nor does it give up its theoretical-methodological basis, however, when the disciplinary language is no longer able to provoke the interaction between the knowledge of the various disciplines created by modern science, multidisciplinary, pluridisciplinarity, interdisciplinarity and transdisciplinarity emerge gradually (FAZENDA, 2008:37).

In Multidisciplinary, a subject is studied from the perspective of several disciplines simultaneously. For example, a painting by Tarsila do Amaral can be studied by the history of art, by modernism, by colors, by geometry, and, in this case, the scholars are not together, therefore, it is a multidisciplinary study, not an interdisciplinary one. , because the conclusions that each scholar arrives at are their own, there is no collaboration between them and the information is not modified or enriched. The theme territorial development can be approached by geography, by economics, by anthropology, by sociology, by the sciences agriculture and others, however if such approaches are made in isolation, it fits into this modality, as it does not change the logic that each professional in each of these areas has on the subject.

In Pluridisciplinarity, cooperation between the disciplines involved in the study of an object is already observed, although the views of each participant remain unchanged. In this case, Magalhães (2005), does not differentiate between multidisciplinary and pluridisciplinarity. For the author, disciplinarity is considered multi or pluri, when more than one teacher works on a common theme at the same time. It exemplifies the fact with the theme “the great navigations”, which can be worked by the mathematics teacher, the geography teacher and the literature teacher. The first “can show how important the use of geometry is for the construction of caravels or even for the practice of navigation”; the second can show “the evolution of cartography”; and, the last one, can “deal with the vast literary production on the subject.” Therefore, there is multi and multidisciplinary when several disciplines work “together” for some time (MAGALHÃES, 2005:29).

It is important here, for greater understanding, to bring some conceptualizations of discipline. The word discipline comes from Latin and can be translated by at least three meanings, according to “Le Dictionnaire du Français” (HACHETTE apud KORTE, 2000:26):

- particular domain of knowledge; teaching subject;
- set of rules imposed on the members of a collectivity to ensure the proper

functioning of the social organization; obedience to these rules and

- rule of conduct that the individual imposes.

For Maheu (2000:2-3), discipline – from an epistemological point of view – means:

“Structured domain of knowledge that has its own object of study, a conceptual scheme, a specialized vocabulary, and also a set of postulates, concepts, particular phenomena, methods and laws. A specific set of knowledge that has its own characteristics in terms of teaching, formulation, methods and subjects” (LEGENDRE apud MAHEU, 2000, p. 2-3).

Interdisciplinarity takes a step forward in the process, producing knowledge through theoretical and methodological exchanges, generating new concepts and methodologies, with the objective of understanding complex phenomena, “being, therefore, the convergence of two or more areas of knowledge, not belonging to the same class, that contribute to advancing the frontiers of science and technology [...]” (CAPES, 2017:1).

In the same direction, Araújo (2014); Nisenbaum; Pinheiro (2016), define interdisciplinarity as “dialogical doing”, where concepts from other areas are re-signified and dialogues allow the construction of knowledge, which can be both individual, when the researcher works in different areas, and collective, when researchers from different areas of knowledge develop studies and research in collaboration to provide answers to society's problems.

The term interdisciplinarity should be used to designate “the level at which the interaction between

various disciplines or heterogeneous sectors of the same science leads to real interactions, to a certain reciprocity in exchange, leading to mutual enrichment”. The interdisciplinary approach seeks original concepts, methods and theoretical structures through the agglutination of concepts, methods and theoretical structures from different disciplines (ROGERS and RIZZO, 2006).

The interdisciplinary approach, therefore, depends on the theoretical-methodological progress of each of the sciences involved and on the preparation of professionals in the domain of their area of expertise. Without this, there is a risk of the superficiality of the approach, without reflection and without the due contribution to the formulation of new concepts and new knowledge. Since the 1990s of the last century, Santos (1995:38) has already pointed out that, in Education, interdisciplinarity should be seen “as a cooperative form of work to replace individualistic procedures”, since the integration of knowledge between the different areas responds to the demand of today's society, which requires – from students of higher education and postgraduate courses – the search for knowledge that goes against a fragmented knowledge, employed by separate disciplines.

For the Paulo Freire Institute (2005), the methodology of an interdisciplinary work implies: “1st - content integration; 2nd - move from a fragmentary conception to a unitary conception of knowledge; 3rd - overcoming the dichotomy between teaching and research, considering study and research, based on the contribution of different sciences; 4th - teaching-learning centered on a vision that we learn throughout our lives.”

It is the search for universal knowledge, which is not divided into several fields, as Fazenda (2005: 26) rightly states. With the same understanding, Nicolescu (2005:18) states that if there is interdisciplinarity, there is a transfer of methods from one discipline to another, and this occurs in the following degrees:

Degree of application: the methods of nuclear physics are transferred to medicine and this leads to the emergence of new treatments for cancer, through nuclear medicine;

Transdisciplinarity, on the other hand, is concerned with what is between disciplines, across different disciplines, and beyond all disciplines. Its goal is to find the unity of knowledge, within a total system, without any boundary between disciplines (NICOLESCU, 2005:8). According to this author, transdisciplinarity is fueled by disciplinary research and its pillars are:

- A. The multiple levels of reality;

B. Middle logic included and

C. Complexity, which determine the methodology of transdisciplinary research.

It is a form of self-transformation that allows the creation of a new art of living in society (NICOLESCU, 2005:9).

As Santos (1995) explains in the Interdisciplinary Letter:

“(…) transdisciplinarity brings out, from the confrontation of disciplines, new data that articulate them among themselves and that give us a new vision of nature and reality. Transdisciplinarity does not seek the domination of several disciplines, but the opening of all disciplines to what crosses and surpasses them.”

## II. THE CHALLENGES OF INTERDISCIPLINARY EDUCATION IN HIGHER EDUCATION

If in the 20th century the specialization and fragmentation of knowledge was the keynote in the academy, in this 21st century there is no room for the continuity of such a procedure and the trend that presents itself is the application of interdisciplinarity in the teaching-learning processes. Interdisciplinarity, not just as a combination of two or more disciplines to better understand or address a particular issue or problem, but as an approach that allows the emergence of new points of view that go beyond the limits of the disciplines themselves (AUGSBURG, 2016; REPKO, 2008).

The search for knowledge in the wake of time has produced successive fragmentations, and this dismemberment of science and knowledge has generated a distance from totality, without respect for human indivisibility, resulting in researchers and scholars who

know almost everything about almost nothing. Breaking with the traditionalism of higher education in Brazil is not an easy task, as it implies understanding, as stated by Freire (2007: 47), that “teaching is not transferring knowledge, but creating possibilities for its production or construction”, which requires an interdisciplinary behavior and the connection of knowledge.

The academic world is the world of disciplines, where the process of division and stratification in the scientific field is expressed by two worldviews: scientific knowledge and common sense knowledge, with widespread inferiority to popular knowledge, generated by non-schooled traditional populations. This dichotomous view is a mistake, since interdisciplinary knowledge must be a communication between knowledge and knowledge, not a way of neutralizing all the meanings of other disciplines. An interdisciplinary attitude will lead the specialist to know the limitations of his discipline and welcome other disciplines, in an attempt to replace fragmented knowledge with more global knowledge. This gives validity to the knowledge of common sense, because it is through everyday life that we give meaning to our lives (FAZENDA:1996:38).

It is also clear that universities have shown themselves to be fragile in the treatment of interdisciplinarity, as they treat it in a fragmented and non-comprehensive way, which ends up resulting in a waste of financial resources directed to the theme and energy of researchers dedicated to this cause, since they do not able to accomplish what they could or should (RHOTEN, 2004).

The worrying point of this fragmentation is the lack of integration of the content of the various curricular components, in addition to the disarticulation of the academic environment with the social environment, where the student will be inserted as a market professional and the holistic vision to solve socioeconomic issues (SEVERINO, 2008).

For Santos (2005: 28), in this model of rationality, knowledge advances through the specialization and disciplining of scientific knowledge, which makes the scientist a “specialized ignorant”, causing negative effects, since knowledge must seek universal totality, without isolate the place. From this perspective, it is necessary to appropriate several fields of knowledge to answer questions that cannot be answered by a single form of knowledge, and interdisciplinarity is capable of breaking with this fragmentation.

In the view of Fazenda, one of the most respected theorists on the subject (1994:22), “university education should demand an interdisciplinary attitude that

would be characterized by respect for teaching organized by disciplines and by a review of the existing relationships between disciplines and between disciplines. the problems of society”, where interdisciplinarity would not only be a panacea to ensure the evolution of universities, but a point of view capable of exercising an in-depth, critical and healthy reflection on the functioning of the university institution, allowing the consolidation of self-criticism, the development of research and innovation. (FAZENDA, 1994:22).

Within this vision, the author states that interdisciplinarity is not a category of knowledge, but an action that develops from the disciplines themselves, making it evident that it is impossible to reach the propositions listed by her without dealing with the training of educators, considering that the great most teachers come from a disciplinary background (1994:23).

In Gaudêncio Frigotto's analysis (1995:26), interdisciplinarity is imposed by the very way in which “man produces himself as a social being and as a subject and object of social knowledge”. It is based on the dialectical character of social reality, guided by the principle of contradiction, by which reality can be perceived, at the same time, as one and diverse. Something that requires us to delimit the objects of study by demarcating their fields, without, however, fragmenting them. It means that, although the problem to be studied is delimited, we cannot abandon the determined multiplicity and the historical mediations that constitute it.

For interdisciplinary learning to occur, teachers and students need to identify, incorporate and value different perspectives and recreate their own knowledge, understanding and practices on a given topic from the learning acquired with each other, establishing a sense of community to build a final product. (BRADBEER, 1999).

On the relationship between interdisciplinarity and higher education, Isaía (2006:68) points out the challenges of teaching, which are increasingly complex, in the sense of interpellation between the areas of knowledge, which impose on the teacher the need for constant updating and require, above all, interest and motivation on your part, with didactics being the flagship.

However, upon entering higher education, many teachers without training for teaching assume full responsibility for the subjects from the beginning, without the support of more experienced colleagues, nor with institutional spaces aimed at learning to be a teacher, developing many sometimes a feeling of pedagogical loneliness, due to helplessness and unpreparedness, not technical, but pedagogical.

The situation worsens when the same professor develops the same subject for different courses, for which he has no specific training and the question that arises is: how to make the didactic transposition of scientific knowledge to the academic and from this to the professional, when does he not know the field for which he allegedly forms? (ISAIA, 2006:77).

A ready answer to this question does not exist, however, if the anxieties and difficulties in the training and monitoring of professors at the university were in fact resolved, the interdisciplinary experience in different courses could be of fundamental value for the improvement of their teaching. It is also important to consider, as Santos (2004:76) states, the ecology of knowledge, which consists of the production of dialogues between scientific knowledge produced by the university and popular, urban and rural knowledge that exist in society.

If such an understanding is valid for the academy, it is also very relevant for the pattern of economy of this century, where modern high-tech corporations no longer consider Taylorism-Fordism as the only production model to solve their management problems. On the contrary, they are seeking in society, together with the consumers of their products, how to act more effectively, understanding that their organizations are part of a systemic and multidimensional whole, where everyone depends on each other, influencing and being influenced by them, which is why which higher education institutions should use interdisciplinarity in the training of their students (CEZARINO et al, 2019). It allows solving problems and answering questions that cannot be satisfactorily answered by unique approaches or methods (ASHBY; EXTER, 2019).

Interdisciplinarity in management education is a social system that requires the development of complex thinking. Therefore, students should be introduced to a critical and systemic way of thinking, avoiding approaches based on a single discipline (ASHBY; EXTER, 2019). Authors such as Nascimento; Feather-See; Silveira (2008), since 2008, already argued that higher education in universities should be inserted not only in the interdisciplinary discourse, but also in the transdisciplinary one, facing the demands that demand transformations in society. However, building an interdisciplinary team requires effort and dedication, as well as a period of personal adaptability (JACOB, 2015:32).

As Jacob (2015:33) rightly states:

(...) disciplinary approaches are considered islands



of knowledge on certain topics and fail to address larger issues and broader contexts, although they are essential, within specific fields of study, for understanding particular forms of knowledge (JACOB, 2015).

Globalization has determined an inversion in the flow of knowledge. If before, the meaning was from the school to the community, today it is the outside world that invades the school. There is, of course, no need (or possibility) of making a reconversion (CHASSOT, 2000:82).

Closing this topic, we bring Japiassú (1976:74), stating that interdisciplinarity presents itself in the form of a triple protest: against a fragmented knowledge; against the distance between compartmentalized universities and society as a whole; and against the conformism of acquired situations.

For him, the term interdisciplinarity does not have its own concept, because it has several understandings and meanings, but the fundamental thing is that it is characterized by the intensity of exchanges between specialties and by the degree of real integration of the disciplines within the same teaching project. and/or research (JAPIASSÚ, 1976:74). His mentor Georges Gustorf, quoted by Fazenda (1978:8), informs us that the theme of the unity of knowledge already existed among Greek philosophers, patriarchs of pedagogy or paideia, the oldest form of teaching and learning. For the quantitative accumulation of information, the price paid is the dismemberment of intelligence, named by Japiassu (1976:77). of Knowledge Pathology.

### III. CONCLUSIONS

In this article, the main point of reflection was the role of interdisciplinarity in the teaching and learning process and its implications in the current world of extreme complexity, whose solutions to problems require connections of the most varied natures, from the most basic to the most complex contents. of the sciences, be they exact, natural, social, human or others, taking care to clarify that interdisciplinarity does not constitute the negation of disciplinarity nor does it advocate its end, as it essentially depends on it.

Therefore, it is necessary for the teacher to acquire an interdisciplinary training, improving attitudes such as humility, cooperation, sharing, opening up to the other, and building with him the foundation of knowledge, not only to serve society, but to enhance life. The university, as a legitimate place of learning, production and reconstruction of knowledge, is also an environment of life and an instrument of access to democracy and autonomy, but it increasingly needs to accompany the transformations of the interconnected, interdisciplinary and complex society, in order to to exercise a critical reflection on its functioning, to seek viable alternatives for its innovation, which is a great challenge, considering the traditionality that still remains in most public institutions of higher education. In any case, even facing the multiple difficulties, the teacher needs to become a professional with an integrated view of reality, understanding that a deeper understanding of their area of training is not enough to handle the entire teaching process. He also needs to appropriate the multiple conceptual relationships that his area of training establishes with other sciences, making sure that the assumptions of his discipline will always be valued. Increasing dialogue between disciplines is an essential step for the advancement of contemporary knowledge and it is a barrier that needs to be overcome within universities, still very attached to the structures of the past centuries that organized them and which, in a way, still restricts them until today.

### REFERENCES

- [1] ASHBY, I.; EXTER, M. **Designing for interdisciplinarity in higher education: considerations for instructional designers**. TechTrends, v. 63, n. 2, p. 202-208, 2019.
- [2] AUGSBURG, T. **Becoming interdisciplinary: An introduction to interdisciplinary studies**. Dubuque, IA: Kendall/Hunt, 3 ed., 254 p., 2016.
- [3] BRADBEER, J. **Barriers to interdisciplinarity: Disciplinary discourses and student learning**. Journal of Geography in Higher Education, v. 23, n. 3, p. 381-396, 1999.
- [4] CAPES. Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. Documento de área –**Área 45: interdisciplinar**. Brasília: Ministério da Educação, 2019. Disponível em: <https://www.gov.br/capes/pt-br/centrais-de-conteudo/INTERDISCIPLINAR.pdf>.
- [5] CAPES. Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. **Plano Nacional de Pós-Graduação: PNPG 2011-2020**. Brasília,DF:CAPES, 2010. v. 1.
- [6] CAPES. Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. **Avaliação Quadrienal**, 2016.
- [7] CAPES. Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. Documento de área: **Ciências Sociais Aplicadas I**. 2016.

- [8] CAPES. Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. **Requisitos para a apresentação de propostas de cursos novos** (apcn): interdisciplinar. 2016
- [9] CAPES. Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. Relatório de avaliação: interdisciplinar. **Avaliação quadrienal**. 2017
- [10] CEZARINO, L. O.; CORRÊA, H. L. Mensuração da interdisciplinaridade nos cursos de graduação em Administração. **Avaliação**, v. 24, n. 1, p. 174-188, 2019.
- [11] CHASSOT, Attico. **Catalisando transformações na educação**. Ijuí: Editora Unijuí, 2000.
- [12] FAZENDA, I.C.A. **Integração e interdisciplinaridade no ensino brasileiro: efetividade ou ideologia?** São Paulo: Loyola, 1979.
- [13] FAZENDA, I. C. **Interdisciplinaridade: história, teoria e pesquisa**. Campinas: Papirus; 1994.
- [14] FAZENDA, I. C. **Interdisciplinaridade: um projeto em parceria**. São Paulo: Loyola; 1995.
- [15] FAZENDA, I. C. (Org.). **Didática e interdisciplinaridade**. Campinas: Papirus; 1998.
- [16] FAZENDA, Ivani C.A.(Org.). **Práticas interdisciplinares na escola**. 10. ed. São Paulo: Cortez, 2005.
- [17] FAZENDA, Ivani Arantes. **Interdisciplinaridade e transdisciplinaridade na formação de professores**. Revista do centro de educação e letras da UNIOESTE, Foz do Iguaçu, v. 10, n. 01, p. 93-103, 2008.
- [18] FREIRE, P. **Pedagogia da esperança: um reencontro com a pedagogia do oprimido**. 14. ed. Rio de Janeiro: Paz e Terra, 2007.
- [19] FRIGOTTO, Gaudêncio. A interdisciplinaridade como necessidade e como problema nas ciências sociais. In: JANTSCH, Ari Paulo; BIANCHETTI, Lucídio (Orgs.). **Interdisciplinaridade: para além da filosofia do sujeito**. Petrópolis: Vozes, 1995.
- [20] GADOTTI, Moacir. **Perspectivas atuais da educação**. Porto Alegre: Artes médicas, 2000.
- [21] GUSDORF, Georges. **La parole**. Paris, Presses Universitaires de France, 1952.
- [22] GUSDORF, GEORGES. **Projet des Recherche interdisciplinaire dans les sciences humaines**. In: **Les sciences de l'homme sont des sciences humaines**. Univ. de Strasbourg, 1967.
- [23] INSTITUTO Paulo Freire. **InterTransdisciplinaridade e Transversalidade**. 2005. Disponível em: [http://www.inclusao.com.br/projeto\\_textos\\_48.htm](http://www.inclusao.com.br/projeto_textos_48.htm)
- [24] ISAIÁ, Silvia Maria de Aguiar. **Desafios à docência superior: pressupostos a considerar**. In: RISTOFF, D; SEVEGNANI, P. **Docência na educação superior**. Brasília: INEP. (Coleção Educação Superior em Debate), 2006, p. 65-86.
- [25] JACOB, J. W. **Interdisciplinary trends in higher education**. Palgrave Communications, v. 1, n. 1, p. 1-5, 2015.
- [26] JAPIASSU, H. **Interdisciplinaridade e patologia do saber**. Rio de Janeiro: Imago, 1976.
- [27] JAPIASSU, Hilton. **O sonho transdisciplinar**. Rio de Janeiro: Imago, 2006.
- [28] KORTE, Gustavo. 2000. **Introdução à metodologia Transdisciplinar**. Disponível em: [http://www.gustavokorte.com.br/publicacoes/metodologia\\_a\\_Pdf](http://www.gustavokorte.com.br/publicacoes/metodologia_a_Pdf).
- [29] LÜCK, H. **Pedagogia interdisciplinar: fundamentos teóricos e metodológicos**. São Paulo: Vozes, 2008.
- [30] MAGALHÃES, Everton Moreira. **Interdisciplinaridade: por uma pedagogia não fragmentada**. Disponível em: [www.ichs.ufop.br/AnaisImemorial](http://www.ichs.ufop.br/AnaisImemorial).
- [31] MAHEU, Cristina d'Ávila. 2000. **Interdisciplinaridade e mediação pedagógica**. Disponível em: [www.nuppead.unifacs.br/artigos/interdisciplinaridade.pdf](http://www.nuppead.unifacs.br/artigos/interdisciplinaridade.pdf)
- [32] MENEZES, A. C. S. & ARAÚJO, L. M. **Currículo, contextualização e complexidade: espaço de interlocução de diferentes saberes**. Ministério da Educação. Brasília - DF, 2008.
- [33] NASCIMENTO, Elimar Pinheiro do e PENA-VEGA, Alfredo. **Novas dimensões da Universidade: sustentabilidade, interdisciplinaridade e inserção social**. Rio de Janeiro: Garamond, p.39-76, 2012.
- [34] NICOLESCU, Basarab. Um novo tipo de conhecimento: transdisciplinaridade. In: NICOLESCU, Basarab et al. **Educação e transdisciplinaridade**. Brasília: UNESCO, 2005.
- [35] NISENBAUM, M. S. A.; PINHEIRO, L. N. V. R. **Métodos para medição da interdisciplinaridade adotados na Ciência da Informação** In: ENCONTRO NACIONAL DE PESQUISA EM CIÊNCIA DA INFORMAÇÃO, 17., 2016, Salvador. Anais eletrônicos... Salvador: UFBA, 2016.
- [36] POMBO, O. GUIMARÃES, H. M.; LEVY, T. A **interdisciplinaridade: reflexão e experiência**. Lisboa: Texto, 1994.
- [37] REPKO, A.F. **Interdisciplinary reseach: process and theory**. Thousand Oaks: Sage, 2008.
- [38] RICHTER, D.M.; PARETTI, M. C. **Identifying barriers to and outcomes of interdisciplinarity in the engineering classroom**. European Journal of Engineering Education, v. 34, n. 1, p. 29-45, 2009.
- [39] RHOTEN, D. **Interdisciplinary research: Trend or transition**. Items and Issues, v. 5, n. 1-2, p. 6-11, 2004.
- [40] ROGERS, Yvonne; RIZZO, Antonio. **Isn't Multidisciplinarity Enough? When Do We Really Need Interdisciplinarity?** Disponível em: <http://www.irit.fr/ACTIVITES/GRAC>, 2006.
- [41] SANTOS, Boaventura de Souza. **Um Discurso sobre as Ciências**. São Paulo: Cortez, 2004.
- [42] SANTOS, Renato P. dos. **Transdisciplinaridade. Cadernos de Educação nº 8**, pp. 7-9, 23/11/1995, Instituto Piaget, Lisboa.
- [43] SEVERINO, Antonio Joaquim. **Metodologia do trabalho científico**. 22. ed. São Paulo: Cortez, 2008.
- [44] SILVA, M. D. P. (2018). **A interdisciplinaridade como tecnologia de Ação Comunicativa: uma análise hermêutico - dialética**. Tese de doutorado, Universidade Federal de São Carlos, São Carlos, SP, Brasil.

# Analytics Hierarchy Process for Decision-making in Network Infrastructure Replacement

Vinícius de Marchi Borri, Fernando Gasi, Alessandra Akkari

Federal University of ABC (UFABC), Brazil

Received: 25 Aug 2022,

Received in revised form: 16 Sep 2022,

Accepted: 21 Sep 2022,

Available online: 29 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Analytics Hierarchy Process, Multicriteria decision-making, Telecommunication.*

**Abstract**— Among all methodologies to support multi-criteria decision making, the Analytics Hierarchy Process is widely used in the most diverse situations. Different authors treat it as one of the best alternatives when there is a need to introduce subjective criteria within the decision-making process, in addition to having adaptability to situations with a high number of alternatives using ratings. In this work, a comparison was made between the ranking results of 30 areas for replacing the network infrastructure with fiber optic networks through numerical criteria and reordering by decision makers and through a model using AHP with ratings. As a result, a similar final ranking can be seen, which enables the use of AHP as a tool to improve the decision-making process for this situation.

## I. INTRODUCTION

Decision making in the corporate world is ruled, most of the time, with the goal of increasing the company's profitability, whether by a new product or service, media, brand recognition, production cost reduction, increasing productivity, among others. The telecommunications industry is not different. Due to technological advances in terms of network infrastructure, the current Brazilian scenario involves a need to replace older networks infrastructures by more recent ones, which are based on the use of optical fibers.

The demand caused by the evolution of telecommunication technologies, as well as the need for greater bandwidth by products and services linked to internet access, year after year companies in the sector invest billions of reais to increase and improve their infrastructure (CONEXIS, 2022) and consequently the service coverage.

The time required for the financial return is long due to the high value of the initial investment made by the operators before having any customer subscribing to the service (FRIGO, 2004). In this way, when case studies of

deployment of networks entirely built with fiber optic are investigated, they are rated as economically difficult, given this combination of high initial investment and the uncertainty of how many customers will subscribe to the services and in how long the network will reach the amount of customers projected (DOMINGO, 2014).

In general, two main points are evaluated for choosing a new area: technical feasibility and market data. By technical feasibility, it is understood the analysis of the existing infrastructure and the identification of future needs, thus determining the physical possibility of implantation of the network in the place. Therefore, there are only two possible results for such an analysis, the location is viable or not. The analysis of market data, on the other hand, basically considers the population, the number of households, the distribution of social classes of these households, the verticalization of the analyzed area, the number of businesses, financial indicators, and consumption profiles.

Although difficult, this is a critical part of decision making, defining the best combinations between indicators and what weights each of them will have in the result. This aspect is defined according to the strategy of each

company, however, a common factor for all of them is that these are all numerical indicators and do not consider the peculiarities and qualitative information of each area, which are essential and powerful to make choosing a particular region a commercial success or failure.

In this work, the numerical model used by one of the largest telecommunication operators in Brazil to decide on the constructive order of replacing the current network infrastructure by an optic fiber network in 30 areas of the Brazilian territory was the start point and a new qualitative variable was inserted to incorporate the vision of commercial success into the result. For this, the model based on weights of each numerical criteria and subsequent inference of qualitative characteristics was replaced by a model based on Analytics Hierarchy Process (AHP), which allowed the use of this type of variable.

## II. METHOD

Decision making is intrinsic to human biology and is the most central activity of their lives, being done consciously or unconsciously and it is extremely necessary for survival (SAATY, 2016). All people in the world make decisions daily, some more difficult, some easier, but regardless of the situation, decision-making is constant. We live in an interdependent universe, where everything depends on everything else and if we know how to measure the intangible, a much wider horizon of scientific interpretation will open (SAATY, 2008). We are inclined to believe that the more types of information and the greater the amounts of it, the better decision-making will be. However, too much information can be as bad as too little information. For decisions to be made properly, the ideal is to have all relevant criteria under evaluation (GOMES et al, 2010).

Developed by Thomas L. Saaty in 1980, the AHP method divides the problem into hierarchical levels, seeking to make it easier to understand and evaluate, helping the decision maker to prioritize or classify the alternatives after the method has been applied (SILVA et al, 2010).

According to Saaty (2006), to make a decision in a structured way and generate priorities, it is necessary to decompose the process into the following steps:

- a) Define the problem and determine the type of answer needed.
- b) Structure the decision hierarchy from the top with the decision goal and using a broader perspective, then moving to the intermediate levels, until reaching the lowest level, which is usually a set of alternatives.

- c) Build a set of pairwise judgment matrices, with each element in the higher levels being used to compare the elements in the level immediately below.
- d) Use the priorities obtained from the judgments to weight the priorities at the next level. Then, for each element of the lower level, the weighted values are added, and the overall or global priority is obtained. This process must be followed until the final priorities of the alternatives at the lower levels are obtained.

In this work, the telecommunication company provided the constructive order resulted from the weighted numerical model already changed after many hours of reunions discussing the qualitative features of each area, as well as the criteria considered and their respective values and weights. This rank can be found below in Table 1.

Table.1: Ranking provided by the company

| Alternative | Ranking | Alternative | Ranking |
|-------------|---------|-------------|---------|
| Area 1      | 1       | Area 16     | 30      |
| Area 2      | 15      | Area 17     | 20      |
| Area 3      | 14      | Area 18     | 16      |
| Area 4      | 19      | Area 19     | 21      |
| Area 5      | 6       | Area 20     | 27      |
| Area 6      | 7       | Area 21     | 22      |
| Area 7      | 8       | Area 22     | 23      |
| Area 8      | 9       | Area 23     | 5       |
| Area 9      | 10      | Area 24     | 3       |
| Area 10     | 11      | Area 25     | 4       |
| Area 11     | 13      | Area 26     | 24      |
| Area 12     | 12      | Area 27     | 28      |
| Area 13     | 17      | Area 28     | 29      |
| Area 14     | 2       | Area 29     | 25      |
| Area 15     | 18      | Area 30     | 26      |

For comparison purposes, the same criteria weights and values were used in the construction of the model in AHP, except for the qualitative variable created and introduced to provide the perception of commercial success in the model.

In the AHP method with ratings (SILVA and BELDERRAIN, 2009) the evaluation structure is fixed, and the alternatives must be evaluated according to their performance in each criterion. Thus, the main advantage observed is the reduction of the number of judgments necessary when facing a decision with many alternatives.

As the study situation has a high number of alternatives and what is expected as a result is a preference ranking, the

AHP method with ratings was used with the help of a free software called Super Decisions to perform the calculations.

The mathematics calculations will not be showed in this work as well as the calculation steps once the software will be used to do so and the weights and criteria will also be the same as the company. The model in AHP with ratings is shown in the Fig. 1 below, where the left block contains the same criteria that the company used and, at the right, the new criteria inserted to translate commercial perception.

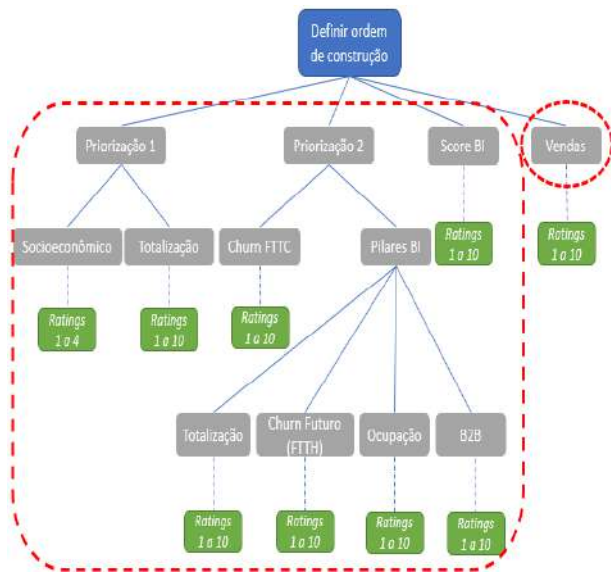


Fig. 1: Hierarchy structure for AHP with qualitative criteria in the right

III. RESULTS

After creating the hierarchical structure within the Super Decisions software, weights were assigned and pairwise comparisons were performed, and each alternative was linked to a rating value for each criterion. The software itself performs inconsistency index checks and for both ratings ranging from 1 to 4 and for those ranging from 1 to 10, the indexes satisfied the requirements, as can be seen in Fig. 2 for the case of ratings from 1 to 4:

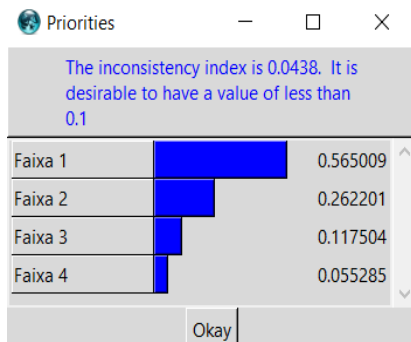


Fig. 2: inconsistency index for ratings from 1 to 4

With every parameter configured properly in the software, the result from the calculations of the model in AHP with ratings is the following:

Table.2: Ranking from the model in AHP with ratings- software result

| Alternative | Ranking | Alternative | Ranking |
|-------------|---------|-------------|---------|
| Área 1      | 1       | Área 16     | 28      |
| Área 2      | 20      | Área 17     | 29      |
| Área 3      | 21      | Área 18     | 26      |
| Área 4      | 23      | Área 19     | 27      |
| Área 5      | 7       | Área 20     | 30      |
| Área 6      | 15      | Área 21     | 6       |
| Área 7      | 9       | Área 22     | 10      |
| Área 8      | 8       | Área 23     | 17      |
| Área 9      | 18      | Área 24     | 5       |
| Área 10     | 3       | Área 25     | 16      |
| Área 11     | 25      | Área 26     | 4       |
| Área 12     | 19      | Área 27     | 12      |
| Área 13     | 22      | Área 28     | 11      |
| Área 14     | 2       | Área 29     | 13      |
| Área 15     | 24      | Área 30     | 14      |

IV. DISCUSSION

With both rankings on hands, it is possible to place them side to side and compare the results, as in the Table 3.

Table.3: Results comparison

| Alternative | Company | AHP | Absolute Difference |
|-------------|---------|-----|---------------------|
| Area 1      | 1       | 1   | 0                   |
| Area 2      | 15      | 20  | 5                   |
| Area 3      | 14      | 21  | 7                   |
| Area 4      | 19      | 23  | 4                   |
| Area 5      | 6       | 7   | 1                   |
| Area 6      | 7       | 15  | 8                   |
| Area 7      | 8       | 9   | 1                   |
| Area 8      | 9       | 8   | 1                   |
| Area 9      | 10      | 18  | 8                   |
| Area 10     | 11      | 3   | 8                   |
| Area 11     | 13      | 25  | 12                  |

|                          |    |    |     |
|--------------------------|----|----|-----|
| Area 12                  | 12 | 19 | 7   |
| Area 13                  | 17 | 22 | 5   |
| Area 14                  | 2  | 2  | 0   |
| Area 15                  | 18 | 24 | 6   |
| Area 16                  | 30 | 28 | 2   |
| Area 17                  | 20 | 29 | 9   |
| Area 18                  | 16 | 26 | 10  |
| Area 19                  | 21 | 27 | 6   |
| Area 20                  | 27 | 30 | 3   |
| Area 21                  | 22 | 6  | 16  |
| Area 22                  | 23 | 10 | 13  |
| Area 23                  | 5  | 17 | 12  |
| Area 24                  | 3  | 5  | 2   |
| Area 25                  | 4  | 16 | 12  |
| Area 26                  | 24 | 4  | 20  |
| Area 27                  | 28 | 12 | 16  |
| Area 28                  | 29 | 11 | 18  |
| Area 29                  | 25 | 13 | 12  |
| Area 30                  | 26 | 14 | 12  |
| <b>Average Variation</b> |    |    | 7,9 |

It was expected that the AHP model with the sales perception variable inserted would be in line with the company's result obtained after evaluating the numbers and rounds of discussion among decision makers, as the variables and objective were the same.

However, it is worth mentioning that there are differences, but they can be adjusted by redoing the pairwise judgments in the AHP model or even including or excluding new criteria for this decision.

### V. CONCLUSION

Decision making is present in all professional and personal aspects and in the business sphere it is directly linked to the success or failure of operations. The possibility of reducing the duration of exhaustive meetings by including a subjective criterion together with numerical criteria can bring greater speed in decision making and consequently a monetary advantage for the company.

It is extremely important to use methodologies to aid decision making, since when setting up the hierarchical structure with real market data and incorporating the subjectivity into the model, the result is less influenced by decision makers' guesswork.

### REFERENCES

- [1] Domingo, A., Van der Wee, M., Verbrugge, S., & Oliver, M. (2014). Deployment strategies for FTTH networks and their impact on the business case: A comparison of case studies.
- [2] Estatísticas – Conexis - Sindicato Nacional das Empresas de Telefonia e de Serviço Móvel, Celular e Pessoal. (2022). Retrieved June 4, 2022, from CONEXIS: <https://conexis.org.br/numeros/estatisticas/>
- [3] Frigo, N. J., Iannone, P. P., & Reichmann, K. C. (2004). A view of fiber to the home economics. *IEEE communications Magazine*, 42(8), S16-S23.
- [4] Gomes, C. C., Da Silva, A. C. S., & Gonçalves, T. J. M. (2010). Aplicação do Método AHP com Abordagem Ratings para a Ordenação das Lojas de uma Rede de Varejo em Função do Risco de Crédito. In: XVII Simpósio de Engenharia de Produção. Bauru, Brazil.
- [5] Saaty, T. L. (2006). Rank from comparisons and from ratings in the analytic hierarchy/network processes. *European Journal of Operational Research*, 168(2), 557-570.
- [6] Saaty, T. L. (2008). Decision making with the analytic hierarchy process. *International journal of services sciences*, 1(1), 83-98.
- [7] Saaty, R. W. (2016). Decision making in complex environments: the analytic network process (ANP) for dependence and feedback; A Manual for the ANP Software SuperDecisions. Pittsburgh, Creative Decisions Foundation, PA, 15213, 4922.
- [8] Silva, A. C. S., & Belderrain, M. C. N. (2009). O problema de seleção de fornecedores: abordagem AHP com uso de ratings. *Simpósio Brasileiro de Pesquisa Operacional*, Rio Grande do Sul, RS, Brasil, 42.
- [9] Silva, A. C., Belderrain, M. C. N., & Pantoja, F. C. M. (2010). Prioritization of R&D projects in the aerospace sector: AHP method with ratings. *Journal of Aerospace Technology and Management*, 2, 339-348.

## Trail Analysis with and without Inoculation of *Azospirillum brasilense* in the Corn Crop in GURUPI-TO

David Willker de Sousa Santos<sup>1</sup>, Weder Ferreira dos Santos<sup>1\*</sup>, Clóvis Maurílio de Souza<sup>1</sup>,  
Joênes Mucci Peluzio<sup>2</sup>, Layanni Ferreira Sodrê Santos<sup>3</sup>, Fernando Barnabé Cerqueira<sup>4</sup>,  
Talita Pereira de Souza Ferreira<sup>1</sup>, Leonardo Alves Lopes<sup>5</sup>, Cícero Antônio Sobreira  
Fidelis<sup>5</sup>, Magno de Oliveira<sup>6</sup>, Antônio Henrique Camilo Ribeiro<sup>7</sup>, João Victor Rodrigues  
Fernandes<sup>1</sup>, Matheus Rodrigues de Andrade<sup>1</sup>

<sup>1</sup> Federal University of Tocantins, Gurupi, Tocantins, Brazil.

<sup>2</sup> Federal University of Tocantins, Palmas, Tocantins, Brazil.

<sup>3</sup> E.M.E.I.F Ullisses Guimarães, Santa Maria of Barreiras, Pará, Brasil.

<sup>4</sup> Faculty Guaraí, Guaraí, Tocantins, Brazil.

<sup>5</sup> Federal Institut of Pará, Conceição do Araguaia, Pará, Brazil.

<sup>6</sup> University of Valley Taquari - Univates, Rio Grande do Sul, Brazil.

<sup>7</sup> Máxima Consulting, Research and Innovation, Gurupi, Tocantins, Brazil.

\*Corresponding Author

Received: 19 Aug 2022,

Received in revised form: 11 Sep 2022,

Accepted: 16 Sep 2022,

Available online: 29 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Bacterium. Path analysis.*

*Corn genotypes. Zea mays.*

**Abstract** – This study aimed to evaluate the analysis of trails with and without inoculation of the corn crop in the municipality of Gurupi-TO. The experimental design used was randomized blocks. It used 20 treatments, in a factorial scheme 2x10. The treatments consisted of 10 maize cultivars. The agronomic characteristics evaluated were Number of grains per row (NGPF), Number of rows on the cob (NFE), Plant height (AP), Height of the ear (AE), Humidity (UMID), and grain yield in kg ha<sup>-1</sup> (PRODG). Trail analysis was performed through the Gene computer program. Highlighting that the Number of Rows in the Spike, Plant Height, and Humidity showed statistically higher productivity results.

### I. INTRODUCTION

The corn (*Zea mays* L.) has been standing out by having good productivity results and becoming the largest crop in recent decades, thus reaching the mark of 1 billion tons the expressive value that abandons rice and wheat. The corn stands out for its versatility because we see it with several applications of more than 3500 of this cereal. In addition to the relevance in the aspect of food safety, in human food and, mainly, animals, it is possible to produce with corn a multitude of products, such as fuels, beverages, polymers, etc. [1].

In Brazil, corn is the second most economically important crop, second only to soybeans. The states with the highest cereal production are Mato Grosso, Paraná and Mato Grosso do Sul [2]. Forecasts production of 116.7 million tons for the 2021/22 crop in the face of an expected increase in 28% productivity of crops.

Although many of the typical foods in Brazil are made from corn, only a small fraction of the corn produced is destined for human consumption its largest portion is destined for animal feed, grains are rich in energy, carbohydrates, proteins, vitamins, minerals, and fibers [3].

Second Pinheiro et al. (2021) [4] by highlighting that the corn crop has very instigating study characteristics, as it provides the basis for future advances. Corn has been gaining space in the national territory, in the same way as all other traditional crops, which used less developed technology, seeking land not yet agricultural, as well as the natural fertility of soils. The evaluation of properties of physical attributes is an alternative to improve the quality of the performance of large-scale corn yields because from these characteristics one can aim at productivity.

Being these factors of interest, path analysis consists of the study of the direct and indirect effects of explanatory variables on a basic variable, whose estimates are obtained through regression equations, in which the variables are previously standardized. Although the correlation is an intrinsic characteristic of two variables, in the given experimental condition, its decomposition is dependent on the set of variables studied, which are usually evaluated by the researcher through the previous knowledge of its importance and possible interrelationships expressed in the "trail diagrams" [5].

The search is the need to find alternative sources to reduce cost, in addition to helping the plant have productivity, the bacterium promoting plant growth (BPCP) is a biological alternative that acts to increase various activities such as nitrate reductase, solubilization of phosphate, and acting as a biological pathogen control agent. The ability of this bacterium to biologically fix nitrogen [6].

Gender *Azospirillum* has been standing out in several studies with great results [7]. Or *Azospirillum brasilense*

promotes plant growth through the production of plant hormones and by providing other nutrients such as phosphorus [8].

Studies on *Azospirillum brasilense* in corn crop [9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20]. However, in the state of Tocantins, there are few studies of trail analysis associated with *Azospirillum brasilense*.

Thus, because of the above, this work aims to evaluate trail analysis with and without inoculation of *Azospirillum brasilense* in the corn crop in Gurupi-TO.

## II. MATERIAL AND METHODS

The Trials were conducted at the Federal University of Tocantins (UFT) Gurupi (11°44' latitude S, 49°05' longitude W, and altitude of 280 Meters) in the crop 2019/20. The region presents the climate classified as Aw, a tropical region, with a moderate water deficiency, the region has average annual temperatures of 33°C in periods of drought and averages of 26°C in the rainy seasons [21], with annual rainfall around 1804 mm, rainy summer, and dry winters, according to the classification of Köppen [22].

Starting the soil preparation, the first activity was the case in which two tons of ha<sup>-1</sup> dolomitic limestone Filler, which was incorporated into the soil utilizing plowing and grading operations in the surface layer, soon after the swelling in the area, then the fertilizers were applied and sowing performed manually, the doses of correctives and fertilizers followed, 5<sup>a</sup> Approach [23], according to the characteristics obtained in the chemical and physical analysis of the soil, expressed in Table 1.

Table 1. Chemical and textual attributes in the layer 0-20 cm to the site of the experiment. Gurupi – TO, 2020, the agricultural year 2019/20.1

| pH <sup>1</sup> | M.O.                          | P <sup>2</sup>      | K <sup>2</sup>                    | K <sup>2</sup> | Ca <sup>3</sup>               | Mg <sup>3</sup> | Al <sup>3</sup> | H+Al <sup>3</sup> | SB                            | CTC  | V  |   |
|-----------------|-------------------------------|---------------------|-----------------------------------|----------------|-------------------------------|-----------------|-----------------|-------------------|-------------------------------|------|----|---|
|                 | dag.kg <sup>-1</sup>          | mg dm <sup>-3</sup> | -----cmolc.dm <sup>-3</sup> ----- |                |                               |                 |                 |                   |                               |      |    | % |
| 5.2             | 1.7                           | 2.2                 | 30                                | 0.08           | 1.2                           | 0.7             | 0.0             | 2.50              | 1.98                          | 4.48 | 44 |   |
|                 | Clay<br>(g kg <sup>-1</sup> ) |                     |                                   |                | Silt<br>(g kg <sup>-1</sup> ) |                 |                 |                   | Sand<br>(g kg <sup>-1</sup> ) |      |    |   |
|                 | 275                           |                     |                                   |                | 50                            |                 |                 |                   | 675                           |      |    |   |

(1): CaCl<sub>2</sub> 0.01 mol L<sup>-1</sup>; (2): Extractor Mehlich; (3) KCL 1mol; M.O.: Organic matter.

The recommendation for basic fertilization was 500 kg ha<sup>-1</sup> of the Formulated 5-25-15 and for fertilization coverage 150 kg ha<sup>-1</sup> from urea (43% from N), fractional in two applications, in the V<sub>4</sub> (Fourth expanded sheet) and V<sub>6</sub> (Sixth expanded sheet).

An experimental design was used in randomized blocks, with 3 replications, in a factorial scheme 2 x 10, Totaling 20 Treatments. The first factor consisted of the use of seeds treated in the management of with and without *Azospirillum*

*brasilense*. In the treatment with *Azospirillum brasilense*, a ratio of 100 ml of the inoculum to 50 kg of seed was used and homogenized in a plastic bag. The second factor refers to the ten commercial maize cultivars, which are listed below (Table 2) with their respective agronomic characteristics.



Table 2. Agronomic characteristics of the ten maize cultivars used in the experiment.

| Trade name  | Gene tic basis | Transge nics | Cyc le | Technolog ical level | Purpose of use |
|-------------|----------------|--------------|--------|----------------------|----------------|
| AG8088 PRO2 | HS             | PRO2         | P      | A                    | G/MV/SPI       |
| M 274       | HS             | C            | P      | B/M                  | G/SPI          |
| ANHEM BI    | PPA            | C            | P      | B/M                  | G/SPI          |
| AG 1051     | HD             | C            | SM P   | M/A                  | G/MV/SPI       |
| BR 2022     | HD             | C            | P      | B/M                  | G/SPI          |
| BR 205      | HD             | C            | P      | B/M                  | G/SPI          |
| BM 3051     | HS             | C            | P      | M/A                  | MV/SP I        |
| CATIVE RDE  | PPA            | C            | SM P   | M                    | G/MV/SPI       |
| PR27D28     | HD             | C            | SP     | B/M                  | G/SPI          |
| BRS 3046    | HT             | C            | SM P   | M/A                  | G/MV/SPI       |

HS: simple hybrid, HD: double hybrid, HT: triple hybrid, PPA: open pollination populations, G: grain, MV: corn green, SPI: whole plant silage; C: conventional; PRO2: technology VT PRO 2™; P: precocious; SMP: semi-precocious; SP: Super-precocious; A: high; M: medium and B: low. The adapted of Cruz et al. (2015) [24], Pereira Filho and Borghi (2016) [25], Pereira Filho and Borghi (2020) [26].

The experimental unit consisted of two rows of 3.0 m in length, adopting spacing of 1 m between rows with an experimental area of 6 m². In each linear meter, 5 seeds obtained the finals population of 50.000 Plants ha⁻¹. The entire experimental area was used for the evaluation.

In pre-sowing, seeds with fungicide and insecticide (active ingredient Piraclostrobrina, Tiofanato Metílico and Fipronil). For cartridge Caterpillar control (*Spodoptera frugiperda*), Caterpillar elasm (*Elasmopalpus lignosellus*), and Caterpillar-threaded (*Agrotis ipsilon*) throughout the crop cycle, insecticides were used: Deltamethrin (200 mL ha⁻¹); Clorpirifós (1 L ha⁻¹); Lambda-Cialotrina + Chlorantranilprole (150 mL ha⁻¹). For control of the Green-

bellied Bedbug (*Dichelops furcatus*), Cigarrinha-do-milho (*Dalbulus maidis*) and fly white (*Bemisia argentifolii*) used: Tiametoxam + Lambda-Cialotrina (180 mL ha⁻¹), Imidacloprid + Bifenthrin (400 mL ha⁻¹) and Acetamiprid + Alfa-Cypermethrin (250 mL ha⁻¹) [27].

The management for the control of weeds, pests, and diseases was carried out according to the technical recommendations found in the literature for corn crops [28].

The harvest was performed when the plants reached the ideal physiological stage (R6) of grain production. The ears were harvested in the two central lines that make up the useful area and the characteristics, grain yield in kg ha⁻¹ (PRODG), and the explanatory: Number of grains per row (NGPF), Number of rows on the cob (NFE), Plant height (AP), Height of the ear (AE), Humidity (UMID) [29].

After the data were obtained and tabled, Pearson's correlation coefficients were estimated between the characters. Correlations with values of r ≥ 0.6 or r ≤ -0.6, from the methodology proposed by Dancy et al. (2018) [30], where r above 0.6 is considered moderate to strong. Then, trail analysis was performed, and correlations were unfolded in direct and indirect effects of the variables (independent variables) on the productivity of straw-without ears (PESP) [31].

The analyses were performed using the Computational Genes program, 2007 [32].

### III. RESULTS AND DISCUSSION

In the analysis of variance (Table 3), one can observe the representative effects obtained by the variation of the bacterium *Azospirillum*, through the management with and without application of *Azospirillum brasilense*, we observed that there was a significant difference in the following characteristics of NGPF, PRODG with *Azospirillum* or without *Azospirillum*, already note that in the characteristics NFE, AP significant values were obtained only with *Azospirillum* and the AE only features in the following feature AE.

Table 3. Summary of variance analysis of the grain number per row characteristic 3(NGPF), Number of rows on the cob (NFE), Plant height (AP), Height of the ear (AE), Humidity (DE), and grain yield in kg ha⁻¹ (PRODG), relating to 10 maize genotypes.

| Source of variation | GL | Medium Squares |       |      |                   |        |                     |     |                     |                   |                    |            |           |
|---------------------|----|----------------|-------|------|-------------------|--------|---------------------|-----|---------------------|-------------------|--------------------|------------|-----------|
|                     |    | NGPF           |       | NFE  |                   | AP     |                     | AE  |                     | UMID              |                    | PRODG      |           |
|                     |    | C/A            | S/A   | C/A  | S/A               | C/A    | S/A                 | C/A | S/A                 | C/A               | S/A                | C/A        | S/A       |
| Block               | 2  | 3.7            | 15.8  | 0.2  | 0.2               | 43.2   | 16.6                | 171 | 37.6                | 28.9              | 9.1                | 941135.0   | 283724.6  |
| Cultivate           | 9  | 61.9*          | 49.4* | 4.3* | 2.8 <sup>ns</sup> | 578.3* | 233.1 <sup>ns</sup> | 626 | 208.4 <sup>ns</sup> | 4.9 <sup>ns</sup> | 13.4 <sup>ns</sup> | 6260931.8* | 484970.0* |
| Residue             | 18 | 11.5           | 11.4  | 1.6  | 1.6               | 92.57  | 272.9               | 246 | 219                 | 15.5              | 17.8               | 826231.6   | 1354864.4 |

|         |      |      |      |      |      |      |       |       |       |       |       |       |
|---------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|
| Average | 35   | 34   | 15.8 | 15.5 | 192  | 193  | 88    | 94    | 29.9  | 29.9  | 7167  | 6766  |
| CV (%)  | 9.82 | 9.94 | 7.94 | 8.25 | 5.01 | 8.54 | 17.84 | 15.67 | 13.18 | 14.12 | 12.68 | 17.20 |

ns; \* significant at 5% probability by the F test. GL – Degree of freedom. C/A – With *Azospirillum*. S/A – Without *Azospirillum*.

The coefficients of variation (CV) observed that the coefficient values below 10% in the following characteristics NGPG, NFE, and AP. The coefficient of variation below 10% is considered low which indicates good accuracy, already the values are as it is 10 until 20% you mean average like literature [33].

The Coefficients of Determination reveal that we have a strong relationship with Productivity and other variables

Table 4. Estimates of the direct and indirect effects involving the main variable, grain yield in 4 kg ha<sup>-1</sup> (PRODG), and the explanatory: Number of grains per row (NGPF), Number of rows on the cob (NFE), Plant height (AP), Height of the spike (AE), Humidity (DE), 10 maize genotypes.

| Characters                                     | Association Effects      | With <i>Azospirillum</i> | Without <i>Azospirillum</i> |
|------------------------------------------------|--------------------------|--------------------------|-----------------------------|
|                                                |                          | Estimate                 |                             |
| NGPF                                           | Direct effect on PRODG   | 0.0240                   | 0.9664                      |
|                                                | Indirect effect via NFE  | -0.0954                  | -0.0094                     |
|                                                | Indirect effect via AP   | 0.1573                   | 0.1392                      |
|                                                | Indirect effect via AE   | 0.0194                   | -0.3501                     |
|                                                | Indirect effect via UMID | 0.5054                   | 0.1023                      |
|                                                | Full                     | 0.6106                   | 0.8484                      |
| NFE                                            | Direct effect on PRODG   | 0.2018                   | -0.0510                     |
|                                                | Indirect effect via NGPF | -0.0113                  | 0.1774                      |
|                                                | Indirect effect via AP   | -0.1582                  | 0.0128                      |
|                                                | Indirect effect via AE   | -0.0246                  | -0.0754                     |
|                                                | Indirect effect via UMID | -0.2540                  | -0.0251                     |
|                                                | Full                     | -0.2464                  | 0.0387                      |
| AP                                             | Direct effect on PRODG   | 0.4235                   | 0.3112                      |
|                                                | Indirect effect via NGPF | 0.0089                   | 0.4322                      |
|                                                | Indirect effect via NFE  | -0.0754                  | -0.0021                     |
|                                                | Indirect effect via AE   | 0.0899                   | -0.3544                     |
|                                                | Indirect effect via UMID | 0.2651                   | 0.1267                      |
|                                                | Full                     | 0.7119                   | 0.5137                      |
| AE                                             | Direct effect on PRODG   | 0.1159                   | -0.4349                     |
|                                                | Indirect effect via NGPF | 0.0040                   | 0.7780                      |
|                                                | Indirect effect via NFE  | -0.0429                  | -0.0088                     |
|                                                | Indirect effect via AP   | 0.3284                   | 0.2536                      |
|                                                | Indirect effect via UMID | 0.3138                   | 0.1319                      |
|                                                | Full                     | 0.7192                   | 0.7197                      |
| UMID                                           | Direct effect on PRODG   | 0.7183                   | 0.1840                      |
|                                                | Indirect effect via NGPF | 0.0169                   | 0.5372                      |
|                                                | Indirect effect via NFE  | -0.0714                  | 0.0070                      |
|                                                | Indirect effect via AP   | 0.1563                   | 0.2144                      |
|                                                | Indirect effect via AE   | 0.0506                   | -0.3118                     |
|                                                | Full                     | 0.8707                   | 0.6308                      |
| Coefficient of determination (R <sup>2</sup> ) |                          | 0.9752                   | 0.7809                      |
| Effect of residual variable                    |                          | 0.1576                   | 0.4681                      |

indirect in the estimates (Table 4). With *Azospirillum* (0.9752) and without *Azospirillum* (0.7809) being a positive point demonstrating that these variables have a significant contribution to corn yield. Residual Variable Effect with *Azospirillum* (0.1576) and without *Azospirillum* (0.4681) is considered low.

Mundim et al. (2013) [34], report that the value of the coefficient of determination reflects how much, as a

percentage, of the variation of the main variable, is explained by those used in the trial analysis.

In (Table 4) the NGEF in conditions with *Azospirillum* (C/A) and without *Azospirillum* (S/A) showed a direct effect on the PRODG (0.0240 C/A) and (0.9664 S/A) and indirect routes estimates AP from (0.1573 C/A) and (0.1392 S/A) and UMID (0.5054 C/A) and (0.1023 S/A) also AE (0.0194 C/A), however, it had indirect effects on the variables in NFE from (-0.0954 C/A) and (-0.0094 S/A), also in AE from (-0.3501 S/A), having negative effects on the effect of PROD. Guimarães et al. (2021) [11], point out that the treatments that have been used by the *Azospirillum*, or NGEF has a greater contribution to the productivity effect compared to treatment without the use of inoculant.

In the estimates (C/A) that show the relationship NFE that has via positive direct effect PRODG (0.2018), with this the negative indirect effects via NGPF (-0.0113), AP (-0.1582), AE (-0.2046) and UMID (-0.2540). With a total in the feature NFE direct and indirect means has a negative value (-0.2464). In the estimate (S/A) the relationship NFE note that it came back with negative NFE between the direct effect route PRODG (-0.0510), indirect via AE (-0.0754) and UMID (-0.0251), and indirect positive via NGPF (0.1774) and AE (0.0128). Guimarães et al. (2021) [11] highlight that the inoculated plant has a better vegetative development which causes a greater nitrogen reserve which justifies this result.

Carvalho et al. (2018) [35], Faria et al. (2021) [36], and Oliveira et al. (2021) [37] report that high values of correlations and right effect reveal direct, the cause-effect association between the attributes used in the analysis.

In relation to the AP, there were direct effects on the PRODG (0.4235 C/A) and (0.3112 S/A) and indirect via NGPF (0.0089 C/A) and (0.4322 S/A), UMID (0.2651 C/A) and (0.1267 S/A) and AE (0.0889 C/A), and negative indirect effect via NFE (-0.0754 C/A) and (-0.0021 S/A), AE (-0.3544 S/A).

The variable AE with *Azospirillum* positive direct effect on the PRODG (0.1159), indirect via NGPF (0.0040), AP (0.3284), and UMID (0.3138), and negative via NFE (-0.0429). The variable AE without *Azospirillum* there is a negative direct effect on the PRODG (-0.4349) and an indirect positive via NFG (0.7780), AP (0.2536), and UMID (0.1319), however, it had a negative indirect effect on NFE (-0.0088). Santos et al. (2018) [38], observed in 16 maize genotypes that, although AE has no relation to productivity, the ear should be inserted into the middle part of the plant, possibly avoiding bedridden and plant breaking.

The UMID provided a positive direct effect on the PRODG (0.7183 C/A) and (0.1840 S/A), and indirect positive via NGPF (0.0169 C/A) and (0.5372 S/A) and AP (0.1563 C/A) and (0.2144 S/A), AE (0.0506 C/A) and NFE

(0.0070 S/A), in the meantime it had a negative indirect effect via NFE (-0.0714 C/A) and AE (-0.3118 S/A).

Guimarães et al. (2021) [11] highlight that the use of inoculation proved agronomically efficient in the corn crop, being close to the values presented in this work where the comparative treatment is used by the *Azospirillum*, the variable NFE, NGEF, AP, and AE productivity effect was obtained values close to or higher than fertilization only with nitrogen application the treatment of inoculant use in conjunction with the initial application, which is based on the effect of the indirect variables addressed.

In the general context, the effects of the developments, through the analysis of the correlation coefficients of NGPF, AP, AE, and UMID past NFE (C/A), were positive with high significance. But the effect of NFE (S/A) which had a positive direct effect with PRODG was negative and was explained by the negative variables of indirect effect.

#### IV. CONCLUSION

The variables Number of grains per row, Number of rows on the cob, Plant height, Spike height, Humidity, and a positive direct effect are closed by comparing the two estimates with and without *Azospirillum brasilense*.

Highlighting the number of rows in the ear, Plant Height and Humidity presented statistically higher productivity results being more indicated for indirect selection for productivity handling *corn with Azospirillum brasilense* in the Southern Region of Tocantins.

#### REFERENCES

- [1] Contini, E., Mota, M.M., Marra, R., Borghi, E., Miranda, R.D., Silva, A.D., Mendes, S.M. 2019. *Milho: caracterização e desafios tecnológicos*. Brasília: Embrapa.
- [2] CONAB. *Boletim da Safra de Grãos*. 2021. Disponível em: <<http://www.conab.gov.br/info-agro/safras/graos/boletim-da-safra-de-graos>>. Acesso em: 13 maio 2022.
- [3] Duarte, J.O., Mattoso, M.J., Garcia, J.C. *Importância Socioeconômica*. 2021. Disponível em: <[https://www.agencia.cnptia.embrapa.br/gestor/milho/arvore/CONTAG01\\_8\\_168200511157.html](https://www.agencia.cnptia.embrapa.br/gestor/milho/arvore/CONTAG01_8_168200511157.html)>. acesso em: 13 maio 2022.
- [4] Pinheiro, L.S., Silva, R.C., Vieira, R.C., Aguiar, R.O., Nascimento, M.R., Vieira, M.M., Sousa, R.F., Oliveira, J.T., Silva, J.N., Silva, V.F.A., Silva, P.A. 2021. Análise de trilha dos atributos físicos de milho (*Zea mays* L.) em sistema de cultivo convencional. *Research, Society and Development*. 10(1): e8010110832-e8010110832.
- [5] Cruz, C.D., Carneiro, P.C.S. Regazzi, A.J. 2014. *Modelos biométricos aplicados ao melhoramento genético*. 3 ed. Viçosa: UFV. 668p.

- [6] Dickmann, L. 2019. Residual da adubação fosfatada e efeito da inoculação com *Azospirillum brasilense* nas culturas em sistema plantio direto no Cerrado. Tese. Universidade Estadual Paulista (UNESP). Disponível em: <[https://oasisbr.ibict.br/vufind/Record/UNSP\\_9d3530ff849a10e6bc3e28cbd578c05](https://oasisbr.ibict.br/vufind/Record/UNSP_9d3530ff849a10e6bc3e28cbd578c05)>. Acesso em: 13 maio 2022.
- [7] Lima, C.S. 2020. Rendimento da cultura do milho em resposta à inoculação com *Azospirillum brasilense* associado às diferentes doses de nitrogênio e plantas de cobertura. Disponível em: <<https://bibliodigital.unijui.edu.br:8443/xmlui/handle/123456789/6604>>. Acesso em: 13 mai. 2022.
- [8] Hungria, M. 2016. *Azospirillum*: um velho novo aliado. Disponível em: <<https://www.embrapa.br/busca-de-publicacoes/-/publicacao/1057259/azospirillum-um-velho-novo-aliado>>. Acesso em: 13 mai. 2022.
- [9] Coelho, B.A., Dias, V., Pelúzio, J.M., Souza, C., Siqueira, G., Santos, W.F. 2019. Produtividade do milho cultivado em baixa latitude na entressafra inoculado com *Azospirillum brasilense* com diferentes doses de nitrogênio. *Journal of Bioenergy and Food Science*. 6(1): 18-28.
- [10] Garcia, M.M., Pereira L.C., Braccini, A.L., Angelotti, P., Suzukawa, A.K.S., Marteli, D.C.V., Felber, P.H., Bianchessi, P.A., Dametto, I.B. 2017. Effects of *Azospirillum brasilense* on growth and yield compounds of maize grown at nitrogen limiting conditions. *Revista de Ciências Agrárias*. 40(2):353-362.
- [11] Guimarães, V.F.; Klein, J.; Klein, D.K. 2021. Inoculante líquido contendo estirpe de *Azospirillum brasilense*, via sementes na cultura do milho, associado à adubação nitrogenada promovendo ganhos em produtividade. *Research, Society and Development*. 10(3): e8210311292-e82018210311292.
- [12] Júnior, N.B., Alves, G.H.T., Bellettini, S., Bellettini, N.M.T. 2020. Parcelamento de nitrogênio e inoculação das sementes com *Azospirillum brasilense* na cultura do milho. *Brazilian Journal of Development*. 6(11): 89544-89663.
- [13] Morais, M., Amaral, H.F., Nunes, M.P. 2018. Desenvolvimento e assimilação de nutrientes da cultura de milho inoculado com *Azospirillum brasilense* e diferentes doses de nitrogênio e potássio. *Revista Terra & Cultura: Cadernos de Ensino e Pesquisa*. 34(n.esp.): 160-176.
- [14] Mumbach, G.L., Kotowski, I.E., Schneider, F.J.A., Mallmann, M.S., Bonfada, E.B., Portela, V.O.P., Bonfada, É.B., Kaiser, D.R. 2017. Resposta da inoculação com *Azospirillum brasilense* nas culturas de trigo e de milho safrinha. *Scientia Agraria*. 18(2): 97-103.
- [15] Portugal, J.R., Arf, O., Peres, A.R., Gitti, D.C., Garcia, N.F.S. 2017. Coberturas vegetais, doses de nitrogênio e inoculação com *Azospirillum brasilense* em milho no Cerrado. *Revista Ciência Agronômica*. 48(4): 639-649.
- [16] Raspe, D.T., Raspe, C.R. 2021. Inoculação e aplicação de diferentes doses de *Azospirillum brasilense* e sua influência no desenvolvimento da cultura do milho. *Revista Uningá Review*. 36: eURJ3638-eURJ3638.
- [17] Rocha, R.A.S., Coltro, G.L., Lizzoni, G.C. 2020. Adubação nitrogenada associada à inoculação de *Azospirillum brasilense* na cultura do milho. *Biodiversidade*. 19(4): 73-81.
- [18] Rockenbach, M.D.A., Alvarez, J.W.R., Fois, D.A.F., Tiecher, T., Karajallo, J.C., Trinidad, S.A. 2017. Eficiência da aplicação de *Azospirillum brasilense* associado ao nitrogênio na cultura do milho. *Acta Iguazu*. 6(1): 33-44.
- [19] Silva, Z.D., Santos, W.F., Ferreira Junior, O.J., Maciel, L.C., Santos, L.F.S., Ribeiro, A.C., Dias, V.C., Barbosa, A.S., Fidelis, C.A.S., Borges, T.A.S.L., Peluzio, J.M. 2021. Path Analysis for Maize (*Zea mays*) Silage Cerrado-Amazon Ecoton. *International Journal of Advanced Engineering Research and Science*. 8(4): 57-63.
- [20] Zeffa, D.M., Perini, L.J., Silva, M.B., Sousa, N.V., Scapim, C.A., Oliveira, A.L.M., Amaral JR, A.T., Gonçalves, L.S.A. 2019. *Azospirillum brasilense* promotes increases in growth and nitrogen use efficiency of maize genotypes. *PLoS One*. 14(4): e0215332.
- [21] INMET. Instituto Nacional de Meteorologia. 2021. Disponível em: <[http://www.inmet.gov.br/sonabra/pg\\_dspDadosCodigo\\_si\\_m.php?QTAXOQ==>](http://www.inmet.gov.br/sonabra/pg_dspDadosCodigo_si_m.php?QTAXOQ==>). Acesso em 13 mai. 2022.
- [22] Dubreuil, V., Fante, K.P., Planchon, O., Sant'anna Neto, J.L. 2019. Climate change evidence in Brazil from Köppen's climate annual types frequency. *International Journal of Climatology*. 39(3): 1446-1456.
- [23] Ribeiro, A.C., Guimarães, P.T.G., Alvarez V.V.H. 1999. *Recomendação para o uso de corretivos e fertilizantes em Minas Gerais*: 5a aproximação. Viçosa-MG: Comissão de Fertilidade do Solo de Minas Gerais - CFSEMG.
- [24] Cruz, J.C., Pereira Filho, I.A., Borghi, E., Simão, E.D.P. 2015. *Quatrocentos e setenta e sete cultivares de milho estão disponíveis no mercado de semente na safra 2015/16*. Sete Lagoas: Embrapa Milho e Sorgo.
- [25] Pereira Filho, I.A., Borghi, E. 2016. *Mercado de sementes de milho no Brasil: safra 2016/2017*. Sete Lagoas-MG: Embrapa Milho e Sorgo. 28p.
- [26] Pereira Filho, I.A., Borghi, E. 2020. *Sementes de Milho: nova safra, novas cultivares e contínua a dominância dos transgênicos*. Sete Lagoas-MG: Embrapa Milho e Sorgo.
- [27] Borém, A., Galvão, J.C.C., Pimentel, M.A. 2017. *Milho do plantio à Colheita*. 2. ed. Viçosa-MG: UFV.
- [28] Borém, A., Galvão, J.C.C., Pimentel, M.A. 2015. *Milho: do plantio à Colheita*. 2. ed. Viçosa-MG: UFV.
- [29] Marafon, F., Neumann, M., Ribas, T.M.B., Reinehr, L.L., Poczynek, M., Bueno, A.V.I., Fianco, B. 2015. Análise do efeito da colheita da planta de milho em diferentes estádios reprodutivos e do processamento dos grãos sobre a qualidade da silagem. *Semina: Ciências Agrárias*. 36(5): 3257-3268.
- [30] Dancey, C.P., Reidy, J., Viali, L. 2018. *Estatística Sem Matemática para Psicologia: Usando SPSS para Windows*. 7. ed. Porto Alegre: Penso.
- [31] Wright, S. 1921. Correlation and causation. *Journal of Agricultural Research*. 20(7): 557-585.
- [32] Cruz, C.D. 2016. Genes Software – extended and integrated with the R, Matlab and Selegen. *Revista Acta Scientiarum Agronomy*. 38(4): 547-552.

- [33] Cruz, C.D. 2019. *Genes*: Programa para análise e processamento de dados baseado em modelos de genética e estatística experimental. Viçosa: UFV.
- [34] Mundim, G.B., Viana, J.M.S., Maia, C., Paes, G.P., Lima, R.O. 2013. Genetic diversity and path analysis for nitrogen use efficiency in popcorn inbred lines. *Euphytica*. 191: 291-299.
- [35] Carvalho, E.V., Afférrri, F.S., Peluzio, J.M., Colombo, G.A., Dotto, M.A. 2018. Análise de trilha e variação genética na cultura do milho em condições de cerrado. *In Colloquium Agrariae*. 14(2): 13-23.
- [36] Faria, L.A., Peluzio, J.M., Santos, W.F., Souza, C.M., Siqueira, G.B., Santos, D.B.R., Naoe, A.M.L., Lima, M.D., Reina, E., Monteiro, F.F., Oliveira, M. 2021. Cause and effect ratio of grain chemical components on soybean yield. *Asian Journal of Microbiology, Biotechnology & Environmental Sciences*. 23(4): 618-625.
- [37] Oliveira, R.M., Oliveira, R.A., Neves, J.C.L., Oliveira, E.M., Botelho, M.E., Oliveira, J.T. 2021. Relação entre índice de colheita do milho e eficiências de fósforo por meio de análise de trilha. *Research, Society and Development*. 10(2): e13510212358-e13510212358.
- [38] Santos, W.F., Vaz, P.C.P., Haesbaert, F.M., Ferreira, T.P.S., Sodré, L.F., Soares, L.B., Pereira, J.S. 2018. Análise de trilha em genótipos de milho no Sul do Tocantins. *Revista Tecnologia & Ciência Agropecuária*. 12(3): 49-52.

# Epidural dexamethasone showed a better analgesic profile over epidural betamethasone as adjuvant in acute neuropathic lumbar pain

Antonio T Kitayama, M.D, MSc<sup>1</sup>; Celia S Oliveira, M.D.<sup>1</sup>; Natalia V de Moraes, BSc, MSc, PhD<sup>2</sup>, Claudia R Lauretti, M.D., MSc, Ph.D.<sup>3</sup>, Helton A. Defino, M.D., MSc., Ph.D.<sup>4</sup>; Gabriela R. Lauretti, M.D.\*, M.Sc., Ph.D., FIPP<sup>5</sup>

<sup>1</sup>Postgraduate Students, School of Medicine of Ribeirão Preto, University of São Paulo (S.M.R.P.- U.S.P.), Brazil

<sup>2</sup>Department of Pharmaceutics, Center for Pharmacometrics and Systems Pharmacology, College of Pharmacy, Orlando – Lake Nona, U.S.A.

<sup>3</sup>Consultant in Ophthalmology, S.M.R.P.- U.S.P.

<sup>4</sup>Professor of Orthopedics, S.M.R.P.- U.S.P.

<sup>5</sup>Professor of Anesthesia and Interventional Pain Management, S.M.R.P.- U.S.P.

\*Corresponding author

Received: 25 Aug 2022,

Received in revised form: 15 Sep 2022,

Accepted: 20 Sep 2022,

Available online: 29 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** epidural dexamethasone, epidural betamethasone, epidural lidocaine, acute neuropathic pain, ocular pressure.

**Abstract—** Background: The study was designed to evaluate dexamethasone and betamethasone as adjuvants in epidural management of acute radicular pain related to pain, ocular pressure, weight gain and systemic effects. Methods: Twenty six patients with neuropathic pain secondary to disc herniation acted as their own control related to the epidural administration of dexamethasone and betamethasone. Thirteen patients have started with dexamethasone during the first two weekly procedures, and after 3 weeks of wash-out were submitted to two weekly sequences of sacral betamethasone and cross-over. Patients were evaluated related to analgesia, blood pressure, ocular pressure, weight gain, adverse effects and plasmatic measurements of ions, glycemia, ACTH and cortisol. Results: Dexamethasone was superior to betamethasone analgesia ( $p<0.05$ ). Plasma cortisol and ACTH reduced on the 7<sup>th</sup> day after the block ( $p<0.001$ ). The plasmatic concentrations of the ions  $Na^+$ ,  $K^+$ ,  $Ca^{++}$ , control and post-prandial glycemia, blood pressure, weight were similar between groups and did no differ from initial control values ( $p>0.05$ ). Three patients that received dexamethasone after the first block and 2 that received betamethasone had cortisone glaucoma on day-7 ( $p<0.001$ ). Discussion: Epidural dexamethasone/lidocaine analgesia was superior to betamethasone/lidocaine analgesia and both drugs resulted in similar unaware increase in ocular pressure and sleep disturbance.

## I. INTRODUCTION

Although the indication of epidural corticosteroids as part of the treatment of acute neuropathic pain when the conservative treatment have failed is well recognized,<sup>1,2,3</sup> there have been concerns

related to which corticosteroid would be the best indication, as there is the risk of particulate aggregation and serious adverse effects secondary to their own pharmacological properties or intra vessel aggregation and obliteration.<sup>4,5,6</sup> Besides, there is no available information regarding the non-particulate dexamethasone or the

particulate betamethasone would offer better efficacy for analgesia effect. The study was aimed to evaluate their analgesic and systemic effects.

## II. METHODS

This clinical protocol and patient consent forms were designed in accordance with the revised Declaration of Helsinki and the Good Clinical Practice of the International Conference on Harmonization and approved by the Ethics Committee of the School of Medicine of Ribeirão Preto, University of São Paulo (USP) (Reg 14302010). Blood analysis was done at the Laboratory Center of Pharmacometry and Toxic Analysis, School of Pharmaceutical Sciences of the U.N.E.S.P., Araraquara. The prospective study was conducted at the Clinic for Pain Treatment- EPPA- Comprehensive Level, at the same hospital. Each patient acted as his/her own control after writing informed consent.

This prospective study comprised 26 consecutive patients at the Pain Center with clinical history of neuropathic lumbar pain (less than 3 months) secondary to disc herniation at L4-L5 or L5-S1, which diagnostic was based on clinical and magnetic resonance, who accept participating, who previously underwent conservative treatment with physical therapy under oral medication, albeit complaining of pain classified as VAS > 3 cm (VAS 0-10 cm).<sup>7</sup> The concept of visual analog scale (VAS), which consisted of a 10 cm line with 0 equaling “no pain at all” and 10 equaling “the worst possible pain” was introduced.

During this period, all patients were taking daily combination of 25 mg amitriptyline before bedtime, dipyrone three to four times daily and diclofenac 50 mg three times daily during the first 5 days. After introduction into the study, it was maintained only amitriptyline 25 mg and diclofenac was kept as rescue analgesic as part of the protocol. Subjects had to be willing and able (e.g. mental and physical condition) to participate in all aspects of the study, including use of medications, completion of evaluations, attending the scheduled clinic visit and compliance with protocol requirements as evidenced by providing written, informed consent. Patients were excluded from the study for the following reasons: evidence of clinically unstable disease, renal problems, glaucoma or history of glaucoma in the family, psychiatric disease, refusal or known allergy to the devices used, diabetes, previous cardiac infarction or angina, coagulation disturbance, or infection.

Patients acted as their own control related to the epidural administration of dexamethasone and betamethasone. Thirteen patients started with

dexamethasone during the first two weekly procedures (Dexa group (G)), and after 3 weeks of wash-out were submitted to two weekly sequence of sacral betamethasone (Beta G). The other patients have started with epidural betamethasone, followed by dexamethasone after 3-week rest. Patients were evaluated related to analgesia, blood pressure, ocular pressure, weight gain, adverse effects and plasmatic measurements of ions, glycaemia, ACTH and cortisol. Demographics characteristics were noted regarding all patients.

The caudal block was performed with either 10 mg dexamethasone or 10 mg betamethasone combined to 40 mg lidocaine diluted to final 10 ml volume with normal saline. The blocks were performed in the operating room with the aid of the fluoroscopy and non-iodinated contrast. Motorization for all patients consisted of non-invasive blood pressure, pulse oximetry and continuous electrocardiography. Patients were maintained on light sedation with 2 mg IV midazolam combined to 100 mcg IV alfentanil, administered in order to keep conscious sedation.

Blood pressure, ocular pressure (with Perkins tonometer, measured by the same ophthalmologist), weight (kg), pulse rate, plasmatic measurements of glycaemia, Na<sup>+</sup>, K<sup>+</sup> and Ca<sup>++</sup> were evaluated before each block during all the study period. Glycosylated hemoglobin was evaluated on days 1 and 35 (just before 1<sup>st</sup> and 3<sup>rd</sup> block, respectively, Figure 1). Plasmatic cortisol and adrenocorticotrophic hormone (ACTH) were evaluated on days 1, 7 and 35 for both drugs (Figure 1). However, only all 13 patients scheduled for the participation in the first part of the study were included for each drug evaluation related to cortisol and ACTH, after the administration of either dexamethasone during two consecutive weeks in 13 patients, or after the betamethasone administration in 13 patients.

Analgesia was evaluated by VAS pain scores (0-10 cm), and by number of rescue analgesic consumption. As rescue analgesics, it was prescribed 50 mg diclofenac at 8-hour interval if necessary (VAS > 3cm). Figure 2 describes the VAS measurements prior to first block during the two moments of the study after the 3-week wash-out period. For the VAS, all patients were included in the final evaluation for both drugs. The rescue analgesic consumption was equally evaluated in two times (days 14 and 49 of the study) including all patients. The VAS at day-7 reflected analgesia after the first block, while the VAS at day-14 reflected the analgesia after the 2<sup>nd</sup> block. Similarly, the VAS at day-42 reflected the analgesia after the third block (second moment of the study after wash-out period), and VAS at day-49 reflected the analgesia after

the 4<sup>th</sup> block (Figure 1). Rescue analgesic consumption was evaluated as mean daily tablet numbers at day-14 and

at day 49 for both groups.

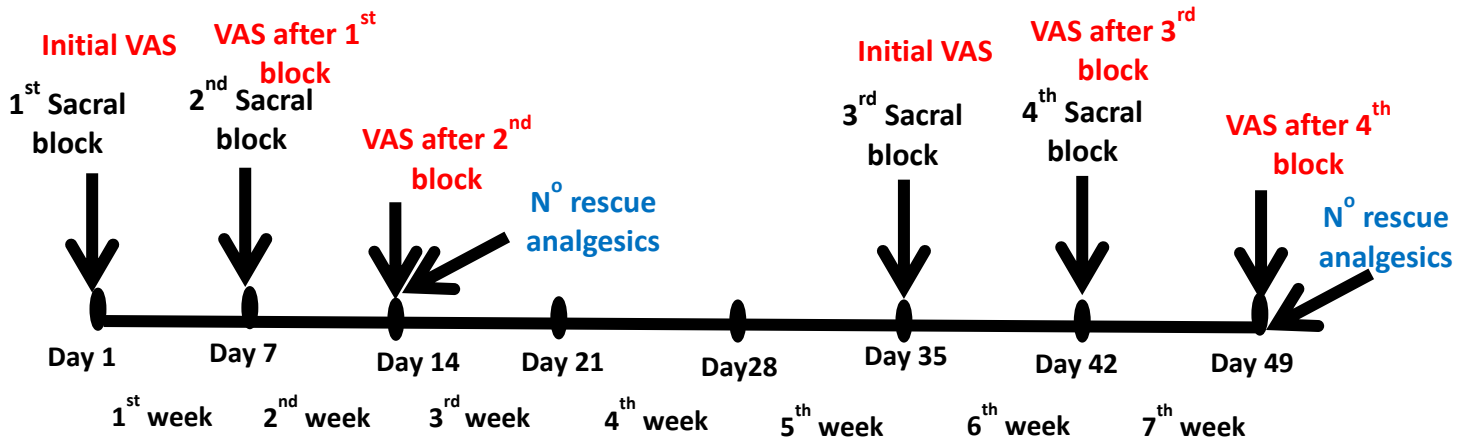


Fig.1. Study organograma for pain evaluation

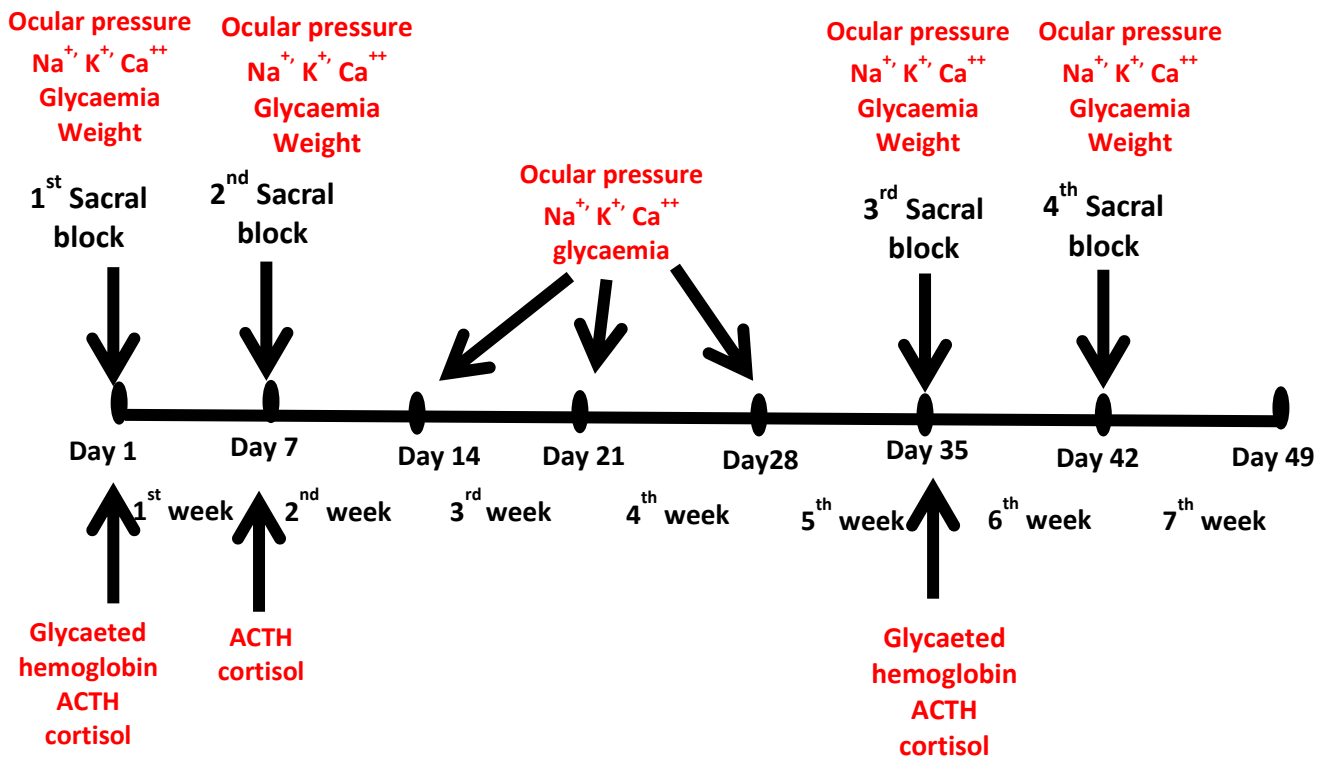


Fig.2. Organogram of the study related to blood collection and ocular pressure.

### III. STATISTICS

The power of the study was based upon preliminary data. We hypothesised that the dexamethasone analgesia would be 40% improved compared to epidural betamethasone. With a beta value of 80% and an alpha value of 0.05, these assumptions would require at least 18 patients. P<0.05 was considered significant. Data are expressed as mean±STD, unless otherwise stated. The study included 26 patients to avoid bias..

The normality of the data was evaluated by the Shapiro Wilkings test. Demographic data was described. The statistical analysis was performed using Friedman and Wilcoxon signed-rank test. Significance was set at P<0.05. Adverse effects were described.

### IV. RESULTS

The final data set included 23 subjects. One patient from Dexa G was excluded from the study due to



loss of blood material. The second patient excluded (from Beta G) did not come to receive the fourth block. Finally, a third patient from Dexa G refused to continue the study due to intense vaginal pruritus after the first block.

Thirteen patients were female and ten male. The mean time for pain prior to the study was 3±1 weeks. The variability of weight (kg) was similar when compared the weight before each block, at days 1, 7, 35 and 42 (p>0.05); independent of the phase of the study. The pain VAS prior to the study was 8±2 cm for the 23 patients. However, on day 7, patients from Dexa G showed lesser pain scores compared to the Beta G at both day-7 and day-14 (Day 7- 3±1 cm; *versus* 5±1 cm; p<0.05) (Day 14- 2±1 cm; *versus* 3±2 cm; p<0.05) (Figure 3). After 3 weeks wash-out, prior to start the second phase of the study protocol, the patient who have been previously during the first phase to the Dexa G showed lesser VAS scores showed lower scores compared to the first phase of Beta G during the day-35 (p<0.05). However, Figure 4 refers to the second phase of the study, and by the 42<sup>th</sup> and 49<sup>th</sup> days of the study, both groups were similar (p>0.05). Related to the number of rescue analgesics at day-14 and at day-49 for both groups, the Dexa G had a lower diclofenac rescue analgesic consumption 1(0-1) tablets (25% a 75%) and 2(2-3) (Beta G) at day 35 (p<0.05), however similar for both groups on 42<sup>th</sup> and 49<sup>th</sup> days.

Mean blood pressure was similar during all weeks of the study for all patients (p>0.05, data not shown). Related to ocular pressure, 5 of 23 patients (22%) had cortisone glaucoma on day-7. The mean ocular pressure of those 5 patients prior to the study was 13±2 mmHg (similar to the others of the study group p>0.05). However, on the 7<sup>th</sup> day evaluation, the mean ocular pressure of the 5 patients was 30±3 mmHg (p<0.001). These patients were followed by a Glaucoma specialist, and all used beta-blocker eye drops to keep ocular pressure between 10-15 mmHg. However, one of the patients underwent trabeculectomy surgery.

The plasmatic concentration of Na<sup>+</sup> (mean 140±3 mEq/l), K<sup>+</sup> (mean 4±0,3mEq/l) Ca<sup>++</sup> (mean 9,7±0,4mEq/l) fasting blood glucose (92±6 mg/dl), blood glucose 120 minutes after food ingestion (mean 114±7 mg/dl), and glycated hemoglobin (mean 5.2±0.3%) were similar during all study week evaluations (p>0.05).

The cortisol plasmatic concentrations (µg/dl) were lower at day-7 compared to day-1 (p<0.001), but similar to day-35 (p>0.05) for both groups. Table 1 describes the plasmatic cortisol levels at 1<sup>st</sup>, 7<sup>th</sup> and 35<sup>th</sup> days for the Dexa G and Beta G. Table 2 describes the ACTH plasmatic levels (pg/dl) at 1<sup>st</sup>, 7<sup>th</sup> and 35<sup>th</sup> days (p<0.01) for the groups. Similarly, the ACTH plasmatic concentrations

were lower at day-7 compared to day-1 (p<0.01), but similar to day-35 for both groups (p>0.05).

Table 1. Plasmatic cortisol (µg/dl) for Dexa G and Beta G at days 1<sup>st</sup>, 7<sup>th</sup> and 35<sup>th</sup>.

|               | Dexa G                                     | Beta G                                     |
|---------------|--------------------------------------------|--------------------------------------------|
| <b>Day 1</b>  | 21.5±5.65                                  | 21.7±5.79                                  |
| <b>Day 7</b>  | 11.5±4.07                                  | 11.2±3.32                                  |
| <b>Day 35</b> | 25.3±2.14                                  | 26.5±5.68                                  |
| <b>P</b>      | 1 <sup>st</sup> day >7 <sup>th</sup> day   | 1 <sup>st</sup> day >7 <sup>th</sup> day   |
|               | 35 <sup>th</sup> day > 7 <sup>th</sup> day | 35 <sup>th</sup> day > 7 <sup>th</sup> day |
|               | 1 <sup>st</sup> day = 35 <sup>th</sup> day | 1 <sup>st</sup> day = 35 <sup>th</sup> day |

Mean ± STD. Dexa G- dexamethasone group; Beta G- betamethasone group

1<sup>st</sup> day > 7<sup>th</sup> day 1<sup>st</sup> day (p<0.001), but similar to 35<sup>th</sup> day (p>0.05) for both groups

Table 2. Plasmatic ACTH (pg/dl) for Dexa G and Beta G at days 1<sup>st</sup>, 7<sup>th</sup> and 35<sup>th</sup>. day-7 It was lower at the 7<sup>th</sup> day compared to the 1<sup>st</sup> day (p<0.01), but similar to 35<sup>th</sup> day (p>0.05).

|               | Dexa G                                     | Beta G                                     |
|---------------|--------------------------------------------|--------------------------------------------|
| <b>Day 1</b>  | 27.5±5.68                                  | 26.9±7,27                                  |
| <b>Day 7</b>  | 15.3±2.86                                  | 15.8±4,39                                  |
| <b>Day 35</b> | 25.9±2.14                                  | 24.1±2.91                                  |
| <b>P</b>      | 1 <sup>st</sup> day >7 <sup>th</sup> day   | 1 <sup>st</sup> day >7 <sup>th</sup> day   |
|               | 35 <sup>th</sup> day > 7 <sup>th</sup> day | 35 <sup>th</sup> day > 7 <sup>th</sup> day |
|               | 1 <sup>st</sup> day = 35 <sup>th</sup> day | 1 <sup>st</sup> day = 35 <sup>th</sup> day |

Mean ± STD. Dexa G- dexamethasone group; Beta G- betamethasone group

1<sup>st</sup> day > 7<sup>th</sup> day 1<sup>st</sup> day (p<0.001), but similar to 35<sup>th</sup> day (p>0.05) for both groups

Related to adverse effects, one patient from Dexa G refereed intense vaginal pruritus and felt discomfortable, refusing to continue the study protocol. Another two patients from Beta G felt epigastralgia. Although 16 of 23 patients referred difficulty to sleep from the 1<sup>st</sup> -3<sup>rd</sup> day after sacral block, they did not take it as adverse effect, as they felt disposition during the following days. No others complain were noted.

## V. DISCUSSION

The results revealed that epidural 10 mg dexamethasone was clinically superior to epidural betamethasone related to analgesia, with similar adverse effects. The Dexa G showed less pain VAS scores during the study evaluation at day-7, day 14 , day-42 and day 49

( $p < 0.05$ ). In addition, the Dexa G also showed lesser number of rescue analgesic consumption at day 14 and day-49 ( $p < 0.05$ ). Moreover, there was no change in weight and blood pressure during all study evaluation and no differences regarding the plasmatic concentration of  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{++}$ , fasting blood glucose, blood glucose 120 minutes after food ingestion, and glycated hemoglobin during the study evaluation ( $p > 0.05$ ).

Recently, a systematic review of 26 total studies revealed that epidural steroids decreased the need for surgery as a primary outcome examined the same patient cohort.<sup>8</sup> In addition, we have decided for lidocaine, as an effect of crystallization has been described for the combination of ropivacaine and the non-particulate steroid dexamethasone.<sup>9</sup> Besides, 7 other meta-analysis studies demonstrated superior analgesic effect of lidocaine combined to steroids.<sup>10</sup> Apart from blocking presynaptic expression of functional Tetrodotoxin-Resistant  $\text{Na}^+$  channels and shaping presynaptic action potentials and transmitter release at the first sensory synapse,<sup>11</sup> spinal lidocaine may be involved preventing noxious stimuli by attenuating Nav1.3 up-regulation and suppressing activation of spinal microglia.<sup>12</sup> as well as inhibiting persistent  $\text{Na}^+$  current in the damaged dorsal ganglion.<sup>13</sup> Its effective anti-inflammatory action on neuropathic pain may also be secondary to lidocaine promotion of the suppressors of cytokine-signaling protein 3 expression in microglia, in turn suppressing IBA1<sup>+</sup> microglia accumulation and p38 MAPK and NF- $\kappa$ B.<sup>14</sup>

Corticosteroids been used frequently in pain treatments since 1952. Due to a review of the complications as a result of their application in epidural injections, the United States of America Food and Drug Administration issued an "alert controversy" requesting that a warning label should be added to injectable corticosteroids, where risks must be described, such as loss of sight, brain damage, paralysis and death) when administering by this route.<sup>15</sup> Even the time of preparation superior to 5 minutes may induce aggregation of betamethasone.<sup>17</sup> Nevertheless, epidural steroids are still a good option via the sacral route,<sup>16</sup> and dexamethasone was the nonparticulate steroid of choice.<sup>16</sup> Related to steroids, epidural dexamethasone had an attenuating effect on the peripheral inflammatory tissue injury induced hyperalgesia and this effect was mediated through the inhibition of intraspinal cytosolic phospholipase A<sub>2</sub> expression and the primary site of action was the laminae I-II of the spinal cord.<sup>18</sup> Moreover, dexamethasone treatment significantly reduced the levels of immune mediators, and prevented inflammatory and/or neurodegenerative lesions in the central and peripheral nervous systems, and apoptosis in the dorsal root ganglia.<sup>19</sup> There is also a suggestion that

dexamethasone could resolve brain inflammation possibly through microglial phenotypic switching from pro-inflammatory M1 to anti-inflammatory M2.<sup>20</sup>

Concerning the plasmatic evaluation, both the control levels of cortisol and ACTH were similar between groups prior to the study (Tables 1 and 2), but reduced at day-7 ( $p < 0.01$ ). However, at day-35, cortisol and ACTH levels returned to baseline in both groups ( $p > 0.05$ ), in accordance to others.<sup>21</sup> The ions  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{++}$ , fasting plasma and post feeding plasma glucose were similar among groups when evaluated before each block for both groups ( $p > 0.05$ ). In accordance to others,<sup>22</sup> fasting glucose plasma levels was back to baseline values on the third day after the epidural administration of steroid, and after 2<sup>23</sup> to 4<sup>24</sup> days in diabetic patients. That would explain why our values were all back to baseline on day-7.

When the ocular pressure was evaluated, 3 patients from Dexa G and 2 from Beta G had an increase of ocular pressure on day-7 in the order of 30 mmHg, while normal ocular pressure is taken between 8 to 20 mmHg.<sup>25</sup> Corticosteroid glaucoma is directly linked to a corticosteroid treatment.<sup>26</sup> Among the risk factors it is described diabetes, myopia, young age; and the mode of steroid administration.<sup>25,27</sup> Increase in ocular pressure to 30 mmHg is taken clinically as corticosteroid glaucoma, and is described from 7 to 30 days after systemic steroids, with an incidence of 12.8%.<sup>27</sup> A different study suggested that patients over 51year-old were more susceptible to increase ocular pressure after intravitreal dexamethasone.<sup>28</sup> Clinically, 4 of the patients had good response to eye drops, but one of them was submitted to trabeculectomy three months after the episode.

Apart from ocular pressure, other adverse effects were described although not statistically significant, albeit the power of the study was based on analgesia effect. One of the patients referred intense vaginal pruritus and was excluded from the study.<sup>29</sup> Its mechanism of action is not well known, its incidence is not significant, however its discomfort was considered catastrophic by the patient. Although 16 of 23 patients referred insomnia after the caudal steroid administration for up to three days, it was not taken as a problem by the patients, as they felt disposition during the day-time. That would justify the low incidence described by others.<sup>30</sup>

As conclusions, caudal dexamethasone combined to lidocaine resulted in superior analgesia compared to caudal betamethasone and lidocaine, and both drugs resulted in unaware increase in ocular pressure and sleep disturbance.

## ACKNOWLEDGMENTS

The authors thank CAPES-Brazil for financial support to make possible this project.

## REFERENCES

- [1] Lipetz J, Zelinger P, Kline M, Chahine N, Bloom O. Lumbar Radicular Pain Response to First Injection with Non-particulate Steroid. *Cureus*. 2020; 26:12:e7104.
- [2] Choi JH, Hong JY, Suh SW, et al. What Is the Role of Epidural Steroid Injections in Lumbar Spinal Disease with Moderate Disability? *Pain Physician*. 2016;19:293-298.
- [3] Ter Meulen BC, Maas ET, Vyas A, et al. Treatment of acute sciatica with transforaminal epidural corticosteroids and local anesthetic: design of a randomized controlled trial. *BMC Musculoskelet Disord*. 2017;25:18:215.
- [4] Wahezi SE, Lederman A, Algra J, et al. Human Serum Modifies Aggregation Properties of Commonly Used Epidural Steroids. *Pain Physician*. 2015;18:1131-1138.
- [5] Gazelka HM, Burgher AH, Huntoon MA, et al. Determination of the particulate size and aggregation of clonidine and corticosteroids for epidural steroid injection. *Pain Physician*. 2012;15:87-93.
- [6] Choi EJ, Kim DH, Han WK, Lee HJ, Kang I, Nahm FS, Lee PB. Non-Particulate Steroids (Betamethasone Sodium Phosphate, Dexamethasone Sodium Phosphate, and Dexamethasone Palmitate) Combined with Local Anesthetics (Ropivacaine, Levobupivacaine, Bupivacaine, and Lidocaine): A Potentially Unsafe Mixture. *J Pain Res* 2021;14:1495-1504.
- [7] Goncharov DI, Zagorul'ko OI, Medvedeva LA, et al. Epidural blockades use in low back pain treatment. *Anesteziol Reanimatol*. 2014;;72-76.
- [8] Bicket MC, Horowitz JM, Benzon HT, Cohen SP. Epidural injections in prevention of surgery for spinal pain: systematic review and meta-analysis of randomized controlled trials. *Spine J*. 2015;15:348-362.
- [9] Watkins TW, Dupre S, Coucher JR. Ropivacaine and dexamethasone: a potentially dangerous combination for therapeutic pain injections. *J Med Imaging Radiat Oncol*. 2015;59:571-577.
- [10] Manchikanti L, Knezevic NN, Boswell MV et al. Epidural Injections for Lumbar Radiculopathy and Spinal Stenosis: A Comparative Systematic Review and Meta-Analysis. *Pain Physician*. 2016;19:365-410.
- [11] Medvedeva YV, Kim MS, Schnizler K, Usachev YM. Functional tetrodotoxin-resistant Na(+) channels are expressed presynaptically in rat dorsal root ganglia neurons. *Neuroscience*. 2009;159:559-569.
- [12] Cheng KI, Lai CS, Wang FY, et al. Intrathecal lidocaine pretreatment attenuates immediate neuropathic pain by modulating Nav1.3 expression and decreasing spinal microglial activation. *BMC Neurol*. 2011;11:71.
- [13] Dong H, Fan YH, Wang YY, et al. Lidocaine suppresses subthreshold oscillations by inhibiting persistent Na(+) current in injured dorsal root ganglion neurons. *Physiol Res*. 2008;57:639-645.
- [14] Zheng Y, Hou X, Yang S. Lidocaine Potentiates SOCS3 to Attenuate Inflammation in Microglia and Suppress Neuropathic Pain. *Cell Mol Neurobiol*. 2019;39:1081-1092.
- [15] Orduña-Valls JM, Nebreda-Clavo CL, López-Pais P, et al. Characteristics of particulate and non-particulate corticosteroids. Indications for their use in chronic pain treatments. *Rev Esp Anestesiol Reanim*. 2016;63:333-346.
- [16] Mallinson PI, Tapping CR, Bartlett R, Maliakal P. Factors that affect the efficacy of fluoroscopically guided selective spinal nerve root block in the treatment of radicular pain: a prospective cohort study. *Can Assoc Radiol J*. 2013;64:370-375.
- [17] Orduña-Valls JM, David L Cedeno DL, Nebreda-Clavo C, Tornero-Tornero C, Alvarez-Escudero J, Martinez MF, Valverde-Navarro AA, Ruiz-Sauri A. Microscopic Study of Injectable Steroids: Effects of Postmixing Time on Particle Aggregation. *Pain Physician* 2020;23(4):E417-E424.
- [18] Benzon HT, Chew TL, McCarthy RJ, et al. Comparison of the particle sizes of different steroids and the effect of dilution: a review of the relative neurotoxicities of the steroids. *Anesthesiology*. 2007;106:331-338.
- [19] Min SH, Soh JS, Park JY, et al. Epidural dexamethasone decreased inflammatory hyperalgesia and spinal cPLA<sub>2</sub> expression in a rat formalin test. *Yonsei Med J*. 2014;55:1631-1639
- [20] Dey R, Bishayi B. Dexamethasone exhibits its anti-inflammatory effects in *S. aureus* induced microglial inflammation via modulating TLR-2 and glucocorticoid receptor expression. *Int Immunopharmacol*. 2019;75:105806.
- [21] Ramesh G, Meisner OC, Philipp MT. Anti-inflammatory effects of dexamethasone and meloxicam on *Borrelia burgdorferi*-induced inflammation in neuronal cultures of dorsal root ganglia and myelinating cells of the peripheral nervous system. *J Neuroinflammation*. 2015;12:240.
- [22] Chutatape A, Menon M, Fook-Chong S, George JM. Metabolic and endocrinal effects of epidural glucocorticoid injections. *Singapore Med J*. 2019;60:140-144.
- [23] Moon HJ, Choi KH, Lee SI, et al. Changes in blood glucose and cortisol levels after epidural or shoulder intra-articular glucocorticoid injections in diabetic or nondiabetic patients. *Am J Phys Med Rehabil*. 2014;93:372-378.
- [24] Gonzalez P, Laker SR, Sullivan W, et al. The effects of epidural betamethasone on blood glucose in patients with diabetes mellitus. *PM R*. 2009;1:340-345.
- [25] Kim WH, Sim WS, Shin BS, et al. Effects of two different doses of epidural steroid on blood glucose levels and pain control in patients with diabetes mellitus. *Pain Physician*. 2013;16:557-568
- [26] Roberti G, Oddone F, Agnifili L, Katsanos A, Michelessi M, Mastropasqua L, Quaranta L5, Riva I, Tanga L, Manni G. Steroid-induced glaucoma: Epidemiology, pathophysiology, and clinical management. *Surv Ophthalmol*. 2020;65:458-472.
- [27] Bremer F. Origin of corticosteroid glaucoma. *Bull Soc Belge Ophthalmol*. 2007;304:111-116.
- [28] Choi W, Bae HW, Choi EY, Kim M, Kim EW, Kim CY, Kim M, Seong GJ. Age as a risk factor for steroid-induced

ocular hypertension in the non-paediatric population. Br J Ophthalmol. 2020. pii: bjophthalmol-2019-314559.

[29] El Abd O, Pimentel DC, Amadera JE. Generalized pruritus as an unusual side effect after epidural injection with dexamethasone. PM R. 2015;7:206-209.

[30] Plataras C, McCormick ZL, Garvan C, et al. Adverse events associated with fluoroscopically guided lumbosacral transforaminal epidural steroid injections. Spine J. 2015;15:2157-2165.

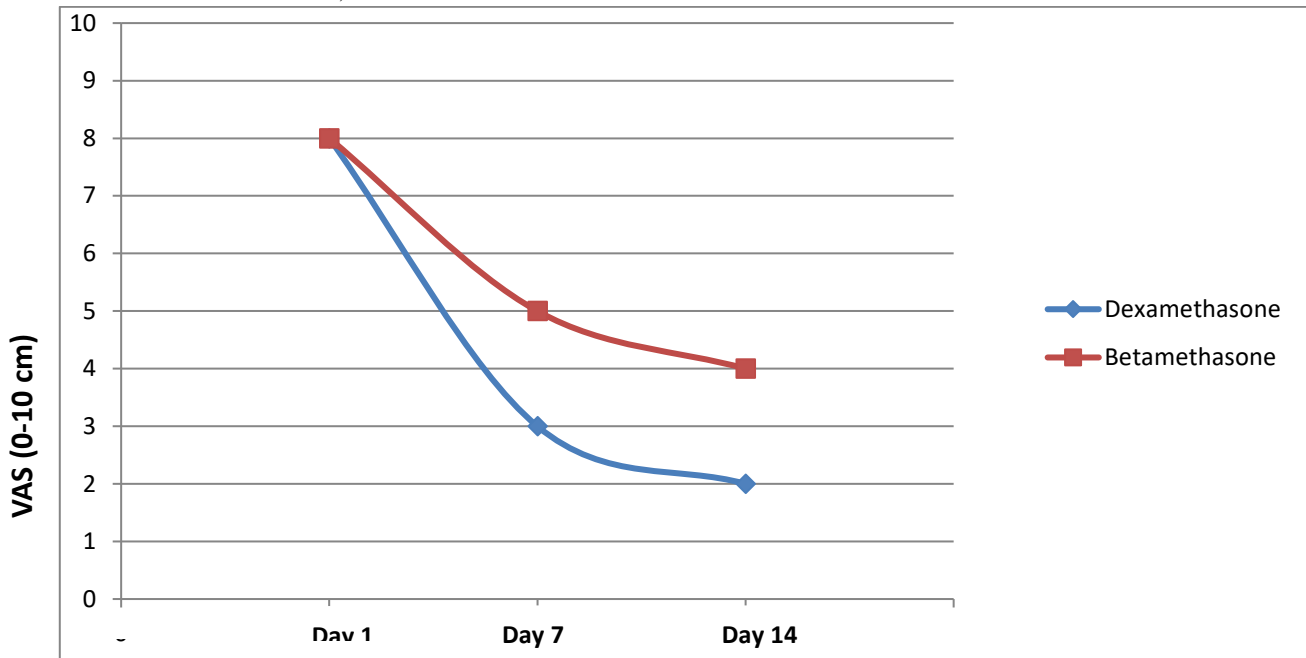


Fig.3. Pain VAS scores (0-10 cm) for groups Dexa G and Beta G just prior of the block.  $P < 0.05$  at 1<sup>st</sup>, 7<sup>th</sup> and 14<sup>th</sup> –day Dexamethasone group < Betamethasone group at days 7<sup>th</sup> and 14<sup>th</sup>(  $p < 0.05$ ).

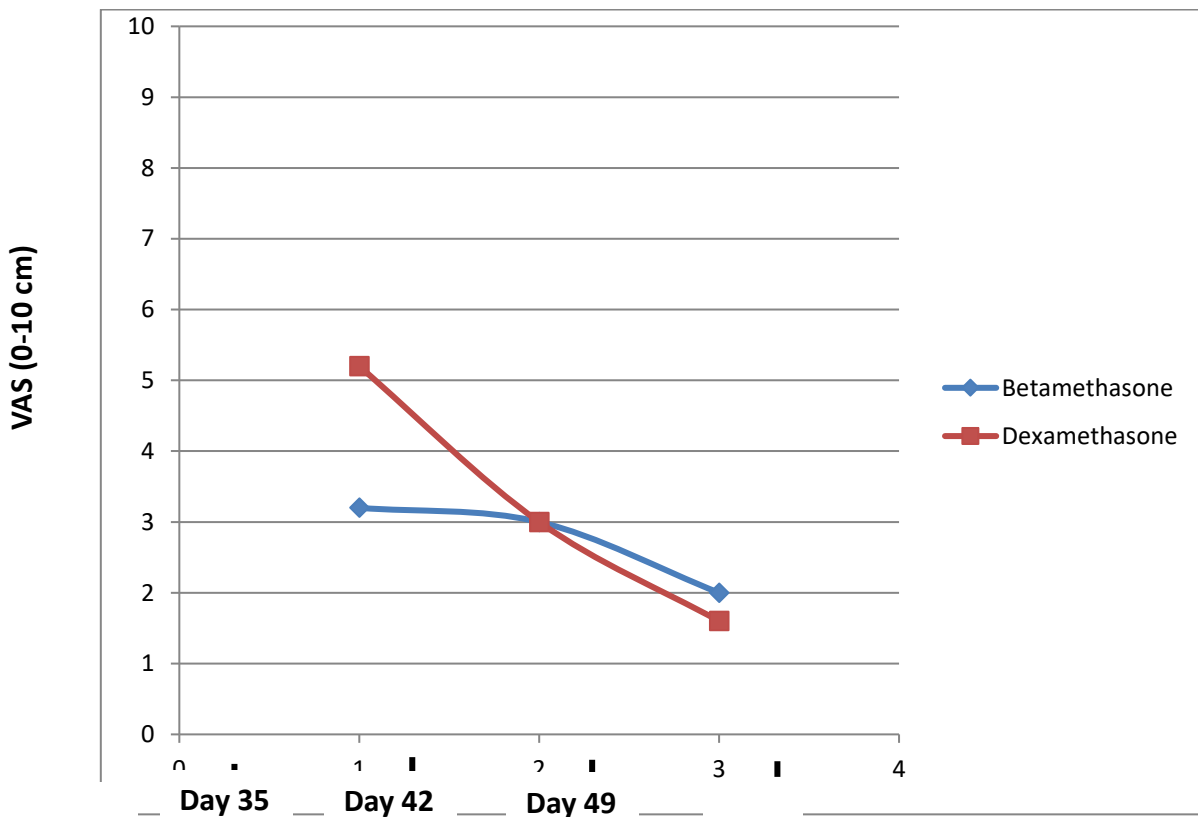


Fig4. After the wash-out, the cross-over of the groups. Pain VAS scores (0-10 cm) for groups DexaG and Beta G. Dexa G < Beta G at 35<sup>th</sup> day ( $p < 0.05$ ).

## Study on absenteeism and underuse of specialized consultations and exams in the municipalities of the Rio Caetés Region, Pará, Amazon

Rejane Brandão Pinto<sup>1</sup>, Ilma Pastana Ferreira<sup>2</sup>, Heliana Helena de Moura Nunes<sup>3</sup>, Silvia Ferreira Nunes<sup>4</sup>, Rosane Gomes Alves Lopes<sup>5</sup>, Valéria Regina Cavalcante dos Santos<sup>6</sup>

<sup>1</sup>Department of Fundação Santa Casa de Misericórdia do Pará (FSCMPA), Belém – Pará, Brazil.

<sup>2,3,4,6</sup>Department of Fundação Santa Casa de Misericórdia do Pará (FSCMPA), Postgraduate Program in Management and Health in the Amazon, Belém -Pará, Brazil.

<sup>5</sup>Department of Postgraduate Program in Health Surveillance (FIOCRUZ), Rio de Janeiro, Brazil

Received: 22 Aug 2022,

Received in revised form: 13 Sep 2022,

Accepted: 19 Sep 2022,

Available online: 29 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— Absenteeism, Regulation,  
Underutilization.

**Abstract**— Health regulation is responsible for ordering timely access by users to health care services in the Brazilian public system. **Objective:** To analyze losses due to underutilization and absenteeism of consultations and specialized exams in the municipalities belonging to the Rio Caetés Region, Pará, Brazil, Amazon. **Methodology:** These are methodological procedures of a quantitative and qualitative research. The sample consisted of 42 professionals working in the 16 municipalities of the Municipal Regulation Centers. **Results:** The overall rate found in the Rio Caetés Region, Pará, in the year 2021, was 76.06% of underutilization and 23.65% for absenteeism in the group of specialized consultation procedures, specialized exams. Despite the values, the general average of absenteeism in consultations was 25.99% and 56.84% in exams, some consultations and exams exceed these values: Gynecology (52.01%), Gastroenterology (34.74%) and in group of exams: Echocardiogram (47.07%), Upper Digestive Endoscopy (39.23%). In view of these results, there was a need to contribute to municipal and regional strategic management by developing a technological product that establishes parameters such as "Usage Score" contributing to the definition of actions to improve the regulatory macro process and strategic planning. **Conclusion:** Collaborate in the development of strategies to improve the work process of professionals, mitigating losses due to absenteeism and underutilization in the Region.

### I. INTRODUCTION

A recurring subject that has always provoked discussions among managers, health researchers and several professionals who are interested in raising the issue of promoting the improvement of health care for Brazilian citizens.

It is notorious to identify that access to the right to health was regulated by the Ministry of Health through the Organic Health Law n° 8.080/1990, which makes the Unified Health System (SUS) the system of guarantees.

From this, management was decentralized to the States and Municipalities, based on the doctrinal system of universality, integrality and equity. When the SUS was created, the former National Institute of Medical Assistance and Social Security – INAMPS was extinguished. In this way, the attributions that belonged to INAMPS started to be assumed by the SUS as control, evaluation and audit (BRASIL, 2018).

Thus, the introduction of regulatory actions for health care in the SUS has been more explicitly stated by the

Ministry of Health, since the publication of the Operational Norm for Health Care (NOAS), in 2001, continues as a Pact. for Health in 2006 and accentuates the more recent institutionalization process, through the creation of the National Regulation Policy, published in 2008, which deals with three dimensions: regulation of the Health System, Regulation of Health Care and Regulation of Health Care or Regulation (Access Regulation or Assistance Regulation) that must be implemented in all units of the federation (BRASIL, 2018).

Thus, this research focuses on losses due to underutilization or primary losses, which are associated with the non-use of medical interventions (exams, consultations and procedures) in the various health systems. Thus, the level of interventions varies across the health system. Therefore, in this directed understanding, the primary and secondary losses measure the use of spaces used in a given period. Primary losses or underutilization indicate the non-utilization of available spaces. With regard to secondary losses or absenteeism, they represent the non-use of an offer after it has been scheduled for a particular user (UNA-SUS, 2018).

O sistema de saúde há décadas trava o desafio do absentismo dos usuários do sistema de saúde diante do não comparecimento para os procedimentos de consultas e de exames, revelando assim, um problema crônico. A literatura demonstra que, de acordo com estudos publicados no Brasil, em relação aos prejuízos monetários para o sistema de saúde, são escassos os dados que possibilitem uma avaliação econômica mediante a apresentação de método analítico para se ter uma estimativa do custo que são desperdiçados ao não comparecimento dos usuários nas consultas e exames (BELTRAME; OLIVEIRA; SANTOS, 2019).

On the other hand, secondary loss or absenteeism, which comprises the user not attending the consultation or examination, after having been scheduled, has several reasons: unnecessary indication of the procedure, scheduling the procedure too far away or unknown to the user, scheduling performed in “out of time” or not notified “in a timely manner” to the user, lack of economic conditions on the part of the user for the necessary displacement, absence of transport for the user to get around, lack of commitment by the user to the offer itself and/or its health, occurrence of unforeseen events that make it impossible for the user to go to the performing unit.

Given this scenario, the regulation of access to the 4th CRS is located in Capanema, through the Complexo Regulador Regional – CRR, the 1st complex established in Pará, since 2014, pilot of the actions to be implemented in the reordering of consultations and specialized exams for

the Macroregion II, which comprises 39 municipalities in two health regions: Metropolitan Health Region III with 23 municipalities and Rio Caetés Region with 16 municipalities.

Thus, this article aims to: Analyze losses due to underutilization and absenteeism of consultations and specialized exams in the municipalities belonging to the Caetés Region, Pará, Brazil, Amazon.

## II. SITUATIONAL DIAGNOSIS OF THE RIO CAETÉS HEALTH REGION

The data collection of this research refers to the Situational Diagnosis of the Rio Caetés Region collected in the Regional Regulatory Complex - CRR with all the municipalities that make up the Health Region through consultation with the State Regulatory System (SER) to verify the number of consultations and specialized exams available, scheduled and performed. Aiming to classify the municipalities regarding the distribution rates of underutilization and absenteeism of consultations and specialized exams related to each Municipal Regulation Center selected for the year 2021.

Data were presented regarding the overall rate of losses due to underutilization and absenteeism in the municipalities, in the year 2021, showing the group of consultation procedures and exams offered, scheduled, performed. It is noted that the number of losses due to underutilization is greater than the number of absenteeism in the analyzed year.

The overall prevalence of underutilization of the municipalities in the groups of procedures, consultations and specialized exams, was the general average for the year of 76.06%. In relation to absenteeism from consultations and specialized exams, the average prevalence was 22.33%.

Thus, it is worth discussing the primary losses of exams and consultations that increased between the years, with a reduction only in the last year for exams, which may be related to the decrease in supply. The hypothesis must be raised that the available offers are greater than the health needs of the regions served by the AMEs, associated with a perhaps unrealistic demand, equipment in maintenance, lack of rescheduling of demands in relation to supply. (CAMPOVILLE, 2019).

Also with the corroboration of Campoville (2019), it states that the city of São Paulo adopted the use of overbooking as a strategy and reduced the rate of primary loss or underutilization for specialized procedures by 2%. With this low use of specialized consultations, it may be related to the distribution of consultations in the network, the lack of adequacy in the opening hours, the availability of the user, the number of vacancies offered.

Thus, the definition of absenteeism parameter, essential for monitoring by services and managers, both from the management perspective and in the organization and regulation of the system (CAVALCANTI, 2018).

The study showed that absenteeism values by type of consultations and specialized exams are relatively lower than losses due to underutilization. Despite the values, the general average of absenteeism in the year 2021 presented 25.99% in consultations and 56.84% in exams, some consultations and exams exceed these values as is the case of Gynecology (52.01%), Gastroenterology (34.74%) and Trauma-Orthopedics (29.04%) and in the exams again the procedures are repeated: Echocardiogram (47.07%), Upper Digestive Endoscopy (39.23%) and Mammography (25.12%).

It was observed that the prevalence of underutilization and absenteeism found in the Rio Caetés Region, although it is high, as shown in the research, cannot be classified due to the lack of a loss parameter regulated by a competent State Agency. It is necessary to resort to parameters from other states or municipalities, in view of this absence in the state reference.

The rates of underutilization (76.06%) and absenteeism (23.65%) in the Rio Caetés Region in the State of Pará, in the year 2021, were high, in addition to the recommended, according to the reference of other states. The global average used as a reference in this study was that of the specialty medical outpatient clinics in the city of São Paulo, which uses 15% as the ideal absenteeism rate.

It was possible to conclude that studies on this topic draw attention to the importance of involving the care network as a whole so that more complex and varied measures, at the strategic, tactical and operational levels, with the implementation of both focal and systemic strategies, as well as the incorporation of evaluation and monitoring systems, are sought to solve the problem of underutilization and absenteeism in accessing scheduled appointments.

### III. CONCLUSION

It was observed that, along the way, new challenges emerged, such as: the increase in losses due to underutilization and absenteeism of consultations and exams, which has become a problem to be overcome and faced in the day-to-day of the regulation and reason for master's and doctoral scientific studies in several national and international literatures, as well as the agenda of several debates on health.

In short, the research contributed to the analysis of losses and identifies that the prevalence of underutilization of specialized services is above the state average of several states and countries, as reported in the literature. The

prevalence investigated in our study was 71.44% in consultations, 23.48% in imaging exams and 82.1% compared to studies in the states of São Paulo and Rio de Janeiro, which present an acceptable loss parameter of 15% and 18% respectively.

### REFERENCES

- [1] Brasil, Resolução CIB SUS/PA Nº 140.2018 (2018) Ministério da Saúde. Retrieved from: <https://cosemspa.org.br/wp-content/uploads/files/documentos/241/res-140-de-09-de-agosto-de-2018-macrorregi-es-.pdf>.
- [2] UNA-SUS.(2018) Programa de Qualificação para Profissionais de Regulação do Sistema Único de Saúde, Retrieved from: <https://www.unasus.gov.br/cursos/curso/44662>
- [3] Beltrame, S. M. Oliveira, A. E. & Santos, M. A. B. dos (2019). Absenteísmo de Usuários como fator de desperdícios: desafio para sustentabilidade em sistema universal de saúde. *Saúde Debate*. v. 43. n. 123. Retrieved from: <https://doi.org/10.1590/0103-1104201912303>.
- [4] Campoville, J. M. H. (2019). Estudo sobre absenteísmo em ambulatórios médicos especializados no interior de São Paulo. *Rev. Esc. Enferm USP*. v.55. Retrieved From: <https://doi.org/10.1590/1980-220X-REEUSP-2020-0380>
- [5] Calvalcanti, R. P. Cruz, D. F. da. & Padilha, W. W. N. (2018) Desafios da Regulação Assistencial na Organização do Sistema Único de Saúde, Retrieved from: <https://docs.bvsalud.org/biblioref/2018/09/913906/31872-92105-1-pb.pdf>.

# Integrative and Complementary Health Practices in the Unified Health System and the use of Medicines in the Rural Population of Municipalities in Rio Grande do Sul

## Práticas Integrativas e Complementares em Saúde no Sistema Único de Saúde e o uso de Medicamentos na População Rural de Municípios do Rio Grande Do Sul

Carina Suzana Pereira Corrêa<sup>1</sup>, Guilherme Mocelin<sup>2</sup>, Cézane Priscila Reuter<sup>3</sup>, Suzane Beatriz Frantz Krug<sup>4</sup>

<sup>1</sup>Doutoranda em Promoção da Saúde pela Universidade de Santa Cruz do Sul (UNISC); Mestre em Promoção da Saúde pela UNISC. Enfermeira Responsável Técnica pelo Hospital de Campanha;

<sup>2</sup>Enfermeiro, Mestrando do Programa de Pós-graduação em Promoção da Saúde da Universidade de Santa Cruz do Sul (UNISC), bolsista CAPES/CNPq, modalidade I;

<sup>3</sup>Doutora em Saúde da Criança e do Adolescente (UFRGS). Farmacêutica, docente do Programa de Pós-Graduação – Mestrado e Doutorado em Promoção da Saúde da Universidade de Santa Cruz do Sul (UNISC);

<sup>4</sup>Doutora em Serviço Social (PUC/RS). Enfermeira, docente do Programa de Pós-Graduação – Mestrado e Doutorado em Promoção da Saúde da Universidade de Santa Cruz do Sul (UNISC).

Received: 15 Aug 2022,

Received in revised form: 15 Sep 2022,

Accepted: 20 Sep 2022,

Available online: 29 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Complementary Therapies, Rural Population; Pharmaceutical Preparations.*

**Descritores**— *práticas integrativas e complementares, população rural e medicamento.*

**Abstract**— *This work is an exploratory, descriptive, qualitative study, developed in six rural municipalities of the 13th Regional Health Coordination (CRS) of Rio Grande do Sul (RS). Study conducted with 19 subjects. The objective was to investigate the use of integrative and complementary health practices (PICS) in the Unified Health System (SUS) as a contributory factor for changing the reality of medication use by users living in the rural area of municipalities in the 13th CRS / LOL. The rural population has important difficulties in accessing health services, with that, integrative therapies are very common and disseminated in rural areas. PICS have the ability to generate positive responses to drug treatments in the psychological or physiological realm, and can be used to reduce the use of medications or as an adjunct to treatments and disease prevention. The vast majority of therapies contribute to improving the quality of life of users, and may reduce the use of medicines, especially those for continuous use, however, they are not substitutes.*

**Resumo**— *Este trabalho trata-se de um estudo de caráter exploratório, descritivo, qualitativo, desenvolvido em seis municípios rurais da 13ª Coordenadoria Regional de Saúde (CRS) do Rio Grande do Sul (RS). Estudo realizado com 19 sujeitos. O Objetivo foi investigar o uso das práticas integrativas e complementares em saúde (PICS) no Sistema Único de Saúde (SUS) como fator contributivo para a modificação da realidade*



*de utilização de medicamentos por parte de usuários residentes na área rural de municípios da 13ª CRS/RS. A população rural possui dificultadores importantes no acesso aos serviços de saúde, com isso, as terapias integrativas são muito comuns e disseminadas no meio rural. As PICS têm a capacidade de gerar respostas positivas a tratamentos medicamentos no âmbito psicológico ou fisiológico, podendo ser usadas para reduzir o uso de medicações ou ainda coadjuvante aos tratamentos e prevenção de doenças. A grande maioria das terapias contribuem na melhora da qualidade de vida dos usuários, podendo reduzir a utilização de medicamentos principalmente os de uso contínuo, porém, não sendo substitutivo.*

## I. INTRODUÇÃO

Os modelos assistenciais associados ao conceito de saúde trazem singularidades históricas associadas a valores e expectativas de vida, acompanhados de mudanças sociais, políticas e econômicas, as quais influenciam diretamente na sua definição. A saúde é o maior recurso para o desenvolvimento social e para a qualidade de vida. Sendo assim, as práticas de promoção da saúde vêm ganhando força no modelo de saúde atual em busca do empoderamento dos pacientes, oferecendo novas possibilidades de cuidado com seu maior recurso<sup>1</sup>.

As práticas tradicionais, integrativas e complementares são assuntos vastamente discutidos no campo científico, trazendo conceitos inovadores para a área da saúde de ampla relevância mundial. Essas práticas vêm se tornando fundamentais para a colaboração da extinção do conceito biomédico e ainda para o conceito do indivíduo como responsável pela sua saúde, aumentando a compreensão e a construção de um modelo diferenciado, focado na saúde e não na doença<sup>2</sup>. No Brasil, a Política Nacional de Práticas Integrativas e Complementares (PNPIC) foi fundamental para o surgimento das chamadas pelo mundo científico de medicina tradicional, complementar e integrativa ou medicina alternativa e complementar, ou ainda Práticas Integrativas e Complementares em Saúde (PICS), termo que se generalizou no Sistema Único de Saúde (SUS), porém, ainda deixa a desejar em alguns pontos no decorrer da sua elaboração, facilitando generalizações não condizentes com a realidade do país e dificultando a sua implantação<sup>3,4</sup>.

Em relação à ação das PICS, percebe-se que conta com bibliografia escassa sobre o processo de medicalização, devido ao seu caráter “desmedicalizante”. “Esse tema tem relevância devido ao intenso processo de medicalização social e suas transformações neste século, incluindo cuidado clínico curativo e preventivo”<sup>3</sup>

O aumento da população idosa é um dos maiores responsáveis pelo aumento da medicalização em virtude do crescimento das doenças crônicas não transmissíveis

(DCNT). Com isso, ao ampliar a saúde com os atendimentos com as PICS abrangendo fatores espirituais e emocionais, as práticas são mais facilmente relacionadas a uma mudança no padrão do uso das medicações contínuas por esses pacientes<sup>3</sup>.

No entanto, pouco se discute no meio científico sobre as áreas rurais e quando são abordadas, associam o local ao atraso, isolamento ou a falta de estrutura. Faz-se necessário destacar a relevância da população que reside no meio rural e as diferenças e peculiaridades destes locais para o desenvolvimento da sociedade, pois o meio rural é um local de moradia, educação e, acima de tudo, saúde<sup>5</sup>. Com isso, torna-se singular e relevante o estudo relacionado às PICS de pessoas que moram no meio rural, fazendo uso delas de alguma forma em suas comunidades como medicamentos.

As PICS têm desempenhado um papel importante na prevenção e tratamento das doenças há muitos anos em todo o mundo. A comunidade rural possui o uso mais disseminado devido ter um acesso mais facilitado muitas vezes às terapias e por outro lado, uma dificuldade em conseguir atendimento médico alopático, tanto pela distância quanto pelo elevado custo<sup>6</sup>.

Em virtude disso, o cenário do presente estudo foram municípios da região de abrangência da 13ª Coordenadoria Regional de Saúde (CRS) do Estado do Rio Grande do Sul (RS), que totaliza 13 municípios, sendo que vários deles possuem maior quantidade de população rural do que urbana<sup>7</sup>. A partir disso, o estudo tem como objetivo investigar o uso das práticas integrativas e complementares em saúde no SUS como fator contributivo para a modificação da realidade de utilização de medicamentos por parte de usuários residentes na área rural de municípios da 13ª CRS/RS.

## II. MÉTODO

O estudo é de caráter exploratório, descritivo, qualitativo. Foi desenvolvido em municípios da 13ª

CRS/RS. Essa Coordenadoria tem sede em Santa Cruz do Sul, composta por 13 municípios e abrange uma população de 327.146 habitantes, desse total, em torno de 63% residem em áreas urbanas, e 37%, em áreas rurais. A população, na maioria, é composta de descendentes de origem alemã no Norte, e açoriana ao Sul, a densidade demográfica é de 31,5 hab/km<sup>2</sup> <sup>8</sup>. A Figura 1 representa graficamente a localização e abrangência da 13ª CRS/RS:

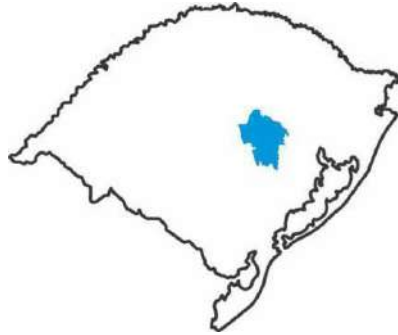


Fig.1 – Mapa da região da 13ª Coordenadoria Regional de Saúde no Rio Grande do Sul

Fonte: RIO GRANDE DO SUL. Secretaria do Estado do RS, 2016.

Elegeram-se como base geográfica para o estudo municípios que apresentam população rural maior que 70%, o que perfaz um campo empírico dos seis municípios: Gramado Xavier, Herveiras, Passo do Sobrado, Sinimbu, Vale do Sol e Vale Verde.

Os seis municípios estudados possuem particularidades quanto a suas realidades e potencialidades. Gramado Xavier possui um contingente populacional que migrou ao povoado constituído basicamente de ascendência italiana e conta atualmente com 4.190 habitantes <sup>8,9</sup>. Herveiras tem 2.954 habitantes<sup>10</sup>, possui cinco escolas, sendo quatro municipais e uma estadual <sup>8,10</sup>. Passo do Sobrado possui uma economia baseada na produção primária, possuindo em torno de 1.500 propriedades rurais, com população total de 6.011 habitantes<sup>8,10</sup>. Sinimbu teve sua origem na imigração alemã, totaliza uma população de 10.404 habitantes, destes, 8.646 habitam áreas rurais e a cultura do fumo, do milho e do feijão são a base da economia local<sup>11</sup>. Vale do Sol possui 1822 propriedades rurais e 11.077 pessoas compõem a sua população<sup>10</sup> e Vale Verde possui 3.253 habitantes<sup>8,10</sup>.

Ao contatar as unidades básicas dos municípios selecionados para o estudo, verificou-se que dois municípios realizaram práticas integrativas entre 2017 e 2019, sendo Gramado Xavier e Sinimbu. O município de Gramado Xavier possui uma Estratégia de Saúde da Família (ESF) abrangendo 100% da população e Sinimbu possui três ESFs abrangendo 100% da população. As PICS

realizadas nos dois municípios de estudo eram em grupo, sendo Lian Gong, Reiki florais e meditação, com encerramento no início de 2020 com a vinda da pandemia mundial por coronavírus.

A amostra de sujeitos integrantes do estudo foi composta por pessoas residentes nesses municípios caracterizados como rurais, usuários da rede de atenção primária de saúde SUS e que realizaram alguma PICS em grupos nas unidades de saúde, entre os anos de 2017 e 2019. Os pacientes foram localizados com o auxílio da equipe das ESFs.

O instrumento de coleta de dados foi uma entrevista semiestruturada, com intuito de compreender de uma forma mais ampla o sujeito pesquisado. A entrevista revela condições da fala para obter informações, na qual o entrevistado tem a possibilidade em colocar as suas experiências a partir do foco do entrevistador, sendo composta por questões semi-estruturadas levando em conta o embasamento do pesquisador<sup>11,12</sup>. A entrevista foi realizada individualmente, com 19 integrantes de grupos de PICS. O período das coletas dos dados foi entre julho e outubro de 2020.

Os dados obtidos foram transcritos na íntegra, sendo realizada a Análise de Conteúdo, no qual há uma verificação da frequência de determinados termos e referências a um dado texto<sup>13</sup>. Foram elaboradas quatro unidades temáticas de análise, constituídas a partir das questões da entrevista: a) conhecimento sobre PICS; b) Contribuições das PICS: a visão dos moradores rurais; c) O uso de medicamentos e as PICS e d) Peculiaridades sobre saúde na área rural.

Foi apresentado o Termo de Consentimento Livre e Esclarecido aos sujeitos por meio da exposição dos objetivos e procedimentos do estudo, com intuito de informar e autorizar a entrevista. Constituído em duas vias, permaneceu uma via com o pesquisador e uma com o sujeito da amostra, estando os mesmos livres de se isentar da pesquisa, a qualquer momento, se assim desejarem. O protocolo de aprovação do CEP número do Parecer: 3.914.561 e CAAE: 26886719.5.0000.5343. Os sujeitos foram identificados por nome de ervas medicinais usadas frequentemente na fitoterapia com o intuito de preservar suas identidades.

### III. RESULTADOS E DISCUSSÃO

A amostra foi composta por 19 sujeitos, a maioria mulheres, casadas, agricultoras, predominantemente da terceira idade e com grau de instrução no nível de ensino fundamental incompleto. A seguir os dados estão descritos e analisados nas unidades temáticas elaboradas.

## Conhecimento sobre PICS

As PICS são compreendidas como tratamentos que utilizam recursos terapêuticos baseados em conhecimentos tradicionais, com o intuito de prevenir diversas doenças. Em alguns casos, também podem ser usadas como tratamentos paliativos em algumas doenças crônicas. Em relação às entrevistas realizadas, o conhecimento a respeito das PICS mostrou-se, em sua maioria, relacionado à prática que realizavam, apontando desconhecimento acerca das PICS como um todo. A maioria dos participantes referiu que não tinha muito conhecimento conceitual sobre o tema solicitado. As falas a seguir traduzem esse contexto:

*“Não sei muita coisa. Mas as vezes que participei foi bom.”* (Alcachofra)

*“Sei muito pouco ainda, mas que são novos tratamentos que usam recursos terapêuticos baseados em conhecimentos tradicionais, medicinas tradicionais”* (Maracujá)

As PICS são diversas e de várias origens diferentes, o que muitas vezes dificulta o entendimento por parte da população sobre o seu significado. O conhecimento vem se disseminando de forma lenta tanto na população quanto no meio científico, gerando uma certa desinformação por parte dos usuários<sup>14</sup>. Com o aumento gradativo da oferta de novas PICS, foi-se despertando um maior interesse e conseqüente uma busca ascendente sobre o assunto por parte tanto de usuários como de profissionais de saúde. Outras integrantes do estudo manifestaram conceitos associados à dimensão da integralidade do ser humano:

*“Para mim PICS são uma forma de terapia alternativa que trata o ser humano como um todo respeitando seus sentimentos, emoções e buscando a cura interior, a paz”* (Boldero do Chile)

*“Reiki - ajuda o físico e o espiritual devido às trocas de energia. Pois acredito que não são as mãos de quem o faz*

*que está a trabalhar no nosso corpo”* (Cáscara sagrada)

As PICS ganharam força política no país no passado e fez-se necessário mais profissionais destas terapias nos locais que aderiram ao processo. Infelizmente, na atualidade, as PICS perderam um pouco da sua “força” de atuação e de disseminação no Brasil, tendo sofrido um retrocesso em sua evolução<sup>15</sup>. Percebe-se então, uma mudança nos conceitos e no entendimento das práticas pelos usuários. Muitos dos participantes, tiveram um entendimento diferente dos demais, mostrando a variedade da compreensão sobre as PICS, sendo entendido pela maioria que essas terapias elevam o bem-estar, como as falas a seguir:

*“fazem muito bem para alma e para o corpo”* (Calêndula)

*“que faz bem, melhora o ego, melhora o pensamento, tira a exaustão”* (Trevo-vermelho)

O estilo de vida dos pacientes que utilizam as PICS reflete em vários benefícios, dentre eles, o aumento na qualidade de vida, estimulando o bem-estar em todos os seus aspectos reduzindo os danos e aumentando a eficácia de possíveis tratamentos realizados<sup>16,17</sup>. Sabe-se que muitas das indicações para a realização das PICS estão relacionadas com a redução do uso de medicamentos alopáticos. Sendo assim, os demais participantes, fazem uma associação com o uso de fármacos, traçando um paralelo da associação com as práticas das terapias:

*“faz bem e substitui outras medicações”* (Sene)

*“são práticas muito benéficas nos tratamentos como ansiedade, estresse, insônia. Procurar ajuda e fazer o tratamento como opção de me livrar do uso de medicamentos controlados.”* (Espinheira Santa)

As PICS têm a capacidade de gerar respostas positivas a tratamentos medicamentos no âmbito psicológico ou fisiológico, podendo ser usadas para reduzir o uso de medicações ou ainda coadjuvante aos tratamentos e prevenção de doenças<sup>18,19</sup>. O incentivo e valorização das

PICS é primordial para realizar uma articulação do saber científico com o uso racional das medicações<sup>20</sup>.

### Contribuições das PICS: a visão dos moradores rurais

Os moradores das áreas rurais possuem um acesso mais restrito aos serviços de saúde em todos os municípios e a nível mundial também. Sendo assim, as PICS têm um papel fundamental na saúde dessa população. Os pacientes das áreas rurais, buscam as práticas para as suas necessidades particulares, sendo assim, a terapia escolhida varia de acordo com este importante fator.

A contribuição das PICS sob a visão dos moradores rurais é de extrema relevância para o estudo, uma vez que partindo do ponto de vista dos entrevistados sobre o tema, pode-se perceber limitações e facilidades que as práticas oferecem aos usuários do interior. Os entrevistados a seguir percebem as PICS como terapias para melhorar o estado espiritual de diversas formas, como segue abaixo:

*“buscar o alívio da dor, equilíbrio entre corpo e mente”* (Valeriana)

*“ajuda física e espiritualmente a me tornar uma pessoa cada vez melhor e ajuda a encaminhar os espíritos que vagam precisando de luz”* (Cáscara sagrada)

Muitos destes conceitos relatados, aparecem devido algumas práticas integrativas serem mais sutis, elevando a consciência do praticante e permitindo uma tranquilidade aos pensamentos, atuando na parte mental, emocional e espiritual, possibilitando o autoconhecimento individual<sup>21</sup>. Sendo assim, muitos dos praticantes ou pacientes que aderem às PICS tendem a buscar mais de uma técnica para exercer ao mesmo tempo, tanto para terapia quanto para exercício de auto tratamento.

As PICS ainda possuem um resultado satisfatório na redução das dores de diversas ordens. Algumas técnicas são mais eficazes para algumas dores que outras. Sendo assim, o paciente precisa de uma avaliação prévia para ver em qual técnica melhor se enquadra<sup>16</sup>. Por isso, a maioria dos entrevistados buscou as PICS para a redução das dores, como percebe-se nas falas:

*“para dor na coluna, ossos e depressão”* (Guaraná)

*“fiz para dor no joelho”* (Hortelã)

A dor é um fator de grande desconforto por parte dos pacientes acometidos para alguma patologia que a provoque, seja em menor ou maior grau e de acordo com a sensibilidade de cada um. Algumas das práticas possuem resultados satisfatórios em pacientes com uso de medicações diversas, além de serem consideradas mais seguras e menos iatrogênicas do que muitos analgésicos usados. Muitas são as terapias que vêm para reduzir o uso de vários medicamentos, com maior ênfase na área mental como depressão e com ótimos resultados<sup>22</sup>.

### O uso de medicamentos e as PICS

Muito tem se discutido sobre o uso de medicamentos isoladamente ou em concomitante com a prática das PICS por pacientes da área rural. As terapias alternativas estão em constante evolução e consequente aceitação por parte dos usuários<sup>1,3</sup>. Em contrapartida, não é possível pensar em uma simples substituição de medicação, sem o envolvimento de vários aspectos na vida do paciente. Nas entrevistas realizadas, percebem-se resultados de redução e de manutenção no uso de medicamentos pelos usuários. Os pacientes que não tiveram resultados são citados abaixo:

*“não tive mudança nos medicamentos”* (Camomila)

*“ainda não diminui a medicação anti-hipertensiva”* (Sene)

Sabe-se que na área rural, algumas drogas são mais usadas que outras, sendo assim, as classes de medicamentos mais citadas pela população do estudo foram os analgésicos e ansiolíticos e as patologias mais mencionadas foram ansiedade e dores mais localizadas nas pernas e costas, de persistência diária e com agravamentos ao passar dos anos devido ao intenso trabalho por eles exercido na área rural.

A alteração no uso de medicações com a prática das PICS não se dá de uma forma abrupta. Algumas práticas são mais eficazes que outras para certas patologias, dependerá de o terapeuta saber avaliar e conduzir o paciente à terapia que melhor se encaixa. A grande maioria das terapias contribuem na melhora da qualidade de vida dos usuários, podendo reduzir a utilização de medicamentos principalmente os de uso contínuo<sup>23,24</sup>.

“Cabe ressaltar que a resposta à abordagem terapêutica, seja farmacológica ou não dependerá de diversos fatores patológicos, físicos, químicos e psicológicos relacionados à progressão e/ou contenção da doença”<sup>25</sup>.

As terapias alternativas como forma complementar associada ao uso de medicamentos,

reduzem os efeitos colaterais e possibilitam um tratamento mais individualizado e de qualidade aos usuários. Muitos dos entrevistados referiram uma melhora significativa com a associação de ambos como vemos a seguir:

*“sim, logo após minha medicação diminuiu e hoje estou sem antidepressivos, apenas medicamento para ansiedade”*  
(Bartibamão)

*“Sim, diminui o uso da ciclobenzaprina e celocoxibe”*  
(Valeriana)

As pacientes acima utilizavam medicação contínua e em dosagens elevadas. Com a prática das PICS, ambas tiveram uma redução significativa do uso e/ou substituição por medicação menos potente para as patologias que possuíam. Já outras entrevistadas, deixaram de usar totalmente as medicações que usavam antes da realização das PICS. As usuárias a seguir, demonstram tal resultado:

*“por conta da medicação natural e a meditação, não precisei usar medicamentos de tarja”*  
(Trevo vermelho)

*“sim, eu tomei antidepressivo por muito tempo agora não estou fazendo uso de nenhuma medicação”*  
(Bolto do Chile)

Diversos estudos mostram a eficácia e segurança no uso de algumas terapias para a redução ou até modificação ou ainda a suspensão do uso de medicamentos. Porém, outros estudos ainda são escassos e muitos profissionais possuem receio em prescrevê-las na maioria das vezes por desconhecimento sobre o assunto. O conhecimento popular busca ser uma forma complementar à medicina alopática, facilitando o acesso a todas as populações que desejarem<sup>26,25,22</sup>. Ressaltando que para realizar as PICS, o profissional precisa estar habilitado e com formação específica na área e regulamentação em seu conselho profissional.

### Peculiaridades sobre saúde na área rural

A questão sobre as peculiaridades da saúde na área rural com o uso das PICS teve várias interpretações pelos usuários entrevistados, sendo que muitos deles não responderam ou tiveram dúvidas ao responder. A ideia com a questão abordada, era que os entrevistados demonstrassem as suas análises a respeito do acesso à saúde por eles na área rural.

*“sim, pela dificuldade de se locomover, muita gente não tem condição de chegar onde precisa para buscar solução, no interior existe muito preconceito sobre espiritualidade e práticas deste gênero onde se conseguiria ajudar muita gente se fosse dado condições para as pessoas irem até o local”*  
(Cáscara sagrada)

O acesso é o maior fator dificultador para a população rural até os grandes centros, pois muitas vezes os tratamentos oferecidos pelos municípios ficam concentrados nas cidades e não no interior. Sendo assim, os usuários rurais, sofrem como a falta de acesso aos tratamentos que poderiam ser realizados por eles para a promoção da saúde, como percebemos em diversas falas.

*“a maior dificuldade seria o acesso aos profissionais que aplicam as técnicas e procedimentos, onde na maioria das vezes se tem um custo além do deslocamento até a área urbana. Muitas vezes não se tem nem o conhecimento destas práticas e seus benefícios na vida”*  
(Espinheira Santa)

A área rural sofre em vários aspectos ao acesso aos serviços de saúde, seja pela distância, falta de profissionais ou até por falta de materiais para dar continuidade às terapias que realizam. Percebe-se ainda, o desconhecimento pela maioria dos moradores rurais sobre as PICS e interesse de outros em realizar e não ter a possibilidade para tal.

Igualmente ao acesso, percebe-se o custo como um forte argumento apresentado pelas usuárias entrevistadas. Diversas vezes o atendimento precisa ser pago para poder ter acesso à saúde e isso implica em uma grande dificuldade para a população rural, uma vez que a maioria não possui condições financeiras elevadas.

#### IV. CONSIDERAÇÕES FINAIS

O estudo proporcionou investigar o uso das práticas integrativas e complementares em saúde no SUS como fator contributivo para a modificação da realidade de utilização de medicamentos por parte de usuários residentes na área rural de municípios da 13ª CRS/RS evidenciando que as PICS possuem sim um fator contributivo para a modificação do uso de medicações destes usuários pesquisados.

As práticas integrativas em sua grande maioria contribuem com outras formas de solução ou alívio para o sofrimento por ser uma potente “ferramenta” para desmedicalizar. Sendo assim, percebe-se que o uso das práticas integrativas e complementares em saúde no SUS podem ser um fator contributivo para a modificação da realidade de utilização de medicamentos por parte de usuários residentes na área rural de municípios da 13ª CRS/RS, mas não substitutivo.

Percebe-se que a população rural tem o uso mais discriminado e por consequência um conhecimento maior da sua aplicação, sendo a parcela da sociedade que mais usa algumas terapias de uma forma mais empírica e antiga, porém, com grande propriedade.

As PICS possuem potências e limites, características próprias e lógicas de ação, que produzem tendências, facilidades e dificuldades específicas. Com isso, dependerá muito da técnica usada e do paciente, bem como da medicação que ele usa para o resultado ser mais ou menos eficaz, mas sempre com uma resposta positiva na redução da medicação usada.

O estudo teve uma limitação relevante de amplitude mundial. A pandemia do Coronavírus, com início no ano de 2020 no Brasil, teve grande repercussão no trabalho, dificultando ou ainda impossibilitando diversas tarefas que deveriam ter sido desenvolvidas durante o processo de construção do estudo como um todo. No entanto, ressalta-se que o estudo foi concluído e teve grande contribuição acadêmica em uma área tão escassa de bibliografia sobre o tema pesquisado.

Por se tratar de uma pesquisa que envolve um assunto até então menos comum que os demais, sugerem-se mais estudos sobre a temática, uma vez que as práticas de cuidado são essenciais para a melhoria das condições de saúde da população assistida, com ênfase na população

rural, a qual possui diversas especificidades culturais extremamente relevantes no contexto da saúde e mais ainda das PICS.

#### REFERÊNCIAS

- [1] Bezerra IMP, Sorpreso ICE. Conceitos de saúde e movimentos de promoção da saúde em busca da reorientação de práticas. *J. Hum. Growth Dev.*, São Paulo, v. 26, n. 1, p. 11-20, 2016. Disponível em <[http://pepsic.bvsalud.org/scielo.php?script=sci\\_arttext&pid=S0104-12822016000100002&lng=pt&nrm=iso](http://pepsic.bvsalud.org/scielo.php?script=sci_arttext&pid=S0104-12822016000100002&lng=pt&nrm=iso)>. acessos em 25 nov. 2020. <http://dx.doi.org/10.7322/jhgd.113709>.
- [2] Soares RD, Pinho JRO, Tonello AS. Diagnóstico situacional das Práticas Integrativas e Complementares na Atenção Primária à Saúde do Maranhão. *Saúde em debate*, Rio de Janeiro, v. 44, n. 126, p. 749-761, Sept. 2020 Available from <[http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0103-11042020000300749&lng=en&nrm=iso](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-11042020000300749&lng=en&nrm=iso)>. access on 25 Nov. 2020. Epub Nov 16, 2020. <https://doi.org/10.1590/0103-1104202012612>.
- [3] Tesser CD, Dallegrave D. Práticas integrativas e complementares e medicalização social: indefinições, riscos e potências na atenção primária à saúde. *Cadernos de Saúde Pública*, Rio de Janeiro, v. 36, n. 9, e00231519, 2020. Available from <[http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0102-311X2020000903001&lng=en&nrm=iso](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0102-311X2020000903001&lng=en&nrm=iso)>. access on 25 Nov. 2020. Epub Sep 04, 2020. <https://doi.org/10.1590/0102-311x00231519>.
- [4] Habimorad PHL, et al. Potencialidades e fragilidades de implantação da Política Nacional de Práticas Integrativas e Complementares. *Ciência e saúde coletiva*, Rio de Janeiro, v. 25, n. 2, p. 395-405, Feb. 2020. Available from <[http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S1413-81232020000200395&lng=en&nrm=iso](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1413-81232020000200395&lng=en&nrm=iso)>. access on 25 Nov. 2020. Epub Feb 03, 2020.
- [5] Ponte, KF. (Re) Pensando o Conceito do Rural. *Revista Nera*. Ano 7, n4, janeiro/julho 2004.
- [6] Assefa, BR, Gerhard VS, Stege. Ethnomedicinal uses of *Hagenia abyssinica* (Bruce) J.F. Gmel. among rural communities of Ethiopia. *Journal of ethnobiology and ethnomedicine*. 2010. 6. 20. 10.1186/1746-4269-6-20.
- [7] Rio Grande do Sul. Conselho Regional de Desenvolvimento (COREDE). Porto Alegre, RS, 2015.
- [8] Rio Grande do Sul. Secretaria da Cultura, Turismo, Esporte e Lazer do Rio Grande do Sul. 2019. Disponível em: <<https://www.turismo.rs.gov.br/inicial>>.
- [9] IBGE – Instituto Brasileiro de Geografia e Estatística. Pesquisa Nacional por Amostra de Domicílios. Rio de Janeiro, 2014.
- [10] IBGE. Pesquisa Nacional por Amostra de Domicílios. Rio de Janeiro, 2010.
- [11] Minayo M. C. S. O desafio do conhecimento: pesquisa qualitativa em saúde. 14 ed. São Paulo: Hucitec, 2014. 407p.
- [12] Trivinos ANS. Introdução à pesquisa em ciências sociais: a pesquisa qualitativa em educação. São Paulo: Atlas, 1987.

- [13] Duarte J, Barros A (org). Métodos e técnicas de pesquisa em Comunicação. 2 ed. São Paulo: Atlas. 2006. 384p.
- [14] Guimarães MB et al . As práticas integrativas e complementares no campo da saúde: para uma descolonização dos saberes e práticas. Saúde e sociedade. São Paulo, v. 29, n. 1, 2020 . Available from <[http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0104-12902020000100314&lng=en&nrm=iso](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-12902020000100314&lng=en&nrm=iso)>. access on 03 Dec. 2020. Epub Apr 17, 2020.
- [15] Kraicik MLA, Pereira PMB, Iser BPM. Medicina Integrativa: um parecer situacional a partir da percepção de médicos no Sul do Brasil. Saúde em debate. Rio de Janeiro, v. 43, n. 123, p. 1095-1105, Oct. 2019. Available from <[http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0103-11042019000401095&lng=en&nrm=iso](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-11042019000401095&lng=en&nrm=iso)>. access on 03 Dec. 2020. Epub Mar 09, 2020.
- [16] Alves KYA, Assis YMS, Salvador PTCO, Nascimento CPA, Tourinho FSV, Santos VEP. Práticas Integrativas e Complementares no Tratamento Oncológico e o papel da enfermagem. Rev pesqui cuid fundam. 2015; 7(4):3163-3174.
- [17] Magalhães MGM, Alvim NAT. Práticas Integrativas e Complementares no Cuidado de Enfermagem: Um enfoque ético. Esc Anna Nery. 2013; 17(4): 646-653.
- [18] Bastos RAA, Lopes AMC. A fitoterapia na Rede Básica de Saúde: o olhar da enfermagem. Rev Bras Cienc Saude. 2010; 14(2):21-8.
- [19] Nelson JP. Being in Tune With Life Complementary Therapy Use and Well-Being in Residential Hospice Residents. J holistic nurs. 2006;24(3):152-61.
- [20] Rissardo, LK et al. Práticas de cuidado ao idoso indígena - atuação dos profissionais de saúde. Revista brasileira de enfermagem, Brasília, v. 67, n. 6, p. 920-927, Dec. 2014. Available from <[http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0034-71672014000600920&lng=en&nrm=iso](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0034-71672014000600920&lng=en&nrm=iso)>. access on 02 Feb. 2021. <https://doi.org/10.1590/0034-7167.2014670609>.
- [21] Esper MV, Gnatta JR, Silva MJP. Caracterização da produção científica sobre meditação na área da saúde e na Enfermagem: revisão de literatura. Cad Naturologia Terapias Complementares. 2016; 5(8):39-46.
- [22] Enthoven WTM et al. NSAIDs for Chronic Low Back Pain. JAMA. 2017 Jun 13;317(22):2327-2328.
- [23] Guterrez M. Homeopatia no SUS. Pharmacia Brasileira, Brasília, v. 63, p. 9-16, jan. 2008. Entrevista concedida a Aloísio Brandão.
- [24] Brasil. Ministério da Saúde. Política Nacional de Práticas Integrativas e Complementares. 2015. Acesso em: 03 set. 2019.
- [25] Pereira RDM, Silva, WWO, Ramos, JCR, Alvim, NAT, Pereira CD, Rocha, TR. Práticas Integrativas e Complementares de Saúde: Revisão Integrativa sobre medidas não farmacológicas à dor oncológica. Revista de Enfermagem UFPE on line , v. 9, p. 710-717, 2015.
- [26] Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Coordenação Nacional de Práticas Integrativas e Complementares. Relatório de Gestão: 2006/2010. Práticas Integrativas e Complementares no SUS. Brasília: Ministério da Saúde, 2011.

# Role of Sericulture in Uplifting Socio-Economic Status of Casual Workers and Constructors: A Case Study of Sheema, Kiruhura, Kween and Mukono District in Uganda

Sabunyo Noah, Clet Wandui Masiga

Tropical Institute of Development Innovations P.O Box 397, Mukono

Received: 26 Aug 2022,

Received in revised form: 17 Sep 2022,

Accepted: 22 Sep 2022,

Available online: 29 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** Sericulture, Employment, Socio-economic impact, Status, Development.

**Abstract—** This study was undertaken in the four sericulture research stations of Sheema, Kiruhura, Kween and Mukono in Uganda with the main objective of documenting the socio-economic impact of sericulture project on the livelihood for permanent and temporary casual workers and constructors/ builders at different sericulture stations. Sericulture is labour intensive projects that need both permanent and temporary casual workers and constructors/ builders who are required for smooth running of daily sericulture field activities. Sixty five casual workers and constructors were randomly selected as respondents to the structured questionnaire aspects related to the factors such as sex, education, age, marital status, type of family, nature of employment, household expenditure, household assets acquired and challenges faced by casual workers and constructors/builders were collected by well-structured questionnaire through personal interview method. The results obtained revealed that more 52.3% male workers were employed than female workers, 36.9% of the respondents were in the age group of 31-40 years, the biggest percentage 73.8% were married, 50.8% of the respondents were working as casual workers whereas 49.2% as constructors/builders, a majority 83.1% of respondents were working as permanent workers and only 16.9% as temporary workers. A majority of the respondents reported that the salaries earned at the end of month has positively impacted and changed their livelihoods of many respondents and this has help them to meet all the family needs and requirements such as family feeding, educating their child's, buying clothing for themselves and for their child's, health, pay utilities bills, drinking alcohol, others have managed to acquired different family assets such as land, some have managed to build houses, mobile phones, radios, televisions solar panels, bicycles and motorcycles and livestock's such as cows, goats, sheep, birds, pigs, turkey and ducks, this can fetches them little economic support for their families and can serve as addition income.

## I. INTRODUCTION



Sericulture is the art and science of rearing of silkworms for the production of raw silk and its end product is silk. Silk is referred as “Queen of fabrics” and is well known for its natural colour, purity and unusual lustre. It is natural fabric, animal oriented and produced from silkworm (Hiware 2012). Sericulture refers to conscious mass-scale rearing of silk producing organisms in order to obtain silk from them (Ganga 2006). Sericulture is an important labour intensive, agro-based industry providing gainful employment to unemployed/underemployed in the rural and semi-urban areas and facilitates economic development and improvement in the standard of life of the people. It is the only cash crop that gives returns within 30 days (Kamili and Masoodi, 2000). Sericulture is the only cash crop which provides frequent and attractive returns in the country through year. Most of the crops in world can be grown once or twice in a year but sericulture can be practiced 4-8 times in a year and thus provide regular employment to the rural and urban communities which ultimately check the migration of population from rural areas to urban areas (Thapa & Shrestha, 1999); and hence, it is considered as an essential tool for the rural development for improving the standard of living of human population of village level. These opportunities include planting of mulberry gardens, management of mulberry gardens, harvesting mulberry leaves to feed silkworms, silkworm rearing, production of silkworm seed, reeling of silk cocoons, processing silk fabrics, printing, dyeing and finished product making and their marketing (Thangavelu, 2002; Mahapatra, 2009).

Sericulture industry has played a vital role in improving economic development in several countries across the world. The leading producers of silk in the world are China, India, Uzbekistan, Brazil, Japan, Republic of Korea, Thailand, Vietnam, DPR Korea, and Iran but a few others that produce minute quantities are recognized; Kenya, Botswana, Nigeria, Zambia, Zimbabwe, Bangladesh, Colombia, Egypt, Japan, Nepal, Bulgaria, Turkey, Uganda, Malaysia, Romania, Bolivia (International Sericultural Commission, 2018; Nagaraju, 2008). Uganda was ranked 20th out of 22 silk producing countries with 3.10 metric tonnes of silk produced in the year 2019. (International Sericultural Commission Statistics, 2020).

Socio-economic benefits of sericultural technology transfer is labour-intensive farming enterprise employing 1 million workers in China, 7.9 million people in India, and 20,000 weaving families in Thailand. (International Sericultural Commission, 2020) Sericulture can help keeping the rural population employed and to prevent migration to big cities and securing remunerative employment; it requires small investments while providing raw material for textile

industries. Casual workers and constructors/ builders are required for smooth running of daily sericulture field activities such as planting of mulberry gardens, management of mulberry gardens, harvesting mulberry leaves to feed silkworms, silkworm rearing, production of silkworm seed, reeling of silk cocoons, yarn making, weaving and fabric processing, printing, dyeing and finished product making and their marketing (Ahmed & Rajan, 2011).

Agriculture is the core of the economy and the primary source of employment, employing 73 percent of the country's (Uganda) labor force primarily in the rural areas and jobs available on the market lack required working experience, low qualifications and about 30 percent of the youths who are institutionally qualified in Uganda every year are unable to find jobs, and the situation is even worse for semi-skilled and unskilled ones. Youth who remain unemployed or underemployed and those who do not exploit their full potential, are often associated with high incidences of drug abuse, prostitution and gambling (Peter Magelah and Barbara Ntambirweki 2014), leading to high poverty and criminal cases (Tregenna, 2015). Big problem in Uganda and Africa is having high increased rural-urban migration in search for new opportunities and improve their lives such as better paying jobs, inadequate land access, and family disputes in urban areas and failure to find better new opportunities resort to extreme poor conduct namely; prostitution and sex abuse, drug abuse and any other criminal acts (Tangri & Mwenda, 2013). Rural urban migration is one of the causes of youth unemployment this affects youth between 18-30 years. Over 29.3 percent of the Uganda youth population migrate to urban centres for better opportunities (Mukwaya et al, 2011). In Uganda the biggest problem is youth unemployment between the age of (15-30 years) comprising of approximately 77 percent of the country's population (UBOS, 2014).

The International Monetary Fund advises that government of Uganda has to create 600,000 jobs annually to stay on track with its poverty reduction goals (IMF 2015). Ugandan government has put in a number of interventions to address youth unemployment since 2013 and has been expedited by over 6,181 projects by December 2015 with an aim of providing youth with grand opportunities to invest in productive ventures (National Planning Authority, 2017) such as Youth Livelihood project, Directorate of Industrial Training (DIT) the government has endeavoured to train youth in various vocational skills to promote self-development in a network of about 110 government institutions across the country, Youth SACCOs, parish development model and Non-Government Organizations (NGOs) such as Action Aid

Uganda (AAU), Uganda Youth Network, Uganda Youth Development Link (UYDL) have been at the fore front to ensure youth change their mind-set and attitude towards work and take opportunity to make a living. Through the trainings offered, youth have gained skills and built potential to compete in the job market (Mbasalaki, 2011). Currently in Uganda, one of the leading research institution promoting sericulture project (Tropical Institute of Development Innovations) under the project entitled Commercialization of Sericulture Technologies and Innovations in Uganda is government funded project through Ministry of Science, Technology and Innovation strategic intervention in addressing the Uganda National Development Plan (NDP) II. The project started in 2018 with one sericulture research station at Rubare sericulture station in Sheema district now after three years (2018-2022) establishment it has been spread to more than thirty two (32) districts and continue to spread to other districts in Uganda, a total of 100 technical staffs, around 800 casual workers and 150 constructors/builders are employed, all these employees earn a living in form of salaries and wages from sericulture related activities. The creation of more job opportunities through sericulture industry has employed many youths as casual workers, constructors/ builders and technical staffs within the sericulture value chain which would help arrest unemployment problem in Uganda.

## II. METHODOLOGY

The study was to examine the role of sericulture in uplifting socio-economic status of casual workers and constructors under commercialization of sericulture technologies in Uganda. The study was conducted in four districts namely Sheema, Kiruhura, Kween and Mukono. The study composed of 65 casual workers and constructors who have been working on different sericulture research stations were randomly selected. Casual workers and constructors are actively engaged in different activities of sericulture such as planting of mulberry, management of mulberry gardens, harvesting mulberry leaves to feed silkworms, silkworm rearing, reeling of silk cocoons, yarn making, construction of rearing houses and construction of staff houses etc. The pre-tested interview questionnaire covering activities such as demographic characteristics of respondents, socio-economic impact, income and livelihood improvement and challenges faced by respondents was used for data collection and the data collected was analysed using SPSS (version 26).

## III. RESULTS AND DISCUSSION

According to the demographic characteristics of the respondents studied in Table1, a majority 52.3% of the respondents interviewed were male while as 47.7% were female and this implied that sericulture project employed more of male as compared to female casual workers and constructors. Majorities 64.6% were found to be household head, only 35.4% were not the house head. This is partly as a result of social and cultural norms in community that both young men and women must be married in order to be considered heads of their households. Jera and Ajayi (2008) in their study reported that traditional power structures and controls over household productive resources are less favourable towards women than male-headed households. The majority 36.9% of respondents belonged to the age group of 31-40 years, meaning that they are energetic enough to perform the manual work in sericulture field activities such as planting of mulberry gardens, management of mulberry gardens, harvesting of mulberry leaves to feed silkworms, silkworm rearing, reeling of silk cocoons, silk yarn making and construction of rearing houses and staff houses, 73.8% of the respondents were married and only 10.8% were single. Saghir et al (2005) in their study reported that majority (76.5%) of the farm workers in rural areas were married followed by (17.5%) who were unmarried. This showed that respondents worked very hard to take care of their families and other needs. Most of the respondents had attended formal education. It was found out that 49.2% of the respondents had ever attended primary education, 24.6% had attained secondary education though dropped out at lower secondary. The government of Uganda launched a free Universal Primary Education in 1996 (UPE) and Universal Secondary Education (USE) in 2007 with the aim of provide greater access to primary and secondary education to do so tuition-free for the majority of children throughout the country. The results obtained from Table, revealed that majority 52.3% of the respondents had 0-5 people living in their families followed by 43.1% who had 5-10 peoples in families.

Table1. Demographic characteristics of respondents

| Characteristics                   | Classification | Frequency | Percent (%) |
|-----------------------------------|----------------|-----------|-------------|
| Sex of the respondents            | Male           | 34        | 52.3%       |
|                                   | Female         | 31        | 47.7%       |
| Household head of the respondents | Household head | 42        | 64.6%       |
|                                   | Not house head | 23        | 35.4%       |
|                                   | 18-30 years    | 16        | 24.6%       |

|                                                  |                |    |       |
|--------------------------------------------------|----------------|----|-------|
| <b>Age of the respondents</b>                    | 31-40 years    | 24 | 36.9% |
|                                                  | 41-50 years    | 14 | 21.5% |
|                                                  | 51-60 years    | 9  | 13.8% |
|                                                  | Above 60 years | 2  | 3.1%  |
| <b>Marital status</b>                            | Married        | 48 | 73.8% |
|                                                  | Single         | 7  | 10.8% |
|                                                  | Divorced       | 5  | 7.7%  |
|                                                  | Widowed        | 5  | 7.7%  |
| <b>Education</b>                                 | Illiterate     | 6  | 9.2%  |
|                                                  | Primary        | 32 | 49.2% |
|                                                  | Secondary      | 16 | 24.6% |
|                                                  | Tertiary       | 11 | 16.9% |
| <b>Number of respondents living in household</b> | 0-5 members    | 34 | 52.3% |
|                                                  | 6-10 members   | 28 | 43.1% |
|                                                  | 11-15 members  | 3  | 4.6%  |

#### IV. EMPLOYMENT UNDER SERICULTURE AND SOCIO-ECONOMIC IMPACT OF SERICULTURE

According to the results obtained from Table 2, revealed that 50.8% were employed as casual workers and 49.2% were employed as constructors/builders. A majority 83.1% of the respondents were recruited on permanent and only 16.9% on temporary basis and they were directly and indirectly employed for smooth running different sericulture field activities such as mulberry cultivation, maintenance of mulberry plantations, harvesting of mulberry leaves, silkworm rearing, cocoon production, cocoon reeling, yarn making, weaving and fabric processing and construction of rearing houses and all these activities were carried out by respondents who were mainly gaining livelihood in form of employment and being paid a monthly salaries in the sericulture sector casual workers and constructors. These results suggested that the casual workers and builders had a very positive attitude towards sericulture development in Uganda as a major source of employment and income. Narsimha (2003), in their study reported that Sericulture enterprise generated a remunerative and meaningful employment to the farming communities. Malik et al (2008), in their study reported that sericulture played very important role in natural resource utilization for socio-economic upliftment of livelihoods, employment and income generation. A majority 55.4% of respondents were earning between 50,000/= to 100,000/= per month, implicating that these

respondents worked on only one acre of mulberry or worked on few days in construction department and these who earned between 100,000/= and above, this implied that they worked on more than one acre of land or for more days in constructions, 9.2% of the respondents were working as mansons and 13.8% earning between 600,000-800,000/= were working as foreman/supervisor and engineer in the construction department. The results from study showed that Commercialization of Sericulture Technologies and Innovations was the main source of their daily income to support family's needs. Thangavelu (2002), Mahapatra (2009) in their study reported that silk industry had tremendous socio-cultural and traditional contributions and played a big role on developing rural economies. About 53.8% of the respondents were saving part of their monthly income and 46.2% were not saving any money. This means that respondents who were savings will help them have a reserve saved fund to cater for their needs in case of shortage of funds. And the respondents noted that the wages/salaries they earned at the end of month mainly helped them to meet all the family needs and requirements such as family feeding, educating their child's, buying clothing for themselves and for their child's, health, investments, pay utilities bills and others mainly it to drinking alcohol. This means that their monthly earns mainly helped them to meet family needs and requirements by buying different types of food to improve on their healthier diets and educationing their children are giving them a chance to acquire knowledge on various fields of education and by obtaining knowledge.

Table2. Nature employment under sericulture, salary, savings and borrowing money

| Characteristics                             | Classification          | Frequency | Percent (%) |
|---------------------------------------------|-------------------------|-----------|-------------|
| <b>Nature of Employment</b>                 | Casual worker           | 33        | 50.8%       |
|                                             | Constructors/Builders   | 32        | 49.2%       |
| <b>Status of the respondents employment</b> | Permanent               | 54        | 83.1%       |
|                                             | Temporary               | 11        | 16.9%       |
| <b>Most important source of livelihood</b>  | Income from Sericulture | 58        | 89.2%       |
|                                             | Income from agriculture | 5         | 7.7%        |
|                                             | Income from livestock   | 2         | 3.1%        |
| <b>Monthly</b>                              | 50,000-100,000          | 36        | 55.4%       |
|                                             | 200,000-400,000         | 14        | 21.4%       |

|                              |                      |    |       |
|------------------------------|----------------------|----|-------|
| <b>Salary and wages</b>      | 400,000-600,000      | 6  | 9.2%  |
|                              | 600,000-800,000      | 9  | 13.8% |
| <b>Saving</b>                | Saving money         | 35 | 53.8% |
|                              | Not saving money     | 30 | 46.2% |
| <b>Household expenditure</b> | Family feeding       | 64 | 98.5% |
|                              | Education            | 50 | 76.9% |
|                              | Buying Clothing      | 62 | 95.4% |
|                              | Health and treatment | 55 | 84.6% |
|                              | Investments          | 20 | 30.8% |
|                              | Pay utilities bills  | 15 | 23.1% |

|                                       |             |    |       |
|---------------------------------------|-------------|----|-------|
| <b>Household assets acquired</b>      | Motorcycle  | 1  | 1.5%  |
|                                       | Bicycle     | 5  | 7.7%  |
|                                       | Solar panel | 5  | 7.7%  |
|                                       | Radio       | 17 | 26.2% |
|                                       | Cell phone  | 18 | 27.7% |
|                                       | Sofa sets   | 2  | 3.1%  |
| <b>Household livestock's acquired</b> | Cows        | 15 | 23.1% |
|                                       | Goats       | 32 | 49.2% |
|                                       | Sheep       | 4  | 6.2%  |
|                                       | Birds       | 40 | 61.5% |
|                                       | Pigs        | 10 | 15.4% |
|                                       | Turkey      | 2  | 3.1%  |
|                                       | Ducks       | 1  | 1.5%  |

Respondents have managed to acquired different family assets such as land; some have managed to build houses. This means that respondents who have acquired land and build houses, shows that their economic status majority of the respondents reported that the salaries earned at the end of month has impacted positively on their lives as they has changed. Acquiring assets such as mobile phones, radios and televisions by respondents could easily receive timely information regarding sericulture project, other government policies and communication was also easily among workers. Respondents who have acquired solar panels, bicycles and motorcycles, this means that respondents having acquired solar panel and installed it could help them to use at home and even their children's can extend their reading hours and also eases their transport means to go for work at different sericulture stations. Trivedi and Sarkar, (2015) in their study reported that sericulture was an important labour intensive; agro based industry providing gainful employment to unemployed/underemployed population in the rural and semi-urban areas and facilitates economic development and improvement in the standard of life of the casual workers. The respondents who have acquired different livestock such as cows, goats, sheep, birds, pigs, turkey and ducks. This showed that respondents who have engaged themselves in rearing of different livestock's have direct impact on the respondent's status because this fetches them little economic support for their families and can serve as addition income.

Table 3. Household assets and livestock's acquired

| Characteristics | Classification | Frequency | Percent (%) |
|-----------------|----------------|-----------|-------------|
|                 | Land           | 8         | 12.3%       |
|                 | Television     | 3         | 4.6%        |
|                 | Build a house  | 6         | 9.2%        |

According to the results obtained from Table 4, revealed that 100% of the respondents reported lack of garden tools such as hoes, pangas, gumboots and overalls. This means that they were not providing such tools because most them could easily take them way and claim that were lost from the garden. A majority 76.9% of the respondents reported the challenge of delayed salary payment after work done. The organization (TRIDI) get funds from government of Uganda through Ministry of science and technology were they have control over releasing funds therefore it delays their monthly salaries. About 35.4% of the respondents claimed that they were low/under payment for work done and this was due to respondents who work on only 1 acre or less than an acre and others who work for few days in constructing of the rearing houses at different sericulture research stations could get low/under payment at the end of month. Respondents of Kween sericulture research station reported the challenge of scarcity of water and housing problem and could be the delay of funds to solve such problems. Few respondents reported the challenge of discrimination and abusive treatment by their field supervisors but this could be solved by top management through addressing these issues with field supervisors and their workers at different sericulture stations.

Table 4. Challenges faced by casual workers and constructors/builders

| Description                 | Frequency | Percent (%) |
|-----------------------------|-----------|-------------|
| Delayed Salary/wage payment | 50        | 76.9%       |
| Low/under payment           | 23        | 35.4%       |
| Discrimination              | 3         | 4.6%        |

|                                           |    |       |
|-------------------------------------------|----|-------|
| Abusive treatment                         | 4  | 6.1%  |
| Lack of equipment's to use at the station | 65 | 100%  |
| Scarcity of water                         | 10 | 15.4% |
| Housing problem                           | 15 | 23.1% |

## V. CONCLUSION

Commercialization of sericulture technologies has emerged in Uganda as the most important cash crop for providing employment opportunities for rural and urban communities. This study focused on how sericulture has uplifting socio-economic status of casual workers and constructors. The results obtained revealed that a biggest number of respondents 83.1% were employed on permanent basis and only 16.9% were working as temporary workers, a majority of respondents reported that the salaries earned at the end of month has impacted positively on their lives through acquiring different assets as such land, some have managed to building houses, mobile phones, radios and televisions etc., and also helped them to meet all their family needs and requirements such as family feeding, educating their child's, buying clothing for themselves and for their child's, health, investments, pay utilities bills and others mainly it to drinking alcohol. However 100% of the respondents reported lack of garden tools such as hoes, pangas, gumboots and overalls, a majority 76.9% of the respondents reported the challenge of delayed salary payment after work done. There was need to document the impact of sericulture project on the livelihoods of respondents involved after a period of time.

## REFERENCES

- [1] S.A. Ahmed, & Rajan, R.K. (2011). Exploration of Vanya silk biodiversity in north eastern region of India: Sustainable livelihood and poverty alleviation. Proceedings of the International Conference on Management, Economics and Social Sciences (MESS' 11). Bangkok, pp. 485-489.
- [2] P. Mukwaya, Bamutaze, Y., Mugarura, S., & Benson, T. (2011, May). Rural-Urban Transformation in Uganda. Paper presented at the joint IFPRI and University of Ghana conference on Understanding Economic Transformation in Sub-Saharan Africa, Accra.
- [3] M.S. Malik, Kaushal, P. & Sah, R.B. (2008). Socioeconomic upliftment of tribal communities in Jharkhand through Agroforestry based farming system. Birsa Agril. University, Ranchi.
- [4] M.L. Narsimha, (2003). Problems and Prospects of Sericulture (1st ed.). New Delhi: Discovery Publishing House.
- [5] K. Thangavelu, (2002). Future research strategy for non-mulberry sericulture with particular reference to tasariculture: Advances in Indian sericulture research. Proceedings of the National Conference on Strategies for Sericulture Research and Development, Nov. 16- 18, CSRTI, CSB, Mysore, India, pp. 365-368.
- [6] R. Tangri, & Mwenda, A. (2013). Routledge Studies in African Politics and International Relations – Politics of Elite Corruption in Africa: Uganda in Comparative African Perspective. London: Routledge.
- [7] K. Thangavelu, (2002). Future research strategy for non-mulberry sericulture with particular reference to tasariculture: Advances in Indian sericulture research. Proceedings of the National Conference on Strategies for Sericulture Research and Development, Nov. 16- 18, CSRTI, CSB, Mysore, India, pp. 365-368.
- [8] A. Saghir, Ali, T. and Ahmad, M., 2005., An analysis of nutritional status of farm women in Punjab: A case study of tehsil Fateh Jung. Pak. J. Agri. Sci., 42(34): 83- 88
- [9] R. JERA, & AJAYI, O.C., 2008. Logistic modelling of smallholder livestock farmers' adoption of tree-based fodder technology in Zimbabwe. Agrekon, 47(3):379-392.
- [10] R. B. Thapa, and K. B. Shrestha, "Silkworm rearing technology," Proceedings of the Workshop at Bhaktapur, Nepal, Dec. 21, 1999.
- [11] M. Peter Barbara, N (2014), Youth Unemployment and Job Creation in Uganda Opportunities and Challenges, (<https://www.wacode-u.org>).
- [12] Uganda Bureau of Statistics (2016). The National Population and Housing Census 2014 – Main Report, Kampala, Uganda
- [13] R. Tiwari, R.(2010). Occupation, Skin Problem in Construction Workers. Indian Journal of Dermatology. Vol. 55, pp. 348-351.
- [14] R. Lakhani, (2004). Occupational Health of Women Construction Workers in the Unorganised Sector. Journal of Health Management, 6(2), pp.187-200.
- [15] P. Mbasalaki, (2011): "'Gendered Scripts' –Narratives of Ugandan women who experienced sexual harassment in the workplace", Utrecht University.
- [16] National Planning Authority (2017) Uganda; Country Self-Assessment Report; African Peer Review Mechanisms

# The Importance Audit of Pharmacist in the management of a Hospital Unit

Leonardo dos Santos Camargo, Ramon dos Santos Camargo, Beatriz Oliveira Neres, Vinicius Fonseca dos Santos, Brenda Romagnha Brandenburg, Igor Alves de Souza, Kamila Roldi Corrêa, Renan Rocha Camilato Knopp, Ana Maria Alves Petri, Iagor Francisco Costa, Jayne Buelone Barreto, Kenia Guimarães Macieira Fernandes, Daniel Rodrigue Silva

Received: 22 Aug 2022,

Received in revised form: 13 Sep 2022,

Accepted: 19 Sep 2022,

Available online: 29 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** Audit, Nursing, Hospital Management

**Abstract—** The audit is a management tool that is used in order to evaluate the quality of care and the costs of providing such activity where healthcare professionals, especially nurses in the hospital is meeting the needs of health care institutions in the control of factors causing high cost processes , and user of most consumables and must have attention to the costs involved in the care process, in order to ensure the provision and suitability of materials for use and, especially, the quality of care for nursing. nursing audits in running a hospital. The methodology used was the present work it is a survey of literature review, qualitative, exploratory. Was held consultation papers through the variables, where the search was made through the SciELO, Brazilian Journal of Nursing, Electronic Journal of Nursing. The collection of articles was conducted in the period 2005-2013. Searches were conducted in Portuguese. References were selected by date, being included in the study publications found within the period of the last ten years. The articles were previously selected by reading their titles and were subsequently held a critical reading and reflective summaries to eliminate items that do not correlate with the objective of this work. The nursing audit is taking new dimensions over the years and showing its importance in the hospitals. The articles were previously selected by reading their titles and were subsequently held a critical reading and reflective summaries to eliminate items that do not correlate with the objective of this work. The nursing audit is taking new dimensions over the years and showing its importance in the hospitals. The articles were previously selected by reading their titles and were subsequently held a critical reading and reflective summaries to eliminate items that do not correlate with the objective of this work. The nursing audit is taking new dimensions over the years and showing its importance in the hospitals.

## I. INTRODUCTION

Auditing emerged in Italy in the 15th and 16th century, originating from the accounting practices of commercial bookkeeping. The development of accounting

audits was driven by the capitalist mode of production where financial control was used to account for expenses and gains in a business (PINTO apud MELO, 2010).

According to DIAS et al (2011), quality care and increased competitiveness among organizations that provide services in health services increased the demand for professional nurses who audit hospital bills.

In view of this, JÚNIOR apud MATSUDA (2011) reports that quality management is summarized in greater productivity, satisfaction, participation of customers and workers, stimulating creativity and teamwork. The interest in the subject arose from the reading of scientific articles, where we became aware of the importance and benefits of the nursing audit in the control of material resources and in the quality of care provided, bringing satisfaction to users. Therefore, the objective of this work is to evaluate the importance of the nursing audit in the management of a hospital unit.

## II. METHODOLOGY

The present work is a research of bibliographical revision, qualitative, of exploratory character. Scientific articles were consulted through the variables, where the search was made through Scielo, Revista Brasileira de Enfermagem, Revista Eletrônica de Enfermagem. The collection of articles was carried out in the period of 2005 to 2013. Searches were carried out in Portuguese. Articles were selected by date, and publications found within the last ten years were included in the study. The articles were previously selected by reading their titles and later a critical and reflective reading of the abstracts was carried out in order to eliminate articles that did not correlate with the objective of this work.

## III. DEVELOPMENT

Auditing began in the health area in the 20th century, where it was used as a tool to verify care quality, control, regulate the use of health services and directing its focus to cost control PINTO & MELO (2010).

According to CAMELO et al (2009), in 1990 Brazil had the need to create the National Audit System - SNA, through Law n° 8080, known as the Organic Health Law. In 1993, Law No. 8689, of July 27, 1993, established as competence the monitoring, inspection, control, technical, scientific, accounting, financial and patrimonial evaluation of health actions and services.

For PINTO & MELO (2010) auditing is a practice originating in accounting, which emerged between the 15th and 16th centuries, in Italy, from practices of commercial bookkeeping. The development of accounting audit was driven by the capitalist mode of production, which used it as a financial control tool, for accounting for the expenses and gains of a business.

DIAS et al (2011) reports that the word audit originates from the Latin *audire* which means to listen. However, the term can be better explained by the English word *audit*, which means to examine, correct and certify. With that the *audit* means evaluating systems actively and formally an activity and determine whether it is being carried out in accordance with its objectives.

Auditing can be classified into two types: the retrospective and the operational or recurrent. The retrospective audit is performed after the patient is discharged and uses the medical record for evaluation. The operational or recurring audit is done while the patient is hospitalized or in outpatient care (SETZ et al. INNOCENZO, 2009).

That is why hospital institutions, especially those in the private sector, concerned with the competitive environment and maintaining space in the market, have advanced in the development of computerized materials management systems that allow greater control in the purchase and distribution of materials, have collaborated for the cost reduction. In the hospital area, there are few studies that report on the computerization of material management, being necessary to develop research on this subject (PASCHOAL et al CASTILHO, 2010).

The most used system are the medical records, which contain written patient information that reflects the care and treatment provided during hospitalization. Everything must be recorded from the patient's evolution, reactions and concerns, using terms that clearly explain the facts. The nursing team must provide the time to make the records in the medical record of each patient, as they are part of the legal responsibilities of nursing (SETZ et al. INNOCENZO, 2009).

According to JÚNIOR et al MATSUDA (2011) participation in hospital administration is important, the planning and implementation of programs aimed at humanization and the allocation of incentives to the training of clinical competences and training of the nurse's managerial practice are also fundamental requirements for the development of health quality.

All assistance provided must be recorded in the patient's medical record, which is important for the ethical and legal support of the professional responsible for the care, as well as the patient. When this record is scarce or inadequate, it compromises the care provided to the patient as well as the institution and the nursing team. Impossible to ensure safety and the perspective of patient care, in addition to the difficulty in measuring the care results arising from the nurse's practice (SETZ et al. INNOCENZO, 2009).

Several programs and policies were created in Brazil to encourage the improvement of the quality of hospital services, even without specifically using the Quality Management approach (JÚNIOR et al MATSUDA, 2011).

Annotation is also a way to improve the quality of hospital services, as it facilitates nursing communication, taking into account that its purposes are: to establish effective communication between the team and other professionals involved in caring for human beings; serve as a basis for the elaboration of the care plan for the patient; constitute a source of subsidies for the evaluation of the assistance provided; serve to monitor the patient's evolution; constitute a legal document, both for the patient and for the nursing team regarding the care provided; contribute to nursing auditing and collaborate for nursing teaching and research. Nonetheless, (SETZ et al. INNOCENZO, 2009) also classifies the audit in terms of: the form of intervention (internal and external); time (continuous and periodic); the nature (normal and specific) and the limit (total and partial).

According to JÚNIOR et al MATSUDA (2011), the search for quality in health services is characterized as a worldwide phenomenon, with a focus on the need to meet the growing demand of users for improvements in care, has raised numerous discussions and investigations.

Therefore, the audit will not only indicate the flaws and problems, but also point out suggestions, solutions, reviewing and controlling to inform the administration about the efficiency and effectiveness of the programs under development, thus assuming an eminently educational character (SETZ et al. INNOCENZO, 2009).

In Brazil, the first work developed to improve the quality of hospital services was in 1935, where the Hospital Inquiry Form, proposed by the physician Odair Pedroso, was used, which specified how the organization of a hospital institution should be at that time (JÚNIOR et al. MATSUDA, 2011).

The health sector, after the globalization of the country's political-financial scenario, began to look for new alternatives for management, focusing on the need for health organizations to adapt to an increasingly competitive market. (CAMELO et al, 2009).

Faced with these issues, administrators of health organizations have increased interest in controlling costs and improving material management systems (PASCHOAL et al CASTILHO, 2010).

It is important to emphasize that the agents who work in this health work process, where nursing stands out for being a professional category that assumes activities

such as: care, monitoring, educational practices and administration of health services. Knowing that the history of this category is marked by religious influence, distinction of the female gender and relationship with medicine while structuring a field of scientific knowledge (ALVES et al 2011 apud MERHY 2007 apud LIMA 2005 apud MOREIRA 1999).

With that theThe main objective of health care services is to provide the best possible quality, with effectiveness, efficiency, equity, acceptability, accessibility and suitability. Cunha proves that nursing is in a privileged place within institutions to act in this context, because, among health workers involved in care and treatment, nursing is the only category that remains 24 hours assisting the client (CAMELO et al. , 2009).

The nurse in thisThe work process acts as an integral social part of collective health work, where it is composed of two complementary dimensions: assisting and managing. To assist the nurse, the object of intervention is the needs of nursing care and, as a purpose, comprehensive care; And to manage the object of work, the organization of work, human resources in nursing, the means and instruments are the different administrative knowledge, materials, equipment and installations, in addition to the technical instruments of management, such as: personnel sizing, planning, education continuous/permanent, supervision, performance evaluation, which are used in order to create and implement adequate conditions for the production of care and performance of the nursing team (SANTOS & LIMA, 2011).

Therefore, nursing is strongly marked by teamwork and acquires, in modernity, a role focused on care and focused on the rationalization of actions and guided by biomedicine (ALVES et al 2011 apud MOREIRA, 1999).

There needs to be quality in nursing services, to contribute to the process of restoring the client's health, improving living conditions, guidance on self-care, simplification and safety in nursing procedures, but also the result of the hospital product, measured through the quality of documentation and registration of all nursing actions. The quality of the record of care actions reflects the quality of care and work productivity. And, with these records, build better care practices, in addition to implementing actions aimed at improving operational results (SETZ et al. INNOCENZO, 2009).

Thus, health work involves nursing to assume the role of a vehicle for the materialization of care, being able to make encounters with the other, potential moments that contribute to the improvement of the health situation of



individuals. Nursing care must be managed in order to develop technical-scientific and leadership skills to manage work, staff and assist patients (ALVES et al 2011 apud SPAGNOL, 2002).

SANTOS & LIMA, (2011) states that the nursing process confirms the nurse's role as care manager, as it allows the implementation of a nursing care plan and a constant assessment of care. Thus, nurses can favor the qualification and better direction of nursing care in the search for specific results aimed at meeting the individual's needs.

the audit is a management tool that is used in order to assess the quality of care and the costs resulting from the provision of this activity where health professionals, especially nurses, use it (DIAS et al, 2011).

In 2001, the Federal Nursing Council approves the activities carried out by the auditing nurse through Resolution n. 266/01 (MINISTRY OF HEALTH, 2005 apud PINTO E MELO, 2010).

The first audit carried out in the health sector was in 1918 with the objective of evaluating medical practice (CAMELO et al 2009).

In Brazil, nurse auditors will be able to contribute to the optimization of physical and material resources available in health services and to develop people, improving, in addition to the planning and technical execution of the work, the cost-benefit ratio for the patient, the hospital and the purchaser of health services. The audit is an educational process, it provides subsidies for the implementation and management of quality care (PINTO E MELO, 2010).

Planned health care includes not only the relationship between nurses and users, but also with the relatives of patients/companions of patients, as it is up to these professionals to decide on their entry and stay in the emergency service. Therefore, the presence of family members of patients in the emergency department is a controversial issue among nurses (SANTOS & LIMA, 2011).

In the hospital context, the nursing audit comes to meet the needs of health institutions in the control of factors that generate high-cost processes, being a user of most consumables, paying attention to the costs involved in the care process, in order to ensure the provision and adequacy of materials use and, especially, the quality of nursing care. The nursing audit is responsible for identifying deficient areas of nursing services, providing concrete data for decisions to be taken in relation to the relocation and increase of personnel, enabling the improvement of nursing care (DIAS et al, 2011).

In the management of nursing actions, the nurse is primarily responsible for organizing the work process of his team. Therefore, the insertion of nursing in management initiatives aimed at quality is a necessary condition because the whole process requires planned, structured and continuous actions, aimed at serving the user in a welcoming and resolute way (JÚNIOR et al MATSUDA, 2011).

Thus, when managing care, the focus of professional actions must use administrative processes with technologies, through direct actions with users or through delegation and articulation with other professionals in the health team. When the nurse manages care, he plans, delegates or does it, when he foresees and provides resources, trains the nursing team and interacts with other professionals, occupying spaces of articulation and negotiation in favor of achieving care improvements (SANTOS et al. LIMA, 2011).

PASCHOAL et al CASTILHO (2010), point to the need to adopt cost management systems to contain expenses and at the same time maintain services performed with quality and efficiency.

It is essential for quality health care to occur, that the service has adequate physical, human and material resources and values the affective bond as a link in the user-worker relationship (JÚNIOR et al MATSUDA, 2011).

It is impossible to talk about management of work processes and not talk about leadership, as it is one of the main instruments used by nurses to coordinate and articulate the activities that involve the production of health and nursing care, as well as the professionals who perform them (SANTOS et al. al LIMA, 2011).

To promote quality, it is important that nurses develop care strategies aimed at satisfying professionals based on the recognition of the worker's contributions to the work performed; organization of norms and values and; the establishment of alliances and pacts between the team (JÚNIOR et al MATSUDA, 2011).

The health work process is carried out through a dynamic, relational production activity that brings together different types of technologies (therapeutic conducts, instruments and tools) and is fulfilled, by the creative intervention of the worker, being evaluated as a live work in act. (ALVES et al 2011 apud MERHY, 2007).

#### IV. CONCLUSION

The audit is highlighted as an extremely important process in the management of hospital services, identifying

possible problems, pointing out solutions and enabling improvement in the quality of care provided.

In hospital services it is impossible to talk about auditory and not talking about Nursing, which has contributed a lot in this new role that was recognized by the Federal Council of Nursing in 2001, which approves its activities through Resolution no. 266/01.

In view of this, health systems began to realize how auditing in nursing could bring benefits to organizations in order to adapt to a more competitive market.

THE Auditing in nursing will not only indicate the difficulties, but systematically evaluate the programs under development, as organizations are looking for trained professionals to control costs and provide users with a better quality of life.

in However, it can be seen that this study was very important and relevant, as it showed one more capacity of the professional nurse to act as an auditor in the job market, where they can make a lot of difference in a hospital institution and in the entire administrative process of an institution.

Finally, the users of these hospital institutions need to be attended with quality, equity, accessibility and that the service can contribute to better living conditions for their clients, emphasizing that the nursing class is the most adequate for this assistance, as it is the only category that remains 24 hours watching your customer.

## REFERENCES

- [1] ALVES, Camila Aloísio; DESLANDES, Suely Ferreira; MITER, Rosa Maria de Araújo; MANAGING THE NURSING WORK PROCESS IN A MEDIUM AND HIGH COMPLEXITY PEIATRIC NURSE: A DISCUSSION ABOUT CO-MANAGEMENT AND HUMANIZATION. Interface Communication, Health, Education. Interface, vol.15, no. 37, Botucatu Apr/ June 2011. Available at:<http://www.scielo.br/pdf/icse/2011nahead/aop0711.pdf>.
- [2] CAMELO, Silvia Helena Henriques; PINHEIRO, Aline; CAMPOS, Domitila; OLIVEIRA, Tatiana Lentz; NURSING AUDIT: A SYSTEMATIC REVIEW OF THE LITERATURE. Electronic Journal of Nursing Brasília 2011 Sep-Oct. Available in:[http://www.fen.ufg.br/fen\\_revista/v11/n4/pdf/v11n4a28.pdf](http://www.fen.ufg.br/fen_revista/v11/n4/pdf/v11n4a28.pdf).
- [3] DIAS, Teresa Cristina Lyporage; SANTOS, José Luís Guedes; CORDENUZZI, Onélia da Costa Pedro. NURSING AUDIT: A SYSTEMATIC REVIEW OF THE LITERATURE. Brazilian Journal of Nursing, 2011 Sep - Oct. Available in:<http://www.scielo.br/pdf/reben/v64n5/a20v64n5.pdf>.
- [4] JUNIOR, José Aparecido Bellucci; MATSUDA, Laura Misue. THE NURSE IN QUALITY MANAGEMENT IN EMERGENCY HOSPITAL SERVICE: INTEGRATIVE LITERATURE REVIEW. Revista Gaúcha de Enfermagem, vol.32, n°4, Porto Alegre Dec. 2011. Available at:[http://www.scielo.br/scielo.php?pid=S1983-14472011000400022&script=sci\\_arttext](http://www.scielo.br/scielo.php?pid=S1983-14472011000400022&script=sci_arttext).
- [5] MINISTRY OF HEALTH; TECHNICAL GUIDELINES ON AUDIT IN OUTpatient and HOSPITAL CARE IN SUS. National Department of Auditing in the SUS, 2005. Available at:[http://bvsms.saude.gov.br/bvs/publicacoes/auditoria\\_assistencia\\_ambulatorial\\_hospitalar\\_v3.pdf](http://bvsms.saude.gov.br/bvs/publicacoes/auditoria_assistencia_ambulatorial_hospitalar_v3.pdf)
- [6] PASCHOAL, Maria Lúcia Habib; CASTILHO, Valeria; IMPLEMENTATION OF THE COMPUTERIZED MATERIALS MANAGEMENT SYSTEM OF THE UNIVERSITY HOSPITAL OF THE UNIVERSITY OF SÃO PAULO. Journal of the School of Nursing at USP. Vol.44, n°4, São Paulo, dec, 2010. Available at:<http://www.scielo.br/pdf/reesp/v44n4/18.pdf>.
- [7] PINTO, Karina Araújo; MELO, Cristina Maria Meira. THE NURSE'S PRACTICE IN HEALTH AUDIT. Rev. Esc Enferm USP 2010. Available at:<http://www.scielo.br/pdf/reesp/v44n3/17.pdf>.
- [8] SANTOS, José Luís Guedes; LIMA, Maria Alice Dias da Silva. CARE MANAGEMENT: ACTIONS OF NURSES IN AN EMERGENCY HOSPITAL SERVICE. Gaúcha Journal of Nursing. Vol.32, no. 4. Porto Alegre dec. 2011. Available at:[http://www.scielo.br/scielo.php?pid=S1983-14472011000400009&script=sci\\_arttext](http://www.scielo.br/scielo.php?pid=S1983-14472011000400009&script=sci_arttext).
- [9] SETZ, Vanessa Grespan; D'INNOCENZO, Maria; ASSESSMENT OF THE QUALITY OF NURSING RECORDS IN THE HANDBOOK THROUGH THE AUDIT. Acta Paulista de Enfermagem, vol.22, n°3. São Paulo May/ June, 2009. Available at:<http://www.scielo.br/pdf/ape/v22n3/a12v22n3.pdf>.

# Analysis of the Association of Psychological Symptoms with Successful Aging Strategies and Spirituality in Elderly People

Rita de Kássia Wichmann Gallas, Sabina Maria Stedile, Viviana Rodrigues de Alcântara, Deise Claudiane Rodrigues Antunes, Kelen Lord Kleemann, Marcele Medina Silveira, Marcelo Wüst, Henrique Zimmermann Kunert, Geraldine Alves dos Santos

Feevale University, Brazil.

Received: 26 Aug 2022,

Received in revised form: 16 Sep 2022,

Accepted: 24 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**—*Successful aging, Spirituality,  
Psychological symptoms.*

**Abstract**—*Taking into account the increase in longevity and the positive and negative aspects brought by the aging process, the elderly often go through many losses. In this process, elderly people may be affected by physical and psychological problems, leading them to create or not strategies for aging well. The aim of this research is to analyze the association between psychological symptoms with spirituality and strategies for successful aging in the elderly. This study consists of a quantitative, correlational and cross-sectional research. The sample consisted of 49 people over 60 years of age, who actively participated in computing groups in the city of Novo Hamburgo, Brazil. The instruments used were the Selection, Optimization and Compensation Scale (SOC), the Symptom Assessment Scale (SAS-40) and the Spirituality Scale. Descriptive statistical analyzes, correlation by Spearman's test and linear regression by stages were performed. The results showed significant relationships between the psychological symptoms of anxiety, obsessiveness/compulsiveness, psychoticism and somatization. Spirituality, especially hope and optimism, and strategies to promote successful aging, especially optimization, are relevant aspects for the reduction and control of these psychological symptoms. Hope, optimism and optimization are strategies that allow subjects to control the symptoms of psychoticism and obsessiveness. Hope and optimism aid in the control of anxiety and optimization helps in the somatization symptom. Based on these results, our conclusion is that it is necessary to improve public policies to allow the elderly to have opportunities to optimize their potential and develop hope and optimize the promotion of mental health.*

## I. INTRODUCTION

Taking into account the increase in longevity, a perception on the aging process is of utmost importance, which begins from birth and extends throughout life. Mari et al. [1] refer that the perception about one's own health has a great impact on the aging process and is of great

importance to adopt a healthy lifestyle. According to the authors, this perception can be positive or negative, depending on each person. A negative perception of one's own health can lead to pain, discomfort, and illnesses and could be related to cultural, social, psychological and environmental factors. The authors understand that in order to have strategies for aging well, it is necessary for

people to develop a positive perception of their lives, so that they can cope with working in terms of their physical, psychological, social and spiritual well-being.

The strategies for successful aging do not depend only on the individual's own perception and positive acceptance. In fact, this process is not possible without the improvement of public policies. Miranda, Mendes and Silva [2] refer that advances in the field of health and technology are contributing to a better quality of life for elderly people. But it is still necessary that investments in preventive actions throughout the mortality process continue to be made, to solve current challenges and the ones still to come. The authors show that the continuous increase in the elderly population has led the countries to understand more and more about the aging process to seek alternatives to enable the largest possible number of elderly people to be socially and economically integrated and independent. However, in Brazil, there is still a lot of work to be done to respond to these demands.

According to Brito et al. [3] the involvement in social activities has a therapeutic effect, in which it deals with positive and affective relationships. Connecting with other people important to your life can prevent illnesses caused by stress, contributing to health and healing, adding more years to one's life. The absence of social contacts in the lives of the elderly is considered as harmful as conditions such as smoking, high blood pressure, obesity and the loss of physical activity, which can affect or aggravate health problems, not only due to inappropriate habits and diseases, but also by reducing the quantity and quality of social relations.

According to Fernandes [4], loneliness, the act of doing nothing, freedom at all times, becomes a burden, forcing people to rebuild their lives. When this stage is reached, several other threats appear, as the years go by, such as the desire not to become a burden to anyone and the suffering of losses in general, organics, physis, cognitive and of family and friends. It is at this stage that people try to avoid the impression of disability and worthlessness. Rocha [5] says that, as changes in the aging process range from mental aspects, of the very own personality, people's motivations and social skills, that is, from the psychological point of view, aging depends on genetic, pathological, of individual potential with interference from the environment and the socio-cultural context. Therefore, in dealing with some of these issues the elderly may be concerned, they may experience negative feelings and have no support, especially from the ones around them and psychological problems may arise.

Among the innumerable psychological problems that can affect the elderly, this study seeks to deepen the topic

in four dimensions that are part of one of the measures applied. They are somatization, anxiety, obsessiveness/compulsiveness and psychoticism. According to Santos, Pereira and Martins [6], somatization is determined by repressed aspects of the unconscious and involves several mechanisms, in particular, the repressed content that can be integrated into the psyche. Costa et al. [7] refer that anxiety is an arrangement of feelings such as fear, apprehension and worry, which causes anxiety and refers to physiological responses to any stimulus that the brain considers dangerous or threatening. According to Maia et al. [8] obsessions are thoughts or ideas, impulses, images, scenes, that is, mental attitudes that invade the conscience in an involuntary and repetitive way. Since compulsions can happen as obsessions or not, they are repeated behaviors or mental acts that each person has as rituals to be followed. According to Sisto and Oliveira [9], psychoticism concerns a predisposition for people to be tough, cold, aggressive, less concerned with others and to tend to be insensitive and hostile.

According to Arrieira et al. [10], the World Health Organization establishes new rules that expand the concept of health. According to the organization, it is no more only the absence of a disease, but also physical, psychological, social and spiritual well-being. Taking these changes into account, more and more research is showing that spiritual beliefs influence the coping with diseases and reiterate that health professionals must obtain a spiritual history of patients with chronic and severe illnesses or disabilities. They document it as it is already done in relation to physical and psychological aspects. As referenced by Thiengo et al. [11], international studies show that health professionals reflect on the need to address and meet the spiritual needs of their patients, regardless of their personal beliefs. But, as they think the issue goes beyond their role, they resist in dealing with it.

In addition, the authors report that in Brazil, courses that approach the subjects of religion and spirituality are rare, but the professionals, in their majority, are in favor of courses that prepare them about themes such as these in their academic training. The authors refer that according to studies, faced with situations of illness, people tend to express their spiritual beliefs. Therefore, both the subject being treated and his family can receive benefits from some spiritual assistance, if there is an awareness of professionals in this context.

This study aimed to analyze the association between the psychological symptoms of somatization, anxiety, obsessiveness/compulsiveness and psychoticism with strategies for successful aging and spirituality in elderly people who actively participate in a computing group in

the city of Novo Hamburgo, in Rio Grande do Sul (RS), Brazil.

## II. METHOD

The present study has a quantitative, descriptive, correlational and cross-sectional design. A survey was conducted in the city of Novo Hamburgo, RS in partnership with the Directorate of Digital Inclusion of the Municipal Administration Secretariat (SEMAD) of the Municipality of Novo Hamburgo, RS, Brazil.

The sample of this study was non probabilistic, chosen by convenience and comprises 49 participants, of both genders, aged over 60 years. In this study, the instruments used to evaluate successful aging strategies were applied through the Selection, Optimization and Compensation Scale (SOC). Successful development and aging are based on goal selection, optimization of means to reach these goals and on the search for compensation when the means to reach the goals are not available. This instrument evaluates the use of life management strategies. The psychological aspects were applied by the Symptom Assessment Scale - 40 (SAS-40), which measures the characteristics of somatization, anxiety, obsessiveness/compulsiveness and psychoticism and, finally, spirituality was evaluated through the Spirituality Scale, which evaluates to what extent people use spirituality, beliefs, hope and optimism.

## III. RESULTS

The results showed that the average age of the sample of 49 elderly men and women, who regularly participate in computing activities promoted by the municipality of Novo Hamburgo, Brazil was 69, 73 years (sd 6.085), with a minimum age of 60 years and the maximum of 84 years. A total of 43 women (87.8%) and 6 men (12.2%) participated in this study. Regarding the level of education, 34.7% of people had incomplete primary education, 16.3% complete primary education, 16.3% incomplete secondary education, 8.2% complete secondary education, 2% technical education 10, 2% incomplete higher education and 12.2% complete higher education.

Table 1 shows that in relation to the variables studied, the psychological symptoms that stand out the most are somatization and obsessiveness/compulsiveness. Regarding the strategies for successful aging (SOC), we noted that the most used strategy is the loss-based selection. Finally, spirituality demonstrated a similar result for both the beliefs and hope/optimism.

Table 1: Descriptive analysis of the psychological symptoms, successful aging strategies and spirituality (N=49)

| Variable                     | Min. | Max. | Mean  | Sd   |
|------------------------------|------|------|-------|------|
| Somatization                 | 0    | 20   | 7.98  | 4.49 |
| Anxiety                      | 0    | 12   | 3.31  | 3.38 |
| Psychoticism                 | 0    | 11   | 3.02  | 3.05 |
| Obsessiveness/Compulsiveness | 0    | 18   | 6.88  | 3.83 |
| SOC                          | 3    | 11   | 7.35  | 1.96 |
| Elective Selection           | 0    | 3    | 1.88  | 0.90 |
| Loss-Based Selection         | 0    | 3    | 2.14  | 0.76 |
| Optimization                 | 0    | 3    | 1.65  | 0.72 |
| Compensation                 | 0    | 3    | 1.67  | 0.92 |
| Spirituality                 | 9    | 20   | 16.30 | 2.94 |
| Beliefs                      | 2    | 4    | 3.39  | 0.64 |
| Hope/Optimism                | 2    | 4    | 3.17  | 0.68 |

In this study, correlation analyzes were performed by using the Spearman test to evaluate the association of psychological variables. Therefore, associations were found between the somatization and anxiety variables ( $\rho=0.407$ ;  $p=0.004$ ), psychoticism ( $\rho=0.430$ ;  $p=0.002$ ) and obsessiveness/compulsion ( $\rho=0.449$ ;  $p=0.001$ ). The psychological symptom of anxiety also showed a relation with psychoticism ( $\rho=0.559$ ;  $p=0.000$ ) and obsessiveness/compulsion ( $\rho=0.634$ ;  $p=0.000$ ). And psychoticism had a relation with obsessiveness/Compulsion Psychotherapy ( $\rho=0.529$ ;  $p=0.000$ )

Table 2 shows the continuation of the correlation analyses of the Psychological Symptoms (PS) of Somatization (S), Anxiety (A), Psychoticism (P) and Obsessiveness/Compulsiveness (O/C) with the statistics of successful aging (SOC) subdivided into the strategies of elective selection (ES), loss-based selection (LBS), optimization (O) and compensation (C), as well as with spirituality (S) subdivided into the Beliefs (B) and Hope/Optimism (H/O). The outcomes pointed out that somatization is applied inversely to successful aging rates, that is, the more the elderly manage to improve the use of successful aging experiences, the less they will develop somatization symptoms. In relation to anxiety and psychoticism, we identified that the decrease of these symptoms is positively related to the increase in spirituality, in particular hope/optimism. Finally, the reduction in obsessiveness/compulsion symptoms is related to the increase of the skills and abilities optimization strategy, as well as hope/optimism.

Table 2. Bivariate correlations of psychological variables with strategies for successful aging and spirituality (N=49)

| PS  |     | SOC      | ES     | LBS    | O        | C      | S         | B      | H/P       |
|-----|-----|----------|--------|--------|----------|--------|-----------|--------|-----------|
| S   | rho | -0.314 * | -0.214 | -0.183 | -0.232   | 0.001  | -0.217    | -0.117 | -0.219    |
|     | p   | 0.028    | 0.141  | 0.208  | 0.108    | 0.995  | 0.143     | 0.435  | 0.140     |
| A   | rho | -0.031   | -0.089 | 0.037  | -0.002   | -0.056 | -0.350 *  | -0.231 | -0.363 *  |
|     | p   | 0.832    | 0.543  | 0.801  | 0.988    | 0.702  | 0.016     | 0.118  | 0.012     |
| P   | rho | -0.110   | -0.160 | -0.024 | -0.061   | -0.038 | -0.508 ** | -0.260 | -0.582 ** |
|     | p   | 0.452    | 0.273  | 0.872  | 0.679    | 0.797  | 0.000     | 0.077  | 0.000     |
| O/C | rho | -0.248   | -0.212 | -0.154 | -0.284 * | 0.033  | -0.231    | -0.108 | -0.291 *  |
|     | p   | 0.085    | 0.144  | 0.290  | 0.048    | 0.820  | 0.119     | 0.471  | 0.048     |

\* correlation is significant at  $\leq 0.05$   
 \*\* correlation is significant at  $\leq 0.05$

Table 3 shows a linear regression analysis carried out by the stepwise method, with a significance level of  $\leq 0.05$ , with the somatization psychological symptom variable (dependent, explained) directly related to the psychoticism variable and indirectly related to the optimization strategy (independent, explanatory).

Table 3: Multiple linear regression of the somatization variable in elderly people who regularly participate in digital inclusion groups (n = 49)

| Model        | Nonstandard coefficients |       | Standardized coefficients |        | Collinearity statistics |           |       |
|--------------|--------------------------|-------|---------------------------|--------|-------------------------|-----------|-------|
|              | B                        | Error | Beta                      | T      | Sig.                    | Tolerance | VIF   |
| (Constant)   | 7.923                    | 1.399 |                           | 5.665  | 0.000                   |           |       |
| Psychoticism | 0.733                    | 0.162 | 0.345                     | 4.522  | 0.000                   | 1.000     | 1.000 |
| Optimization | -1.328                   | 0.720 | -0.256                    | -2.123 | 0.039                   | 1.000     | 1.000 |

In this model, a 0.361 R-squared ( $R^2$ ) was obtained. This determination coefficient is a measure of the efficiency of the regression equation. It indicates that 36.1% of the changes in the somatization symptom can be explained by the changes in the psychoticism symptom and the optimization strategy. In this group, it is clear that the control of somatization is associated with the control of psychoticism and the increase in the successful aging strategy of optimization.

Table 4 presents a linear regression analysis carried out, by the stepwise method, with the psychoticism psychological variable directly related to the obsessivity/compulsiveness, somatization and optimization variables and indirectly related to hope/optimism.

In this model, a 0.632 R-squared ( $R^2$ ) was obtained, indicating that 63.2% of the changes in the psychoticism symptom can be explained by changes in the other variables. Consequently, in this sample, the control of the psychoticism symptom is associated with the control of the obsessiveness/compulsiveness and somatization symptoms, as well as to the decrease of the use of

optimization and the increase or the hope/optimism strategies.

Table 4: Multiple linear regression of the psychoticism variable in elderly people who regularly participate in computing groups (n = 49)

| Model                          | Nonstandard coefficients |       | Standard coefficients |        | Collinearity statistics |           |       |
|--------------------------------|--------------------------|-------|-----------------------|--------|-------------------------|-----------|-------|
|                                | B                        | Error | Beta                  | T      | Sig.                    | Tolerance | VIF   |
| (Constant)                     | 4.255                    | 2.031 |                       | 2.095  | 0.042                   |           |       |
| Hope/Optimism                  | -1.962                   | 0.454 | -0.435                | -4.317 | 0.000                   | 0.862     | 1.160 |
| Obsessiveness / Compulsiveness | 0.264                    | 0.092 | 0.322                 | 2.873  | 0.006                   | 0.696     | 1.437 |
| Somatization                   | 0.237                    | 0.081 | 0.319                 | 2.917  | 0.006                   | 0.730     | 1.369 |
| Optimization                   | 0.878                    | 0.433 | 0.198                 | 2.025  | 0.049                   | 0.919     | 1.089 |

Table 5 presents a linear regression analysis performed by the stepwise method, with the obesity/compulsivity psychological variable directly related to the psychoticism and anxiety variables and indirectly related to the optimization variable.

Table 5: Multiple linear regression of the obsessiveness/compulsiveness variable in elderly people who regularly participate in computing groups (n = 49)

| Model        | Nonstandard coefficients |       | Standard coefficients |        | Collinearity statistics |           |       |
|--------------|--------------------------|-------|-----------------------|--------|-------------------------|-----------|-------|
|              | B                        | Error | Beta                  | t      | Sig.                    | Tolerance | VIF   |
| (Constant)   | 6.233                    | 1.134 |                       | 5.495  | 0.000                   |           |       |
| Psychoticism | 0.485                    | 0.154 | 0.381                 | 3.032  | 0.004                   | 0.723     | 1.383 |
| Anxiety      | 0.426                    | 0.137 | 0.391                 | 3.105  | 0.003                   | 0.721     | 1.388 |
| Optimization | -1.411                   | 0.581 | -0.260                | -2.430 | 0.019                   | 0.985     | 1.005 |

In this model, a 0.50 R-squared ( $R^2$ ) was obtained, which indicates that 50.9% of the changes in the obsessiveness/compulsion symptom can be explained by changes in the other variables. Therefore, in this sample of elderly people who practice computing activities regularly in the municipality of Novo Hamburgo, the results demonstrated that the control of the obsessiveness/compulsion symptoms is associated with the control of psychoticism and anxiety, as well as with increasing the optimization strategy to promote successful aging.

#### IV. DISCUSSION

In the present study, conducted with elderly people who actively participate in digital inclusion groups in the municipality of Novo Hamburgo, the relation between psychological symptoms of somatization, anxiety, obsessiveness/compulsiveness, psychoticism and the relation of these symptoms with the development of successful aging and spirituality was evaluated.

In the correlation and linear regression analyzes with one variable, the psychological symptom of somatization,

a relation with anxiety, psychoticism, obsessiveness and successful aging strategies was found, especially with optimization. According to Santos, Pereira and Martins [6], somatization appears as a result of experiences or emotional content, which for some reason is not verbalized or released and end up manifesting in the body as a symptom, revealing negative, repressed and unconscious content. Therefore, psychological illnesses can affect a large number of elderly people due to losses in general, the idle time that a retirement may bring, as well as the lack of people to live with.

The construction process of the elderly is related to a network of physical, psychological, social, economic, cultural and spiritual factors. According to Rocha [5], the old age is accompanied, in most cases, by feelings beyond the alterations of the body. Old age can occur associated with a series of psychological changes that eventually block adaptation to new roles. The author refers that at this stage, the subjects begin to reflect on what they did, or stopped doing, and on the meaning of their achievements, each one with their subjectivity. And this process gives rise to concerns and, consequently, negative feelings that, due to the lack of support by close people or from a support network, result in changes in biological and psychological factors, leading to depressive conditions, hypochondria, somatization, low self-esteem, among others. In the present study, we identified that the elderly people who do not present somatization as a symptom are able to organize themselves internally and socially, thus avoiding anxiety, obsessiveness/compulsiveness and psychoticism, but, most importantly, they are able to develop good strategies to adapt to new roles and use their time wisely, thus minimizing the impacts caused by preoccupations and negative feelings related to the aging process. Therefore it becomes important to this group the use of the optimization strategy to age well.

In this sense, Antunes and Almeida [12], demonstrate that the educational groups currently occupy the role of preparing the elderly by optimizing their skills for phases in which the living conditions undergo changes, enabling them to face new challenges, facilitating the access to knowledge and training in various areas and culture. The elderly people who participated in this research attend a computing group on a weekly basis, as well as other activities offered by the municipality, demonstrating a good strategy for aging. However, these attitudes of the elderly and society do not impede the perception of losses, which, when improperly worked, individually or collectively, may lead to the somatization of many symptoms associated with anxiety, obsessiveness/compulsiveness and psychoticism.

Rodrigues and Martins [13] refer to public policies, and argue that due to the increase in the elderly population, strategies and practices that guarantee this population a better quality of life have been discussed more frequently. Accessibility, mobility, social relationships, opportunities to participate in the management of the city, access to culture, innovation, improved skills, among other aspects, lead to successful aging. Also regarding public policies, Roque [14] says that, although there is more and more awareness of these improvements and more and more the elderly are inserted in educational and social groups, they experience difficulties in adapting to the new phase of life, in which they have to exchange professional activities for other actions, as well as to do something with all their free time. According to authors, even though the elderly people in our study actively participate in the computing group, those who have somatic symptoms attend only once a week the activities. However, on the remaining days of the week that may be at home, without a positive perspective, or even in need of other forms of interaction through which they could further expose their feelings and understand these psychological symptoms. In the end, this process is the result of a scarcity of strategies for aging.

The dimension of the psychological symptoms of anxiety demonstrated an association with the psychological symptoms of obsessiveness/compulsiveness, psychoticism and somatization, as well as spirituality, especially with hope and optimism, which becomes a protective factor for this type of symptom. These results corroborate with the study proposed by Baumont [15], which refers to anxiety as a physiological response to stimuli that the brain considers dangerous or threatening. It is an adaptive response used by people to protect themselves from threats or dangers. As Carvalho [16] comments, anxiety can also result from pleasant events, especially when they involve waiting, stimulating the person to act. The anxiety symptoms that appear the most are: insomnia, tension, anguish, irritability and difficulty in concentrating. According to the author, it is possible that anxious people tend to anticipate their inability to face stressful events and ask questions about their intellectual ability.

Colussi, Pichler and Grochot [17] refer that the family, caregivers and friends are present in the development process and the conception of aging happens through the perception of particularities of each family organization, social economic conditions and cultural, moral and spiritual values. According to the authors, the decrease in functional capacity and performance at work, the cognitive decline, the diseases and intergenerational conflicts are inherent obstacles to the aging process. When one faces a great number of negative factors in aging, Silva [18] says

that spirituality can be a coping resource for adverse situations, composing emotional and motivational aspects in the search for meaning in life. In regard to the emotional aspects, feelings of hope, comfort, affection and support should be included. In the motivational aspects, on their turn, a positive perception about life is to be included.

In this sense, elderly people in our sample, may participate in the computing group be due to anxiety, seeking new opportunities, hope and optimism. However, if they get frustrated with the activities, especially in relation to cognitive deficits, their experience can be negative. This situation can extend to other experiences in their lives, as these elderly people are active, independent and participate in different activities. However, the borders between the satisfaction with activities, the developed experiences and frustration may impact on determining the relation found in this study with somatization, obsessiveness/ compulsiveness and psychoticism. Therefore, strategies that enhance hope and optimism are relevant to the mental health of this group of elderly people.

In the correlation and linear regression analyzes with the psychological variable of obsessiveness/ compulsiveness, a relation was found with anxiety and somatization and the strategies for promoting successful aging, mainly with optimization and spirituality in relation to hope and optimism. Lima [19] states that obsessions are characterized as frequent, persistent thoughts, impulses or images, understood as unwanted, that end up causing suffering and anxiety to the individual. Compulsiveness refers to mental or repetitive acts that the person feels forced to perform in response to an obsession. Seabra et al. [20] demonstrate how resources of obsession and compulsion are symptoms of excessive and exaggerated, endless doubts, undesirable thoughts that cause disturbance, accumulation of useless objects and specific object alignment. The authors report that these symptoms can appear and disappear, or even improve or worsen throughout life. In this study, obsessiveness/compulsiveness appeared suggesting symptoms and not necessarily catering for all the symptoms described above to configure an obsessive or compulsive condition.

Kreuz and Franco [21] refer that human aging is a process that involves learning, development and maturation. However, the elderly individual, as time goes by, when facing with different losses, needs to perform an intense emotional understanding. According to the authors, even if aging depends on people's positive perception of this process, or the body and health suffer the impacts of degenerations and end up aging, becoming more and more likely to develop diseases. This situation raises concerns

that are, in a way, constant for the elderly. The results demonstrate that some participants in this study present symptoms of obsessiveness/compulsiveness, suggesting that they are excessively worried with their own aging process, noticing some physical and cognitive declines.

Furthermore, according to Kreuz and Franco [21], old age associated with diseases and unproductivity is still a frequent concept for the elderly, and is not perceived as a normal phase of development. Aging is experienced in a unique way. It is processed differently for each person, even if deeply culture-based. According to Aragão et al. [22], the interpersonal relationships, which are formed throughout a subject's life, are necessary to support the elderly to face the difficult situations that appear in old age, as they give resilience and enable people to use psychological resources to get around their emotional problems. Social relations are related to the execution of health controls, to the sense of stability and psychological well-being. By participating in computing groups, as well as of other available strategies, whether offered by the municipality or not, the elderly enhance their possibilities of coping strategies to face a successful aging process.

In line with these assumptions, Soares and Amorim [23] refer to the importance that spiritual/religious aspects can have in the development of a successful aging process. It seems important to consider that, when reaching an old age, the anxiety triggered by the understanding of finitude, causes a greater development of spirituality, which, in turn, presents feelings of gratitude for life, as well as hope, thus facilitating the confrontation with the aging process. The capacity of having hope and optimism about life seems to be related to the perception of a healthier life. According to the results obtained in this research, some of the elderly people studied showed symptoms of obsessiveness/compulsiveness, but, in those cases, the ability to develop optimization strategies was considered low, as well as hope and optimism thoughts. This situation demonstrates that these optimization and optimism difficulties, combined with the adversities in the aging process, can develop symptoms of greater rigidity on the tasks performed. These situations lead the elderly to fail to carry out their activities, causing frustration and the development of more symptoms of anxiety, somatization and social isolation.

The psychological symptom of psychoticism shows a significant relationship with anxiety, obsessiveness/ compulsiveness, somatization, strategies for promoting successful aging, especially with optimization and spirituality, specifically with hope and optimism. According to Sisto and Oliveira [9], psychoticism is one of the three traits used by psychologist Hans Eysenck in his P-E-N personality model that refers to psychoticism,



extraversion and neuroticism. Generally, people who have psychotic resources tend to feel more lonely and easily create problems with others, are reckless and take pleasure in disturbing others. They can be described as more self-centered and anti-social and are usually impulsive and have little feeling of empathy.

Santos et al. [24] it also states that the aging process has as one of its characteristics difficulties of adaptation or readaptation, so it is important that public policies direct their attention to this population and the transformations that this process brings, allowing the elderly to participate actively in the society. The communication skill in the aging process is quite valuable. Given the innumerable changes through which elderly people undergo, the difficulty of communication can cause social exclusion.

According to Lemos [25], spirituality helps subjects in decision-making scenarios, assists in the process of accepting suffering and has an important role in physical and mental health. Spirituality feeds hope and optimism, decreasing negative feelings and sadness, leads the person to feel more satisfied with the small things achieved. Sá et al. [26] also state that spirituality represents an important means of emotional support that reflects the significant shape in people's physical and mental health. The preservation of spirituality in the lives of the elderly acts as a coping resource for the main stressful issues, such as changes and losses. In this study, a small part of the sample demonstrated characteristics of psychoticism, in contrast, showed a decrease in spirituality, hope and optimism. This result may suggest that, due to the fact that these elderly people have negative predispositions influenced by the difficulties that affect the coming of old age, they cannot be optimistic and expected to reach their objectives, thus, they are incapable of action in favor of developing their spirituality. These elderly people, in addition to not being able to engage socially, are not able to have an adequate view of reality, with pleasure and optimism and, consequently, are unable to optimize their skills.

In the present study, we suggest that some of these elderly people who actively participate in the computing group may have gone through changes and had difficulties adapting to them, imparting a more negative view of life. In the context of computing itself they were challenged to learn something that, many times, they had not had any type of previous experience. Therefore, the importance of working along educational activities was identified, promoting optimization and optimism strategies and not allowing attitudes of social exclusion or anxiety and somatization to be strengthened.

## V. CONCLUSION

Longevity has both positive and negative aspects. A clear and optimistic perception of life, combined with coping strategies on losses and gains promote the development of psychological symptoms during the successful aging process of elderly people. On another perspective, a negative perception leads people not to have hope and optimism and also to be unable to develop strategies that compensate losses, which, in turn, causes physical and psychological diseases. Throughout the development process a balance between losses and gains is necessary and learning to deal with this proposition of successful aging is very important for the development of mental health of the elderly.

The results showed that the psychological symptoms of anxiety, obsessiveness/compulsiveness, psychoticism and somatization demonstrated a significant association. However, spirituality, especially hope and optimism, and strategies to promote successful aging, especially optimization, are relevant aspects for reducing and controlling these psychological symptoms analyzed in our sample of elderly people. Hope, optimism and optimization are strategies that allow people to control the symptoms of psychoticism and obsessiveness/compulsiveness. Hope and optimism aided in the control of anxiety and optimization in the somatization symptom.

The results of this study demonstrate the importance of developing public policies aimed at developing and implementing activities to promote spirituality strategies and optimizing the skills of the elderly to achieve compensation for possible losses that may occur concurrently with the development/aging process. In this sense, the importance of activities such as digital inclusion is reinforced, which promotes, combined with other activities, potentialities for the optimization of skills in old age. This study presented some limitations as it was conducted with people who participate in computing groups. A wider sample may be considered, so the relation between the psychological symptoms, the strategies for successful aging and spirituality in the elderly population of Novo Hamburgo or even in more than one city may be better understood.

Thus, we suggest new studies to be carried out with the aim of identifying differences in psychological symptoms, such as verifying the relations with other variables, both psychological and social. It is important to attain more and more knowledge about the elderly population so that improvements in public policies are increasingly implemented. Therefore, elderly people may age with quality of life.

## REFERENCES

- [1] MARI, F. R. et al. O processo de envelhecimento e a saúde: o que pensam as pessoas de meia-idade sobre o tema. **Revista Brasileira de Geriatria e Gerontologia**, v. 19, n. 1, p. 35-44, 2016. Disponível em: <<https://www.redalyc.org/pdf/4038/403844773004.pdf>>. Acesso em: 28 fev. 2019.
- [2] MIRANDA, G. M. D.; MENDES, A. C. G.; SILVA, A. L. A. O envelhecimento populacional brasileiro: desafios e consequências sociais atuais e futuras. **Revista Brasileira de Geriatria e Gerontologia**, v. 19, n. 3, p. 507-519, 2016. Disponível em: <<https://www.redalyc.org/html/4038/403846785012/>>. Acesso em: 21 mar. 2019.
- [3] BRITO, T. R. P. et al. Redes sociais e funcionalidade em pessoas idosas: evidências do estudo Saúde, Bem-Estar e Envelhecimento (SABE). **Revista Brasileira de Epidemiologia**, v. 21, p. 1-15, 2019. Disponível em: <<https://www.scielosp.org/pdf/rbepid/2018.v21suppl2/e180003/pt>>. Acesso em: 14 mai. 2019.
- [4] FERNANDES, A. T. Processos e estratégias de envelhecimento. **Sociologia: Revista da Faculdade de Letras da Universidade do Porto**, v. 15, p. 223-247, 2017. Disponível em: <[https://scholar.google.com.br/scholar?hl=pt-BR&lr=lang\\_pt&as\\_sdt=0%2C5&as\\_ylo=2015&q=Processos+e+estrat%C3%A9gias+de+envelhecimento.+&btnG](https://scholar.google.com.br/scholar?hl=pt-BR&lr=lang_pt&as_sdt=0%2C5&as_ylo=2015&q=Processos+e+estrat%C3%A9gias+de+envelhecimento.+&btnG)>. Acesso em: 21 fev. 2019.
- [5] ROCHA, J. A. O envelhecimento humano e seus aspectos psicossociais. **Revista Farol**, v. 6, n. 6, p. 78-89, 2018. Disponível em: <<http://revistafarol.com.br/index.php/farol/article/view/113/112>>. Acesso em: 15 mai. 2019.
- [6] SANTOS, L. F. R.; PEREIRA, M. I. F.; MARTINS, C. V. s doenças do coração e as emoções: conversações entre a psicossomática e a psicologia analítica. **Self-Revista do Instituto Junguiano de São Paulo**, v. 2, p. 1-15, 2017. Disponível em: <<https://self.emnuvens.com.br/self/article/view/14>>. Acesso em: 11 abr. 2019.
- [7] COSTA, K. M. V. et al. Ansiedade em universitários na área da saúde. In: II CONGRESSO BRASILEIRO DAS CIÊNCIAS DA SAÚDE, 2, 2017, Campina Grande, Anais. Campina Grande: Realize, 2017. p. 1-10.
- [8] MAIA, L. B. **Transtorno obsessivo-compulsivo: caracterização e o papel da família no tratamento**. 2018. 41p. Monografia (Trabalho de Conclusão de Curso de Formação de Médico), Universidade Federal do Maranhão, São Luís, 2018. Disponível em: <<https://rosario.ufma.br/jspui/bitstream/123456789/3193/1/LaercioBarrosMaia.pdf>>. Acesso em: 24 nov. 2019.
- [9] SISTO, F. F.; OLIVEIRA, A. F. D. Traços de personalidade e agressividade: um estudo de evidência de validade. **Psic: Revista da Vetor Editora**, v. 8, n. 1, p. 89-99, 2007. Disponível em: <<http://pepsic.bvsalud.org/pdf/psic/v8n1/v8n1a11.pdf>>. Acesso em: 29 out. 2019.
- [10] ARRIEIRA, I. C. O. et al. O sentido da espiritualidade na transitoriedade da vida. **Revista de Enfermagem**, v. 21, n. 1, p. 1-6, 2017. Disponível em: <<https://www.redalyc.org/html/1277/127749356012/>>. Acesso em: 27 abr. 2019.
- [11] THIENGO, P. C. S. et al. Espiritualidade e religiosidade no cuidado em saúde: revisão integrativa. **Cogitare Enfermagem**, v. 24, p. 1-12, 2019. Disponível em: <<https://revistas.ufpr.br/cogitare/article/view/58692/pdf>>. Acesso em: 28 abr. 2019.
- [12] ANTUNES, M. C.; ALMEIDA, N. Envelhecer com sucesso: contributos da educação. **Revista Kairós: Gerontologia**, v. 22, n. 1, p. 81-107, 2019. Disponível em: <<https://revistas.pucsp.br/kairos/article/view/43153/28701>>. Acesso em: 14 out. 2019.
- [13] RODRIGUES, R.; MARTINS, E. **Envelhecimento ativo e cidade amiga das pessoas idosas**. Atas do ecUI&D' 19-V Encontro Científico da Unidade de Investigação & Desenvolvimento do ISLA Santarém, p. 123-132, 2019. Disponível em: <<https://comum.rcaap.pt/handle/10400.26/29299>>. Acesso em: 12 nov. 2019.
- [14] ROQUE, C. **A psicologia pensando o envelhecimento**. 2018, 52p. Monografia (Trabalho de Conclusão do Curso de Formação de Psicólogo), Universidade Regional do Noroeste do Estado do Rio Grande do Sul, Santa Rosa, 2018. Disponível em: <<http://bibliodigital.unijui.edu.br:8080/xmlui/handle/123456789/4931>>. Acesso em: 22 abr. 2019.
- [15] BAUMONT, A. C. D. **Estudo de biomarcadores imunológicos e de envelhecimento celular no curso dos transtornos de ansiedade**. 2019. p. 1-47. Tese (Doutorado em Psiquiatria e Ciências do comportamento). Universidade Federal do Rio Grande do Sul Faculdade de medicina. Porto Alegre, 2019. Disponível em: <<https://www.lume.ufrgs.br/handle/10183/196646>>. Acesso em: 29 out. 2019.
- [16] CARVALHO, L. M. O. D. **O autoconceito de idosos e sua relação com níveis de ansiedade e depressão**. 2015. p. 1-76. Dissertação (Mestre em Gerontologia). Programa de Pós-Graduação em Gerontologia. Brasília, 2015. Disponível em: <<https://bdtd.ucb.br:8443/jspui/handle/123456789/1212>>. Acesso em: 29 out. 2019.
- [17] COLUSSI, E. L., PICHLER, N. A., GROCHOT, L. Percepções de idosos e familiares acerca do envelhecimento. **Revista Brasileira de Geriatria e Gerontologia**, v. 22, n.1, 2019. Disponível em: <[http://www.scielo.br/scielo.php?pid=S1809-98232019000100209&script=sci\\_arttext&tlng=pt](http://www.scielo.br/scielo.php?pid=S1809-98232019000100209&script=sci_arttext&tlng=pt)>. Acesso em: 28 out. 2019.
- [18] SILVA, J. P. C. **Idosos que cuidam de idosos: a espiritualidade e a satisfação com a vida aliada aos cuidados informais a idosos**. 2019. 92 p. Dissertação (Mestrado em Gerontologia. Especialização em Gerontologia e Saúde) - Instituto Politécnico de Porto

- Alegre. Escola Superior de Educação e Ciências Sociais  
Escola Superior de Saúde. Porto Alegre, 2018. Disponível em: <<https://comum.rcaap.pt/handle/10400.26/28494>>. Acesso em: 29 out. 2019.
- [19] LIMA, R. D. S. “**Quando tudo pede um pouco mais de calma**”: relato de caso de reabilitação neuropsicológica em paciente com transtorno obsessivo-compulsivo. 2019. 39 p. Monografia (Conclusão do Estágio supervisionado I e II de ênfase em Saúde do Curso de Psicologia) - Universidade Federal do Recôncavo da Bahia. Santo Antonio de Jesus, 2019. Disponível em: <<http://www.repositoriodigital.ufrb.edu.br/bitstream/123456789/1481/1/TCC%20Renata%20Lima%20da%20Silva%20Lima-%20Quando%20tudo%20pede%20um%20pouco%20mais%20de%20calma.pdf>>. Acesso em: 06 nov. 2019.
- [20] SEABRA, I. G. et al. **Toc-transtorno obsessivo compulsivo**. In: CONGREGA MIC, 12, 2017. Bagé. Anais da 12ª mostra de iniciação científica júnior congrega. Bagé, p.1. Disponível em: <<http://revista.urcamp.tche.br/index.php/congregaanaismic/article/view/456/250>>. Acesso em: 06 nov. 2019.
- [21] KREUZ, G.; FRANCO, M. H. P. O luto do idoso diante das perdas da doença e do envelhecimento. **Revista Redalyc**. v. 69, n. 2, p. 168-186, 2017. Disponível em: <<https://www.redalyc.org/pdf/2290/229053873012.pdf>>. Acesso em: 07 nov. 2019.
- [22] ARAGÃO, E. I. S. et al. Padrões de Apoio Social na Atenção Primária à Saúde: diferenças entre ter doenças físicas ou transtornos mentais. **Ciência & Saúde Coletiva**, v. 23, p. 2339-2350, 2018. Disponível em: <<https://www.scielo.org/article/csc/2018.v23n7/2339-2350/pt>>. Acesso em: 14 out. 2019.
- [23] SOARES, A. S. F.; AMORIM, M. I. S. P. L. Qualidade de vida e espiritualidade em pessoas idosas institucionalizadas. **Revista Portuguesa de Enfermagem de Saúde Mental**, n. 2, p. 45-51, 2015. Disponível em: <[http://www.scielo.mec.pt/scielo.php?script=sci\\_arttext&pid=S1647-21602015000100008](http://www.scielo.mec.pt/scielo.php?script=sci_arttext&pid=S1647-21602015000100008)>. Acesso em: 07 nov. 2019.
- [24] SANTOS, P. A. D. et al. A percepção do idoso sobre a comunicação no processo de envelhecimento. **Audiology-Communication Research**, v. 24, 2019. Disponível em: <[http://www.scielo.br/scielo.php?pid=S2317-64312019000100312&script=sci\\_arttext](http://www.scielo.br/scielo.php?pid=S2317-64312019000100312&script=sci_arttext)>. Acesso em: 30 out. 2019.
- [25] LEMOS, C. T. Espiritualidade, religiosidade e saúde: uma análise literária. **Revista Caminhos - Revista de Ciências da Religião**, v. 17, p. 688-708, 2019. Disponível em: <<http://seer.pucgoias.edu.br/index.php/caminhos/article/view/6939/4167>>. Acesso em: 30 out. 2019.
- [26] SÁ, C. M. Q. de et al. Cuidados de enfermagem relacionados à espiritualidade no processo de envelhecimento: uma revisão integrativa. **Mostra Interdisciplinar do curso de Enfermagem, [S.l.]**, v. 3, n. 2, jun. 2019. ISSN 2448-1203. Disponível em: <<http://publicacoesacademicas.unicatolicaquixada.edu.br/index.php/mice/article/view/3301>>. Acesso em: 25 Nov. 2019

# Clinical and Pharmacological Characteristics of Patients with Chronic Kidney Failure on Dialysis: A Study at the Dialysis Center of the Municipality of Ariquemes, Brazilian Amazon

Carlos Alberto Paraguassú-Chaves<sup>1</sup>, Geovana Cruz dos Santos<sup>2</sup>, Nelson Pereira da Silva Junior<sup>3</sup>, Carla Dolezel Trindade<sup>4</sup>, Simão Aznar Filho<sup>5</sup>, Ruy Drummont Smith<sup>6</sup>, Simão Dolezel Aznar<sup>7</sup>, Lenita Rodrigues Moreira Dantas<sup>8</sup>, Fabrício Moraes de Almeida<sup>9</sup>

<sup>1</sup>PhD in Health Sciences - University of Brasília - UnB, Brazil; PhD in Science - University of Havana (CU); Post-Doctor in Health Sciences - UnB and Degli Studi D'Aquila University - IT. Full Professor at the University Institute of Rio de Janeiro - IURJ, Brazil.

<sup>2</sup>Graduated in Pharmacy from the Faculty of Education and Environment - FAEMA, Brazil.

<sup>3</sup>Master in Pharmaceutical Sciences by the Faculty of Pharmaceutical Sciences - UNESP-Araraquara. Professor at the Associated Faculties of Ariquemes FAAr, Brazil.

<sup>4</sup>PhD in Law - Universidad Nacional de Lomas de Zamora (Argentina). Post-doctorate - Università deli Studi di Messina (Italy). Full Professor at the University Institute of Rio de Janeiro - IURJ, Brazil.

<sup>5</sup>PdD in Law - Universidad Nacional de Lomas de Zamora (Argentina). Post-doctorate - Università deli Studi di Messina (Italy). Full Professor at the University Institute of Rio de Janeiro - IURJ, Brazil.

<sup>6</sup>Master in Legal Sciences from the Autonomous University of Lisbon. Adjunct Professor at the Faculty Instituto Rio de Janeiro, Brazil.

<sup>7</sup>Graduated in Law. Master of Law Student, Specialist in Law. Professor at the University Institute of Rio de Janeiro, Brazil.

<sup>8</sup>Geographer expert and lawyer. Researcher of the Institute of Health Sciences and the Amazon environment - AICSA.

<sup>9</sup>PhD in Physics (UFC), with post-doctorate in Scientific Regional Development (DCR/CNPq). Researcher of the Doctoral and Master Program in Regional Development and Environment (PGDRA/UNIR).

Received: 15 Aug 2022,

Received in revised form: 13 Sep 2022,

Accepted: 20 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords—** *Chronic Kidney Failure, hemodialysis, Clinical and Pharmacological Profile, Ariquemes, Brazilian Amazon.*

**Abstract—** *The patient with CRF presents, in addition to kidney damage, other pathologies covered that injure the condition, making treatment difficult. The general objective of the study is to analyze the clinical and pharmacological characteristics of patients with Chronic Renal Failure (CRF) on hemodialysis treated at a dialysis unit in the municipality of Ariquemes, state of Rondônia, Brazilian Amazon. Data were collected through two sources: in medical records and in interviews with patients. The research had a random sampling of 30 patients of both sexes. Systolic arterial hypertension (SAH) is the main cause of CRF with 50% of cases, followed by polycystic kidney disease (PRD) 13.3% and diabetes mellitus (DM) 6.7%, systemic lupus erythematosus (SLE) 3, 3% and other diseases with 25.7%. The relative frequency of SAH as the underlying disease (50%), SAH comorbidity (70%), hematocrit alteration (96.7%), anemic corrective P.M. (96.7%), access condition = fistula (93.3%), report of another pathology (73.3%), phosphorus alteration (46.6%) and P.M with phosphorus correction (46.6%) are the main clinical characteristics found. One hundred percent of patients use medications, 80% know what the drugs they use are for, 80% of patients know how to describe medications, 76.6 follow the prescriptions, 50% receive pharmaceutical guidance and*

80% say they understand the guidance. The use of 4 to 6 medications a day prevailed (53.3%), 20% practice self-medication, 23.3% use teas and medicinal plants and 96.6 seek medical help when necessary. The results presented show several aspects of the population of patients with chronic renal failure in the Amazon scenario, which will serve to support decisions to improve care for these patients, including the creation and long-term maintenance of a comprehensive data and information recording system with the socioeconomic, clinical and pharmacological characteristics, in addition to the follow-up of patients outside the treatment unit, the analysis and dissemination of epidemiological data on patients with CRF undergoing renal treatment in a Dialysis Center.

## I. INTRODUCTION

The kidneys are reddish-brown, bean-like double organs situated just above the waist. Regulates from 11 cm to 13 cm in length, from 5 cm to 7.5 cm in width and from 2.5 cm to 3 cm in thickness in the adult; weighing between 125 g and 170 g in men and between 115 g and 155 g in women. In newborns, this weight varies from 13 g to 44 g. [1]. For Thomé et al., [2] the kidneys are organs that perform vital functions, such as blood filtration, hydroelectrolytic balance and elimination of toxic substances through the urine, and Cabral et al., [3] describe that the kidneys participate in the excretion of water, mineral salts and the control of blood pH, in addition to controlling systemic blood pressure and synthesizing important hormones. According to Guyton and Hall [4] each kidney contains about 1 million nephrons, each one capable of forming urine; there is a gradual decline in the number of nephrons with renal injury, disease or aging, without regeneration of new nephrons.

The kidney plays the most important role in filtering the plasma and removing substances from the filtrate in varying counts, depending on the body's needs. It purifies undesirable substances from the filtrate by excreting them in the urine together with its main functions which are classified as excretory and hormonal [4]. In the excretory function, the kidneys filter the blood and remove the waste resulting from metabolism, and in the hormonal function, blood pressure is controlled by the regulation of water and sodium levels [5]. The breakdown products excreted by the kidney include the metabolism of amino acids such as urea, creatinine from the muscles, uric acid from the metabolism of nucleic acids, fruits of degradation of red blood cells such as bilirubin, metabolism of various hormones and substances ingested as drugs [4].

When a person is affected by a certain chronic disease that leads to damage to kidney functions, it is said that there is CRF [2]. Chronic Kidney Failure (CRF) is a morbid condition that modifies the normal cellular performance of the kidneys, altering body homeostasis. The progressive

loss of renal function leads to life-threatening abnormalities [6]. In CRF, a large number of nephrons are destroyed or damaged, to the point that those that remain cannot perform the normal performance of the kidney. Normally, only one third of the nephrons are able to eliminate all the degradation products of the organism, without their accumulation. Thus, severe CRF symptoms are not often seen until the number of functional nephrons has decreased, at least to 70% below normal. With this decrease occurs the retention of products, including urea and creatinine [4]. Riella [1] refers to CRF as a syndromic diagnosis of progressive and irreversible loss of renal function, characterized by the deterioration of the biochemical and physiological functions of all the body's systems, secondary to the accumulation of catabolites, uremic toxins, alterations in the hydroelectrolytic balance and acid-base, hypervolemia, hyperkalemia, hyperphosphatemia, anemia, hyperparathyroidism, among others.

Lima [7] reports CRF as one of the conditions that affects many people, which is a state of irreversible deterioration of renal function. In a large number of patients in the advanced stage of the disease, it is complex to give the etiology, being able to identify the presence of diseases such as glomerulonephritis, renal vascular disease, chronic infections, embolization of the glomeruli by cholesterol crystals and others.

For some authors, among the main causes of CRF are systemic arterial hypertension (SAH), diabetes mellitus (DM), kidney diseases and uropathies, such as recurrent urinary infections, obstructions and urinary stones [8]; [9] and [10].

To identify the patient with CRF, the glomerular filtration rate (GFR), the urinalysis (EAS) and an imaging exam are used as diagnostic resources, with ultrasound of the kidneys and urinary tract being preferred [11]. In the diagnosis of CRF, the following parameters are used: altered GFR; Normal or close to normal GFR but with evidence of parenchymal kidney damage or abnormal

imaging. Thus, any individual who, regardless of the cause, has a GFR  $< 60$  ml/min/1.73 m<sup>2</sup> for at least three consecutive months has CRF. In cases of patients with GFR  $\geq 60$  ml/min/1.73m<sup>2</sup>, consider CRF if associated with at least one marker of parenchymal renal damage or alteration in the imaging test [11]. The markers of parenchymal kidney injury are: a) Albuminuria  $> 30$  mg/24 hours or Albuminuria Creatininuria Ratio (RAC)  $> 30$  mg/g. b) Hematuria of glomerular origin, defined by the presence of erythrocyte casts or erythrocyte dimorphism on urinalysis (EAS) and c) Electrolyte alterations or other tubular abnormalities. These changes and abnormalities result from alterations in the reabsorption and secretion of the renal tubules, usually secondary to unusual syndromes. These diseases are usually identified in patients with metabolic acidosis of tubular origin (renal tubular acidosis), persistent changes in serum potassium levels, changes in urinary electrolyte dosage, usually performed by nephrologists, and renal function abnormalities of unclear etiology, in cases of proteinuria or suspected glomerular diseases. Renal biopsy is usually indicated by the nephrologist. The following are considered alterations in the imaging exams: polycystic kidneys; hydronephrosis; cortical scarring or changes in cortical texture; signs of infiltrative kidney disease; renal artery stenosis. After the diagnosis of Chronic Kidney Disease, patients are classified into stages according to the glomerular filtration rate, which facilitates the treatment of patients with CKD, as well as the assessment of medical judgment. The classification consists of: Stage 1 when TGF  $\geq 90$  mL/min; Stage 2 if TGF is 60 – 89 mL/min; Stage 3a with TGF 45 – 59 mL/min; Stage 3b with TGF at 30 – 44 mL/min; Stage 4 if TGF is 15 – 29 mL/min; Stage 5 when TGF is  $< 15$  mL/min.

The Brazilian Ministry of Health's clinical guideline on the management of chronic kidney patients determines that, for a better structuring of patients with Chronic Kidney Disease, it is necessary that, after diagnosis, all patients are classified [11]. It should be closely related to prognosis taking into account the outcome of CRF: cardiovascular disease, progression to Renal Replacement Therapy (RRT) and mortality [11]. For a provision of comprehensive care for the patient with CRF, treatment should be classified as: “Conservative when in stages 1 to 3, pre-dialysis when 4 and 5-ND (non-dialysis) and RRT when 5-D (dialytic)”. Conservative treatment consists of: controlling risk factors for CRF progression, as well as cardiovascular events and mortality, with the aim of conserving GFR for as long as possible. Pre-dialysis, for the purposes of this guideline, consists of maintaining conservative treatment, as well as adequate preparation for the initiation of RRT in patients with CRF in more advanced stages[11]. The means of

treatment used in patients with CKD are renal replacement therapy (RRT) through continuous ambulatory peritoneal dialysis (CAPD), cyclic peritoneal and intermittent peritoneal dialysis, hemodialysis (HD) and kidney transplantation [2]. Lately, CRF has become an epidemic, as thousands of people receive RRT, with approximately 150,000 people in Latin America on dialysis, of which 60,000 are in Brazil alone [12].

Sesso et al., [13] in the dialysis census report published by the Brazilian Society of Nephrology (SBN) pointed out that males had a predominance of 57.3% in relation to females with 42.7% of people who were in Renal Replacement Therapy (RRT) in Brazil. According to the Brazilian chronic dialysis survey, the most common type of RRT is hemodialysis [14]. Cavalcante et al., [15] presented hemodialysis as a process that consists of the filtration of extra-corporeal fluids from the blood performed by a machine and a dialyzer, which replaces renal functions. At the beginning of the hemodialysis session, an arteriovenous fistula must be surgically performed, or the placement of a specific catheter in the vein, in order to gain access to the patient's circulation [16] and [17]. During hemodialysis, part of the patient's body blood is withdrawn through the fistula or specific catheter, being transported through the arterial line of the dialyzer, where it is filtered, returning to the patient through the venous line [18]. The hemodialysis process occurs through an artificial kidney, in the hemodialysis machine through the dialyzer that has a system containing a semipermeable membrane, in which there is a counter-parallel flow of the patient's blood and dialysis fluid (dialysate), where migration of substances between the two systems [19].

According to Hoenich, Ronco and Levin [19] hemodialysis treatment promotes the restoration of electrolytes and acid-base balance, in addition to the removal of toxic substances and excess fluid accumulated in the blood and body tissues as a result of renal failure, by the diffusion process. According to Brasil [18] the main objective of hemolytic treatment is to minimize the symptoms caused by the malfunction of the kidneys and to benefit the patient with a better life condition, admitting to know himself well, always evaluating the monitoring of plasma levels of potassium, urea, sodium and chlorides. To ensure the effect of hemodialysis, it is essential that patients show adherence to dialysis treatment, with hemodialysis being the treatment used, which must be performed by patients with CRF for life or until they have a successful kidney transplant [20]. Brunner and Suddarth [21] say that hemodialysis must be concomitant with water restriction, diet therapy, pharmacological treatment, among others. For Rodrigues [22] the pharmacological treatment has a real importance, when the medication has been used mainly as

a form of relief or cure of a certain disease or syndrome.

The number of drugs for each patient on hemodialysis is on average 7 to 11 drugs, and the drugs are prescribed with the hope that they can bring benefits and practical factors to the health of patients [23]. According to this author, high drug consumption influences adherence to pharmacological treatment. Patients with CRF must have an efficient adherence to treatment, especially dietary and pharmacological treatment, which consists of several medications for daily use, with the aim of stabilizing the disease and preventing the emergence of complications [24]. The main drugs of daily use, commonly prescribed to patients with chronic nephropathy include: hypotensive, coronary vasodilator, gastric protector, antianemic, calcium carbonate, ferrous sulfate, B complex, vitamin C, sodium bicarbonate and recombinant human erythropoietin [25] and [26]. Factors such as the amount of drugs, adverse reactions, incompatibility between drugs, the difficulty in understanding the goals of therapy and the implication of their inappropriate use contribute to make it difficult to adhere to the pharmacological treatment of patients with chronic kidney disease undergoing hemodialysis [27]. Munger, Van Tassel, Lafleur in their studies reported the negative effect of polypharmacy on adherence is already known, the fact that many patients do not understand the complicated treatment regimen and have difficulties organizing their schedules. In the same study, they suggest the simplification of the therapeutic regimen as a factor to favor adherence and facilitate the understanding of treatment details. Maldaner et al., [29] say that a complex treatment requires greater attention from the subject, adequate follow-up of guidelines and perception of the importance of treatment for the maintenance of their life.

Therefore, chronic renal failure (CRF) is a progressive and irreversible deterioration of kidney function, in which the body's ability to maintain metabolic and electrolyte balance fails, resulting in uremia or retention of urea and other nitrogenous waste in the blood. Brunner and Suddarth [21] report that the signs and symptoms common to renal failure (RI) are: cardiovascular manifestations, dermatological symptoms and other systemic manifestations, observing in diagnostic findings there is a decreased glomerular filtration rate, sodium and water retention, acidosis, anemia, and calcium and phosphorus imbalance that lead to potential serious complications of kidney failure. The treatment of patients with renal failure tends to delay the onset of end-stage renal disease, which, exceptionally, turns out to be fatal. Treatment consists of hemodialysis, chronic outpatient peritoneal dialysis and kidney transplantation [30]. The patient with CRF presents, in addition to kidney damage, other pathologies covered that injure the condition, making treatment

difficult. It is noted that patients with CRF undergoing dialysis often need a large amount of medication [31]; [6] and [32]. Even in this context, the presence of the Clinical Pharmacist becomes evident, since the concomitant use of several drugs, especially drugs not prescribed by the doctor and those considered innocuous by the patient, such as teas and medicinal plants, determines the accuracy of a detailed analysis of the patient's pharmacotherapeutic history [31]; [6] and [32]. Given the perception that patients with chronic kidney disease (CKD) use many drugs and often do not know their indication and others do not follow medical guidelines, and for a better response to the pharmacotherapy of chronic renal patients on hemodialysis.

Faced with the need to understand an Amazonian reality, the objective of this study is to analyze the clinical and pharmacological characteristics of patients with chronic renal failure (CRF) on hemodialysis undergoing treatment at the Ariqueles Dialysis Center (CDA) in the Municipality of Ariqueles, Rondônia, Amazon Brazilian.

## II. METHODOLOGY

### 2.1 Search Location

The research was carried out at the Ariqueles Dialysis Center (CDA) in the Municipality of Ariqueles, state of Rondônia, Western Amazon, Brazil. The CDA serves a little more than 100 chronic renal patients on hemodialysis in the Vale do Jamari region, and in some cities neighboring Ariqueles, so it was considered this place as a study area.

### 2.2 Sample and Inclusion Criteria

The research subject and sample were the 30 (thirty) patients on hemodialysis, following the inclusion criteria: having been on hemodialysis for more than 5 months, being over 18 years of age, having cognitive and verbal capacity, signing the Free Consent Form and Enlightened (ICF). Exclusion criteria was the inverse of inclusion.

### 2.3 Data Collection

Data collection took place through two sources: data from medical records and data from patients, being carried out on the days when patients went to the clinic for Renal Replacement Therapy (RRT), while they were still in the reception hall waiting for treatment. In the data from the medical records, the directors of the dialysis clinics were first exposed to a prior explanation of the objectives and benefits that the research brings both to patients and to the health system and to science. After authorization from the technician in charge, data relevant to patients undergoing hemodialysis were collected in the medical records, such as: treatment time, age, sex, city of origin, schooling,

underlying disease and medications used according to the results of laboratory tests in the last 6 months, among others. socioeconomic aspects. In laboratory tests, only the results with biochemical alterations were analyzed, such as: hematocrit, hemoglobin, pre- and post-hemodialysis urea, sodium, potassium, calcium, phosphorus, blood glucose, alkaline phosphatase, total proteins and fractions, vitamin D, total cholesterol and fractions, triglycerides, among others.

Thirty patients of both sexes were interviewed, 11 female and 19 male. The collected data were processed and tabulated using the Statistical Package for the Social Science (SPSS) version 17.

#### 2.4 Type of Search

The type of research is applied, descriptive, transversal with a quantitative approach, since the objectives generate knowledge for practical application, where the number of patients with CRF who undergo hemodialysis in the CDA was raised.

#### 2.5 Ethical and Legal Aspects

As for the legal aspects of the research, it was in accordance with what was required by the Ministry of Health to carry out research with human beings, according to resolution 466/12, of the National Health Council. The research was submitted to the Ethics and Research Council (CEP) of the Faculty of Education and Environment (FAEMA). The Free and Informed Consent Term was delivered to each patient, with clarifying information necessary for their participation, demonstrating the relevance of the research and its importance in the academic learning process, giving freedom to the patient to participate or not, guaranteeing the confidentiality of the information, as well as anonymity. The procedures performed ensured reliability, privacy and protection of the participant's image and personal identification.

### III. RESULTS AND DISCUSSION

#### 3.1 Socioeconomic Characteristics

Of the 104 patients enrolled on hemodialysis, 100 (96.1%) met the inclusion criteria and 4 (3.9%) were eliminated because they had less than 6 months of hemodialysis RRT. The population to be studied was totaled in 100 chronic renal patients on hemodialysis. Of these, 30 study subjects were selected by random sampling. According to the analogy of the information collected in medical records and in the questionnaire applied to patients, the data were classified into: socioeconomic characteristics; clinical characteristics and pharmacological characteristics with emphasis on the most prevalent variables. The sample consisted of 19 men interviewed representing 63.3% of the

male gender while 11 women 36.7% represent the female gender. Studies by Cherchiglia et al., [33] confirm that patients who start RRT on hemodialysis are mostly male. In the study by Sesso et al., [13] the distribution of dialysis patients by sex/gender showed 57.7% in men and 42.3% in women. Ribeiro et al., [34] in a study carried out in a state capital in the Northeast region of Brazil, found that most patients are male (67.2%).

The distribution by age group revealed that 63.6% of the patients are between 19 and 64 years old. These data corroborate the age groups noted in this study, which had a prevalence in the age range of 39-58 years, 43.4%; followed by 18-38 years 30%; 59-78 years 20% and over 78 years 6.6%. Studies have shown that the mean age of patients undergoing renal therapy in Brazil varies from 49.3 to 53.9 years [35]; [36] and [37]. Ribeiro et al., [34] found a predominance of patients with CRF aged between 40 and 59 years (40.6%). Sesso et al., [13]; [14] revealed in their study that 63.6% of patients are between 19 and 64 years old. According to Simonetti; Ferreira [38] after 40 years of age, there is a physiological functional decline that increases throughout life and can be influenced by several factors such as physical, organic, genetic, lifestyle, environment, education and socioeconomic conditions. As for marital status, 70% are married; singles 23.4% and 3.3% widowed and separated 3.3%. The presence of males in renal therapy was similar to those found in other studies, as well as the marital status of married was similar to the others surveyed. This indicates that most people with chronic renal failure in Brazil are married, followed by single people [39]; [40] and [36]. This picture is confirmed by Ribeiro et al., [34], who found 60.9% of married patients undergoing treatment in a nephrology unit.

There was also evidence in the mean age of patients undergoing renal therapy in Brazil, which ranges from 49.3 to 53.9 years [35]; [36] and [37]. Of the patients with Chronic Renal Failure assisted in Ariquemes, 66.7% live in other cities, while 33.3% live in Ariquemes. Unlike the present study, Ribeiro et al., [34] found 64% of hemodialysis patients in a capital of a state in Northeastern Brazil residing in the city where the Dialysis Center is located. As for the source of income and occupation, 50% receive sick pay; retirees 26.7%; the unemployed 13.3%; self-employed 6.7 and employed 3.3%. The family composition is around 4 to 5 people in the family and the salary is 1 to 2 minimum wages. CRF causes important limitations to patients and this often leads to withdrawal and early retirements resulting from therapy. Patients with CRF on hemodialysis need to undergo RRT three times a week with a duration of 3 to 4 hours, thus making it difficult for these patients to work regularly. Some studies show that the vast majority of Brazilian patients



undergoing renal replacement therapy have low purchasing power, which should influence their quality of life, in terms of obtaining medication and food [36] and [37]. The assessment of the level of education quantified 36.7% with incomplete primary education; 23.3% had completed elementary school; 16.7% with complete secondary education and 13.3% with incomplete secondary education. In the study by Ribeiro et al., [34] also found a low level of education among patients with CRF. According to this author, the schooling of the individuals surveyed was 53.1% with incomplete or complete

elementary education and a rate of 32.8% of illiterates and semi-illiterates. Thus, it was possible to observe, through the patients' reports, greater difficulty in understanding the recommended guidelines, given by the health team and the extension of the hemodialysis procedure, which can further compromise the health status of the patient undergoing treatment. Lara's study; Sarquis [41], developed in Curitiba, capital of the state of Paraná, showed that approximately 67% of the sample had access only to elementary education.

Table 1. Socioeconomic characteristics

| Gender                       | Fr%  | Resident with how many people | Fr%  | Place of residence           | Fr%  |
|------------------------------|------|-------------------------------|------|------------------------------|------|
| Men                          | 63.3 | With up to 5 people           | 70.0 | Ariquemes                    | 33.3 |
| Women                        | 36.7 | + of 5 people                 | 30.0 | Does not reside in Ariquemes | 66.7 |
| Age Range                    | Fr%  | Marital Status                | Fr%  | Income                       | Fr%  |
| 18-38                        | 30.0 | Married                       | 70.0 | 1 to 2 minimum wages         | 48.8 |
| 39-58                        | 43.4 | Not married                   | 23.4 | 2 to 5 minimum wages         | 36.2 |
| 59-78                        | 20.0 | Separated/ Divorced           | 3.3  | + 5 minimum wages            | 15.0 |
| + que 78                     | 6.6  | Widower                       | 3.3  |                              |      |
| Education                    | Fr%  | Occupation                    | Fr%  |                              |      |
| Incomplete elementary school | 36.7 | Receives sickness AID         | 50.0 |                              |      |
| Complete primary education   | 23.3 | Retirees                      | 26.7 |                              |      |
| High school                  | 16.7 | Unemployed                    | 13.3 |                              |      |
| Incomplete high school       |      | Freelancers                   | 6.7  |                              |      |
| Graduated                    | 13.3 | Employees working             | 3.3  |                              |      |

Fr% Relative frequency

### 3.2 Clinical Features

Systolic arterial hypertension (SAH) is the main cause of CRF in the population studied, representing a frequency of 50% of cases, followed by polycystic kidney disease (PRD) 13.3% and diabetes mellitus (DM) 6.7%, lupus systemic erythematosus (SLE) 3.3% and other diseases with 25.7%. In the study by Santos[42] situations very similar to those of this research were found. The main underlying diseases for CRF are arterial hypertension (38%), followed by the association of two pathologies - hypertension and diabetes - which corresponds to 23%, with diabetes alone accounting for a total of 8%. In addition to these, other diseases are related to the loss of renal function, such as glomerulonephritis (6%), polycystic

kidneys and lupus with 5% each [34]. In relation to other causes, which account for 15%, the following stand out: kidney stones, pyelonephritis, drug abuse, renal agenesis, bilateral renal hypoplasia and accidents that led to the loss of one of the kidneys.

Sesso (2016) points out a proportion of 35% of arterial hypertension followed by diabetes with 29% as a diagnosis of CRF. The main changes in the exams were: decreased hematocrit values as well as elevated hemoglobin and ferrentin; phosphorus elevation; the prescriptions found in the medical records were in accordance with the changes in the exams. There were no prescriptions for medications for daily use by patients in the medical records. The quantification of these drugs was based on what was

described by the patients in the questionnaire applied. In analyzing the changes, it was noted that the correction of anemia was more frequent than the decrease in phosphorus in these patients. This is due to the fact that drugs used as anemic helpers or correctors such as erythropoietin alfa and iron hydroxide are administered to patients after or at the end of the hemodialysis session; while the Sevelamer phosphorus corrector is delivered to the patient for use at home, thus not being able to say if they really make correct use of the drug.

The study of the profile of chronic kidney disease prepared by the associations of chronic kidney patients in Brazil, shows an approximation with results already obtained in other publications, which point out as the main causes of CRF arterial hypertension, diabetes mellitus, family history of CRF, advanced age, glomerulopathies, polycystic kidney disease, autoimmune diseases, systemic infections, recurrent urinary infections, uropathies and neoplasms [43]. Diabetes-related hypertension is closely linked to insulin-mediated water and sodium reabsorption and sympathetic hyperactivity, as well as increased intracellular calcium availability. Insulin has a direct vasodilator effect and resistance to this effect also contributes to arterial hypertension, causing overload on the kidneys, which leads to the loss of their functions [43] and [44].

The main causes of chronic kidney diseases are systemic arterial hypertension (SAH), diabetes mellitus (DM), kidney diseases and uropathies, such as recurrent urinary infections, obstructions and urinary stones [8]; [9] and [10]. Diabetes is an underlying disease in 25.7% of CRF cases in Brazil, ranking second after Systemic Arterial Hypertension (SAH) [18].

Attention to diabetes and its complications is a priority for global public health. In this sense, the prevention of diabetes mellitus must be carried out at different levels of health care, detecting individuals at risk - primary prevention, identifying undiagnosed cases - secondary prevention, and treating individuals already affected by the disease, in order to prevent acute diseases and chronic complications - tertiary prevention [45]. A factor to be considered is that the long-term progression of diabetes mellitus leads to complications involving several organs, called micro and macrovascular complications, that is, nephropathies, retinopathies, neuropathies and cardiovascular complications, which require a well-founded care approach [46]. As for SAH, Bortolotto [47] states that SAH and renal function are related, and hypertension can be both the cause and the consequence of kidney disease. SAH is present in most kidney diseases, especially in glomerulopathies and diabetic nephropathy.

According to Paraguassú-Chaves et al [48] the prevalence of SAH, determined when renal disease is detected, progressively increases as renal function deteriorates, so that in the terminal or dialysis phase of CRF almost all renal patients are hypertensive. According to the same author, the main mechanism of SAH in CRF is related to the progressive loss of renal capacity to excrete sodium, resulting in salt and volume overload. There are other pathologies that make up a group of diseases that, together, represent a higher percentage in relation to the underlying diagnostic diseases of CRF [34]. According to the Brazilian Society of Nephrology, other causes of CRF that can be cited are urinary tract diseases, vascular diseases, medications, toxic agents, environmental and occupational agents (lead, cadmium, mercury and chromium), but diabetic nephropathy and hypertension are the most common causes, representing 23.2% of the total, the highest percentage in relation to these pathologies. Glomerular diseases represent 15.7% of the total as a basic diagnosis of CRF [18].

The main clinical characteristics presented by the patients in this research are: SAH as underlying disease (50%), SAH comorbidity (70%), change in hematocrit (96.7%), Anemic corrective M.P (96.7%), access condition = fistula (93.3%), report of another pathology (73.3%), phosphorus alteration (46.6%) and M.P with phosphorus correction (46.6%).

The main characteristics of patient access are: SAH as underlying disease (62%), SAH comorbidity (78%), change in hematocrit (98%), Anemic corrective M.P (98%), access condition = fistula (95%), report of another pathology (73%), phosphorus alteration (48%) and M.P with phosphorus correction (48%) according to Santos [42]. The authors Dias; Camargo [49] observed that SAH represents the highest percentage as the underlying disease of CRF in relation to DM, GN and other pathologies, being represented by 35.8% of the total. The correction of anemia was more frequent than the decrease in phosphorus in these patients. This is due to the fact that drugs used as adjuncts or correctors of anemia, such as alpha-erythropoietin and iron hydroxide, are administered to patients after or at the end of hemodialysis; while the Sevelamer phosphorus corrector is delivered to the patient for use at home, it is not possible to say if he really makes the correct use of the medication [42] and [48]. Dialysis time prevails from 6 months to 2 years (44.3%), more than 2 years to 5 years (36.7%) and more than 5 years to 8 years (10%), from 8 to 11 years (4%) and more than 11 years of treatment (5%). Patients with hemodialysis treatment time of up to 1 year corresponds to 38%, between 3 and 4 years of treatment there was a drop to 17% and only 3% remain using the hemodialysis machine for more than 10 years

[34]. With an unspecified cause, deaths related to complications inherent to the treatment, kidney transplants and transfers to other hemodialysis services may be involved. In addition, there are factors that make the treatment of CRF difficult.

Among the factors that complicate the treatment are the effects caused by the treatment, which represented 25% of the complaints, by the patients who presented symptoms after the session, such as weakness, asthenia and fatigue. This situation is directly related to the fact that a large part of the population studied had less than 2 years of hemodialysis treatment, where the greatest effects are found due to the adaptation of the organism to the therapy. Then, patients complained about transportation, being represented by 23%. The time spent in each session and its frequency of 3 times a week, are reasons for complaint by 11% of patients, who report not having time or desire to perform activities of daily living that they performed previously [4]. Patients (8%) reported other causes, such as financial difficulties and absence of companions. CRF produces physiological and functional changes, resulting from decreased physical activity, muscle weakness,

anemia, metabolic changes, in addition to impairing quality of life [34]. The study carried out in Anápoles, in the state of Goiás, shows that, among the difficulties encountered, the availability of medication (51%) is the main reason for patients' complaints, followed by transportation (20.5%) and time spent to each session (14.5%). Those who reported treatment dependence and had no complaints corresponded to 3% each [50]. Predisposing factors such as stress, inadequate diet, smoking, use of estrogenic hormones, obesity, sedentary lifestyle and lack of health control make an increase in blood pressure inevitable [51].

According to the Chronic Kidney Associations, Brazilian statistics on chronic kidney disease are compatible with those of other Latin American countries and lower than those of the United States, which point to diabetes and arterial hypertension as causes of CRF in three quarters of dialysis patients. This difference can be explained by the large number of elderly people in developed countries, since life expectancy is higher, and also by the dietary and cultural habits of these countries that favor the emergence of these diseases [43].

Table 2. Clinical features of CRF

| Main causes                          | Fr%  | Dialysis time        | Fr%  |
|--------------------------------------|------|----------------------|------|
| Systolic Arterial Hypertension (SAH) | 50.0 | 6 months to 2 years  | 44.3 |
| Polycystic Kidney Disease (DRPA)     | 13.3 | + 2 years to 5 years | 36.7 |
| Diabetes Millitus (DM)               | 6.7  | + from 5 to 8 years  | 10.0 |
| Systemic Lupus Erythematosus (SLE)   | 3.3  | + from 8 to 11 years | 4.0  |
| Others                               | 25.7 | + 11 years           | 5.0  |
| <b>Clinical features</b>             | Fr%  |                      |      |
| SAH as the underlying disease        | 50.0 |                      |      |
| SAH comorbidity                      | 70.0 |                      |      |
| Alteration of Hematocrit             | 96.7 |                      |      |
| M.P Anemic Corrector                 | 96.7 |                      |      |
| Access Condition = Fistula           | 93.3 |                      |      |
| Reports Another Pathology            | 73.3 |                      |      |
| Phosphorus Alteration                | 46.6 |                      |      |
| M.P Phosphorus Broker                | 46.6 |                      |      |

Fr% Relative frequency

### 3.3 Pharmacological characteristics

Among the male and female patients participating in this study, 100% use medication. Eighty percent know what the drugs they use are for and how to describe them. When asked if they follow the prescriptions, 76.4% say yes. When asked if they receive pharmaceutical guidance, 50% say they receive adequate guidance at the dialysis center itself and 80% say they understand the guidance. When asked about the amount of daily medication, 4 to 6 daily medications prevailed with 53.3%. Only 20% of patients claim to practice self-medication and 23.3% claim to make use of teas and medicinal plants. Almost 100% (96.6%) of patients report that they seek medical help when needed.

By analogy, one can differentiate the pharmacological characteristics between male and female patients. Approximately 85% of men reported knowing the drug's indications while approximately 75% of women reported knowing the indications. Women strictly follow medication prescriptions with 90% while men approach 70%. Male patients were the ones who most reported receiving pharmaceutical guidance (58%), while women were less frequent with 37%. Similar to the frequencies of the guidelines, male patients who understand the guidelines have a frequency of 58% and 37% females. Male patients consume more medications daily than women, in a proportion of 58% for the consumption of 3 to 4 medications a day against 45% for women.

Santos [42] found similar findings. In the study by Santos [42] 80% say they know what the drugs are for, 80% know how to describe the drugs and 76.6% take the drugs correctly. Eighty percent reported not self-medicating and 20% assumed the use of over-the-counter medications, with 33.3% using teas and herbal medicines. Although 80% of respondents reported not using over-the-counter medications, there is disagreement when compared to the use of teas and herbal medicines, believing that 13.3% of

those who reported not self-medicating make use of these substances.

Several studies point to evidence that patients with chronic renal failure make concomitant use of several medications, including teas and medicinal plants [31]; [6] and [32]. Patients with kidney disease in large proportion use many drugs and often do not know their indication and others do not follow medical guidelines. Low education is associated with the current outcome of these people, having little knowledge, they are unable to assess that the use of teas together with some medications can alter plasma flow, increase adverse reactions and reduce the effectiveness of the medication. These patients do not consider the use of teas as self-medication. By associating the results, it is clear that men in their entirety pay less attention to preventive health, justifying the large number of men who enter RRT, but when diagnosed with a chronic disease, they adhere more to treatment.

Patients with CRF are absorbed when they refer to their health, when they feel some discomfort in their health or when they use medication. The class of drugs reported was checked with: antihypertensives, phosphorus correctors, anemic correctors, vitamin supplements and antihypoglycemic agents. The large number of medications favors non-compliance with the therapy or forgetting of some medications, resulting in low adherence. The presence of other pathologies in patients undergoing hemodialysis is associated with a high number of drugs prescribed to these patients and according to the drugs reported. It was observed that most patients who have CRF have a low level of education, reaching a maximum of 8 years of studies, and this factor may interfere with treatment adherence, as there may be some difficulty in understanding them about the disease and its complications.

Table 3. Pharmacological characteristics

| Use medicines                       | Fr%   | Understand the Guidelines    | Fr%  | Receive Pharmaceutical Guidance      | Fr%  |
|-------------------------------------|-------|------------------------------|------|--------------------------------------|------|
| Yea                                 | 100.0 | Yea                          | 80.0 | Yea                                  | 50.0 |
| No                                  | 0.0   | No                           | 20.0 | No                                   | 50.0 |
| They know how to describe medicines | Fr%   | Know Indications             | Fr%  | Fulfill what is in the recipe        | Fr%  |
| Yea                                 | 80.0  | Yea                          | 80.0 | Yea                                  | 76.4 |
| No                                  | 20.0  | No                           | 20.0 | No                                   | 23.6 |
| Seek Medical Assistance             | Fr%   | Makes use of self-medication | Fr%  | Makes use of Teas / Medicinal Plants | Fr%  |
| Yea                                 | 96.6  | Yea                          | 20.0 | Yea                                  | 23.3 |
| No                                  | 3.4   | No                           | 80.0 | No                                   | 76.7 |
| Daily medication quantity           | Fr%   |                              |      |                                      |      |
| 4 to 6 daily                        | 53.3  |                              |      |                                      |      |
| Other quantities                    | 46.6  |                              |      |                                      |      |

Fr% Relative frequency

#### IV. CONCLUSION

The socioeconomic, clinical and pharmacological characteristics of patients with CRF on hemodialysis at the Ariquemes Dialysis Center are well defined and reflect the same situations found in previous studies in this same CRF treatment center. Depending on the severity of renal impairment, many nephropathies can progress to severe states of morbidity and death.

The reality of patients with chronic renal failure in this study does not differ much from other Brazilian realities. The role of the pharmacist is essential, which with its attributes can influence the understanding of the importance of treating underlying diseases, early diagnosis and the practice of self-care. The multidisciplinary health team, including the family, must also play an essential role in this process. The results presented show several aspects of the population of patients with chronic renal failure in the Amazon scenario, which will serve to support decisions to improve care for these patients, including the creation and long-term maintenance of a comprehensive data and information recording system with the socioeconomic, clinical and pharmacological characteristics, in addition to the follow-up of patients outside the treatment unit, the analysis and dissemination of epidemiological data on patients with chronic renal failure undergoing renal treatment at a Dialysis Center.

#### REFERENCES

- [1] RIELLA MC. **Princípios de nefrologia e distúrbios hidroeletrólíticos**. 4 ed. Riode Janeiro: Guanabara Koogan, 2003, pp. 649-60.
- [2] THOMÉ F.S.; GONÇALVES L.F.; MANFRO R.C.; BARROS E.,2006. **Doença renal crônica**. In: BARROS E.; MANFRO R.C.; THOMÉ F.; GONÇALVES L.F. et al.(editores). **Nefrologia: rotinas, diagnóstico e tratamento**. 3ª. ed. Porto Alegre: Artmed; 2007. cap. 24, p. 381-404.
- [3] CABRAL, G.G.; MONICE, L.M.; MACHADO, L.R.D.; CALDEIRA, L.M.N.; SILVA,L.R.; COUTO, H.A. 2012. **Insuficiência renal aguda devido à rabdomiólise**. Acta Biomedica Brasiliensia ,2p. 42-47.
- [4] GUYTON, A. C; HALL, J. E. **Fisiologia humana e mecanismos das doenças**. 6. ed. Rio de Janeiro: Guanabara Koogan, 2010.
- [5] CRUZ, S.C.G.R; OLIVEIRA, S.C; MATSUI, T., 2012. ( Cord. técnica pedagógica). **Curso de Especialização Profissional de nível Técnico em Enfermagem Livro do Aluno: Terapia Renal Substitutiva**. In. Programa de Formação de Profissionais de nível Técnico para Área da Saúde no Estado de São Paulo. São Paulo. FUNDAPE, 2012. 208 p.
- [6] MADALOZZO, J. C. B.; MIYOSHI, E.; RODRIGUES FILHO, N. J.; RIBAS, J. L. C.; HOLK, I. H. **Acompanhamento farmacêutico de pacientes insuficientes renais que realizam hemodiálise na Nefromed**. Ponta Grossa - Paraná: 2006. p. 29-33. Disponível em: < <http://www.uepg.br/revistaconexão/revista/edicao02/edicao02%20-%2029-3%20acompanhamento%20farmaceutico.pdf> > Acesso em: 02/05/2021.
- [7] LIMA, D. R. **Manual de farmacologia clínica, terapêutica e toxicologia**. Rio de Janeiro: Guanabara

- Koogan, 1994. p. 7-8.
- [8] ANDREOLI, M.C.C.; NADALETTO, M.A. 2012. **Serviço de diálise peritoneal do hospital do rim e hipertensão fundação Oswaldo Ramos - UNIFESP/ EPM.** Disponível em: ><http://www.sbn.org.br/Publico/dia-lise.htm><. Acesso em: 29/06/2016.
- [9] MARAGNO, F.; ZANINI, M.T.B.; ROSA, R.; CERETTA, L.B.; MEDEIROS, I.S.; SORATTO, M.T.; ZIMMERMANN, K.C.G. 2012. **A hemodiálise no cotidiano dos pacientes renais crônicos.** Revista Inova Saúde, 2012. Disponível em: ><http://periodicos.unesc.net/index.php/Inovasaude/article/viewFile/817/808><. Acesso em: 26/10/2021.
- [10] SILVA, C.S.; SOUSA JÚNIOR, I. 2012. **Estudo das principais causas da insuficiência renal crônica entre pacientes que realizam tratamento dialítico em uma Clínica de Hemodiálise da cidade de Florianópolis-Brasil.** In: Congresso Norte Nordeste de Pesquisa e Inovação, nº do evento, Palmas, 2012. Anais Palmas, p. 1-8.
- [11] BRASIL. MINISTÉRIO DA SAÚDE. Secretaria de Atenção à Saúde. Departamento de Atenção Especializada e Temática. **Diretrizes Clínicas para o Cuidado ao paciente com Doença Renal Crônica – DRC no Sistema Único de Saúde/ Ministério da Saúde.** Secretaria de Atenção à Saúde. Departamento de Atenção Especializada e Temática. – Brasília: Ministério da Saúde, 2014.
- [12] FERMI, M.R.V. **Diálise para Enfermagem: Guia Prático.** 2 ed. Rio de Janeiro: Guanabara Koogan, 2010.
- [13] SESSO, R.C.C., LOPES, A.A., THOMÉ, F.S., LUGON, J. R., Watanabe, Y., Santos, D.R. **Diálise Crônica no Brasil - Relatório do Censo Brasileiro de Diálise, 2011.** Jornal Brasileiro de Nefrologia. vol.33 no.4 São Paulo, 2012.
- [14] SESSO, R.C.; LOPES, A.A.; THOMÉ, F.S.; LUGON, J.R.; MARTINS, C.T. **Inquérito Brasileiro de Diálise Crônica 2014** J Bras Nefrol 2016.
- [15] CAVALCANTE, F. A. et al. **O uso lúdico em hemodiálise: buscando novas expectativas na qualidade de atendimento ao paciente no centro de diálise.** Revista Eletrônica da Facimed, v. 3, p. 371-384, 2011.
- [16] LOMBA, A.; LOMBA, M. **Especialidades Médicas.** 2º ed. Olinda: Objetivo saúde, p. 114-116, 2005.
- [17] HOSPITAL ALBERT EINSTEIN. Centro de diálise. **Tratamentos. Diálise Peritoneal. Hemodiálise. São Paulo, 2012. Disponível em: Acesso em 10 out. 2021.**
- [18] BRASIL. SOCIEDADE BRASILEIRA DE NEFROLOGIA. **Doenças comuns. Tratamento.** São Paulo, 2012. <<http://www.sbn.org.br/>>
- [19] HOENICH, N. A., RONCO, C., LEVIN, R. **The importance of water quality and haemodialysis fluid composition.** Blood Purification, v. 24, p.11-18, 2006.
- [20] MADEIRO, A. C. et al. **Adesão de portadores de insuficiência renal crônica ao tratamento de hemodiálise.** Acta Paulista de Enfermagem, v.23, p. 546-551, 2010.
- [21] BRUNNER e SUDDARTH, **Tratado de enfermagem médico-cirúrgica/** Smeltzer, S.C., Bare, B.G. e mais 50 colaboradores; [revisão técnica Isabel Cristina Fonseca da Cruz, Ivone Evangelista Cabral, Marcia Tereza Luz Lisboa; tradução José Eduardo Ferreira Figueiredo]. Rio de Janeiro: Guanabara Koogan, 2010. 12ª edição, pg 1398-1403.
- [22] RODRIGUES JT. **A medicação como única resposta: uma miragem do contemporâneo.** Psicol Estud, 2003; pg 13-22.
- [23] TERRA, F.S.; COSTA, A.M.D.D.; FIGUEIREDO, E.T.; MORAIS A.M.; COSTA, M.D.; COSTA, R.D. **Adesão ao tratamento farmacológico de uso diário de pacientes renais crônicos submetidos à hemodiálise.** Revista Brasileira Clínica 2010. Disponível em: <<http://files.bvs.br/upload/S/1679-1010/2010/v8n2/a006.pdf>> Acesso em: 20/05/2021.
- [24] TERRA, F.S. **Avaliação da qualidade de vida do paciente renal crônico submetido a hemodiálise e sua adesão ao tratamento farmacológico de uso diário.** 173 f. Dissertação (Mestrado em Saúde) – Universidade José do Rosário Vellano, Alfenas, 2007.
- [25] THOMÉ, F.S. et al. 2007. **Diagnóstico e tratamento.** 3ª ed. Porto Alegre: Artmed; cap. 24, p. 381-404.
- [26] BERKOW R, FLETCHER AJ. **Manual Merck de Medicina.** 16ª ed. São Paulo: Roca; 1995.
- [27] FIGUEIREDO RM, SINKOC VM, TOMAZIM CC, ET AL.
- [28] MUNGER M.; VAN TASSELL B.W.; LAFLEUR J. **Medication nonadherence: an unrecognized cardiovascular risk factor.** Med.Gen.Med 2007; p:9:58
- [29] MALDANER C.R; BEUTER M.; BRONDANI C.M.; et al. **Fatores que influenciam a adesão ao tratamento na doença crônica: o doente em terapia hemodialítica.** Revista Gaúcha Enfermagem, 2008; p.29:647-53.
- [30] BRENNER, B.C.; CLARKSON, M.R. **O Rim-Referência Rápida.** Artmed, 2007.
- [31] GARABELI, A.A. MIKI L.K.; MADALOZZO, J.C.B.; RODRIGUES FILHO, N.J.; **Perfil do uso de medicamentos por insuficientes renais crônicos em hemodiálise no Nefromed.** Disponível em: <<http://www.uepg.br/proex/anais/trabalhos/7/Oral/24oral.pdf>> Acesso em: 22/05/2021.
- [32] VAZ, P.A.; NOHEMANN L.; GARABELI A.A.; FILHO N.J.R.; MADALOZZO J.C.B. **Adequação das orientações farmacêuticas para o uso correto de medicamentos ao perfil dos pacientes assistidos em clínica de hemodiálise.** Disponível em: <<http://www.uepg.br/proex/anais/trabalhos/142.pdf>>. Acesso em: 20/05/2021.
- [33] CHERCHIGLIA, M.L.; MACHADO, E.L.; SZUSTER D.A.C.; ANDRADE L.G.; ACÚRCIO F.A.; CAIAFFA W.T.; SESSO, R.; JUNIOR A.A.G.; QUEIROZ, O.V.; GOMES, O.C. 2010. **Perfil epidemiológico dos pacientes em terapia renal substitutiva no Brasil, 2000-2004.** Rev. Saúde Pública 2010;44(4):639-49. Disponível em >[www.scielo.br/rsp](http://www.scielo.br/rsp)< Acesso: 23/07/2016.
- [34] RIBEIRO, I.P., PINHEIRO, A.L.S., SOARES, A.L.A., SANTOS, N.F.M. **Perfil Epidemiológico dos portadores de insuficiência renal crônica submetidos à terapia hemodialítica.** Enferm. Foco 2014; 5(3/4): 65-69 65.
- [35] MARQUES, A.B., PEREIRA, D.C; RIBEIRO, R.C.H.M. **Motivos e Frequência de internação dos pacientes de IRC em tratamento dialítico.** Arq. Ciênciase

- Saúde, 2005. Disponível:>  
[http://www.cienciasdasaude.famerp.br/racs\\_ol/Vol-122/2.pdf](http://www.cienciasdasaude.famerp.br/racs_ol/Vol-122/2.pdf).< Acesso: 30/10/2021.
- [36] BARBOSA, L.M.M., JÚNIOR, M.P.A., BASTOS, K.A. **Preditores de qualidade de vida em pacientes com doença renal crônica em hemodiálise**. J Bras Nefrol, 2007. Disponível em: >  
[http://jbn.org.br/audiencia\\_pdf.asp?aid2=132&nomeArquivo=29-04-07.pdf](http://jbn.org.br/audiencia_pdf.asp?aid2=132&nomeArquivo=29-04-07.pdf). < acesso:30/10/2021.
- [37] ROLIM, L.R., FROTA, N.M., ALMEIDA, N.G., BARBOSA, I.V., MELO, E.M. **Estudo clínico-epidemiológico dos pacientes com insuficiência renal aguda**. J Nurs UFPE, 2012. Disponível em>  
<http://www.revista.ufpe.br/revistaenfermagem/index.php/revista/article/viewArticle/>  
 Acesso: 3/10/2021.
- [38] SIMONETTI, J.P., FERREIRA, J.C. **Estratégias de coping desenvolvidas por cuidadores de idosos portadores de doenças crônicas**. Revista Esc. Enferm. USP, 2008.
- [39] PERES L.A.B.; MATSUO T.; DELFINO V.D.A; PERES C.P.A. NETTO J.H.A; ANN H.K.; et al. **Aumento na prevalência de diabete melito como causa de insuficiência renal crônica dialítica – análise de 20 anos na Região Oeste do Paraná**. Arquivo Brasileiro Endocrinológico Metab.2005. Disponível: [http://www.scielo.br/scielo.php?pid=S00047302007000100018&script=sci\\_arttext](http://www.scielo.br/scielo.php?pid=S00047302007000100018&script=sci_arttext). Acesso em 20/07/2021.
- [40] CASTRO M.; CAIUBY A.V.S; DRAIBE S.A.; CANZIANI M.E.F. **Qualidade de Vida de pacientes com insuficiência renal crônica em hemodiálise avaliada através do instrumento genérico**. SF-36. Rev Assoc Med Bras, 2003. Disponível: >  
<http://www.scielo.br/pdf/ramb/v49n3/a25v49n3>.< Acesso: 23/07/2021.
- [41] LARA, E.A., SARQUIS, L.M.M. **O paciente renal crônico e sua relação com o trabalho**. [CD-ROM] [Monografia]. Londrina: Curso de Enfermagem da Universidade Federal do Paraná, 2005.
- [42] SANTOS, G.C. 2016. **Perfil Farmacológico de Portadores de Doença Renal Crônica em Hemodiálise Assistidos em Ariquemes – RO**. Revista Faema.
- [43] Associações de pacientes renais crônicos. Perfil da doença renal crônica: o desafio brasileiro. 2007. [on line] 2007; [citado 2010 mai 24]. Disponível em:  
<http://www.sbn.org.br/noticias/DossieFinal.pdf>.
- [44] ROMÃO Jr JE. O rim e suas doenças. Sociedade Brasileira de Nefrologia. [on line] 2004. [citado 2010 mai 24]. Disponível em: <http://www.sbn.org.br/Publico/rim.htm>.
- [45] ZANETTI, M.L., et al. **O cuidado à pessoa diabética e as repercussões na família**. Ver Bras Enferm, Brasília mar-abr 61(2):186-92, 2008.
- [46] TEIXEIRA, C.R.S., ZANETTI, M.L., PEREIRA, M.C. **O cuidado à pessoa diabética e as repercussões na família**. Acta Paul Enferm (4) 385- 91 São Paulo, 2009.
- [47] BORTOLOTTI, L.A. **Hipertensão arterial e insuficiência renal crônica**. São Paulo. Rev. Bras Hipertensão. vol.15, 2008.
- [48] PARAGUASSU-CHAVES, C.A.,et al.
- PHARMACOLOGICAL PROFILE OF PEOPLE WITH CHRONIC KIDNEY FAILURE IN HEMODIALYSIS: A STUDY IN A CITY IN THE WESTERN AMAZON, BRAZIL**. International Journal of Development Research Vol. 11, Issue, 05, pp. 47034-47042, May, 2021.
- [49] DIAS, B.N., CAMARGO, D.C. 2013. Perfil do Paciente Renal Crônico no Brasil a Partir da Prevalência de Paciente em Tratamento Dial. (monografia. Curso de enfermagem). Faculdades Integradas Aparício Carvalho.
- [50] LIMA, L.R., MENDONÇA, R.R. 2010. Perfil epidemiológico do paciente renal crônico em tratamento hemodialítico em Anapólis – GO. Rev Intersec. [on line] 2008; [citado mai 23]; 9(2): [aprox.7 telas]. Disponível em: [http://www.saocamilo-mg.br/publicacoes/edicao\\_3/sao\\_camilo/artigo\\_04.pdf](http://www.saocamilo-mg.br/publicacoes/edicao_3/sao_camilo/artigo_04.pdf).
- [51] PINHEIRO, M.E., ALVES, C.M.P. 2010. Hipertensão arterial na diálise e no transplante renal. J Bras Nefrol. [periódico na internet]. 2003; [citado maio 24]; 25(3): [aprox.13 telas]. Disponível em: [http://www.sbn.org.br/JBN/JBN\\_Acontece/0203/revisao1.htm](http://www.sbn.org.br/JBN/JBN_Acontece/0203/revisao1.htm).

## Administration of the Reference Service in Newborn Screening in Pará: Experience Report

João Victor Moura Rosa<sup>1</sup>, Tâmilis Feitosa Leal<sup>1</sup>, Lidineusa Machado Araujo<sup>1</sup>, Ilma Pastana Ferreira<sup>1</sup>, Ana Lúcia da Silva Ferreira<sup>1</sup>, Claudia Ozela El-Husny<sup>1</sup>, Felipe Valino dos Santos<sup>1</sup>, Elizabeth Ferreira de Miranda<sup>2</sup>, Michelle da Silva Pereira<sup>3</sup>, Fernanda Rafaela de Souza Rebelo da Costa<sup>4</sup>

<sup>1</sup>State University of Pará, Brazil.

<sup>2</sup>Evandro Chagas Institute, Brazil.

<sup>3</sup>Federal Institute of Pará, Brazil.

<sup>4</sup>Censupeg College, Brazil.

Received: 22 Aug 2022,

Received in revised form: 14 Sep 2022,

Accepted: 23 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— Neonatal screening; Health services; neonatal deaths; Metabolic diseases.

**Abstract**— Objective: To present an experience report regarding the administration of the neonatal screening referral service in Pará. Based on the implementation of the National Neonatal Screening Program through Ordinance n° 822, of June 6, 2001. Method: This is a descriptive study, with a qualitative approach, of the experience report type, experienced by four nurses who work at the Reference Service in Neonatal Screening at the University of the State of Pará, through systematic, structured or controlled observation. Results: An approach to the work process was carried out based on forwarding through postage to the Research and Diagnostic Support Laboratory responsible for the development of the following steps: 1) sample screening, which is a process of evaluating the quality of the material collected; 2) entering the child's information in the VEGA triage system and 3) processing the biological samples to obtain the results. These procedures are in accordance with the provisions of the Neonatal Screening Technical Manual. Conclusion: In this process, the importance of the multidisciplinary team, especially the nurse, is highlighted in the search for empowerment on the importance of neonatal screening for the early diagnosis of metabolic diseases and the prevention of irreversible sequelae, complications and deaths.

### I. INTRODUCTION

In 2001, the Brazilian Ministry of Health implemented the National Newborn Screening Program through Ordinance no. 822, of June 6, 2001, which establishes that every child born in the national territory must undergo the heel prick test, which is free and mandatory with a goal of universal coverage and guarantee of completion of all stages [1].

Newborn screening is a tool used by public health, which seeks to track some diseases in newborns. Through this screening, it is possible to make an early diagnosis of metabolic, genetic and infectious diseases and offer the best available treatment, essential to reduce morbidity and mortality, as well as minimize the damage or sequelae left by these health problems [2].

The newborn screening test, popularly known as the foot test, consists of collecting a small blood sample from



the newborn's heel, which must be collected until the baby's fifth day of life. The test makes the preventive diagnosis for several congenital diseases and, currently, in public health services, it performs the specific diagnosis of six pathologies, among them: phenylketonuria, congenital hypothyroidism, cystic fibrosis, sickle cell disease, congenital adrenal hyperplasia and biotinidase deficiency [3].

The National Newborn Screening Program is developed in the Brazilian states in four stages, according to the diseases evaluated: Stage I: phenylketonuria and congenital hypothyroidism; Stage II: sickle cell anemia and other hemoglobinopathies; Stage III: cystic fibrosis; Stage IV: Biotinidase deficiency and congenital adrenal hyperplasia [2]. In December 2009, the State University of Pará, located in northern Brazil, was accredited by the Ministry of Health as a Reference Service in Newborn Screening in the State, which guarantees screening, confirmation of diagnosis, treatment and free follow-up at the outpatient clinic of the service. In addition, the state of Pará carries out biological screening of stages I, II and III, although the state is already qualified to carry out stage IV, it has not yet been possible to start this practice due to operational and financial complications [4].

According to Ordinance no. 822 of June 2001, the Newborn Screening Reference Service is responsible for operationalizing, executing and controlling the National Newborn Screening Program in its area of operation, from collection, exams, active search, diagnostic confirmation, monitoring and treatment of cases positives detected, as defined in the National Newborn Screening Program. The Reference Service in Newborn Screening, in the State of Pará, was implemented at the Marco School Health Center, linked to the University of the State of Pará since 2009, through Ordinance no. 428 of May 2009. approximately ten thousand test samples of the foot for newborn screening.

The Newborn Screening Reference Service is formed by a multidisciplinary team to develop the activities required in the National Newborn Screening Program. With this, the nurse stands out, who has a relevant role for being close to the user, being able to clarify doubts about the possible diagnoses and follow-up of the children, through the nursing consultation, in addition to acting in the management of the service. In this sense, the objective of this article is to report the experience of nurses in the administration of the reference service in newborn screening in Pará in a higher education institution [5].

## II. METHODOLOGY

Descriptive study with a qualitative approach, of the experience report type, experienced by 04 nurses who work at the Reference Service in Newborn Screening at the State University of Pará, through systematic, structured or controlled observation. The experience occurs in the development of work activities, with the identification of the main problems and correlating the observed findings with the scientific bases [6].

The State University of Pará is a higher education institution that encompasses teaching, research and extension. We also assume assistance activities, including newborn screening. Since February 2010, this institution has assumed the role of newborn screening, in addition to performing diagnoses, the institution responsible for monitoring and treating children tested with newborn screening tests presented changes.

The Reference Service in Newborn Screening of the State of Pará carries out medium complexity activities with the 856 collection points distributed in the basic health units of the 144 municipalities of the state of Pará, it is responsible for the diagnosis through the processing of samples of the foot test, performed at the Research and Support Laboratory Diagnosis and monitoring of children with altered results for phases I, II and III (outpatient clinic) [5].

## III. RESULTS AND DISCUSSION

During the work activities of nurses from the Newborn Screening Reference Service, these professionals worked in the administration of the newborn screening service and experienced the main routines established in the work process of the National Newborn Screening Program. Program that begins at the time of collection of the heel prick test, carried out in the Health Services affiliated to the Unified Health System.

After carrying out the collection in the municipalities and adequate storage, the sample is sent by mail SEDEX to the Laboratory for Research and Support for Diagnosis, which performs the following steps: 1) sample screening, which is a process of evaluating the quality of the material collected; 2) enter the child's information into the VEGA triage system and; 3) process the biological samples to obtain the results. These procedures are in accordance with the provisions of the Newborn Screening Technical Manual [7]. With the results in hand, the report is issued, those that do not show alterations are sent online to the collection points, on the other hand, for those with altered parameters, the children are summoned for a new collection or immediate consultation at the outpatient clinic of the Reference Service in Newborn screening.

After the altered result, the clinic scheduled an appointment with a multidisciplinary team composed of a nurse, psychologist, social worker, nutritionist, pediatrician, endocrinologist and geneticist. Once the

diagnosis is confirmed, if the change is due to sickle cell disease or cystic fibrosis, the children are followed up at the Newborn Screening Reference Service or referred to specialized services, as shown in the flowchart in Figure 1.

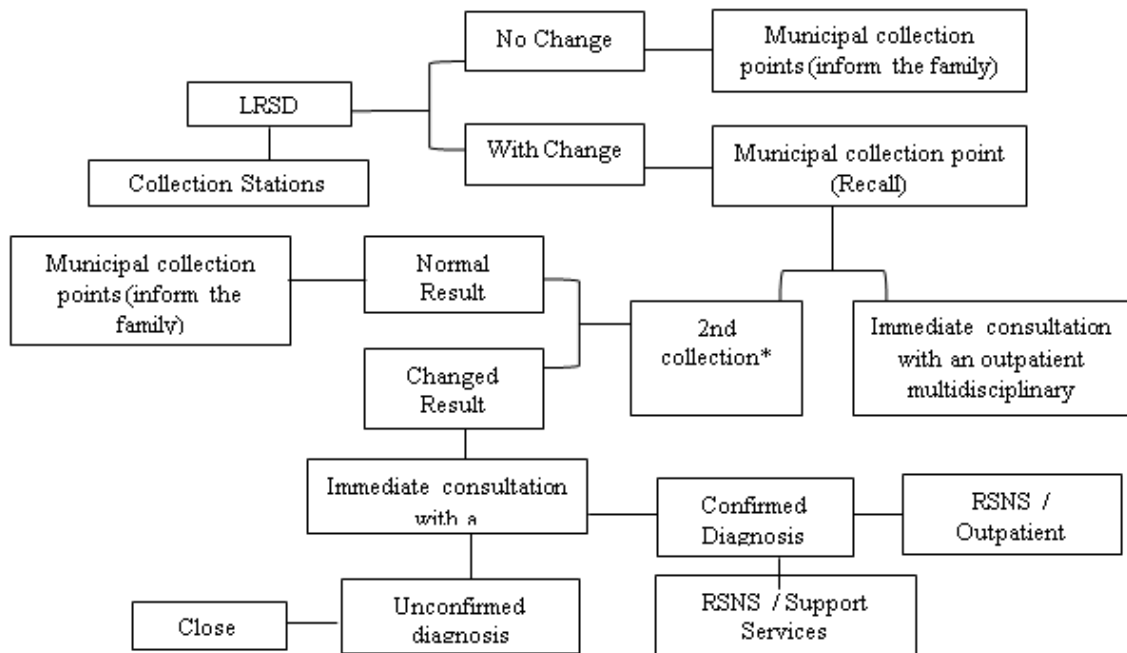


Fig.1 – Flowchart of the Reference Service in Newborn Screening at the University of the State of Pará, 2015-2017.

Source: Authors, 2018.

LRSD: Laboratory for Research and Support for Diagnosis.

RSNS: Reference Service in Newborn Screening.

\*It depends on the evaluation of the outcome parameters for each disease and age of the child in the collection of the foot.

In this work process, the multidisciplinary team, especially the nurse, develops actions to coordinate care, being responsible for quality care, promoting integration between different professionals [8]. With this, use management as seeking tools directed as nursing practices.

Thus, nurses identify the need to assess the quality of newborn screening, seeking to develop the process of management and performance of health services. The number of children screened in the state presents a good result considering the national coverage of collection [9], according to figure 2. It is worth mentioning that not all children undergo their exams through the Unified Health System, additional coverage is obtained through exams carried out in the private network of services.

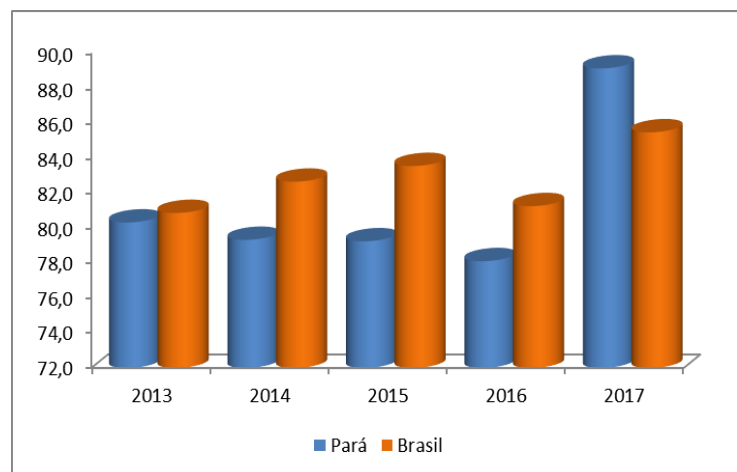


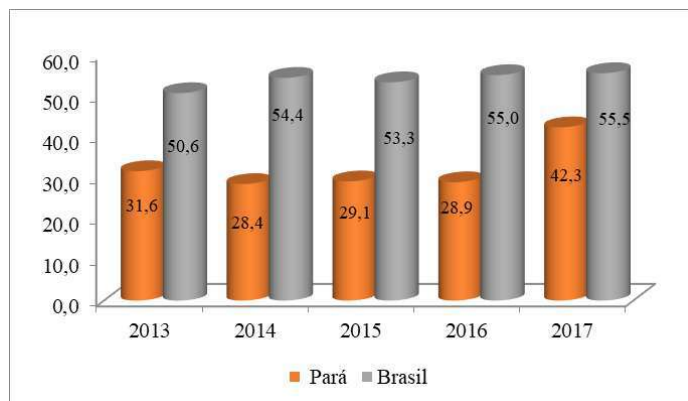
Fig.2 - Coverage of the heel prick test in Brazil and the State of Pará, 2013-2017.

Fonte: National Newborn Screening Program / VEGA Screening / SINASC.

From these data, it was evidenced that the state, despite having a good coverage of the collection of the heel prick test, in the evaluation of the collection at the timely date, the results are not in accordance with the parameters established by the Ministry of Health, as shown in Figure 3.

This may occur due to the difficulties encountered in the state of Pará, which has a territorial extension of 1,248,000 km<sup>2</sup>, is the second largest state in the country, formed by 144 municipalities and has more than 20 thousand kilometers of rivers that cross the state, being the main ones: Amazonas, Tapajós, Tocantins, Xingu, Jari and Pará. It is the most populous state in the northern region with a population of 7,321,493 [10].

This territorial extension and the rivers that cross the state, associated with the poor conservation of the roads, make it difficult for children and their guardians to access the collection points in the opportune period, and the flow of samples within the municipality itself and mainly until the arrival at the Laboratory of Research and Diagnostic Support. Thus, it is highlighted that some samples can take around four weeks to reach the laboratory, harming the main objective of the program, which is to provide an early diagnosis of diseases.



**Fonte:** National Newborn Screening Program / VEGA Screening / SINASC.

*Fig.3 – Proportion of collection of the heel prick test at the ideal date, Brazil and the State of Pará, 2013-2017.*

This difficulty in access also interferes with the median age at which the child with an altered result in the heel prick test goes to the outpatient clinic of the Reference Service in Newborn Screening for diagnostic confirmation and follow-up. On average, children arrive at the service between 90 and 180 days of age. The Ministry of Health defines the ideal period for the first consultation for diseases phenylketonuria up to 15 days of life, congenital

hypothyroidism, up to 10 days of life, sickle cell anemia and cystic fibrosis up to 30 days of life.

In addition to the difficulty of transporting the samples, there is the difficulty of actively searching for children with altered results in the heel prick test and who need to undergo confirmatory tests in the state capital.

After confirming the diagnosis, periodic and definitive follow-up at the Newborn Screening Reference Service is difficult and costly for families, who often cannot afford these financial costs and municipalities, on the other hand, do not assume the expenses through the Out-of-Home Treatment program, as provided for in the guidelines of the Unified Health System.

According to Ordinance No. 648, of March 28, 2006, in item 2, item IV, it is the responsibility of the Municipal Health Departments to organize the "flow of users, aiming at guaranteeing referrals to health services and actions outside the scope of Primary Care".

It is also noteworthy that the financial transfer from the Unified Health System for the maintenance of the program is not compatible with the expenses, especially for the acquisition of kits that allow the processing of samples. This situation is corroborated by Lorenzetti et al. [11] when stating that weaknesses in health management are contributing to serious public health problems.

#### IV. CONCLUSION

The study demonstrates how the Newborn Screening Reference Service has been developing in the state of Pará. Despite the financial difficulties and access to services, it has indicators of satisfactory coverage in the performance of newborn screening with collection, screening and analysis of samples, as well as in the search and follow-up of children.

The experience of nurses who perform the managerial role is a commitment of the profession, especially the knowledge about the elements that surround the work process becomes important for the professional to be sensitized with the awareness that when performing it effectively, it can improve assistance at work.

It is worth mentioning the importance of the nurse in the foot test, as both qualification and professional practice strengthen the practices of the multidisciplinary team, since care and management go hand in hand in the activities of the National Newborn Screening Program.

In this process, the importance of the multidisciplinary team, especially the nurse, is highlighted, seeking empowerment on the importance of newborn screening for the early diagnosis of metabolic diseases and the

prevention of irreversible sequelae, complications and deaths.

In addition, this research aims to ensure that the program has quality, meeting the expectations of the Ministry of Health's proposals and the needs of the population, ensuring universal coverage, in addition to health promotion, protection and recovery actions.

### REFERENCES

- [1] Rodrigues, L. P., Tanaka, S. C. S. V., Haas, V. J., Cunali, V. C. A., & Marqui, A. B. T. (2019). Teste do pezinho: condições materno-fetais que podem interferir no exame em recém-nascidos atendidos na unidade de terapia intensiva. *Rev Bras Ter Intensiva*, 31 (2): 186-192.
- [2] Carvalho, B. M., Tavares, W. R., Vicente, J. B., Sanguino, G. Z., Leite, A. M., & Furtado, M. C. (2020). Acesso precoce à triagem neonatal biológica: coordenação entre programas de ação de assistência à infância. *Rev. Latino-Am. Enfermagem*, 28.
- [3] Silva, F. W. T., Paiva, E. C. C., Santos, M. S., Oliveira, F. B. M., & Almeida, M. M. (2015). Anemia falciforme: cuidados realizados por enfermeiros na Estratégia Saúde da Família. *Rev. Pre. Infec e Saúde*, 1(4):18-26.
- [4] Universidade do Estado do Pará (2014). Site notícias: Pará é habilitado para a Fase IV do Teste do Pezinho.
- [5] Brasil. (2001). Portaria nº 822, de 06 de junho de 2001. Estabelece a obrigatoriedade de que os hospitais e demais estabelecimentos de atenção à saúde de gestantes. Ministério da Saúde.
- [6] Pope C., & Mays N. (2009). Pesquisa qualitativa na atenção à saúde. Porto Alegre: Artmed.
- [7] Brasil. (2016). Ministério da saúde. Manual de norma técnica: triagem neonatal biológica. Brasília, DF.
- [8] Souza, E. A., Teixeira, C. F., & Souza, M. K. B. (2017). Análise da produção científica nacional sobre o trabalho da enfermeira (1988-2014). *Saúde Debate*, 41(113):630-646.
- [9] Brasil. (2019). Ministério da saúde. Indicadores de triagem neonatal. Brasília, DF.
- [10] Governado do Estado do Pará. (2019). Mensagem do Governo do Pará à Assembleia Legislativa. Secretaria de Estado de Planejamento e Administração.
- [11] Lorenzetti J., Lanzoni, G. M. M., Assuiti, L. F.C., Pires, D. E. P., & Ramos, F.R.S. (2014). Gestão em saúde no Brasil: diálogo com gestores públicos e privados. *Texto Contexto Enferm*, 23(2):417-25.

## Interection design and thechnologies developed by brazilian healthtechs

## Design de interação e as tecnologias desenvolvidas pelas healthtechs brasileiras

Cássia Regina D'Antonio Rocha da Silva<sup>1</sup>, Ana Karla de Souza Abud<sup>2</sup>, Sílvio Mário  
Felix Dantas<sup>3</sup>

<sup>1,2</sup>Program of Postgraduate in Intellectual Property Science – Federal University of Sergipe, Brasil

<sup>3</sup>Universidade Tiradentes, Sergipe, Brasil

Received: 22 Aug 2022,

Received in revised form: 14 Sep 2022,

Accepted: 23 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *healthtechs, interaction design,  
interface design, Internet of things.*

**Palavras-chave**— *healthtechs, design de  
interação, design de interface, Internet das  
coisas.*

**Abstract**— *Applications from IoT technologies - The Internet of Things has been used in the market of Brazilian startups that work in the field of health. Such technologies need to offer an efficient and intuitive interface so that the user can make decisions while performing tasks in the digital environment. Based on this assumption, the study aimed to identify the principles of interaction design in the elaboration of interface design for applications that use IoT technologies. To do so, it was sought in the literature review to conceptualize the terms Wearable, IoT, and the theoretical bases of usability criteria, interaction design, and interface design. With an exploratory and descriptive approach, the research presented a documentary survey of the situation of Brazilian healthtechs and how these companies apply IoT technologies in their products and services. To elucidate the theory, the procedure of analysis of the interaction design was used in an application for the treatment of epilepsy by the healthtech Epistemic. As a result, it was found the existence of a group of Brazilian healthtechs that invested in IoT technologies to promote health, well-being, and the fight against COVID-19 through their digital devices. By selecting Epistemic's IoT technology, it was possible to present how the interaction design appropriates the usability criteria to favor the communication process between the system and the user while evaluating the user's experience with the interface from the degree of satisfaction and efficiency in performing tasks.*

**Resumo**— *Aplicativos advindos das tecnologias IoT - Internet das Coisas vêm sendo utilizados no mercado das startups brasileiras que atuam no âmbito da saúde. Tais tecnologias necessitam oferecer uma interface eficiente e intuitiva para que o usuário possa tomar decisões durante à execução de tarefas no ambiente digital. Partindo desse pressuposto o estudo teve como objetivo identificar os princípios do design de interação na elaboração do design de interface para aplicativos que utilizam as tecnologias IoT. Para tanto se buscou na revisão da literatura a*

*conceituação dos termos Wearables, IoT e as bases teóricas dos critérios de usabilidade, design de interação e design da interface. Com uma abordagem exploratória e descritiva a pesquisa apresentou um levantamento documental da situação das healthtechs brasileiras e como essas empresas aplicam as tecnologias IoT em seus produtos e serviços. No intuito de elucidar a teoria se utilizou o procedimento de análise do design de interação em um aplicativo para o tratamento da epilepsia da healthtech Epistemic. Como resultado, se constatou a existência de um grupo de healthtechs brasileiras que investiram em tecnologias IoT para promover através de seus dispositivos digitais saúde, bem-estar e no combate à COVID-19. Ao selecionar a tecnologia IoT da Epistemic foi possível apresentar como o design de interação se apropria dos critérios de usabilidade para favorecer o processo de comunicação entre o sistema e usuário, ao tempo em que avalia a experiência desse mesmo usuário com a interface a partir do grau de satisfação e eficiência para a execução de tarefas.*

## I. INTRODUÇÃO

As empresas globais de tecnologia da Informação (TI) que começaram a surgir por volta da década de 60 no Vale do Silício, localizado na Califórnia – Estados Unidos da América (EUA), obtiveram sua expansão posteriormente nos anos de 1990 quando passaram a ser denominadas startups. Neste mesmo período surgiu a Apple, empresa de tecnologia, 1976; a Microsoft, desenvolvedora de softwares, 1975; a Google, site de busca, em 1998 e, o Facebook, rede social, 2004 (Santos & Capelli, 2019) (Startupbase, 2019).

Considera-se startups a menor versão temporária de uma grande companhia, por ser pequena tem como características a flexibilidade de ideias e a agilidade na tomada de decisões. O caráter temporário indica a necessidade de uma evolução do empreendimento, o que exige investimento de capital de risco para garantir uma rápida expansão (Blank & Dorf, 2014).

Nos primeiros dias os empreendedores de startups se dedicam a criar um modelo de negócio lucrativo para o enfrentamento de ambientes incertos, por isso a necessidade de se buscar um modelo que possa ser replicado e ao mesmo tempo escalável (Hermanson, 2011).

Ainda, na fase embrionária, as startups contam com projetos ligados à pesquisa e o desenvolvimento de ideias inovadoras. Apesar de possuir risco envolvido no negócio “são empreendimentos com baixos custos iniciais e são altamente escaláveis, ou seja, possuem uma expectativa de crescimento muito grande quando dão certo” (Sebrae, 2017, p. 02).

Das 542 startups brasileiras que atuam na área mapeadas pela Distrito Healthtech Report (2020) foi

constatado que 3,9% das healthtechs trabalham com uso da IoT e Wearables e, empregam inovações tecnológicas para resolução de problemas na área da saúde.

Em 2021 as startups brasileiras movimentaram a economia do país com investimentos recordes, foram cerca de 53 milhões de reais (US\$ 9,4 bilhões) injetados no mercado de inovação brasileiro, quase 2,6 vezes que o ano anterior (Arcanjo, 2022). Tais empresas não produzem necessariamente softwares, mas contêm na sua finalidade, as inovações tecnológicas como estratégia para singularização no seu setor de atuação (Hermanson, 2011) (Santos & Capelli, 2019).

Na área da saúde as startups que são denominadas healthtechs criaram um nicho de mercado no intuito de melhorar o setor médico com a utilização dessas novas tecnologias. Pode-se dizer que as tecnologias Wearables e Internet das Coisas (IoT) perpassam diversos campos do conhecimento devido a abrangência do tema que envolvem várias áreas, como por exemplo as engenharias, tecnologia da informação, negócios, design entre outras (Fleisch, 2010).

Este estudo, em especial, se refere à conexão das áreas do design e da tecnologia da informação através dos conceitos de design de interação e usabilidade. As tecnologias Wearables e IoT dependem de uma interface eficiente, segura e intuitiva para o usuário, visando maior conforto e assertividade na compreensão da informação que está sendo transmitida pelo dispositivo (Galarza, 2016). Desta forma os acessos às informações e satisfação de uso influenciam diretamente na navegação o que facilita o manejo, a interação e a experiência satisfazendo o utilizador.

De acordo com Associação Brasileira de Normas Técnicas a usabilidade se refere à disposição de um produto ser usado por utilizadores específicos para alcançar determinados objetivos com eficiência (ABNT, 1998).

Por usabilidade entende-se a capacidade de um dado objeto se adaptar de forma conveniente ao objetivo para o qual foi proposto a partir do ponto de vista do sua funcionalidade pelo utilizador. A usabilidade é um conceito estudado em relação às ferramentas tecnológicas e seus usuários, constituindo uma disciplina da área da ergonomia e da Interação Humano-Computador (IHC) (Moma, 2017).

Galarza (2016) expõe reflexões sobre a interação dos usuários com páginas da Web, que pode ser aplicado aos sistemas digitais como um todo, ao descrever sobre a informação dos sistemas e a satisfação de uso. O referido autor afirma que a aplicação de conceitos de usabilidade permite uma navegação direta, o que significa dizer que quanto mais rápido é o acesso à informação mais reduzido é o tempo de uso e melhor será a experiência.

Neste sentido foi possível questionar a maneira como os aplicativos digitais para dispositivos móveis permitem o acesso dos usuários na realização de tarefas desejadas e necessárias. Diante disso, o estudo teve como objetivo identificar os princípios do design de interação na elaboração do design de interface para aplicativos que utilizam as tecnologias IoT. Justifica-se o estudo por apresentar a atual situação das healthtechs brasileiras e como estão sendo aproveitadas as Wearables que surgiram a partir das tecnologias IoT, e também, apresentar a importância do design de interação para a compatibilidade homem-máquina nesses dispositivos.

## II. METODOLOGIA

Para o procedimento metodológico optou-se por um levantamento documental, para extração dos dados quantitativos em registro sobre mapeamento de startups brasileiras ligadas à área da saúde, disponibilizado pela Distrito Healthtech Tech Report (2020). Na sequência foram selecionadas as healthtechs que possuíam as tecnologias Wearables e IoT, visando a verificação de como tais tecnologias aparecem aplicadas nas startups. Na sequência, foi realizada uma busca no período de junho-julho de 2022 nos sites das referidas healthtechs para identificar seus produtos e/ou serviços. A partir de uma abordagem qualitativa foi elaborada a análise do design de interação para a usabilidade do aplicativo para monitoramento de epilepsia da startup Epistemic. Para a seleção do referido aplicativo os pesquisadores observaram

os 19 softwares e inspecionaram os componentes disponibilizados na interface gráfica acompanhando as indicações previstas no design de interação (Groopman, 2020).

A revisão da literatura buscou a conceituação dos termos Wearables e IoT e contou com a fundamentação sobre a importância do design de interação como mediador para a experiência do usuário em dispositivos digitais. Para esse estudo entende-se IoT como um conjunto de dispositivos conectados através da Internet e interligados para comunicação e transferência de dados entre si e, as Wearables como uma extensão da Internet, na qual há endereçamento de objetos e a possibilidade de fazê-los agir como se fossem pequenos computadores (Fleisch, 2010).

## III. RESULTADOS E DISCUSSÃO

De acordo com a Associação de Startups Brasileiras, em junho de 2022 registrou-se 22.216 startups brasileiras ativas e, encontram-se divididas em múltiplas categorias de atuação, tendo como principais: Educação, Finanças, Saúde e Bem-estar, Adtech e Marketplace. Destacam-se os nichos de Educação, Finanças e Saúde que juntos somam mais de 24% de todas as startups em funcionamento (Abstartups, 2022).

As healthtechs, nome que se origina a partir da junção das palavras health (saúde) e tech (tecnologia), são startups voltadas ao setor da saúde, que buscam inserir procedimentos de inovação e tecnologia para a resolução de problemas através do aperfeiçoamento de equipamentos, aplicativos para dispositivos móveis, softwares e armazenamento em nuvem, para o aperfeiçoamento de atividades do setor (Clicksign, 2021).

Após pesquisas realizadas pela Distrito Healthtech Tech Report – DHTR com auditoria da KPMG International Limited, empresa global que presta serviços de consultoria e auditoria verificou-se a presença de 542 startups de saúde (Giusti, 2020). A Distrito Healthtech Tech Report (DHTR) mapeou as healthtechs seguindo uma metodologia própria, analisando a estadia integral dessas startups no Brasil, onde verificou sinais de atividades da empresa em meios digitais. A DHTR conseguiu criar um mapeamento que segue os princípios de segmentação por nicho, como mostrado na Tabela 1.

TABELA 1 – Mapeamento das Healthtechs Brasileiras

Fonte: Distrito Healthtech Tech Report (2020)

| Segmento                     | Quantidade | %          |
|------------------------------|------------|------------|
| Farmacêutica e Diagnóstico   | 57         | 10,5       |
| Acesso à informação          | 94         | 17,3       |
| Marketplace                  | 74         | 13,7       |
| Gestão e PEP                 | 136        | 25,1       |
| Wearables e IoT              | 21         | 3,9        |
| AI e Big Data                | 35         | 6,5        |
| Medical Devices              | 36         | 6,6        |
| Relacionamento com Pacientes | 36         | 6,6        |
| Telemedicina                 | 53         | 9,8        |
| <b>Total</b>                 | <b>542</b> | <b>100</b> |

Pode-se constatar que as 542 healthtechs subdividem-se nas cinco regiões brasileiras de forma que o sudeste engloba cerca de 64% de todas as startups, tendo como polo central o estado de São Paulo que conta com 43,1% delas, seguindo pela região sul com 23,7%, o nordeste com 7,6%, centro oeste com 4,2% e o Norte sendo a região com menor porcentagem sendo de 0,6% (Fig. 1).

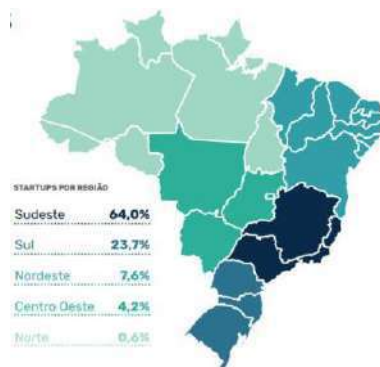


Fig. 1 – Disposição das Healthtechs por região

Fonte: Distrito Healthtech Report (2020, p. 19)

### 3.1 IoT: Tecnologias voltadas a saúde

De acordo com a Distrito Healthtech Tech Report (2020, p. 22) dentre “as startups de saúde presentes em território nacional, no ano de 2020, 3,9% delas atuam fazendo uso das tecnologias de Wearable e IoT”.

As Wearables comumente chamadas de tecnologias vestíveis, são uma vasta extensão de tecnologias aplicadas a equipamentos que usamos em nossos corpos, fazem-se presentes em equipamentos como o leitor de eletrocardiograma, relógios inteligentes até leitores de gastos de calorias dos smartphones. As tecnologias vestíveis ainda que operem com a ajuda de sensores e Internet, frequentemente são confundidas com dispositivos IoT, porém, as Wearables se distinguem por não serem

dispositivo que estão necessariamente sempre conectados a uma rede de Internet, para usarem do seu pleno funcionamento (Fleisch, 2020).

Os potenciais almeçados com o uso das tecnologias inseridas em um contexto social são diversos, a exemplo da IoT, que proporciona o uso de tecnologias já existentes, de forma a criar uma rede de conexões em objetos físicos, integrando-os a uma rede compartilhada e, assim possibilitando o uso em conjunto, interligando diferentes tecnologias. Desse modo podemos reiterar que:

A nova onda de conectividade e software de desenvolvimento será centrada em objetos cotidianos, que, de algum modo, podem ser controlados ou ligados à Internet. O que hoje é chamado de Internet das Coisas – Internet of Things (IoT) – é um conjunto de tecnologias e protocolos associados que permitem que objetos se conectem a uma rede de comunicações e são identificados e controlados através desta conexão de rede. (Cavalli & Meiners, 2019, p. 533)

A IoT vem influenciando o contexto da saúde, visto que pode viabilizar para o monitoramento constante e eficaz de métricas e análises, a interação entre médico e paciente, favorecer maior segurança aos indivíduos, além de possibilitar o controle de possíveis epidemias (Magrani, 2018). A fim de corroborar com a análise dessas novas tecnologias se pode afirmar ainda que através da IoT é possível que diferentes tipos de sensores possam captar informações de diversos parâmetros, e fornecê-las a rede integrada, o que possibilita a medição dos dados e a criação de ambientes que podem analisar e criar um melhor diagnóstico (Cavalli & Meiners, 2019).

As tecnologias Wearable e IoT estão se difundindo dentro da esfera da saúde e bem-estar, com isso se percebe os impactos que provoca as mudanças e oportunidades para o referido setor. Também, ambas tecnologias, tem guiado os profissionais no campo prático trazendo diagnósticos mais precisos e celeridade nos atendimentos (Lottenberg et al., 2019).

### 3.2 Integração da IoT pelas startups brasileiras

Em âmbito nacional, as ferramentas de IoT já podem ser identificadas em uso por instrumentos médicos para diagnóstico, como equipamentos para Raio X, tomografia e eletrocardiogramas, além do uso em prontuários eletrônicos. A utilização de ferramentas integradas podem



ocasionar em diminuição de uso de papéis, o que colabora para a diminuição de grandes arquivos, reduzindo a necessidade de espaços físicos e, desta forma compreender que o uso da IoT no ambiente hospitalar e clínico pode acarretar facilidades com o preenchimento automatizado de informações do paciente em prontuários eletrônicos (Morsh, 2019). Com o auxílio de sensores essas tecnologias captam aspectos do mundo real, como temperatura, umidade, presença, entre outros, criando unidades de informações para que centrais (softwares) que recebem esses dados e as utilizam acordo com a funcionalidade do aplicativo (Nascimento, 2015).

As startups brasileiras voltadas à saúde atuam em sua maioria com o padrão de negócio B2B, sigla que corresponde em inglês a business-to-business que se refere a empreendimentos que prestam serviços para outras empresas, neste contexto, a hospitais e/ou clínicas médicas (Cordovez, 2021).

Atualmente dezenove healthtechs brasileiras estão ativas e desempenhando trabalhos estritamente significativos com a IoT, conforme apresentado Tabela 2.

Tabela 2 – Startups brasileiras que fazem uso de IoT

| Empresas Ativas          | Tecnologias IoT utilizadas                                                                                          |
|--------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>DataClin</b>          | Gestão hospitalar, através de dispositivos de controle e localização de pacientes.                                  |
| <b>Alba Sensors</b>      | Equipamentos para identificação precoce de doenças.                                                                 |
| <b>Tecnosenior</b>       | Dispositivos para monitoramento da saúde de pessoas idosas.                                                         |
| <b>Signove</b>           | Gestão do ambiente hospitalar e sistema de conexão de dispositivos de saúde de forma integrada.                     |
| <b>Beliva (TeleMRPA)</b> | Integração de sistemas MRPA para controle e diagnóstico hipertensos.                                                |
| <b>Senfio</b>            | Tecnologias inteligentes para eliminação de COVID em ambientes e monitores de temperatura para ambientes sensíveis. |
| <b>Artis</b>             | Integração de aparelhos cirúrgicos através de sensores.                                                             |
| <b>Dersalis</b>          | Pulseira que monitora e faz testes de prontidão, vinculando essas informações a um sistema de controle.             |
| <b>Epistemic</b>         | Software para controle e monitoramento de pessoas com epilepsia e link com equipe médica.                           |
| <b>OxIoT</b>             | Monitoramento do consumo de oxigênio medicinal para pacientes que estão em tratamento domiciliar.                   |
| <b>Sensorweb</b>         | Monitoramento de temperatura para                                                                                   |

|                         |                                                                                                                                        |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
|                         | transporte e armazenamento de materiais sensíveis e gestão de sinais vitais.                                                           |
| <b>NeuroUP</b>          | Tecnologia para medição, monitoramento e treinamento muscular.                                                                         |
| <b>Heart Care</b>       | Monitoramento cardíaco.                                                                                                                |
| <b>Packid</b>           | Monitoramento integrado de temperatura e umidade, para cargas ou armazenamentos de produtos.                                           |
| <b>Precision Vitals</b> | Monitoramento de quedas de pessoas idosas, através de relógios inteligentes.                                                           |
| <b>NeuroBots</b>        | Equipamentos de monitoramento físico para auxílio em tratamento fisioterapêuticos e soluções para tratamentos de problemas cognitivos. |
| <b>Hi Lab</b>           | Equipamentos para testes e exames de forma remota.                                                                                     |
| <b>Salvus</b>           | Ferramentas para monitoramento de pacientes Home Care.                                                                                 |
| <b>Reitz</b>            | Equipamento em desenvolvimento para avaliar, quantificar e documentar a dor.                                                           |

As healthtechs brasileiras oferecem várias funcionalidades aos seus aplicativos, a exemplo da Artis, que atua na integração de aparelhos cirúrgicos através de ambientes não convencionais por apresentarem elementos estruturais que permitem o fluxo de dados entre equipamentos e sistemas de gerenciamento, disponibilizando-os de forma adequada para a equipe médica. A Dersalis é fabricante de pulseiras para testes de prontidão, uma tecnologia online que permite para prever riscos ou situações de vulnerabilidade do usuário. O objetivo é rastrear as condições físicas, mentais e sócio-ocupacionais que afetam a prontidão do profissional e que podem colocá-lo em situação de risco. A OxIoT faz medições de oxigênio hospitalar e a PACKID fornece tecnologia de sensores integrados de umidade e temperatura para melhor controle dos ambientes.

Existem tecnologias distintas sendo usadas no exercício das atividades das healthtechs que incrementam as inovações voltadas para gestão de hospitais e/ou clínicas, criando integrações entre setores ou facilitando a execução de funções já existentes no ambiente hospitalar, neste sentido é possível citar as startups DataClin, Signove e a Sensorweb.

O uso de sensores para a tecnologia de IoT podem ser usados de formas que abrangem diferentes práticas e diferentes integrações no campo da saúde. A healthtech brasileira Sensorweb embora não conste da pesquisa da Distrito Healthtech Tech Report (2020) foi acrescentada por se destacar pelo uso de sensores de temperatura.

A Sensorweb foi criada em 2017, atuando no mercado hospitalar e farmacêutico desenvolveu sensores integrados a um sistema de comando para controle de temperatura, integrando isso a caminhões de transporte, salas de armazenamento de medicações e materiais biológicos, por serem produtos e materiais sensíveis à temperatura, fazendo com que qualquer variabilidade seja notificada ao responsável. Outra tecnologia desenvolvida por esta healthtech faz uso de tecnologias integradas a sistemas de sinais vitais de pacientes de unidades intensiva de tratamento. Esse sistema foi utilizado pela equipe de médicos no Estado de Santa Catarina durante o período pandêmico. Através de dispositivos móveis a equipe de médicos é notificada caso ocorra mudança significativa na situação de saúde dos pacientes para agilizar o atendimento dos mesmos (Abstartups, 2022).

Ainda, dentro do cenário hospitalar, a higienização das mãos por parte dos profissionais de saúde e trabalhadores do ambiente hospitalar é de extrema relevância para a redução na propagação de vírus e bactérias, assim expondo a preocupação de tais profissionais no período pandêmico entre 2020 e 2021. Neste intervalo de tempo a Sensorweb concebeu um dispositivo inteligente que possibilita o controle da higienização das mãos, com uso de biometria, assim é possível que através de um painel integrado aos dispositivos, o hospital realizar o manejo da assepsia dos profissionais. Também, a SENFIO desenvolveu equipamentos para ambientes fechados. Essa tecnologia auxilia na eliminação do COVID-19, evitando a propagação do vírus nesses ambientes.

A Tecnosensor faz uso das suas tecnologias com o auxílio de aplicativos, softwares desenvolvidos para celulares e/ou tablets, como para monitoramento de saúde de pessoas idosas. A Epistemic desenvolveu aplicativos e sistemas online para monitoramento do bem-estar de pessoas com epilepsia.

Outros exemplos como a NeuroUP que dispõe de um aplicativo para o monitoramento do treinamento muscular; a Heart Care com o uso de aplicações para monitoramento cardíaco e a Salvus para acompanhamento de pacientes que estão passando por cuidados em domicílio; a Senfio também emprega tecnologias para o controle de temperatura em ambientes sensíveis; a Precision Vitals com o monitoramento de quedas de pessoas idosas a partir de relógios inteligentes; a NeuroBots contribui com equipamentos para monitoramento físico para o auxílio de tratamentos fitoterápicos e a Hi Lab com serviços de envio de soluções para realização de exames laboratoriais de forma remota, possibilitando a facilitação para pessoas com dificuldade de locomoção; como a Beliva com a integrações de sistemas para controle e diagnóstico de hipertensos.

A Alba Sensors detem tecnologias em desenvolvimento, que possibilitam o diagnóstico precoce de doenças, para funcionarem em equipamentos capazes de documentar e avaliar a dor dos pacientes. A Reitz se encarregará da produção dos equipamentos que receberão a nova tecnologia.

Foi possível constatar que as tecnologias prevaletentes, usadas pelas healthtechs brasileiras, são centradas no uso de sistemas ou centrais de comando e monitoramento para controle de sensores, sendo eles de temperatura, umidade ou o uso conjunto dessas tecnologias, monitoramento de status da saúde, gestão hospitalar ou centrada em equipamentos para auxílio de procedimentos cirúrgico.

### 3.3 Epistemic: o design de interação em sistemas IoT

Dispositivos IoT, se comunicam através de coleta de dados de sensores interligados criando um agrupamento de informações, comunicando a equipamentos gerenciadores de dados (gateway), que são transmitidos para interfaces de painéis, sistemas ou aplicativos, que o usuário administra, recebendo e enviando comandos, que são filtrados pelo controlador e encaminhando para os equipamentos.

A boa projeção em uma interface digital somente é obtida, quando o usuário compreende as informações pretendidas, fazendo com que o utilizador seja o elemento central nesse contexto. Para Rodrigues (2021), a relação do objeto com o usuário é estabelecida por meio do design de interação, que procura estabelecer o sentido atribuído ao objeto, de tal modo, sendo possível afirmar que a própria interface gráfica torna-se substancial na modelagem de sistemas IoT.

Dentre as healthtechs, que constam na Tabela 2, destaca-se pelo uso do design de interação, a Epistemic, que apresenta um aplicativo para dispositivos móveis que auxilia o usuário com epilepsia no acompanhamento do seu dia a dia possibilitando-o de construir rotinas mais saudáveis.

A tecnologia usada pela Epistemic proporciona que o utilizador se conecte a equipamentos que auxiliam no monitoramento da rotina, como relógios inteligentes e equipamentos com controle de voz, para utilização de práticas já pré-estabelecidas dentro da aplicação.

O emprego do design de interação nas tecnologias de Internet das coisas é baseado no design centrado no usuário, que concerne em um processo que enfatiza as necessidades e requisitos no usuário. Dado que os sistemas que contemplam essas tecnologias usufruem de coleta e amostragem de dados e utilização de aplicativos móveis, logo, é evidente a necessidade da projeção da interface gráfica, aspirando objetivos como: segurança, desempenho

eficiente, satisfação do utilizador e eliminação de possíveis efeitos negativos a saúde, (Guimarães, 2017).

Os princípios do design de interação possibilitam aos desenvolvedores e designers a projeção mais atenda ao usuário, colocando-o como foco central do processo (Tabela 3).

Tabela 3 – Princípios do design da interação

Fonte: Adaptado de Ribeiro (2012, p. 33-35)

| Princípio             | Definição                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Antecipação           | Prevê que o sistema deve antecipar as necessidades do utilizador, providenciando sempre as ferramentas necessárias que se possa voltar a trás e cumprir os passos necessários para seguir em frente.                                                                                                                                                              |
| Autonomia             | O sistema deve fornecer informação sobre qual a ação que o utilizador está executando, quer seja informação de carácter visual ou textual, seja por uma cor ou uma tela que mostre o tempo da atividade a ser executada, não fazendo o usuário ser obrigado a procurar informações sobre o estado do sistema.                                                     |
| Eficiência do usuário | O sistema deve preocupar-se com a eficiência do usuário e não do computador, ou seja, deve ser criado de forma que permita ao usuário poder cumprir as suas tarefas da forma mais rápida e eficiente possível.                                                                                                                                                    |
| Valores por defeito   | Vários sites utilizam esse critério para identificação de campos em formulários, caixas de pesquisa que podem surgir com os termos “Pesquisar” ou “Procurar” já inseridos, os valores por defeito devem ser devidamente sinalizados para que o usuário não confunda com os dados por si inseridos, sendo identificados por cor, quando alterados pelo utilizador. |
| Daltonismo            | O uso das cores deve levar em consideração a possibilidade do                                                                                                                                                                                                                                                                                                     |

|                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| usuário sofrer um dos vários tipos de daltonismo, tendo assim como alternativas, o uso de diferentes gradações da mesma cor, legendas associadas à cor ou uma formas gráficas diferentes. |                                                                                                                                                                                                                                                                                                                                                                                                   |
| Consistência                                                                                                                                                                              | A consistência de um sistema leva em consideração diferentes aspectos como, comportamento do usuário, componentes invisíveis, componentes visíveis (como ícones, caixas de seleção, etc.) e aspecto geral da interface. Inconsistências devem ser utilizadas somente quando os elementos têm comportamento diferentes, como botões de enviar e cancelar, com tamanhos distintos em um formulário. |
| Interfaces exploráveis                                                                                                                                                                    | Deve-se providenciar ao usuário pontos de referência ao longo da interação, a navegação principal deve ser sempre visível, e permitir ao usuário seguir outros caminhos se assim desejar ou assim precisar, possibilitando ações reversíveis, permitindo o usuário voltar atrás caso siga um caminho que não pretenda.                                                                            |
| Lei de Fitts                                                                                                                                                                              | A lei de Fitts consiste em afirmar que quanto maior o alvo, mais rápido este será de utilizar, ou seja, um botão de dimensão generosa é mais rápido de usar, uma vez que o usuário terá uma área maior para apontar, o que permite maior precisão e menor taxa de erro.                                                                                                                           |
| Objetos Interface-humano                                                                                                                                                                  | Os objetos interface-humano podem ser vistos, tocados ou percebidos de outra forma, os objetos vistos são representados de forma mais fácil nas interfaces gráficas, enquanto os que fazem manifestar outros sentidos, como audição ou tato, são menos familiares, como pode ser citados os ícones que são acionados com sinais auditivos.                                                        |
| Redução de latência                                                                                                                                                                       | Deve-se otimizar o tempo de                                                                                                                                                                                                                                                                                                                                                                       |

espera, de forma a reduzir ao mínimo a frustração do usuário, todos os botões devem prover um tempo de resposta quando ativos em um intervalo de 50 milissegundos, ações que durem entre meio e dois segundos devem ter animações de carregamento para informar ao usuário que a atividade está sendo executada e tarefas que duram mais tempo, devem conter barra de progresso ou tempo estimado.

espaços dos menus ou retirando outras formas de navegação, mas mantendo um layout consistente ao longo das páginas, de forma que o usuário crie uma imagem mental.

Ao colocar o usuário como ponto central do projeto da interface é possível eliminar ambiguidades e atender suas necessidades (Lowdermilk, 2013), por conseguinte se dá a importância de mapear a experiência com os dispositivos de internet das coisas, averiguando quem são os usuários, motivações, desejos e cenários ideais para esses utilizadores, criando, portanto, um suporte essencial na tomada de decisões para produtos e serviços (Campos, 2018).

Para usar de maneira eficiente as ferramentas IoT, o utilizador necessita compreender os status apresentados pelos softwares. Na maioria das vezes não é fácil projetar softwares, aplicativos móveis e interações centradas em quem as utiliza (Groopman, 2020), o que corrobora a importância dos recursos da usabilidade, da arquitetura da informação, da navegação, transições e tudo que se refere a melhoria do desempenho do usuário em relação ao produto (Maia, 2016).

As interfaces intuitivas (de fácil aprendizado) possibilitam aos usuários a chegarem mais rapidamente ao final da atividade que desejam executar. Em vista disso é necessário projetar de modo que a interface não gere momentos de insegurança, que mantenha evidente quais são os resultados de suas ações, para assim, garantir que o usuário realize suas tarefas de forma eficiente, sem criar a necessidade de um “manual de instruções” (Moma, 2017).

Groopman (2020) prevê sete possibilidades de orientação que podem ser levadas em consideração no desenvolvimento, para melhoria do design das interfaces de sistemas IoT, tendo em consideração aspectos como objetivo, contexto pessoal, contexto ambiental, universalidade, energia, segurança e permissões.

Tabela 4 - 7 maneiras de alinhar as interfaces IoT

Fonte: Elaboração dos autores adaptado de Groopman (2020) tradução nossa.

| Orientações de Usabilidade | Descrição                                                                      | Cenário de Uso                                                                    | Considerações de Usabilidade                                                                                                            |
|----------------------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Objetivo</b>            | O objetivo, tarefa, melhoria, custo, energia ou resultado de economia de tempo | A solicitação baseada em gestos ou voz para acender as luzes é superior à rolagem | <ul style="list-style-type: none"> <li>▪ Solicitação rápida</li> <li>▪ Feedback rápido</li> <li>▪ Necessidade de confirmação</li> </ul> |

|                                 |                                                                                                                                                                                                                                                                                             |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Capacidade de aprendizagem      | Idealmente um site ou sistema não deve conter uma curva de aprendizagem, mas na prática, por mais fáceis que sejam de usar, estes necessitam de um processo de aprendizagem.                                                                                                                |
| Uso de metáforas                | O uso de metáforas deve permitir ao usuário compreender o modelo conceitual do sistema e criar uma imagem mental dele. Uma boa metáfora em sites é o uso de carrinhos de compras, pois evoca mentalmente a imagem de um carrinho de supermercado onde o usuário vai colocando suas compras. |
| Proteção ao trabalho do usuário | E essencial garantir que em caso de erro do sistema, o usuário nunca perca o trabalho realizado anteriormente.                                                                                                                                                                              |
| Legibilidade                    | Qualquer texto aplicado em um sistema ou site deve ter auto contraste, privilegiando a utilização de tipografias em um tamanho que favoreça a leitura em telas. Deve-se ainda, manter uma boa estrutura de escalas para hierarquização dos conteúdos com maior importância.                 |
| Monitorar o estado              | As aplicações que são utilizados através de navegadores web, como sites, funcionam em um ambiente sem estado, porém os sistemas devem fornecer alguma informação neste sentido, como janelas que informam a execução de uma tarefa.                                                         |
| Navegação visível               | Reduzir a navegação ao mínimo, não diminuindo os                                                                                                                                                                                                                                            |

|                                  |                                                                                                                                                                       |                                                                                                                                                                    |                                                                                                                                                                                           |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | que motiva o utilizador.                                                                                                                                              | através de aplicativo móvel. Nenhuma confirmação necessária.                                                                                                       | <ul style="list-style-type: none"> <li>▪ Complexidade e da tarefa/informações</li> </ul>                                                                                                  |
| <b>Contexto pessoal</b>          | A personalida de do usuário, dados demográficos saúde, cultura etc., devem ditar as decisões e proteções de design.                                                   | Wearables para idosos podem ser elegantes e ativados por voz para evitar preocupações com deficiência, usabilidade ou perda de controle.                           | <ul style="list-style-type: none"> <li>▪ Complexidade e da tarefa/informações</li> <li>▪ Sensibilidade da tarefa/informações</li> <li>▪ Sensibilidade do fator de forma</li> </ul>        |
| <b>Contexto ambiental</b>        | Considerações espaciais, baseadas em localização, temporais, ambientais ou sociais, incluindo configurações IoT fixas versus móveis.                                  | A interação por voz é ótima para casos de uso de mãos livres em casa, como cozinhar, mas não é ideal enquanto outras pessoas estão dormindo ou em público.         | <ul style="list-style-type: none"> <li>▪ Frequência de interação</li> <li>▪ Condições ambientais</li> <li>▪ Permissão de ruído</li> <li>▪ Complexidade e da tarefa/informações</li> </ul> |
| <b>Universalidade e inclusão</b> | Facilidade de compreensão e usabilidade para reduzir ou eliminar a necessidade de treinamento, bem como evitar alienar segmentos específicos ou privar usuários menos | Uma marca de verificação após a conclusão de uma tarefa é um sinal de confirmação universalmente reconhecido. Ser ciente das variações culturais em gestos, cores, | <ul style="list-style-type: none"> <li>▪ Acesso ao serviço, habilidade</li> <li>▪ Feedback rápido</li> <li>▪ Indicações de status</li> <li>▪ Conectividade e com outros</li> </ul>        |

|                      |                                                                                                 |                                                                                                                                                                                      |                                                                                                                                                                                                                   |
|----------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | experientes em tecnologia.                                                                      | avatars etc.                                                                                                                                                                         |                                                                                                                                                                                                                   |
| <b>Energia</b>       | Quais requisitos de energia informam a UX ideal, incluindo implicações e riscos de interrupção. | As fechaduras das portas conectadas nunca devem depender apenas do Wi-Fi, caso a conectividade seja comprometida. Considere o cenário "sem energia".                                 | <ul style="list-style-type: none"> <li>▪ Necessidades de baixa versus alta energia</li> <li>▪ Local x nuvem</li> <li>▪ Mínimo viável</li> <li>▪ protocolo de conectividade</li> <li>▪ Bateria vs. fixo</li> </ul> |
| <b>Segurança</b>     | Segurança e melhorias de segurança e riscos introduzidos                                        | A entrega de informações de alertas confidenciais, como relatórios de saúde, pode não ser mais bem vocalizada, mas enviada diretamente para um aplicativo móvel protegido por senha. | <ul style="list-style-type: none"> <li>▪ Mãos livres</li> <li>▪ Atenção</li> <li>▪ Complexidade da tarefa/informações</li> <li>▪ Sensibilidade da tarefa/informações</li> <li>▪ Mitigação de risco</li> </ul>     |
| <b>Consentimento</b> | Nível de dados pessoais, confidenciais ou privados necessários para transação ou interação      | Se o usuário solicitar uma tarefa que exija que os sistemas compartilhem dados com terceiros não verificados pelo usuário, alerte o usuário e solicite permissão para a transação.   | <ul style="list-style-type: none"> <li>▪ Complexidade da tarefa/informações</li> <li>▪ Sensibilidade da tarefa/informações</li> <li>▪ Agência, controle</li> </ul>                                                |

Tendo em consideração os princípios supracitados buscou-se elucidá-los a partir da análise da interface do aplicativo construído pela Epistemic. O referido aplicativo permite aos usuários com epilepsia relatar em forma de diário os indicadores de saúde e bem-estar, suas crises e medicações, criando um compartilhamento dos dados com seu médico, possibilitando um melhor assistência e controle de sua epilepsia.

Observa-se que a tela de início do aplicativo da Epistemic apresenta somente informações necessárias para ações relevantes como, por exemplo: o registro de crises e a opção de adicionar no diário a descrição dos remédios que o paciente faz uso contínuo. De maneira bem visível o menu é posicionado na parte inferior, sendo organizado somente por ícones de fácil legibilidade, essas escolhas seguem os critérios de objetividade, autonomia e eficiência do usuário (Fig. 2).



Fig.2 – Tela de início aplicativo da Epistemic

Seguindo as premissas expostas por Groopman (2020), é possível explorar os aspectos do desenvolvimento da plataforma desenvolvida pela Epistemic, observando-se que a projeção da interface não requer somente o lado estético, mas também o funcional, sendo primordial o sucesso da comunicação entre o homem e máquina. Dessa forma a Epistemic procurou facilitar a compreensão da mensagem incluindo ilustrações sugestivas referente ao cotidiano do usuário, exibindo o diário de crises, panorama do sono, medicamentos usados e históricos de atividades físicas (Fig. 3). Neste sentido a interface permite que o usuário poupe tempo ao cumprir suas tarefas de maneira

mais rápida e consequentemente aumente sua autonomia sobre o sistema.



Figura 3 – Indicadores da rotina, aplicativo Epistemic

Ainda se observa que é levado em consideração aspectos como: personalidade do usuário, cultura, localização, contextos sociais e como o usuário lida com a tecnologia proposta, dessa forma é possível citar tecnologias desenvolvidas para pessoas com idade avançada, que englobam o uso de fontes ampliadas, além do uso de determinadas cores, que possuem alto contraste. Esses elementos gráficos se interligam no que condiz a universalidade, levando em consideração a facilidade de compreensão e usabilidade para reduzir ou eliminar a necessidade de treinamento.

O item energia leva em conta medidas para certificar que a usabilidade não seja afetada por percalços causados por queda ou interrupção de serviços, em aplicações para dispositivos móveis. A preservação perante esse item é assegurada pelo sistema do dispositivo, assim como o aspecto de segurança, que diz respeito a medidas tomadas para preservação de dados e as permissões, que são gerenciadas pelos sistemas operacionais dos dispositivos, onde o usuário pode ter acesso ao gerenciamento dessas informações.

Desse modo, o design de produtos IoT centrados no usuário, permite minimizar os passos entre o humano e o objetivo da tarefa, assim como os sensores e conectividades facilitam e aprimoram essa interação, dessa forma, mais opções não equivalem a mais inteligência ou melhor usabilidade, mais sinos e assobios nem sempre significam mais valor ou significados, experiências do usuário mal arquitetadas podem frustrar a fidelidade do usuário, o compartilhamento de dados ou ainda pior a confiança (Groopman, 2020).

“Um dos princípios básicos para análise da usabilidade é a proximidade” (Lowdermilk, 2013, p. 98). A proximidade é um aspecto que possibilita nossa percepção criar unidade ou unidades de elementos dentro de um campo visual. Os elementos da interface criam uma unidade de navegação, ou como representado no aplicativo

desenvolvido pela Epistemic, no setor de indicadores, as métricas estão próximas, como também a sensação de continuidade ao mostrar a sequência de imagens na tela (Fig. 4).



Fig.4 – Ilustração aplicativo Epistemic

A visibilidade no design de interação pode ser entendida como tudo que está sendo utilizado para concentrar o foco visual do usuário em um elemento ou ação na interface do aplicativo, sendo levado em consideração os aspectos: tipo de letra, opacidade, e cor/contraste (Lowdermilk, 2013). Por meio desses princípios se pode detectar o uso de famílias tipográficas, sendo alternado entre negrito e normal, onde é necessário, menor ou maior ênfase ao texto apresentado, como se percebe na tela de apresentação da Fig. 2, ou nos títulos dos indicadores da Fig. 3 e 4. O grau de opacidade remete ao que deve ser priorizado na visualização dos elementos da interface, o que equivale a utilização da cor e contraste para seguir e definir conteúdos dentro do aplicativo Epistemic. Além do uso de cores contrastantes no item “central de ajuda” do aplicativo como se vê na Fig. 5.



Fig.5 – Central de ajuda aplicativo Epistemic

A proeminência orienta que os elementos maiores terão maior visibilidade, assim como visto na Fig. 3 e 4, os elementos que identificam os indicadores são maiores, dando destaque para o indicador selecionado, guiando o usuário a compreender qual elemento está em foco. Compreender os princípios de design de interação aplicados à usabilidade nos impede de cometer erros, tais princípios são relativamente constantes e foram desenvolvidos ao longo de vários anos de estudos cognitivos e do comportamento humano, o que possibilita a criação de diretrizes baseadas na compreensão do humano e na interpretação do mundo ao seu redor (Lowdermilk, 2013, p. 97).

#### IV. CONSIDERAÇÕES FINAIS

Na primeira parte da pesquisa o estudo constatou o avanço da IoT, no que se relaciona à integração das informações online. Neste tipo de tecnologia os dispositivos móveis se integram para o compartilhamento de dados. No decorrer do período pandêmico, entre o auge de 2020 e 2021, as healthtechs brasileiras se posicionaram de forma ativa no combate ao COVID-19 e, de modo célere, fizeram uso das IoT na promoção da saúde, bem-estar social e inovações para tratamento de doenças crônicas através de aplicativos disponibilizados para dispositivos digitais. Durante a pesquisa o aplicativo desenvolvido pela Epistemic, voltado para o cuidado à pessoas com epilepsia, foi escolhido para apresentar a importância do design de interação na interface das

tecnologias IoT. O estudo vem ao encontro das ideias de que o papel dos responsáveis pela projeção do design da interface é definir desde o início as funcionalidades e os conteúdos de um sistema interativo. Para isso se faz necessário verificar qual a utilidade e quanto o produto ou serviço é atraente ou interessante do ponto de vista do utilizador. Quem são os usuários? Quais suas características cognitivas e psicológicas? Quais barreiras tecnológicas e quais os cenários que podemos oferecer? Nesse sentido, em vez de apenas oferecer produtos de IoT, começaremos a oferecer experiências satisfatórias para essa tecnologia (Campos, 2018).

Este estudo atingiu seu objetivo ao apresentar o design de interação aplicado em uma interface IoT de uma startup healthtechs. Como foi possível observar o design de interação utiliza as orientações advindas da usabilidade, tendo como ponto central a preocupação com os usuários e, orienta-o de forma que estes, independentemente das suas sensibilidades ou limitações possam de fato tirar partido da informação, produto ou serviço oferecido em plataformas digitais. Assim se pode confirmar que a projeção da interface é um fator crucial, já que trata do mapeamento das experiências do usuário, ao mesmo tempo, em que se coloca como uma facilitadora para a tomada de decisões e sua projeção precisa atentar para os princípios do design de interação e os critérios de usabilidade nas tecnologias IoT.

Em decorrência do compartilhamento de dados necessários para a utilização das tecnologias IoT acredita-se que um dos aspectos a serem observados em estudos futuros encontra-se a priorização pela segurança da informação, sendo atribuição das healthtechs criar tecnologias que possam garantir esse feito.

## REFERÊNCIAS

- [1] ABNT (1998). In ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS. ABNT ISO/IEC Guia 2: normalização e atividades relacionadas. Vocabulário geral. Rio de Janeiro, 1998.
- [2] Abstartups (2022). In ABSTARTUPS: Associação brasileira de startups. Disponível em: <https://abstartups.com.br/>. Acesso em 21 jun. 2022,
- [3] Arcanjo, D. (2022, 11 de janeiro). *Investimento em startups no Brasil mais que dobra em 2021 e passa de US\$ 9,4 bilhões*. Folha de São Paulo. Disponível em: <https://www1.folha.uol.com.br/mercado/2022/01/investimen-to-em-startups-no-brasil-mais-que-dobra-em-2021-e-passa-de-us-94-bilhoes.shtml>. Acesso em 12 jun. 2022.
- [4] Blank, S., & Dorf, B. (2014). *Startup: manual do empreendedor*. Alta Books.
- [5] Campos, E. (2018, 4 de junho). *IoT e Design: os desafios para a Experiência do Usuário*. Recife: CESAR: Centro de invocações. Disponível em: [update/iot-e-design-os-desafios-para-a-experi%C3%A2ncia-do-usu%C3%A1rio-e07343c2cab2](https://medium.com/cesar-update/iot-e-design-os-desafios-para-a-experi%C3%A2ncia-do-usu%C3%A1rio-e07343c2cab2). Acesso em 12 jun. 2022.
- [6] Cavalli, Olga; Meiners, Federico (2019). Internet das Coisas e inovação na América Latina. In: Horizonte presente: tecnologia e sociedade em debate / Alberto Silva ... [et al.] ; organizado por Jhessica Reia ... [et al.]. - Belo Horizonte: Casa do Direito ; FGV – Fundação Getúlio Vargas. 532-542.
- [7] Clicksign. (2021). *Healthtechs: o que são e como elas têm modernizado a saúde?* Disponível em: <https://www.clicksign.com/blog/healthtechs-o-que-e-e-como-elas-tem-modernizado-a-saude/>. Acesso em 20 jun. 2022.
- [8] Cordovez, D. (2021, 14 de novembro). *O que é B2B? O negócio do século!*. Recuperado 23 Junho, 2022, Disponível em: <https://meetime.com.br/blog/gestao-empresarial/o-que-e-b2b/>. Acesso em 20 mai. 2022.
- [9] Distrito Healthtech Tech Report (2020). *Distrito Healthtech Report Brasil 2020*. Disponível em: <https://materiais.distrito.me/nr/healthtech-report>. Acesso em 12 jun. 2022.
- [10] Fleisch, Elgar (2010) *What is the Internet of Things?: An Economic Perspective*. Economics, Management, and Financial Markets, 5 (2): 125-157.
- [11] Galarza, P. C.(2016). *Usabilidad web y la experiencia de usuario*. Tecnología & Diseño, 5(6): 23-33.
- [12] Giusti, Leonardo (2020). *Brasil já conta com 542 startups de saúde*. Disponível em: <https://home.kpmg/br/pt/home/insights/2020/10/brasil-542-startups-saude.html#:~:text=O%20HealthTech%20Mining%20Report%20aponta,Consulta%20J%20C%20Vittude%20e%20SIM>. Acesso em 12 jun. 2022.
- [13] Groopman, Jessica (2020). *Design IoT user interfaces beyond the screen*. Disponível em: <https://www.techtarget.com/IoTagenda/feature/The-IoT-user-interface-designs-Thinking-beyond-the-screen>. Acesso em 11 jul. 2022.
- [14] Guimarães, FM (2017, 29 de novembro). *O que é Design Centrado no Usuário?* Publicado em Aela. Disponível em: <https://medium.com/aela/o-que-%C3%A9-design-centrado-no-usu%C3%A1rio-11a9c13c3a2f>. Acesso em 11 de jul. de 2022.
- [15] Hermanson, B. (2011). *O que é uma startup?* São Paulo: Mundo Sebrae. . Disponível em: <http://www.mundosebrae.com.br/2011/01/o-que-e-uma-startup/>. Acesso em 10 mai. 2019.
- [16] Lottenberg, C., Silva, P., & Klajner, S. (2019). *A Revolução Digital na Saúde: Como a inteligência artificial e a internet das coisas tornam o cuidado mais humano, eficiente e sustentável* (1st ed.). Editora dos Editores.
- [17] Lowdermilk, T. (2013). *Design Centrado no Usuário* (1 ed.). Novatec.
- [18] Magrani, Eduardo (2018). *A Internet das Coisas*. 1. ed. Rio de Janeiro: FGV Editora. Disponível em: <https://bibliotecadigital.fgv.br/dspace/bitstream/handle/10438/23898/A%20internet%20das%20coisas.pdf?sequence=1&isAllowed=y>. Acesso em 12 jun. 2022.



- [19] Maia, L. (2016, 28 de dezembro). *Design de interface: você sabe o que é e qual a importância?* Duo-me. Recuperado em 12 de julho de 2022, de <https://agenciaduo.me/design-de-interface-voce-sabe-o-que-ee-qual-a-importancia/>. Acesso em 10 mai. 2022.
- [20] Moma, G. (2017, 2 de Agosto). *10 heurísticas de Nielsen para o design de interface*. Publicado in UX Collective BR. Disponível em: <https://brasil.uxdesign.cc/10-heur%C3%ADsticas-de-nielsen-para-o-design-de-interface-58d782821840>. Acesso em 20 jul. 2022.
- [21] Morsch, JA (2019). *9 exemplos de como a internet das coisas avança na s*. Morsch Telemedicina. Disponível em: <https://telemedicinamorsch.com.br/blog/IoT-na-medicina>. Acesso em 20 jul. 2022.
- [22] Nascimento, R. (2015, 12 de março). *O que, de fato, é internet das coisas e que revolução ela pode trazer?* It Forum. Disponível em: <https://itforum.com.br/noticias/o-que-de-fato-e-internet-das-coisas-e-que-revolucao-ela-pode-trazer>. Acesso em 24 jun. 2022.
- [23] Ribeiro, H. (2012). *Usabilidade acessível: Metodologias para a Avaliação Qualitativa da Usabilidade no Design para a Web*. [Dissertação de Mestrado, Faculdade de Belas Artes da Universidade do Porto]. Disponível em: <https://core.ac.uk/download/pdf/143401516.pdf>. Recuperado em 24 mai. 2022.
- [24] Rodrigues, JM (2021). *Comportamento sustentável através de estratégias associadas à utilização de internet das coisas* [Dissertação de Mestrado, Universidade Federal do Paraná]. Disponível em: [https://www.prrpg.ufpr.br/siga/visitante/trabalhoConclusaoWS?idpessoal=113538&idprograma=40001016053P0&ano\\_base=2021&idtc=92](https://www.prrpg.ufpr.br/siga/visitante/trabalhoConclusaoWS?idpessoal=113538&idprograma=40001016053P0&ano_base=2021&idtc=92). Acesso em 24 jun. 2022.
- [25] Santos, AF d., & Capelli, R. B. (2019). A evolução das startups. *Revista Qualia: a ciência em movimento*, v.5 (2): 89-108. <https://revistas.unifan.edu.br/index.php/RevistaICSA/article/view/499>. Acesso em 11 de jul. de 2022.
- [26] Sebrae (2017). *Inovação o que é uma empresa Startup?* SEBRAE. Disponível em: <https://www.sebrae.com.br/Sebrae/Portal%20Sebrae/Anexos/O+que+%C3%A9+uma+empresa+startup.pdf>. Acesso em 20 ago. 2022.
- [27] Startupbase (2019). Startups. Retrieved May 2, 2022, Disponível em: <https://startupbase.com.br/home/startups?q=&states=all&cities=all&groups=all&targets=all&phases=all&models=all&badges=all>. Acesso em 20 ago. 2022.

## The assistance provided by the nurse to the patient with the onset of preeclampsia and preeclampsia: Literature review

### A assistência prestada pelo enfermeiro ao paciente com início de pré-eclâmpsia e eclâmpsia: Revisão de literature

### La asistencia brindada por el enfermero a la paciente con inicio de preeclampsia y preeclampsia: revisión de la literatura

Gleison Faria<sup>1\*</sup>, Suzana Nogueira<sup>1</sup>, Márcia Gisele Peixoto Kades<sup>1</sup>, Paulo Henrique Campos da Silva<sup>1</sup>, Francisco Leandro Soares de Souza<sup>1</sup>, Taís Loutarte Oliveira<sup>1</sup>, Jackson Firigolo<sup>1</sup>, Alexandra Alves de Carvalho<sup>1</sup>, Thais Antunes Betin<sup>1</sup>, Cleci da Silva<sup>1</sup>, Thauany Ferreira Tavares<sup>1</sup>, Francielly Maira Bordon<sup>2</sup>, Wellington Ferreira de Souza<sup>2</sup>, Vitória de Oliveira Peres<sup>2</sup>, Iana Carbonera Solcia<sup>2</sup>, Giselen Maleski Cargnin<sup>3</sup>, Marco Rogério da Silva<sup>4</sup>, Cleverson de Oliveira Santos<sup>5</sup>, Mateus Duarte Vieira<sup>6</sup>, Welesmar Barros dos Santos<sup>6</sup>, Moises Sobral Pereira<sup>6</sup>, Natielen Aparecida de Paula<sup>6</sup>, Samira Sbardelatti Regis Pereira<sup>6</sup>, Cleitineia da Silva Souza<sup>6</sup>, Letícia Ferreira Gomes<sup>6</sup>, Sueli Onofre<sup>6</sup>, Elizamar de Souza Lima<sup>6</sup>, Letícia Aparecida de Moura Freitas<sup>6</sup>, Francisco Jonábio Castro Lima<sup>6</sup>, Emilia Costa Rodrigues<sup>6</sup>, Hingreedy Fischer da Silva<sup>6</sup>, Tatiana Moreira de Almeida<sup>7</sup>, Deusirene Sousa Rodrigues<sup>8</sup>

<sup>1</sup>Graduated/Undergraduate student at Unifacimed-Faculty of Biomedical Sciences of Cacoal – FACIMED – RO, Brazil.

<sup>2</sup>São Lucas University Center, Ji-Paraná, Rondônia, Brazil

<sup>3</sup>Nurse at the Claretian University Center - CEUCLAR - Porto Velho – RO

<sup>4</sup>Nurse at the University of Vale do Rio dos Sinos – UNISINOS - São Leopoldo, Rio Grande do Sul, Brazil

<sup>5</sup>Graduated from Higher Education in Cacoal, FANORTE, Rondônia, Brazil

<sup>6</sup>Nursing student at Universidade Paulista, Jí - Paraná, Rondônia, Brazil

<sup>7</sup>Graduate student at Faculdade Estácio UNIJIPA - Ji - Paraná-RO, Brazil

<sup>8</sup>Graduated from the Interamerican Faculty of Porto Velho – UNIRON, Porto Velho – RO, Brazil

Received: 16 Aug 2022,

Received in revised form: 15 Sep 2022,

Accepted: 22 Sep 2022,

**Abstract**— Family Health Strategies (ESFs) play an important role in nursing and aim to expand, define and consolidate primary health care. The nurse must integrate the FHS team and work continuously in the chronic disease control program. The objective of this study was to

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords— Hypertension, Diabetes Mellitus, Nursing care.**

**Palavras chaves - Hipertensão. Diabetes Mellitus. Cuidados de enfermagem.**

*describe the role of nurses in the care of patients with diabetes and arterial hypertension in primary care. The method was a narrative review of the literature with an exploratory, observational and retrospective research approach, searching for 20 articles in the literature between 2010 and 2020. RESULTS: When evaluating the nursing effects cited by nurses, nursing was predominant in relation to food and humidity, followed by glycemic control, blood pressure and breastfeeding weight. On the other hand, the nursing process is a technology that can humanize care in a systematic and dynamic way, with positive and low-cost results. It was concluded that the role of the nurse as an educator is fundamental for both the patient and the family, and must follow their guidelines to understand and be aware of the importance of treatment and activities to improve quality of life.*

**Resumo—** As Estratégias de Saúde da Família (ESFs) desempenham um papel importante na enfermagem e visam ampliar, definir e consolidar a atenção primária à saúde. O enfermeiro deve integrar a equipe da ESF e atuar continuamente no programa de controle de doenças crônicas. O objetivo deste estudo foi descrever a atuação do enfermeiro no cuidado ao paciente com diabetes e hipertensão arterial na atenção primária. O método foi um estudo de revisão narrativa da literatura com abordagem de pesquisa exploratória, observacional e retrospectiva, buscando 20 artigos na literatura entre 2010 e 2020. RESULTADOS: Ao avaliar os efeitos de enfermagem citados pelos enfermeiros, a enfermagem foi predominante em relação à alimentação e umidade, seguida do controle glicêmico, pressão arterial e peso da amamentação. Por outro lado, o processo de enfermagem é uma tecnologia que pode humanizar o cuidado de forma sistemática e dinâmica, com resultados positivos e de baixo custo. Concluiu-se que o papel do enfermeiro como educador é fundamental tanto para o paciente quanto para a família, devendo seguir suas orientações para compreender e ter consciência da importância do tratamento e das atividades para melhorar a qualidade de vida.

**Resumen —** Las Estrategias de Salud de la Familia (ESF) juegan un papel importante en la enfermería y tienen como objetivo ampliar, definir y consolidar la atención primaria de salud. El enfermero debe integrar el equipo de la ESF y actuar continuamente en el programa de control de enfermedades crónicas. El objetivo de este estudio fue describir el papel de los enfermeros en el cuidado de pacientes con diabetes e hipertensión arterial en la atención primaria. El método fue un estudio de revisión narrativa de la literatura con enfoque de investigación exploratorio, observacional y retrospectivo, buscando 20 artículos en la literatura entre 2010 y 2020. RESULTADOS: Al evaluar los efectos de enfermería citados por las enfermeras, la enfermería predominó en relación con la alimentación y la humedad, seguido del control glucémico, presión arterial y peso al amamantar. Por otro lado, el proceso de enfermería es una tecnología que puede humanizar el cuidado de forma sistemática y dinámica, con resultados positivos y de bajo costo. Se concluyó que el papel del enfermero como educador es fundamental tanto para el paciente como para la familia, debiendo seguir sus orientaciones para comprender y ser consciente de la importancia del tratamiento y las actividades para mejorar la calidad de vida.

## I. INTRODUCTION

Preeclampsia or (PE) is a significant health problem for pregnant women worldwide. About 1% of PE cases are considered extreme and about 10% of severe PE cases are considered extreme. More than 50,000 women die from health every year worldwide due to complications related to PE, which is a major public health problem in developed countries. In fact, the earlier PE occurs in pregnancy, the greater the risk of maternal and infant mortality among carriers (WHO, 2013; SANTOS & BATISTA, 2018).

The World Health Organization states that the disease progresses without visual signs. However, some signs may be present; these include swelling around the face, hands and eyes, weight gain, nausea, vomiting and epigastric pain. Other signs include changes in vision – blurred and impaired vision – headache, hyperreflexia, anxiety and shortness of breath (WHO, 2013).

According to Ferreira et al (2016), the rate of preeclampsia in primiparous women reaches approximately 10%. It is important to recognize the signs and symptoms so that health teams can act in providing quality care. The severity of complications does not affect the lives of more pregnant women or even their children.

When a pregnant woman suffers from eclampsia, she experiences seizures. However, a pregnant woman suffering from preeclampsia has no other differential diagnoses, such as meningitis, sepsis, or epilepsy. Gold standard medical care is understood to be all care provided by the nursing team based on rigorous scientific methods (EDWARD & MILLS, 2013). This approach can improve patient outcomes, provide better quality of care, minimize costs due to reduced morbidity, mortality, and iatrogenic costs, and raise standards of safety and reliability in healthcare settings.

Caring for women during pregnancy is very important for them, as this type of assistance becomes the ideal choice for nurses to practice their technical and scientific knowledge, as it can promote continuous care for pregnant women. The objective is to determine health needs, determine prioritize, plan, implement and evaluate appropriate care actions to improve the quality and effectiveness of care (AGUIAR, 2010).

The nursing team has an important role to play in prenatal care, in order to correctly and early determine which patients are most likely to have an unfavorable course of the disease, and the woman is welcome from the beginning of pregnancy. . One of the most important treatment methods is to instruct these pregnant women to eat healthily, practice light physical exercise and conduct adequate prenatal counseling (SANTANA et al., 2010).

The theme justifies the importance of nurses in prenatal care (PN) is the monitoring of pregnant women by qualified professionals able to receive the pregnant woman and provide comprehensive and quality care. From the first day of pregnancy to delivery, in order to provide a better quality of life for pregnant women and children. Therefore, professionals who treat pregnant women must understand physical factors, various emotions, economics and family factors, because these factors will affect women's adherence to PN counseling, thus affecting the quality of follow-up (PEIXOTO, 2011).

During pregnancy, some complications can threaten the life of the mother and/or baby, constituting an emergency that requires immediate intervention. The physiological and anatomical changes of pregnancy can interfere with the evaluation of the pregnant woman, and it is necessary that health professionals understand this knowledge so that they can carry out the correct assessment and provide adequate care (QUEROZ, 2012).

Therefore, among the professionals who received training for prenatal care for adequate care, nursing stands out, with a focus on nursing, so that they do things for the human being that they cannot do on their own, that is, provide help or assistance in situations where parts of it cannot be done. Self-care, guide or teach, supervise or recommend other professionals. It should be noted that the treatment of these patients largely depends on care, that is, patients with preeclampsia need quality care that meets their needs (SANTOS, 2018).

Thus, the general objective of the work is to analyze the role of nurses in the reception and care of patients with preeclampsia.

## II. MATERIALS AND METHODS

This study is a comprehensive review that focuses on the investigation, description and analysis of scientific results published in the main nursing journals on the theme of the nurse's role in the reception and care of patients with preeclampsia, from which 20 articles were selected.

The selection of articles was carried out through the online electronic scientific library (SciELO), Google Scholar and the virtual health library database, using the health sciences descriptor (Decs): Nursing, Hypertension and Pregnancy. For its selection, the following inclusion criteria were followed: language of publication (Portuguese, Spanish and English), established deadline, 2010 to 2022.

The bibliographic search also uses official documents such as laws, reports, technical manuals and book chapters related to the subject available on the Ministry of Health website.

Bibliographic works without complete texts and those that do not allow a deep reflection of the nursing area on the subject in question are excluded. Data analysis is performed through the description of research and information, analysis of results, compilation of results and evaluation of results on the proposed themes.

### III. LITERATURE REVIEW

#### Pregnancy

Pregnancy represents a transition that is part of the normal developmental process, involving a change of identity and a new role definition. In the case of the primiparous, in addition to being a daughter and wife, she also assumes the role of mother (PIO & CAPEL, 2015). This is a moment of crisis, through which there are conflicting points of decision and emotional growth, determinants of the health of the woman and the family or mental illness. It also mentions that motherhood touches the core of the female bonding matrix and significantly alters the pattern of interaction with the family of origin. Such events are considered essential and, in addition to preparing the baby's arrival, they are often conducive to the transformation brought about by pregnancy and the fulfillment of the role of 'being' of adaptation" (CAMACHO et al., 2010).

The feelings and desires that arise during pregnancy, including expectations and plans after childbirth, can influence the next 12 months of a child, especially in relation to their relationship with the mother (SABROZA, LEAL, SOUZA & NOGUEIRA, 2011). At the moment of birth, when the expectations of the first phase are exhausted, other sensations begin, influenced by the connections made during pregnancy. Babies are actually considered new members of the family and are no longer fictitious (CAMACHO et al., 2010). According to the authors above, the basis of the mother-baby relationship, after birth, can begin with pregnancy, being influenced by the expectations and emotions that occur in most primiparous women during this turbulent period, especially for multiparous ones (CAMACHO et al., 2010).

Most illnesses that develop during pregnancy result in hospitalization. It is known that hospitalization can be a stressful factor for pregnancy due to several environmental factors, such as distance from the home environment, loss of privacy, labeling the pregnant woman as "sick" when reading a pregnancy at risk. In the hospital, many doubts can arise and during medical consultations, when women are interested in knowing about their condition. Unfortunately, most of the time, these moments are not properly valued, increasing your anxiety levels, which can make the situation worse. The cited authors also emphasize

the need for a good doctor-patient or nurse-patient relationship, as research shows that when a health professional and abstains from exchanging information, it only reduces trust between the two parties (PIO & CAPEL, 2015).

#### Pathophysiology of preeclampsia

The cause of preeclampsia is unknown. In 1916, Zwiefeld had already described it as a "theoretical disease". Many theories and factors have been proposed to explain its cause, but most have not been proven. More than 60 years ago, Page coined the concept of preeclampsia, a reduction in placental perfusion. Currently, the immunological, genetic aspects and failure of placental invasion are unanimously accepted. Evidence of endothelial damage associated with increased inflammatory response and stress is the latest theory for the development of preeclampsia (VERLOHREN et al., 2015; KAHHALE et al., 2018).

Vasoreactivity, permeability and activation of coagulation are increased, mainly damaging vascular endothelium, kidneys, central nervous system, liver and placenta; thus, patients may have multiple organ involvement of varying severity (VERLOHREN et al., 2015; KAHHALE et al., 2018).

In our opinion, it seems well established that preeclampsia occurs in the presence of placental tissue, a multifactorial pathological entity influenced by environmental and immunological factors, as well as the genetic makeup of the mother. The onset of placental hypoxia leads to oxidative stress and the release of trophoblastic products and excess antiangiogenic factors, such as soluble endoglybin and the Flt-1 (sFlt-1) receptor called "fms-like tyrosine kinase-1". identified early in pregnancy. Due to insufficient trophoblast invasion, insufficiently perfused trophoblasts produce toxic substances that damage endothelial cells, leading to the clinical syndrome of preeclampsia (VERLOHREN et al., 2015).

#### Pre eclampsia

Preeclampsia is defined as the development of hypertension with proteinuria and/or swelling of the hands. Occurs after the 20th week of gestation, or earlier in gestational trophoblastic disease. Preeclampsia is primarily a condition in primiparous women (KAHHALE et al., 2018).

More recently, preeclampsia was defined as the appearance of hypertension with proteinuria, that is, the resolution of the edema was recommended as a diagnostic criterion and the mandatory presence of proteinuria. For research protocols, this concept may be valid, as there will be a greater chance of including patients with true

preeclampsia. Systemic edema that does not resolve with rest should be considered a very important clinical symptom, and experience has shown that the classic concept of hypertension with proteinuria and/or development of edema of the hands or face is correct. Therefore, waiting for the clinical manifestation of proteinuria in preeclampsia can have serious clinical implications, delaying treatment or preventing maternal-fetal complications. Exacerbations in people with preeclampsia can occur at very different rates. Some people stabilize before the pregnancy ends, some get progressively worse over a few weeks, and some show severe signs within days or even hours. Therefore, it is common to care for pregnant women with severe preeclampsia, HELLP syndrome or even eclampsia without proteinuria (KAHHALE et al., 2018). In a new publication 25 years later, ACOG published its recommendations in late 2013, referencing 1972 concepts and classifications, but with some differences. Therefore, preeclampsia is diagnosed when SBP > or equal to 140 or DBP > or equal to 90 mmHg and 24-hour urine proteinuria greater than or equal to 300 mg. In the absence of proteinuria, consider hypertension associated with one of the following: thrombocytopenia, renal failure, liver damage, pulmonary edema, and neurological or visual symptoms. Although significant clinical edema or rapid weight gain, or both, increases the clinical suspicion of preeclampsia, edema is not considered a diagnostic criterion.

It is also worth mentioning that when preeclampsia appears at an earlier gestational age (below 34 weeks), that is, well before term, it should always be considered a severe form and has a higher recurrence rate in subsequent pregnancies.

#### Diagnosis

Preeclampsia is characterized by a symptomatic triad: edema, hypertension and proteinuria. Hypertension is a "necessary condition" and must be accompanied by edema or proteinuria or both. The presence of these findings, especially in primiparous women, or worsening of the hypertensive condition, suggests the diagnosis after the 20th week. Gradually, as the condition develops and intensifies, a wide variety of conditions can develop and the components of the syndrome can be expressed in different ways. Complete blood count, platelet count, tape and/or 24-hour proteinuria, urea and creatinine, type I urine, uric acid, hemolysis profile (DHL), liver enzymes (TGO and TGP), and total and partial bilirubin (KAHHALE et al., 2018).

Preeclampsia is a multisystem disorder that affects pregnant women and can develop with marked deterioration of Organs affected organs. Eclampsia and HELLP syndrome are more likely to have complications such as: disseminated intravascular coagulation; acute renal failure;

acute pulmonary edema; intracranial hemorrhage and hepatic rupture. At this stage of the disease, patients are prioritized for multidisciplinary care in the intensive care unit (KAHHALE et al., 2018).

#### Pharmacological Treatment

For a long time, researchers have sought therapy for the prevention of preeclampsia. In the last three decades, numerous studies with large numbers of patients have been published in an attempt to reduce the incidence or severity of preeclampsia. Recent systematic reviews from the Cochrane library have evaluated the results of calcium supplementation, magnesium supplementation, protein intake, salt intake, prostaglandin precursors such as fish oil, and more recently antioxidants such as vitamins C and E, but no results can be found. show real benefit from these interventions.

Most randomized trials for the prevention of preeclampsia, including more than 37,000 patients, used low-dose aspirin. Recognition of the imbalance in the prostacyclin/thromboxane ratio as a key in the pathophysiology of the disease resulted in the application of low doses of aspirin, which selectively inhibit thromboxane synthesis in platelets, without affecting the production of prostacyclin in the vessels (ASKIE et al., 2007 apud). KAHHALE et al., 2018). A total of 32,217 pregnant women participated in a study and concluded that antiplatelet therapy produces a moderate but consistent reduction in preeclampsia and its consequences, especially birth before the 34th week. All these data suggest that the preventive effect of aspirin is greater in high-risk pregnant women, at a dose of 100mg daily at night, used early (before the sixteenth week). This therapy is safe for the fetus, even in the first trimester.

The analysis of the most recent works in the literature allows us to continue using the protocol of the Obstetric Clinic of the Faculty of Medicine of the University of São Paulo, already published and in use for the last thirty years<sup>4</sup>. We indicate in the high-risk group, that is, in pregnant women with a previous history of eclampsia and Hellp syndrome, recurrent preeclampsia, chronic arterial history with perinatal death, pregnant women with nephropathies and collagen diseases, kidney transplant recipients and those with antiphospholipid antibody syndrome. (KAHHALE et al., 2018).

#### Clinical Treatment

The goal of preeclampsia treatment is to prevent maternal-fetal complications such as placental abruption, stroke, acute pulmonary edema, renal failure, clinical worsening of severe preeclampsia, Hellp syndrome and eclampsia; fetal side, preterm delivery and neonatal respiratory distress. Once preeclampsia is diagnosed, the

pregnant woman should be hospitalized and kept in a relatively rested left lateral position to facilitate venous return, increase cardiac output and increase renal plasma sodium excretion, improving hypertension and uteroplacental perfusion. A low-sodium diet containing 2 to 3 grams of salt and high in protein is essential (BRASIL, 2013).

Sedation is important to reduce mood vascular instability; for this, we take an antipsychotic (levomepromazine) 3 mg (3 drops) orally every 8 hours. This therapy, by blocking alpha receptors, causes a slight drop in blood pressure. Benzodiazepines are used in doses of 5 to 10 mg every 8 or 12 hours (KAHHALE et al., 2018).

Mild cases of preeclampsia can be treated on an outpatient basis for socioeconomic reasons and/or lack of hospital beds. The patient is instructed to remain in bed most of the time, on the left side. In addition, she was advised to seek medical attention at any time and immediately report symptoms such as headache, epigastric pain, visual disturbance, rapid onset of generalized edema, and significantly reduced urine output. It is evaluated weekly, followed by clinical examination, proteinuria, and fetal viability testing. After the observation of any severe symptoms or change in fetal viability, the patient was hospitalized for more adequate supervision (SARMENTO et al., 2020).

In the case of severe preeclampsia, when the pregnant woman presents for the first time with hypertensive manifestations at term or close to term, especially if the cervix is favorable for inducing labor, the procedure is straightforward and performed without difficulty. However, there is a subset of women with severe hypertension in early pregnancy who require early delivery, which increases the risk of neonatal preterm delivery and may require prolonged hospitalization in the treatment unit. Neonatal Intensive Care (KAHHALE et al., 2018). When the mother's life is at risk, there is no doubt that childbirth is the right decision. However, this is rare. The choice of expectant management requires access to a tertiary hospital, well-trained staff, facilities to assess the clinical status of the mother, laboratory tests, adequate assessment of fetal motility, and a decision to prolong the pregnancy on a daily basis.

The nurse's role in preventing preeclampsia

The nurse's role in the care of pregnant women is to monitor prenatal care and take preventive and/or therapeutic measures to minimize complications. As such, it is shown to be a positive factor in the care of pregnant women during prenatal care and even during pregnancy, during family planning consultations to look for risk factors and diseases that cause certain complications during pregnancy,

especially in the most vulnerable populations. vulnerable (BRASIL, 2013).

Special care for women with preeclampsia and/or eclampsia can reduce complications, morbidity and mortality. The care described in this review mainly includes a complete physical examination; early identification of signs of preeclampsia/eclampsia; monitoring of laboratory tests; fetal assessment; professional training, including the need for continuing education; instrument-based care standardization; use of cuffs around the arm measure blood pressure; slow mercury deflation rates ( $\leq 2$  mmHg); need to standardize blood pressure measurement techniques; early identification and treatment of hypertensive crises through institutional protocols; and case review and workflow (SARMENTO et al., 2020).

The daily development and adoption of nursing protocols based on scientific evidence in the clinical practice of nurses help guide the decision-making process and ensure the provision of quality and safe care (FERREIRA et al., 2016).

Understanding the role of care in the management of preeclampsia is important to ensure the quality of care provided. Many pregnant women only discover their morbidity when they are hospitalized, causing them countless emotional discomforts, with hormonal changes having an even greater impact on how they feel. This ignorance of the disease can be avoided through effective prenatal care and continuous monitoring, as care based on guidelines during pregnancy and the correction of concerns engage pregnant women in the self-care process to provide a healthy pregnancy (SANTANA et al., 2019).

Nursing consultations in primary health care are carried out according to a script prepared by the Ministry of Health. This guideline provides adequate guidelines and favors an adequate approach to meet the specific needs of women with whom professionals interact in prenatal counseling, in essential health units that should be reference portals for pregnant women (BRASIL, 2013; SARMENTO et al., 2020).

High-risk pregnancies require care based on a scientific approach, making patient health the gold standard of care (SANTANA et al., 2019). The use of an adequate and humane approach, where the patient is the main focus of care, will lead to better results, as it will provide greater care capacity, reducing costs due to the reduction of morbidity and mortality; in addition to promoting trust in standard health and safety institutions (BARBOSA et al., 2011).

It was also highlighted that, by being more involved in the care provided to mothers and newborns, nurses are able to provide the continuous surveillance necessary for this

complex and challenging public health disease (FERREIRA et al., 2019).

More effective practices of nurses in the face of preeclampsia

Nurses' responsibilities include assisting users in pregnancy planning, diagnosis, routine and first prenatal consultations, planning return consultations, frequency of consultations, immunizations, educational activities, home visits, referrals and referrals, always aiming to provide subsidies. aimed at care and communication, an indispensable resource in the health area, aims to build trust and connect users with professionals (SARMENTO et al., 2020).

Regardless of the complexity of care, professional nurses have a responsibility to participate in the process of evaluating "nursing work" in order to contribute to the assistance provided by health services (EDWARD & MILLS, 2013).

While nursing treatment is characterized by the nurse's performance, direction, supervision, assistance or guidance to the patient, it is also evidenced through specific educational actions that there is prevention. Several factors are important in treatment decisions, such as the type of hypertensive syndrome, the severity of the disease, the period of gestation in which the disease occurs, and the maintenance of maternal-fetal homeostasis. The table below shows some treatments for women with this disorder (NORONHA et al., 2010).

The goal of treatment is to prevent maternal-fetal complications such as placental abruption, stroke, renal failure, acute pulmonary edema, severe preeclampsia, HELLP syndrome, and increased clinical manifestations of eclampsia. In the case of the fetus, it prevents premature birth and respiratory distress in the neonate (KAHHALE et al., 2018).

#### IV. FINAL CONSIDERATIONS

The nurse's humanitarian action seeks special help because it passionately protects the patient's life, in addition to providing effective assistance to maternal health, it also includes assessing the viability of the fetus through procedures such as examinations.

The nurse's role is, therefore, an important tool to reduce the complications of preeclampsia, improve care through changes in clinical practice and carry out actions aimed at preventing complications during pregnancy and reducing morbidity and mortality.

#### ACKNOWLEDGEMENTS

Thanking colleagues for their performance in the construction of the work and the advisor for their patience and tips

#### REFERENCES

- [1] AGUIAR, Maria Isis Freire de; FREIRE, Priscilla Brasileiro Galvão; CRUZ, Isabella Marfisa Pessoa; LINARD, Andréa Gomes; CHAVES, Emília Soares; ROLIM, Isaura Letícia Tavares Palmeira. Sistematização da assistência de enfermagem a paciente com síndrome hipertensiva específica da gestação. *Rev. Rene. Fortaleza*, v. 11, n. 4, p. 66- 75, out./dez.2010
- [2] AMERICAN COLLEGE OF OBSTETRICIANS AND GYNECOLOGISTS; Task Force on Hypertension in Pregnancy. Hypertension in pregnancy: report of the American College of Obstetricians and gynecologists' Task Force on Hypertension in Pregnancy. *Obstet Gynecol* 2013; 122: 1122-31. doi: 10.1097/01.AOG.0000437382.03963.88
- [3] ASKIE LM, DULEY L, HENDERSON-SMART DJ, STEWART LA. Antiplatelet agents for prevention of preeclampsia: a meta-analysis of individual patient data. *Lancet*. 2007;369:1791-8. doi: 10.1016/S0140-6736(07)60712-0.
- [4] BARBOSA TLA, GOMES LMX, DIAS OV. O pré-natal realizado pelo enfermeiro: satisfação das gestantes. *Cogitare Enferm* 2011;16(1):29-35. <https://doi.org/10.5380/ce.v16i1.21108>
- [5] BRASIL, Ministério da Saúde. Departamento de Atenção Básica. Estratégias para o cuidado da pessoa com doença crônica: hipertensão arterial sistêmica. Brasília 2013. Disponível em: [http://bvsm.s.saude.gov.br/bvs/publicacoes/manual\\_pre\\_natal\\_puerperio\\_3ed.pdf](http://bvsm.s.saude.gov.br/bvs/publicacoes/manual_pre_natal_puerperio_3ed.pdf)
- [6] EDWARD KL, MILLS C. A hospital nursing research enhancement model. *J Contin Educ Nurs*. 2013;44(10):447-54.
- [7] EDWARD KL, MILLS C. A hospital nursing research enhancement model. *J Contin Educ Nurs* 2013;44(10):447-54. <https://doi.org/10.3928/00220124-20130801-45>
- [8] FERREIRA ETM, MOURA NS, GOMES MLS, SILVA EG, GUERREIRO MGS, ORIÁ MOB. Características maternas e fatores de risco para pré-eclâmpsia em gestantes. *Rev Rene* 2019;20:403-27. <https://doi.org/10.15253/2175-6783.20192040327>
- [9] FERREIRA MBG, et al. Nursing care for women with preeclampsia and/or eclampsia: integrative review. *Rev Esc Enferm USP*. 2016.
- [10] FERREIRA MBG, SILVEIRA CF, SILVA SR, SOUZA DJ, RUIZ MT. Nursing care for women with preeclampsia and/or eclampsia: integrative review. *Rev Esc Enferm USP* 2016;50(2):320-30. <https://doi.org/10.1590/S0080-623420160000200020>



- [11] KAHHALE S, FRANCISCO RPV, ZUGAIB M. Pré-eclampsia. *Rev Med (São Paulo)* 2018;97(2):226-34. <https://doi.org/10.11606/issn.16799836.v97i2p226-234>
- [12] KAHHALE S, VIEIRA-FRANCISCO RP, ZUGAIB M. Pré-Eclampsia. *Rev Med (São Paulo)*. 2018 mar.-abr.;97(2):226-34. doi: <http://dx.doi.org/10.11606/issn.1679-9836.v97i2p226-234>
- [13] NORONHA NC, SOUZA ASR, AMORIM MMR. Tratamento da pré-eclâmpsia baseado em evidências. *Rev Bras Ginecol Obstet* 2010;32(9):459-68. <https://doi.org/10.1590/S0100-72032010000900008>
- [14] ORGANIZAÇÃO MUNDIAL DE SAUDE (OMS). Recomendações da OMS para a prevenção e tratamento da pré-eclampsia e eclampsia. Brasília: OMS 2013.
- [15] PEIXOTO CR. O pré-natal na atenção primária: o ponto de partida para reorganização da assistência obstétrica, *Revista enfermagem UERJ*, Rio de Janeiro. 2011.
- [16] PIO DAM; CAPEL MS. Os significados do cuidado na gestação. *Rev. Psicol. Saúde, Campo Grande*, v. 7, n. 1, p. 74-81, jun. 2015. Disponível em <[http://pepsic.bvsalud.org/scielo.php?script=sci\\_arttext&pid=S2177093X2015000100010&lng=pt&nrm=iso](http://pepsic.bvsalud.org/scielo.php?script=sci_arttext&pid=S2177093X2015000100010&lng=pt&nrm=iso)>. acessos em 10 set. 2022.
- [17] SANTANA FS, et al. Atuação da enfermagem em urgências - gestação de alto risco - hipertensão arterial. 2010.
- [18] SANTANA RS, COSTA ACRR, FONTES FLL, CARVALHO FR, MOURA FF, DUARTE JM, et al. Importância do conhecimento sobre sinais e sintomas da pré-eclâmpsia para implementação dos cuidados de Enfermagem: *Revista Eletrônica Acervo Saúde* 2019;11(15):1-6. <https://doi.org/10.25248/reas.e1425.2019>
- [19] SANTOS CR. Assistência de enfermagem à a gestante com pré-eclâmpsia durante o pré-natal. Piauí. 2018
- [20] SANTOS CR; BATISTA FMA. Assistência de enfermagem à gestante com pré-eclampsia duarnte o pré-natal. Piauí-PE. Universidade Federal do Piauí (UFPI). 2018.
- [21] SARMENTO RS, SILVA WM, GOMES MA, MELO LNT. Pré-eclâmpsi an gestação: ênfase na assistência de enfermagem. *Enfermagem Brasil* 2020;19(3):261-267. <https://doi.org/10.33233/eb.v19i3.4127>
- [22] VERLOHREN S, HERRAIZ I, LAPAIRE O. The sFlt-1/PLGF ratio in different types of hypertensive pregnancy disorders and its prognostic potential in preeclamptic patients. *Am J Obstet Gynecol*. 2012;206:58.e 1-8. doi: 10.1016/j.ajog.2011.07.037.

# Business Incubators and Sustainability: A Literature Review

Samuel Carvalho de Azevedo Marques<sup>1</sup>, Hugo Saba<sup>2</sup>, Ingrid Winkler<sup>3</sup>, Aloisio Santos Nascimento Filho<sup>4</sup>

<sup>1</sup>Doutorando, PPG em Gestão & Tecnologia Industrial SENAI Cimatec University Center, Brazil

<sup>2</sup>Department of Exact and Earth Sciences, Universidade do Estado da Bahia, Brazil

<sup>3,4</sup>Professor, PPG em Gestão & Tecnologia Industrial, Department of Management and Industrial Technology, SENAI Cimatec University Center, Brazil

Received: 26 Aug 2022,

Received in revised form: 19 Sep 2022,

Accepted: 24 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Business incubator, Entrepreneurship, Sustainability, Sustainable Development.*

**Abstract**— *Incubators are models to support entrepreneurship, being central to economic growth and as catalysts for the formation of new business. Incubators have a practical relevance as an effective mechanism to support small business development. In relation to the sustainability, however, few authors have explored the notion of incubation for sustainability to meet global development agendas. The incubator-sustainability relationship in practice can support sustainable development through new companies and incubators profiled on sustainable. Few attentions have been given to the engagement of incubators in activities aimed at sustainable development. In this sense, the present study aims to investigate the application of the term sustainability in studies on business incubators. For this a literature review study was conducted, based on the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) and bibliometric techniques. This review identifies links between incubators and sustainability and observes differences in the application of the notion of sustainability. From the analysis updated terms emerges related to sustainability may represent trends and new areas of interest. The findings of the review highlight that knowledge is expanding and still need to be deepened for strengthen the role of incubators in sustainable development. As limitations, we can highlight the lack of clear definition of concepts and a research agenda on the topic. At the end, it is suggested that future work may expand the research on incubators and sustainability.*

## I. INTRODUCTION

Business incubators emerged within the scope of entrepreneurship to support the creation of new businesses and ventures at an early stage. Its traditional focus is linked to inexperienced entrepreneurs, technology-based incubation, with emphasis on university-based incubators and a regional development focus. Hausberg and Korreck (2020) note that other formats of incubators, such as accelerators, have emerged and reconfigured the

phenomenon. There is a growing variety of incubator models, defined with heterogeneity and specialization of the phenomenon (Klofsten *et al.*, 2020). There are both technology-based incubators, with others for social purposes, government incubators, corporate incubators in companies and incubators created by academic institutions, aimed at meeting economic and social demands.

The number of incubators has exceeded 7,000 units worldwide (Eveleens *et al.*, 2017). Mian *et al.* (2021) identified the existence of more than 1,400 incubators in the United States, according to data from iNBIA. Mian *et al.* (2021) discusses this universe from information collected in national and regional professional associations of incubators and web sources, on the numbers of existing incubation programs in several countries: Germany, three hundred (BVIZ, 2019); Brazil, 363 (ANPROTEC, 2019); China, 670; and India, 276 (IIM, 2019).

Parallel to the practical phenomenon, a research tradition has been formed and research interest has been maintained, generating recent studies deriving themes and constant academic publication (Hackett & Dilts, 2004; Albort-Morant & Ribeiro-Soriano, 2016). The literature on business incubators has expanded, as shown by literature reviews that systematized research in incubation, currently focusing on accelerators, startups, and technology base (Eveleens *et al.*, 2017; Hausberg & Korreck, 2020). In general, incubators continue to provide services to support business development, in its initial stages, through diverse services and access to knowledge (Deyanova *et al.*, 2022). Hackett and Dilts (2004), almost twenty years ago, signaled that much attention had been paid to the facilities of incubators and little attention was focused on incubated companies, innovations they disseminated and incubation results. Since then, studies have addressed the performance of incubators, effectiveness (Theodorakopoulos *et al.*, 2014) and incubation impacts (Albort-Morant & Ribeiro-Soriano, 2016).

Previous studies highlight the gap in explanation of the link between incubators and sustainable development (Hernández & Carrà 2016). And even if an increase in the number of studies on innovation and technology focused on sustainability is observed (Markard *et al.*, 2012), the role of technological innovation in the Sustainable Development Goals (SDGs) is still considered unexplored and a research gap (Castro *et al.*, 2021). Despite this, studies have specialized in the importance of technology to address the SDGs (Secundo *et al.*, 2020). In the growing field of studies on incubators, there are studies on sustainability-oriented incubators (Bank *et al.*, 2017) or their involvement in activities aimed at sustainable development (Battering & Masurel, 2020).

There are studies on opportunities for creating green jobs (Gliedt *et al.*, 2018) and reflections on what incubation services would be needed to develop eco-opportunities (Battistoni & Barbero, 2019). The performance of incubators in relation to the environment or from the perspective of a more sustainable society can be evaluated in terms of their environmental maturity (Fonseca & Chiappetta Jabbour, 2012). There are

theoretical developments of this incubator-sustainability relationship that in practice can support sustainable development through new companies (Bank *et al.*, 2017).

This study began with a question concerning the application of the concept of sustainability in business incubators research and incubation. It was found that the relationship between these elements has not yet been analyzed in studies and reviews, being an opportunity to present a synthesis of this knowledge in the field of business incubation. With the absence of systematization on this topic, the research then aimed to provide an overview of existing studies on incubators with a focus on the application of the concept of sustainability.

Considering the evolution of studies on business incubators we research about the application of the term "sustainability". This research thus conducts a literature review and mapping of this knowledge. This review aims to clarify and identify the differences in the application of the term sustainability in studies on business incubators.

The article is structured as follows: Introduction, section 1, presents the problem, gaps in previous work, contribution, and objective of the article. Section 2 on the method describes the investigation procedures and research development stages. In Results and Discussion, Section 3, presents the results of the literature review and discussion. In the conclusion, section 4, presents final considerations of the main points, applications, advantages, and limitations of the article.

## II. METHOD

The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) standards were followed in the conduct of this systematic review (Page *et al.*, 2021). Additionally, the seven-step method described in Booth (2016) and Freitas *et al.* (2022) were utilized, which consists of seven steps: planning, defining the scope, searching the published research, assessing the evidence base, synthesizing, analyzing, and writing. To provide an overview and synthesis based on the scientific articles available in the Scopus and Web of science (WOS) databases. This review is based on the use of bibliometric techniques to map the application of the concept of sustainability associated with business incubator e networked incubation.

### 2.1 Planning

In the context of the objective of the article, of the literature on business incubators and the relationship between incubators and sustainability is observed in the studies through bibliometric analysis of the literature. This study aims to inform about the literature, using techniques

of citation analysis, networking of authors' keywords, mapping, and analysis of literature. In the study, the bibliometric method is applied analyzing selected studies, strictly in the production of original and review articles published and stored in a scientific knowledge database.

Databases were consulted between December 2021 and March 2022, and data were extracted from Scopus and Web of Science databases. Bibliographic analyzes and scientific mappings consider the number of publications and citations, journals, and countries in the selected studies. The most influential authors are identified based on citations and the most cited articles. After defining the initial research intention and the topic to be addressed, exploratory searches were conducted in the databases for original and review articles to verify the existence of a research gap to be explored.

2.2 Defining the Scope

Defining the scope relates to research questions. To investigate the research gap, two pertinent research questions were formulated for this review, namely: Q1: How is the concept of sustainability applied in research on business incubators? And Q2: What are the main characteristics of the use of the notion of sustainability and sustainable development in business incubators?

2.3 Literature Search

To this end, steps were defined to be followed. In the initial search, the following search descriptors were used: "business incubator", "incubation", "sustainability", these terms, to be found in the article title, abstract or keywords. The descriptors used were "business incubator" and "business incubation". The search string was as follows: "(title ("business incubator") OR title ("business incubation")) OR key ("business incubator") OR key ("business incubation"))". Considering the variations "sustainability" and "sustainable". Several combinations of these descriptors with logical operators were evaluated in the search for review articles and originals.

As a search step 1, we used an initial String, and aimed at searching for studies and most influential works. In search stage using the String we searched for studies focusing on the guiding question of the research, with the relationship between business incubators and the term sustainability. The selection was finalized in April 2022. The result of the search is shown in Table 1.

Table.1: Search results in the databases

| Search step 1: String                             | WOS | Scopus |
|---------------------------------------------------|-----|--------|
| ((business incubator AND sustainab* development)) | 68  | 100    |

2.4 Assessing the Evidence Base

In the study, from the original articles and published review articles, the guiding question is aimed at selecting and electing studies on business incubators with a focus on the application of the concept of sustainability. After filtering and exclusion procedures, forty-seven documents remained. Of these, were excluded twenty-one due to duplicity and due to thematic criteria after reading the abstracts. Remaining in twenty-six studies for analysis on the question raised, as shown in Fig. 1. The assessment step applied inclusion and exclusion criteria filters to reduce the number of related articles identified during the search step. By combining the following exclusion criteria, we to limit the number of documents identified: E1: Exclude articles that did not include the terms "sustainability", "Sustainable Development". And E2: Exclude articles that did not contain the terms "incubator", "incubation".

2.5 Synthesizing and Analyzing

Based on the identified works and abstracts, studies on incubators were included and those that did not have thematic relevance or did not meet the criterion of the guiding question were excluded. After this selection and eligibility step, reading the abstracts and documents, they were selected for analysis in the Vosviewer software.

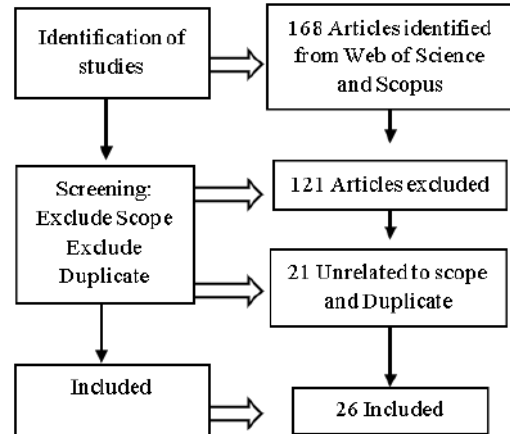


Fig. 1: flow diagram for inclusion of articles.

III. RESULTS AND DISCUSSION

In the literature on business incubators, studies on the performance of incubators, the impact of support and the effects of incubation on the growth of incubated ventures are traditional. The theme of performance brings the concept of sustainability closer, associating it with the sustained growth of the incubator or the supported business. However, there is no review on this approach and application of the concept in studies on incubators, nor on incubators linked to sustainable development

specifically. In this context, there is no clear distinction on the application of the term sustainability in these studies, which suggests an opportunity for review and systematization. In this sense, Table 2 shows the reviews produced on business incubators.

Table.2: Previous literature reviews published on business incubators

| Author (Year)                            | Title                                                                                                                      | Times cited |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------|
| Hackett and Dilts (2004)                 | A Systematic Review of Business Incubation Research                                                                        | 462         |
| Albort-Morant and Ribeiro-Soriano (2016) | A bibliometric analysis of international impact of business incubators                                                     | 139         |
| Hausberg and Korreck (2020)              | Business incubators and accelerators: a co-citation analysis-based, systematic literature review                           | 81          |
| Theodorakopoulos et al. (2014)           | What matters in business incubation? A literature review and a suggestion for situated theorizing                          | 75          |
| Eveleens et al. (2017)                   | How network-based incubation helps start-up performance: a systematic review against the background of management theories | 64          |
| McAdam et al. (2006)                     | Business Processes and Networks in University Incubators: A Review and Research Agendas                                    | 45          |
| Deyanova et al. (2022)                   | Hatching start-ups for sustainable growth: a bibliometric review on business incubators                                    | 1           |

As shown, previous reviews of the literature on business incubators have not yet addressed sustainability. Business incubators have great practical relevance (Deyanova et al. 2022) and there are no signs that other models are replacing them to support entrepreneurship. Incubators remain an effective mechanism to support small business development (Mcadam & Marlow 2008). In the recent period, shown in Fig. 2 and Fig. 3, the number of original and review articles published and the citations in the last 10 years is observed. The average publication per year was forty articles. And these articles had an average

of 821.7 citations per year in the period between 2012 and 2021.

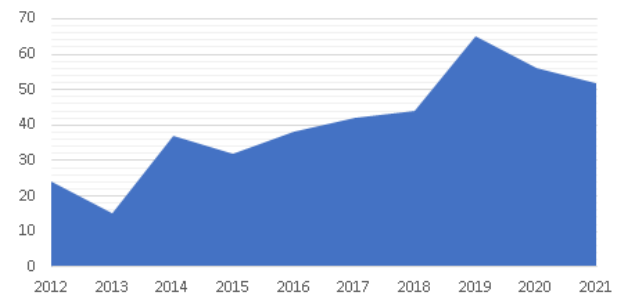


Fig. 2: business incubators, number of original and review articles published per year

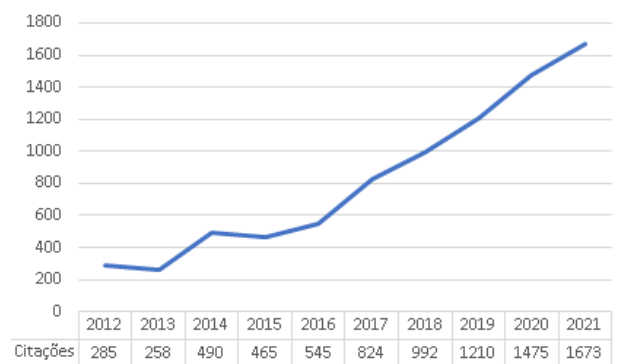


Fig. 3: business incubators, number of citations of these documents per year

With entrepreneurship being central to economic growth in most developed economies, incubators serve as catalysts for the formation and development of business clusters, according to Carayannis and Von Zedtwitz (2005). Technological incubators, for example, have been used by governments as an effective strategy to facilitate technological innovation (Sun & Cheng 2021). In addition, incubators are also seen as mechanisms that facilitate social inclusion and inclusive growth, according to Baskaran and Chandran (2019). However, there is almost no attention to the engagement of incubators in activities aimed at sustainable development, even though a significant proportion of European incubators engage in activities for sustainable development, according to Battering and Masurel (2020). And few studies have focused on sustainable incubators or those aimed at supporting sustainable development through new companies (Bank et al., 2017).

According to Hernandez and Carrá (2016), there is a gap in theoretical explanation for understanding incubators linked to sustainable development. There is even a lack of proposals to assess the “greening” of incubators or even

discussions about incubators and the environment (Fonseca & Chiappetta Jabbour 2012). Incubators as innovation intermediaries could be employed for green economic development” and creating a window of opportunity to create “green jobs” (Gliedt *et al.*, 2018).

Sustainability and growth, suited to sustainable transitions and the circular economy, seem to have been neglected by traditional entrepreneurs, according to Millette *et al.* (2020). However, science, technology and innovation have been seen to achieve sustainable development goals (SDGs) through start-ups (Surana *et al.*, 2020). The so-called sustainable development start-ups (SDSs) are high-risk ventures for investment, which, with a network of financial support, investments, and knowledge, could reduce these restrictions, according to Van Rijnsoever (2022).

There is an emerging field of research called “Sustainable Entrepreneurial Ecosystems”, aiming at the nexus between entrepreneurship and sustainability, in which the explicit link with the SDGs appears as the current stage of evolution of this field, according to Volkmann *et al.* (2021). Bajwa *et al.* (2021) identifies the concept of sustainability with alignment with sustainable development and reports that despite the private sector having a proactive stance towards the SDGs, the initiatives have not gained scale. The authors explore the concept of thematic incubation for corporate sustainability to meet global development agendas through innovation, products, and services. The Sustainable Development Goals involve ending poverty, protecting the planet, and improving the lives of people everywhere. There are seventeen goals that were adopted by all UN Member States in 2015, as part of the 2030 Agenda for Sustainable Development, in which a 15-year plan was established for achieving the goals (UN).

The circular economy concept, in turn, would seek to integrate economic growth and sustainability. Aiming to extend the useful life of resources and minimize waste through reuse, recycling, repairs, and remanufacturing. In this cycle proposed by the circular economy, four components would be necessary for the concept: 1) resource recirculation, demand minimization and waste value recovery, 2) a multilevel approach, 3) its indication as a means for sustainable development, and 4) a close relationship with the form of innovation in society. (Prieto-Sandoval *et al.*, 2018).

Innovation studies have discussed ways and policies to deal with climate change and accelerate the transition to sustainability (Fagerberg, 2018). Eco-innovations, one of these forms, are determined by drivers and barriers that affect companies that decide to innovate with a focus on sustainable transition (Kiefer *et al.*, 2019). The drivers are

resources, competences, physical capacity, involvement in green supply chains, corporate culture favorable to eco-innovation, technology, market attraction and internal financial resources, according to research by Kiefer *et al.* (2019).

In a systematic review work on innovation intermediaries in transitions to sustainability, Gliedt *et al.* (2018) found studies on innovation intermediaries as incubators and accelerators with a focus on sustainability. These intermediaries play the role of providing information, services, and mediation, connecting activities and institutions by disseminating new technologies and practices (Gliedt *et al.*, 2018). In the field of research on business incubators, there are research topics and interests related to types of incubators. The specializations in the practice of incubation and developed through studies encompass the theme of sustainability, which, although it is explored, has not had its development reviewed or structured. If this complex and dispersed field of studies also has a high production of academic publications (Deyanova *et al.*, 2022), it is necessary to seek to consolidate the themes and research paths. To structure the knowledge of the studies carried out and available approaches for future research and solutions to current and future problems.

The analysis data presented in this section serve to establish the subject and the evolution of both the context related to sustainability and the evolution of the incubators and the connection between the themes identified. From the literature it is also possible to identify main ideas under discussion. We propose an initial contextualization also of a bibliometric nature to situate the results on incubators and sustainability.

### 3.1 Sustainability and incubators

Thus, we raise the issue of sustainability from the descriptor “Sustainability” in the Scopus database. The descriptor “Sustainability” in the title in combination with one of the keywords “Sustainable Development”, “Sustainability”, “Sustainable Development Goals”, “Sustainable Development Goal”, “SDGs”, “Sustainable Development Goals (SDGs)”, extracting only documents from the “Business” area, 3,800 documents were found. The figures below show the Number of articles published per year (Fig.4), main journals (Fig.5), authors (Fig.6) and countries of origin (Fig.7), for the descriptor “Sustainability” (in title) combined with the keyword Sustainable Development Goals. Here, strictly considering documents such as original and review articles, from 2015 to 2021. On average, 1,841 articles were published per year. Adding a total of 12,891 documents in 7 years (2015-2021). The year 2015 was the starting point for the SDGs.

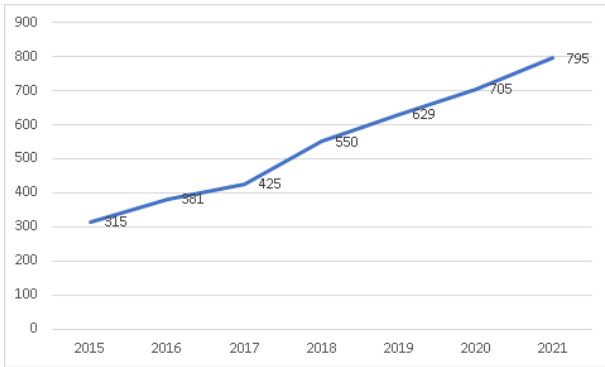


Fig. 4: Sustainability combined with Sustainable Development Goals; articles published per year

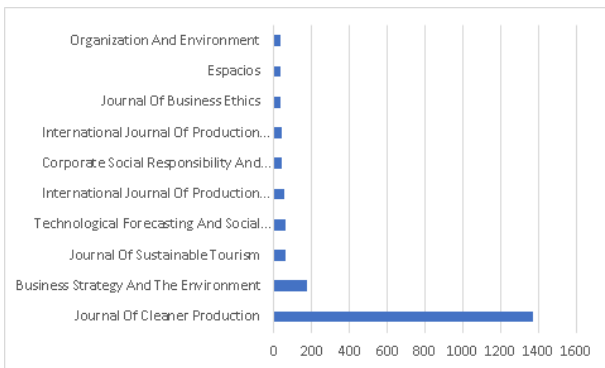


Fig. 5: Sustainability combined with Sustainable Development Goals, main journals

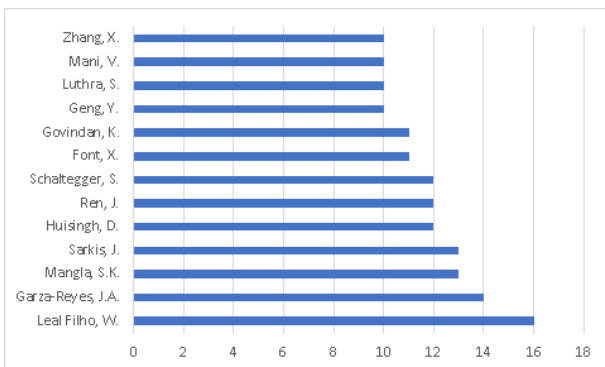


Fig. 6: Sustainability combined with Sustainable Development Goals, authors

The growth of research on this topic and publications already reflects the relevance of this topic. On the other hand, research on business incubators also has an evolution. By offering services, knowledge and access to networks to entrepreneurs, business incubators can help to develop new businesses, products and services intensive in scientific and technological knowledge that improve environmental conditions. What happens from the business incubation experience of each country where the

incubators are located is related to economic, social and environmental aspects of each country and region, the institutions, the business culture, innovation policies and their own regulations which can represent barriers or incentives for the incubation of companies aimed at sustainability. The Table 6 shows the distribution of selected studies by country of origin.

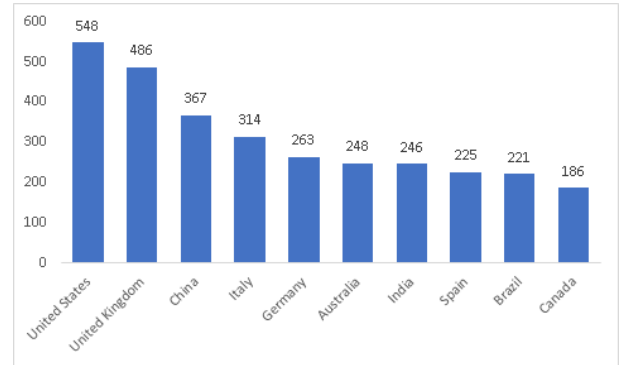


Fig. 7: Sustainability combined with Sustainable Development Goals, countries of origin

Table.3: Articles selected by number of documents published by country and number of citations obtained

| Country           | Documents | Citations |
|-------------------|-----------|-----------|
| 1. United States  | 6         | 30        |
| 2. Sweden         | 4         | 28        |
| 3. Brazil         | 2         | 16        |
| 4. Germany        | 2         | 19        |
| 5. India          | 2         | 14        |
| 6. Italy          | 1         | 18        |
| 7. Netherlands    | 1         | 22        |
| 8. Australia      | 1         | 11        |
| 9. United Kingdom | 1         | 75        |
| 10. China         | 1         | 28        |

In this sense, with recent studies conducted and a field growing, creates a need for new literature reviews and updates. Specifically, to the issue of sustainability, climate change, SDG, and Circular Economy, these are emerging themes in relation to the future. Table 4 shows selected studies about these issues, the number of citations obtained and year of publication. Table 5 shows the main journals.

Table.4: Table caption above the table

| Year                         | Document Title                                                                                                                       | Cited |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|-------|
| Fonseca and Jabbour, 2012    | Assessment of business incubators' green performance: A framework and its application to Brazilian cases.                            | 26    |
| Fonseca, 2015                | Business incubators as vectors to the promotion of clean technologies in small firms: Limits and possibilities                       | 0     |
| Bank and Kanda, 2016         | Tenant recruitment and support processes in sustainability-profiled business incubators.                                             | 13    |
| Hernández and Carrà, 2016    | A conceptual approach for business incubator interdependencies and sustainable development.                                          | 12    |
| Bank et al., 2017            | Sustainability-profiled incubators and securing the inflow of tenants–The case of Green Garage Berlin.                               | 25    |
| Gliedt et al., 2018          | Innovation intermediaries accelerating environmental sustainability transitions.                                                     | 77    |
| Lamine et al., 2018          | Technology business incubation mechanisms and sustainable regional development.                                                      | 46    |
| Baskaran et al., 2019        | Inclusive entrepreneurship, innovation and sustainable growth: Role of business incubators, academia and social enterprises in Asia. | 7     |
| Battistoni and Barbero, 2019 | Systemic Incubator for Local Eco Entrepreneurship to Favour a Sustainable Local Development: Guidelines Definition.                  | 3     |
| Gonsalves and Rogerson, 2019 | Business incubators and green technology: The Gauteng Climate innovation Centre, South Africa                                        | 2     |
| Klofsten et al., 2020        | Incubator specialization and size: Divergent paths towards operational scale                                                         | 12    |
| Millette et al.,             | Business incubators as                                                                                                               | 19    |

|                       |                                                                                                                                                                     |    |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 2020                  | effective tools for driving circular economy.                                                                                                                       |    |
| Surana et al., 2020   | Strengthening science, technology, and innovation-based incubators to help achieve Sustainable Development Goals: Lessons from India.                               | 16 |
| Bajwa et al., 2021    | Co-Producing Knowledge Innovation through Thematic Incubators for Disaster Risk Reduction and Sustainable Development in India.                                     | 1  |
| Hull et al., 2021     | Challenges and opportunities in building circular-economy incubators: Stakeholder perspectives in Trinidad and Tobago.                                              | 9  |
| Deyanova et al., 2022 | Hatching start-ups for sustainable growth: a bibliometric review on business incubators.                                                                            | 0  |
| Van Rijnsoever, 2022  | Intermediaries for the greater good: How entrepreneurial support organizations can embed constrained sustainable development startups in entrepreneurial ecosystems | 1  |

Table.5: The main Journals cited by the selected articles

| Reference Journals in selected studies      | Documents |
|---------------------------------------------|-----------|
| Journal Of Cleaner Production               | 77        |
| Technological Forecasting and Social Change | 15        |
| Journal Of Technology Transfer              | 35        |
| Technovation                                | 30        |
| Research Policy                             | 26        |
| Entrepreneurship Theory and Practice        | 14        |
| Journal Of Business Venturing               | 14        |
| Journal Of Industrial Ecology               | 14        |
| Small Business Economics                    | 13        |
| Entrepreneurship Theory and Practice        | 12        |

These eleven main reference sources are sources for literature on the topic and dissemination. In this context, 5 main high-impact journals also stand out: Journal Of



Cleaner Production (4 selected studies; 77 references); Technological Forecasting And Social Change (2 selected studies; 15 references); Journal Of Technology Transfer (1 study and 35 references); Research Policy (1 study selected; 26 references); and, Technovation (1 selected studies; 30 references). The distribution of the selected studies by the main countries that produced them, has as main: the United States, Sweden, Brazil, Germany, and India.

In the selected literature, we found differences in the application of the notion of sustainability that allow the concept linked to the global environmental issue and to a sustainability of the incubator as an organization, of the incubated and that extends to business and sustainable or self-sustainable entrepreneurship. In this regard, a first analysis made it possible to distinguish two basic groupings to emphasize the application of sustainability. The first emphasize (Table 6) linked to the effectiveness and sustainability in the sense of survival of the incubator-business. And the second emphasize refers to the treatment of the aspect of social, economic, and environmental sustainability approaching SDG, circular economy, and green economy.

Table.6: Emphasis from the selected articles: Self-Sustainable incubator and the Economic Growth

| Author (YEAR)                    | Emphasis 1 Self-Sustainable                       |
|----------------------------------|---------------------------------------------------|
| Ahmed, et al. (2022)             | Sustainable growth of entrepreneurship            |
| Franco, et al.(2021)             | Business sustainability; Economic growth          |
| Deyanova, et al. (2022)          | Sustainable growth                                |
| Gao & Hu (2017)                  | Self-sustaining incubator                         |
| Sun & Cheng (2021)               | Incubator efficiency; sustainable economic growth |
| McAdam & Marlow (2008)           | Incubator sustainability                          |
| Ssekiziyivu & Banyenzaki, (2021) | Sustainability of incubators                      |
| Carayannis & von Zedtwitz (2005) | Sustainable economic growth                       |
| Baskaram, et al. (2019)          | Sustainable growth                                |
| Romein & Trip (2017)             | Cluster sustainable development                   |
| Hernández & Carrà (2016)         | Sustainable development                           |
| Almeida, et al. (2011)           | Sustainability                                    |

The second emphasis (Table 67 refers to the treatment of the external aspect of sustainability, in the sense of sustainable development linking social, economic, and environmental issues. In this other approach and application of the notion of sustainability is the approximation of what the sustainable transition proposes. In this emphasis also uses terms such as eco-entrepreneurship, eco-innovation, sustainable products, green performance, green Jobs, and sustainability-oriented incubators, in this emphasis.

Table.7: Emphasis from the selected articles: Sustainable Development

| Author (YEAR)                                  | Emphasis 2 Sustainable Development                                               |
|------------------------------------------------|----------------------------------------------------------------------------------|
| Bajwa, et al. (2021).<br>Surana, et al. (2020) | SDG                                                                              |
| Millette et al. (2020)                         | Circular economy                                                                 |
| Gliedt, et al. (2018)                          | Sustainability transitions; green economic development                           |
| Lopolito, et al. (2022)                        | Sustainability transitions                                                       |
| Battistoni & Barbero (2019)                    | Eco-entrepreneurship, eco-innovation opportunities; environmental sustainability |
| Klofsten, et al. (2020)                        | Sustainability; sustainability-oriented incubators                               |
| Yamamoto & dos Reis Coutinho (2019)            | Economic and environmental sustainability                                        |
| Van Rijnsoever (2022)                          | Sustainable Development Start-ups                                                |
| Battering & Masurel (2020)                     | Sustainable development; Sustainable business incubators                         |
| Bank, et al. (2017)                            | Sustainability-oriented incubator                                                |
| Fonseca & Chiappetta Jabbour (2012)            | Green performance of incubators                                                  |
| Blankenship et al. (2009)                      | Sustainable development Strategic (SSD); sustainable products                    |
| Ho & Yoon (2022)                               | Social Innovation                                                                |

In an analysis of the occurrence of the keywords in the selected documents, we visualized the links in the most used keywords and the formation of networks and density

clusters. These links allow visualizing, knowing, and suggesting the formation of clusters as sub-themes as a set of ideas that have been shaping these studies. The Fig. 8 shows the links between keywords.

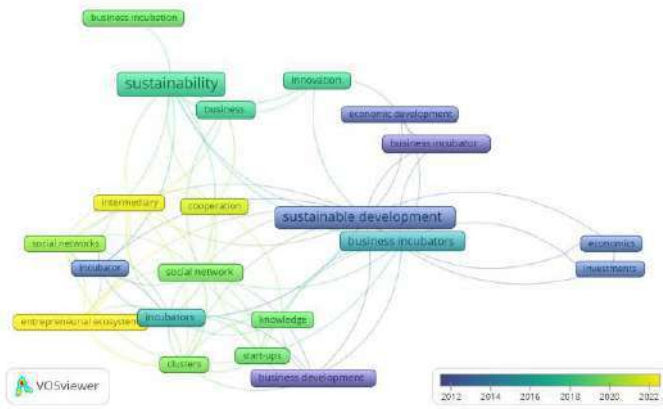


Fig. 8: Network visualization of keywords in selected articles

The Fig. 9 shows clusters of Density map by co-occurrence of the most used words in the selected articles. This serves to illustrate domains that relates incubators and the application of the concept of sustainability.

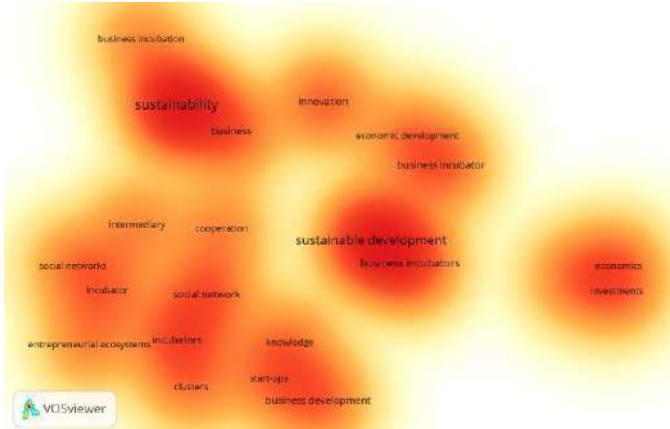


Fig. 9: Density map by co-occurrence of the most used words in the selected articles

For a discussion of these points about the keywords, Emphasis 1 (Self-Sustainable) and Emphasis 2 (Sustainable Development) on the question of the application of the concept of sustainability in studies on business incubators, we can demonstrate a relationship between these elements, still little analyzed in in-depth studies and literature reviews, which can contribute to clarifying the vision of the field of business incubation regarding the involvement with sustainability issues.

Thus, a sample of these works contributes to researchers and practitioners who have the objective of

knowing the panorama of existing studies on incubators with a focus on the application of the concept of sustainability. More in-depth reviews can identify reasons for the differences in the application of the term sustainability in studies and seek practical cases on sustainable incubators with a sustainability profile (Bank et al., 2017).

In seeking to answer the research question on how the concept of sustainability is applied in research on business incubators, we visualize characteristics of the use of the notion of sustainability in business incubators. In which we highlight as main points the Emphasis 1 Self-Sustainable and Emphasis 2 Sustainable Development and identified keywords. This study aims to inform the public about the literature through the techniques of citation analysis, network of authors' keywords and literature analysis, based on original articles and review in Scopus and Web of Science databases.

It can be established that the topic is in initial evolution both in the context of sustainability and in the connection with incubators (Battering & Masurel, 2020). From the literature, it was possible to identify the main ideas and a bibliographic contextualization to situate those interested in the relationship between incubators, sustainability and sustainable development (Hernández & Carrà 2016).

Thus, the results of the review and analysis demonstrate that studies on incubators can advance theoretically and empirically in the field of entrepreneurship for sustainability, Eco-entrepreneurship, eco-innovation opportunities, Sustainability transitions; green economic development (Battistoni & Barbero, 2019; Gliedt, et al., 2018). Based on the literature, it is possible to identify pioneering studies in the area in relation to the theme that point to sustainable development, green performance of incubators and Sustainable economic growth (Fonseca & Chiappetta Jabbour, 2012; Blankenship, et al., 2009; Carayannis & Von Zedtwitz, 2005). This demands new contributions and studies.

Specifically, it is possible to integrate the themes of incubation for sustainability as a necessary strategic action that can collaborate to bring together agents interested in the development of eco-innovations and in the practical perspective of the circular economy (Millette et al., 2020).

This study, as presented, helped to identify new terms related to sustainability such as the SDGs, eco-innovations and circular economy that may represent trends and areas of interest in the topic. And it indicates that there may be new research gaps that can be explored by future studies, in a research continuity.

This review identifies uses and links between the topic of business incubators and the concept of sustainability,

observing differences in the application of the term that can be an initial difficulty. although the results of the review and analysis show that sustainable development has had new contributions that can bring together agents interested in entrepreneurship linked to eco-innovations and in the circular economy perspective, for example.

It appears that in the different uses of the term sustainability, a promising line of work may be the identification of new terms linked to sustainability such as the SDGs, eco-innovations and circular economy that may represent trends and areas of interest in the incubator theme. This may indicate new research gaps to be explored by other studies.

When considering the limits of the results and the approach used, it can be considered that the evolution of research on the subject still demands more precise specifications in future research in the studies of incubators with different uses and notions of sustainability. These elements can be considered analytically and in the face of practical problems linked to sustainable development.

As an overview of this thematic articulation, the articles and periodicals identified can allow the follow-up of the evolution of research based on the use and notion of sustainability. Faced with the research question, the different possibilities of use for the term sustainability, generate a difficulty and a line of work that demands new contributions in theoretical and practical studies.

## CONCLUSION

This review identifies uses and links between business incubators and the concept of sustainability, noting differences in the application of the term. Studies of business incubators can be identified by different uses of notions about sustainability. These elements can be considered analytically and make it possible to associate incubation with sustainability in relation to practical problems linked to sustainable development.

This study, as presented, helped to identify new terms related to sustainability such as the SDGs, eco-innovations and circular economy that may represent trends and areas of interest in the topic. As limitations, we can highlight the lack of definition of concepts and a clear research agenda on the topic of sustainability and incubators.

There is, therefore, an opportunity for the development of new studies aimed at sustainable development, considering the emerging field of research. It is suggested that future work may deepen and expand the dialogue between business incubators and the focus on sustainability.

New studies can analyze the relationship between authors and the most influential references as indicative of this initial basis on the subject. The findings of the review highlight that current knowledge is still being expanded and the characteristics of the phenomenon of incubators in relation to the theme of sustainability still need to be deepened and its expansion can strengthen the role of incubators in sustainable development.

## ACKNOWLEDGEMENTS

The authors would like to thank for financial support from the Fundação de Amparo à Pesquisa do Estado da Bahia (FAPESB), Term of Grant No. BOL0552/2019, REQUEST No. 2116/2019.

## REFERENCES

- [1] Ahmed, N., Li, C., Qalati, S. A., ur Rehman, H., Khan, A., & Rana, F. (2020). Impact of Business Incubators on Sustainable Entrepreneurship Growth with Mediation Effect. *Entrepreneurship Research Journal*, 12, n. 2, p. 137-160, 2022.
- [2] Albort-Morant, G., & Ribeiro-Soriano, D. (2016). A bibliometric analysis of international impact of business incubators. *Journal of Business Research*, 69(5), 1775-1779.
- [3] Almeida, M., Borin, E., Álvarez, C. M., Terra, B., & BIANCheTTI, T. (2011). Analysis of the Rio de Janeiro State Incubator Network (ReINC): characteristics and influence on the organization and sustainability of incubators. *Interciencia*, 36(3), 172-177.
- [4] Bajwa, S., Dabral, A., Chatterjee, R., & Shaw, R. (2021). Co-Producing Knowledge Innovation through Thematic Incubators for Disaster Risk Reduction and Sustainable Development in India. *Sustainability*, 13(4), 2044.
- [5] Bank, N., & Kanda, W. (2016). Tenant recruitment and support processes in sustainability-profiled business incubators. *Industry and Higher Education*, 30(4), 267-277.
- [6] Bank, N., Fichter, K., & Klofsten, M. (2017). Sustainability-profiled incubators and securing the inflow of tenants—The case of Green Garage Berlin. *Journal of Cleaner Production*, 157, 76-83.
- [7] Baskaran, A., Chandran, V. G. R., & Ng, B. K. (2019). Inclusive entrepreneurship, innovation and sustainable growth: Role of business incubators, academia and social enterprises in Asia. *Science, Technology and Society*, 24(3), 385-400.
- [8] Battering, T., & Masurel, E. (2020). Business Incubators and Their Engagement in Sustainable Development Activities: Empirical Evidence from Europe. *International Review of Entrepreneurship*, 18(2).
- [9] Battistoni, C., & Barbero, S. (2019). Systemic Incubator for Local Ecoentrepreneurship to Favour a Sustainable Local Development: Guidelines Definition. *The design journal*, 22(sup1), 65-83.

- [10] Blankenship, H., Kulhavý, V., & Lagneryd, J. (2007). Introducing strategic sustainable development in a business incubator. *Progress in Industrial Ecology*, 6, n. 3, p. 243-264, 2009.
- [11] Bøllingtoft, A. (2012). The bottom-up business incubator: Leverage to networking and cooperation practices in a self-generated, entrepreneurial-enabled environment. *Technovation*, 32(5), 304-315.
- [12] Bøllingtoft, A., & Ulhøi, J. P. (2005). The networked business incubator—leveraging entrepreneurial agency?. *Journal of business venturing*, 20(2), 265-290.
- [13] Booth, A., Sutton, A., Clowes, M., & Martyn-St James, M. (2021). *Systematic Approaches to a Successful Literature Review*; SAGE: Thousand Oaks, CA, USA, 2016.
- [14] Cap, J. P., Blaich, E., Kohl, H., von Raesfeld, A., Harms, R., & Will, M. (2019). Multi-level network management—A method for managing inter-organizational innovation networks. *Journal of Engineering and Technology Management*, 51, 21-32.
- [15] Carayannis, E. G., Popescu, D., Sipp, C., & Stewart, M. (2006). Technological learning for entrepreneurial development (TL4ED) in the knowledge economy (KE): Case studies and lessons learned. *Technovation*, 26(4), 419-443.
- [16] Carayannis, E. G., & Von Zedtwitz, M. (2005). Architecting gloCal (global–local), real-virtual incubator networks (G-RVINs) as catalysts and accelerators of entrepreneurship in transitioning and developing economies: lessons learned and best practices from current development and business incubation practices. *Technovation*, 25(2), 95-110.
- [17] Castro, G. D. R., Fernandez, M. C. G., & Colsa, Á. U. (2021). Unleashing the convergence amid digitalization and sustainability towards pursuing the Sustainable Development Goals (SDGs): A holistic review. *Journal of Cleaner Production*, 280, 122204.
- [18] Chan, K. F., & Lau, T. (2005). Assessing technology incubator programs in the science park: the good, the bad and the ugly. *Technovation*, 25(10), 1215-1228.
- [19] Deyanova, K., Brehmer, N., Lapidus, A., Tiberius, V., & Walsh, S. (2022). Hatching start-ups for sustainable growth: a bibliometric review on business incubators. *Review of Managerial Science*, 1-27.
- [20] Eveleens, C. P., van Rijnsoever, F. J., & Niesten, E. M. (2017). How network-based incubation helps start-up performance: a systematic review against the background of management theories. *The Journal of Technology Transfer*, 42(3), 676-713.
- [21] Etzkowitz, H. (2002). Incubation of incubators: innovation as a triple helix of university-industry-government networks. *Science and Public Policy*, 29(2), 115-128.
- [22] Fagerberg, J. (2018). Mobilizing innovation for sustainability transitions: A comment on transformative innovation policy. *Research Policy*, 47(9), 1568-1576.
- [23] Fonseca, S. A., & Jabbour, C. J. C. (2012). Assessment of business incubators' green performance: A framework and its application to Brazilian cases. *Technovation*, 32(2), 122-132.
- [24] Fonseca, S. A. (2015). Business Incubators as Vectors to the Promotion of Clean Technologies in Small Firms: Limits and Possibilities. *RAM. Revista de Administração Mackenzie*, 16(1), 188-212.
- [25] Franco, M., Neves, D., Haase, H., & Rodrigues, M. (2021). The importance of intellectual capital in networks formed by start-ups. *International Journal of Organizational Analysis*, 2021. Article.
- [26] de Freitas, F. V., Gomes, M. V. M., & Winkler, I. (2022). Benefits and challenges of virtual-reality-based industrial usability testing and design reviews: a patents landscape and literature review. *Applied Sciences*, 12(3), 1755.
- [27] Gao, Y., & Hu, Y. (2017). The upgrade to hybrid incubators in China: a case study of Tuspark incubator. *Journal of Science and Technology Policy Management*, 8(3), 331-351.
- [28] Gliedt, T., Hoicka, C. E., & Jackson, N. (2018). Innovation intermediaries accelerating environmental sustainability transitions. *Journal of Cleaner Production*, 174, 1247-1261.
- [29] Gonsalves, M., & Rogerson, J. M. (2019). Business incubators and green technology. *Urbani Izziv*, 30, 212-224.
- [30] Hackett, S. M., & Dilts, D. M. (2004). A systematic review of business incubation research. *The Journal of Technology Transfer*, 29(1), 55-82.
- [31] Hansen, M. T., Chesbrough, H. W., Nohria, N., & Sull, D. N. (2000). Networked incubators. *Harvard business review*, 78(5), 74-84.
- [32] Hausberg, J. P., & Korreck, S. (2020). Business incubators and accelerators: a co-citation analysis-based, systematic literature review. *The Journal of Technology Transfer*, 45(1), 151-176.
- [33] Hernández, R., & Carrà, G. (2016). A conceptual approach for business incubator interdependencies and sustainable development. *Agriculture and Agricultural Science Procedia*, 8, 718-724.
- [34] Ho, J. Y., & Yoon, S. (2022). Ambiguous roles of intermediaries in social entrepreneurship: The case of social innovation system in South Korea. *Technological Forecasting and Social Change*, 175, 121324.
- [35] Huggins, R., Johnston, A., & Thompson, P. (2012). Network capital, social capital and knowledge flow: how the nature of inter-organizational networks impacts on innovation. *Industry and Innovation*, 19(3), 203-232.
- [36] Hughes, M., Ireland, R. D., & Morgan, R. E. (2007). Stimulating dynamic value: Social capital and business incubation as a pathway to competitive success. *Long Range Planning*, 40(2), 154-177.
- [37] Hull, C. E., Millette, S., & Williams, E. (2021). Challenges and opportunities in building circular-economy incubators: Stakeholder perspectives in Trinidad and Tobago. *Journal of Cleaner Production*, 296, 126412.
- [38] Järvensivu, T., & Möller, K. (2009). Metatheory of network management: A contingency perspective. *Industrial Marketing Management*, 38(6), 654-661.
- [39] Kiefer, C. P., Del Rio Gonzalez, P., & Carrillo-Hermosilla, J. (2019). Drivers and barriers of eco-innovation types for sustainable transitions: A quantitative perspective. *Business Strategy and the Environment*, 28(1), 155-172.

- [40] Klofsten, M., Lundmark, E., Wennberg, K., & Bank, N. (2020). Incubator specialization and size: Divergent paths towards operational scale. *Technological Forecasting and Social Change*, 151, 119821.
- [41] Lamine, W., Mian, S., Fayolle, A., Wright, M., Klofsten, M., & Etzkowitz, H. (2018). Technology business incubation mechanisms and sustainable regional development. *The Journal of Technology Transfer*, 43(5), 1121-1141.
- [42] Lopolito, A., Falcone, P. M., & Sica, E. (2022). The role of proximity in sustainability transitions: A technological niche evolution analysis. *Research Policy*, 51(3), 104464.
- [43] Markard, J., Raven, R., & Truffer, B. (2012). Sustainability transitions: An emerging field of research and its prospects. *Research policy*, 41(6), 955-967.
- [44] McAdam, M., & McAdam, R. (2006). The networked incubator: The role and operation of entrepreneurial networking with the university science park incubator (USI). *The International Journal of Entrepreneurship and Innovation*, 7(2), 87-97.
- [45] McAdam, M., & Marlow, S. (2008). A preliminary investigation into networking activities within the university incubator. *International Journal of Entrepreneurial Behavior & Research*, 14(4), 219-241.
- [46] Mian, S. A. (2021). Whither modern business incubation? Definitions, evolution, theory, and evaluation. In *Handbook of Research on Business and Technology Incubation and Acceleration*. Edward Elgar Publishing.
- [47] Millette, S., Hull, C. E., & Williams, E. (2020). Business incubators as effective tools for driving circular economy. *Journal of cleaner production*, 266, 121999.
- [48] Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Systematic Reviews*, 10(1), 1-11.
- [49] Prieto-Sandoval, V., Jaca, C., & Ormazabal, M. (2018). Towards a consensus on the circular economy. *Journal of cleaner production*, 179, 605-615.
- [50] ROMEIN, A., & TRIP, J. (2017). The role of business incubators in the development of sustainable clusters of cultural and creative industries. *International Journal of Sustainable Development and Planning*, 12(3), 435-445.
- [51] Schwartz, M., & Hornych, C. (2010). Cooperation patterns of incubator firms and the impact of incubator specialization: Empirical evidence from Germany. *Technovation*, 30(9-10), 485-495.
- [52] Secundo, G., Ndou, V., Del Vecchio, P., & De Pascale, G. (2020). Sustainable development, intellectual capital and technology policies: A structured literature review and future research agenda. *Technological Forecasting and Social Change*, 153, 119917.
- [53] Ssekiziyivu, B., & Banyenzaki, Y. (2021). Business incubation practices and sustainability of incubatee start-up firms in Uganda. *Cogent Business & Management*, 8(1), 1963168.
- [54] Sun, X., & Cheng, Y. (2021). Sustainable efficiency evaluation of regional state-level technology business incubating service systems in China: A dynamic two-stage slacks-based measure approach. *Journal of Cleaner Production*, 279, 123688.
- [55] Surana, K., Singh, A., & Sagar, A. D. (2020). Strengthening science, technology, and innovation-based incubators to help achieve Sustainable Development Goals: Lessons from India. *Technological Forecasting and Social Change*, 157, 120057.
- [56] Theodorakopoulos, N., Kakabadse, N. K., & McGowan, C. (2014). What matters in business incubation? A literature review and a suggestion for situated theorising. *Journal of small business and enterprise development*.
- [57] Tötterman, H., & Sten, J. (2005). Start-ups: Business incubation and social capital. *International small business journal*, 23(5), 487-511.
- [58] van Rijnsoever, F. J. (2022). Intermediaries for the greater good: How entrepreneurial support organizations can embed constrained sustainable development startups in entrepreneurial ecosystems. *Research Policy*, 51(2), 104438.
- [59] Volkmann, C., Fichter, K., Klofsten, M., & Audretsch, D. B. (2021). Sustainable entrepreneurial ecosystems: an emerging field of research. *Small Business Economics*, 56(3), 1047-1055.
- [60] Yamamoto, P. T., & Coutinho, A. D. R. (2019). Technological parks in the state of Paraná, Brazil: evaluation based on economic and environmental sustainability. *International Journal of Innovation and Sustainable Development*, 13(2), 117-135.

# Environmental Taxation: Importance and International and National Experiences of its Application

## Tributação Ambiental: Importância e Experiências Internacionais e Nacionais de sua aplicação

Isa Guimarães Duarte<sup>1</sup>, Caio Coêlho de Oliveira<sup>2</sup>, Alessandra Renata Freitas Fontes<sup>3</sup>

<sup>1</sup>Advogada, Especialista em Direito Tributário, Mestranda em Território Ambiente e Sociedade, Universidade Católica do Salvador, Brasil.

<sup>2</sup>Advogado, Mestre em Direito, Doutorando em Território Ambiente e Sociedade, Bolsista CAPES, Universidade Católica do Salvador, Brasil.

<sup>3</sup>Advogada, Mestre em Planejamento Ambiental, Doutouranda em Território Ambiente e Sociedade, Universidade Católica do Salvador, Brasil.

Received: 06 Aug 2022,

Received in revised form: 02 Sep 2022,

Accepted: 07 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Tributação Ambiental, meio ambiente, políticas públicas, tributos, proteção ambiental.*

**Abstract**— *This research aims to study taxation as incentives for environmental protection. It is a study that explores, through national and international experiences, the mechanisms of taxation application to achieve this end. The present research was carried out by means of a bibliographic review through periodicals, conpedios and theses of the most significant authors in the area of Environmental taxation. In the end, it was understood that even though it is an important mechanism of behavioral change, it is little used in Brazil.*

**Resumo**— *A presente pesquisa tem por objetivo o estudo da tributação como incentivos a proteção Ambiental. Trata-se de um estudo que explora por meio das experiências nacionais e internacionais os mecanismos de aplicação da tributação para almejar tal fim. A presente pesquisa foi realizada por meio de revisão bibliográfica por meio de periodicos, conpedios e teses dos autores mais significativos da area da tributação Ambiental. Ao final, compreendeu-se que mesmo se tratando de um importante mecanismo de mudança comportamental é pouco utilizado no Brasil.*

### I. INTRODUÇÃO

A pesquisa tem por temática o estudo da tributação para fins de proteção ambiental. Os países emergentes, como o Brasil, possuem grandes dificuldades em equilibrar o desenvolvimento econômico e suas implicações com a proteção dos recursos naturais pois são influenciados pelos países desenvolvidos na implantação de indústrias e tecnologias que agredem o meio ambiente.

Por isso surge a necessidade de políticas públicas de induzam a um comportamento sustentável. Isto não

significa, por sua vez, que o meio ambiente deve ser intocável, mas requer que o ente público tome medidas de proteção, estas, advindas por meio de políticas públicas para um desenvolvimento que equilibre para uma vida digna, uma sociedade mais igualitária, o desenvolvimento econômico em equilíbrio com um meio ambiente natural protegido.

Desta forma explora-se de que maneira os incentivos tributários podem induzir um comportamento sustentável a sociedade brasileira. Para tanto a pesquisa

pautou-se em uma revisão bibliográfica de autores atuais e significativos para a pesquisa da tributação ambiental e optou-se por uma exploração das experiências internacionais e nacionais da tributação com finalidade de tutela ambiental.

Para tanto, abordou-se no primeiro capítulo os princípios que fundamentam a tributação ambiental, no segundo capítulo as características finalidades e conceito de tributação ambiental, no quarto capítulo as experiências internacionais e nacionais de aplicação de tributos ambientais e ao capítulo cinco as conclusões da presente pesquisa.

## II. PRINCÍPIO DO POLUIDOR-PAGADOR E USUÁRIO PAGADOR

Para Gordilho e Lyrio (2018) as necessidades humanas são ilimitadas, mas os recursos naturais que produzem esses bens são limitados, por isso a necessidade de proteger o meio ambiente. Existe uma diferença entre os bens econômicos e os recursos naturais intitulados como bens livres. Os bens econômicos são estudados por meio da economia e seguem as leis do mercado, ou seja, majoração e minoração dos preços de acordo com a oferta e demanda. No entanto, os bens livres não podem seguir esta lógica de mercado porque não são bens que possuem valor econômico e é neste sentir que a partir das externalidades ocasionadas pela atividade econômica, podem surgir impactos ao meio ambiente.

Ocorre que estas externalidades negativas, como visto na sessão anterior, não são integradas ao preço dos produtos e por isso se tornam custos sociais que muitas vezes podem interferir no futuro do ecossistema terrestre. É a partir deste cenário que surge a necessidade da economia, do direito, ecologia e das demais ciências, por meio de um olhar integrado e sistêmico solucionar o problema das externalidades negativas ocasionadas pela atividade econômica. (NUNES, 2005, AZEVEDO, 2017; AYDOS, 2010)

É a partir da preocupação com a internalização dos custos das externalidades negativas, que os organismos internacionais na declaração do Rio sobre o meio ambiente na conferencia ocorrida em 1992, surge o princípio do poluidor-pagador. Este que não deve ser conceituado como o direito de poluir, ou seja, não é que o agente que polui pode após o ato poluente pagar por isto. O princípio surgiu para reforçar que aquele que polui deve arcar com os custos de seus atos poluidores, bem como provocar que os agentes realizem atos de prevenção contra os atos poluentes. (SILVA, 2017).

Segundo Monteiro (2011) no Brasil, o princípio do poluidor-pagador está fundamentado com a lei 6.938 de 1981 e na constituição federal em seu art. 225 § 3. Segundo a lei disciplinada, esta dispõe sobre a política nacional do meio ambiente para sua aplicação e possíveis aplicações de políticas públicas. De acordo com o art. 4, VII da referida lei, lembra Pinto (2017, p. 122) que será efetuado uma imposição ao usuário pagador da contribuição pela utilização dos recursos ambientais com fins econômicos, e a imposição ao poluidor pagador e ao predador, da obrigação de recuperar e ou indenizar os danos causados. Já a Constituição Federal em seu art. 225 §3 expõe que "as condutas e atividades consideradas lesivas ao meio ambiente sujeitarão os infratores, pessoas físicas ou jurídicas, a sanções penais e administrativas, independentemente da obrigação de reparar os danos causados" (BRASIL, 1988).

Desta maneira compreende-se como lembra Gordilho e Lyrio (2018) que o princípio do poluidor-pagador reflete a internalização dos custos decorrentes da atividade econômica pelo poluidor por meio da eliminação, reparação ou prevenção do dano ambiental. Nesta medida, aquele que realizar uma atividade que polua o meio ambiente ou exerça atividade que pode vir a poluir, deve ser responsabilizados e contribuir com a degradação decorrente da atividade.

De acordo com Azevedo (2017) o princípio do poluidor-pagador é suscetível a orientar políticas públicas na implantação da proteção ambiental pois, é o direito-dever do Estado em tutelar o meio ambiente ecologicamente equilibrado, noutro giro, é dever de todo cidadão em conserva-lo e utilizar dos recursos naturais de modo racional e de impactos menos agressivos ao meio ambiente.

Por sua vez, decorre do princípio do poluidor-pagador, o princípio do usuário pagador. Considera-se por meio deste princípio que o usuário não estará sujeito apenas a reparação eventual do dano que causar em razão das suas atividades. É necessário adotar mecanismos de prevenção com o objetivo de minimizar ou neutralizar os danos causados ao meio ambiente. O usuário do meio ambiente deve assumir o ônus da precaução, e assim deve incentivar pesquisas e estudos para verificar eventuais impactos ambientais da sua atividade no meio ambiente. (PINTO, 2017).

Azevedo (2017) recorda que o princípio do poluidor-pagador é o fundamento para a intervenção do Estado na sociedade para internalizar as externalidades negativas produzidas pela atividade empresarial, por meio de políticas públicas que utilizem da tributação ambiental para induzir por meio dos incentivos fiscais o

desenvolvimento das atividades voltadas para a preocupação ambiental.

Cumprir destacar que há divergência doutrinária quanto a aplicação do princípio do poluidor-pagador. Há autores como Endo (2020, p. 50), Sobral Neto (2020) que fundamentam a existência de incentivos fiscais em prol da proteção ambiental por meio do princípio do protetor-recebido. Para estes autores, a aplicação para incentivos fiscais deveria ser feita por meio da internalização das externalidades positivas e daí justificar a perspectivas de incentivos fiscais por meio do alívio da carga tributária.

Porém, coadunando com a perspectiva trazida por Azevedo (2017, p. 124), Bezerra, Papini e Noda (2021, p. 42) e Gordilho e Lyrio (2018), o princípio do poluidor-pagador (PPP) pode fundamentar perfeitamente a criação de incentivos fiscais para a atividade econômica incorporar condutas sustentáveis. O PPP visa a internalização das externalidades negativas por meio da precaução ou prevenção das atividades poluidoras, ou seja, parte da perspectiva da mudança de comportamento pelos agentes econômicos e por toda a sociedade.

Noutro giro, de acordo com Azevedo (2017), o princípio do poluidor-pagador tem origem na teoria pigouviana. Segundo Viven (2011), pigou abordava sobre a majoração do imposto pigouviano em razão da incidência de externalidades negativas bem como abordava o abrandamento do imposto em razão das externalidades positivas ocasionadas na produção econômica. De acordo com Sobral Neto (2020) o princípio do protetor recebido pode ser considerado o outro lado da moeda do princípio do poluidor-pagador. Assim, percebe-se que o princípio a ser abordado é o PPP a partir da internalização da externalidade positiva do agente econômico será reduzido o valor do tributo.

Para compreender o princípio do poluidor-pagador para justificar a tributação ambiental, faz-se necessário abordar sobre as dimensões da aplicação do princípio. Estas sendo o princípio da precaução e prevenção coadunando com a perspectiva do desenvolvimento sustentável que se verá no próximo tópico.

## **2.1 PRINCÍPIO DA PRECAUÇÃO, DA PREVENÇÃO E DESENVOLVIMENTO SUSTENTÁVEL**

Para Gordilho (GORDILHO; LYRIO, 2018), a aplicação do princípio do poluidor-pagador por meio da precaução e da prevenção engloba por óbvio a reparação. Isto porque, quando o dano ambiental ocorre, é necessário que o causador arque com os danos, seja recuperando o meio ambiente ou indenizando as vítimas do ocorrido. Mas há também um outro aspecto para a aplicação do princípio do poluidor-pagador, qual seja, a prevenção e a precaução na tentativa de se evitar os danos ambientais.

De acordo com Pinto (2017), não resta dúvidas de que os princípios da precaução e da prevenção são pontos relevantes para a proteção ambiental na medida que possui funções de gestão de risco ambiental e de aplicação direta do princípio do poluidor-pagador.

Muito embora os institutos aparentem uma similaridade, a diferença entre os princípios está na avaliação do risco ao meio ambiente. O princípio da precaução existe quando se há uma suspeita da atividade ser potencialmente lesiva ao meio ambiente. Aqui não existe certeza científica de suas consequências. Enquanto que no princípio da prevenção, ocorre em razão da efetiva configuração de risco da atividade a obrigar ao poder público e aos particulares a tomar medidas prévias a evitar a ocorrência do dano ambiental (PINTO, 2017).

Neste sentido, o princípio da prevenção engloba ações preventivas de quando há certeza de risco. Enquanto que o princípio da precaução ocorre quando não há certeza científica do risco. Para se evitar essa degradação ambiental, é necessário a adoção de medidas de incentivo aos agentes econômicos para incorporar as suas atividades medidas de prevenção e segundo Gordilho e Lyrio (2018, p. 368) essa indução a comportamentos voltados a preservação ambiental pode ser realizada por meio dos tributos.

O princípio da precaução e da prevenção, podem ser facilmente identificados no bojo da Constituição Federal em seu art. 225 caput. A necessidade de preservar e proteger o meio ambiente ecologicamente equilibrado para a presente e futura geração é a redução a termo dos princípios da precaução e da prevenção. A perspectiva é de barrar a ocorrência de um dano ambiental antes mesmo que aconteça e assim proteger o meio ambiente para o presente e as futuras gerações. (Gordilho, Lyrio, 2018)

Nesta medida, o que se busca com a aplicação e a discussão destes princípios é o equilíbrio entre a atividade econômica em consonância proteção ambiental. É por isso, que a própria Constituição Federal, em razão do art. 225 combinado com o art. 170 inciso VI impôs ao Estado, quando necessário, a interferência na ordem econômica afim de alinhar a atividade a preservação ambiental (PINTO, 2017).

Deste modo, o poluidor é quem deverá assumir com o custo da reparação, prevenção e/ou precaução, cabendo a ele adotar mecanismos de controle e eliminação dos danos produzidos em decorrência de suas atividades. Aqui, nada impede ao Estado, em razão do princípio do desenvolvimento sustentável para a interferência na ordem econômica de utilizar da tributação ambiental para impor ao poluidor a internalização das externalidades negativas ocasionadas no meio ambiente para corrigir as falhas de



mercado, ou utilizar da tributação como orientador para internalizar estas externalidades.

### III. CARACTERÍSTICAS, CONCEITOS E FINALIDADES DA TRIBUTAÇÃO ECOLÓGICA

Conforme aponta Ataliba (2016, p. 26), as normas jurídicas não disciplinam direitos, privilégios ou intenções, mas tão somente regulam comportamentos humanos. O objetivo do direito, pois, serviria para disciplinar as interações entre as pessoas, configurando os comportamentos que devem se adequar ao conteúdo mandamental da norma. Quanto às normas tributárias, estas fazem parte da conjuntura constitucional que tem por premissa básica a arrecadação de receita para o Estado ou a modulação comportamental, o que justifica a tributação sob o viés da proteção ambiental.

Os tributos quanto à sua finalidade podem ser fiscais, parafiscais ou extrafiscais. A finalidade fiscal está na característica do tributo em arrecadar aos cofres públicos, de suma importância para a organização da sociedade e cumprimento das obrigações estatais. A finalidade parafiscal por sua vez, é quando o fisco na medida que arrecada e fiscaliza, ainda poderá utilizar os valores arrecadados para a aplicação de atividades específicas. Já a extrafiscalidade, que interessa para o fundamento da tributação ambiental de incentivos, é a possibilidade de utilização do tributo para além do arrecadatório, é a possibilidade de sua utilização para prestigiar demandas sociais, econômicas bem como de proteção Ambiental.

Lembra Gonçalves e Reymão (2019, p. 14) que todo tributo tem características fiscais e extrafiscais, na medida que hoje é impossível distinguir um tributo fiscal e um tributo extrafiscal. Significa, que todo e qualquer tributo dentro do ordenamento jurídico brasileiro pode ser utilizado para fins extrafiscais. O tributo mesmo com características preponderantemente fiscal, possui determinada extrafiscalidade tributária podendo ser indutor de condutas a sociedade, econômica ou de proteção ambiental.

Segundo Endo (2020) a norma tributária é de suma importância principalmente para gerar efeitos na atividade econômica. As normas tributárias atuam diretamente com as hipóteses de incidência da atividade econômica e interferem no mercado. Pode-se lembrar do Imposto sobre serviços de qualquer natureza, cujo fato gerador está indicado como a realização de um serviço disposto na lista anexa. Para que ocorra a subsunção do fato ocorrido no mundo fenomênico e conseqüentemente a cobrança do tributo, a realização deste serviço não pode ser gratuita. Acontece que a norma tributária muitas vezes causa efeitos

na atividade econômica que não são pretendidos por ela, como é o caso da indução de comportamentos em razão da fiscalidade tributária. A majoração de uma alíquota do ISS em um determinado município para os serviços advocatícios com base no item 17 da lista anexa, em muitos casos, pode causar a migração do local da prestação do serviço para o município vizinho. Neste caso, vê-se a indução de modo involuntário da norma tributária por meio da fiscalidade (Brasil, 2003).

Já as normas tributárias que se utilizam da extrafiscalidade são diferentes. Segundo Endo (2020), são consideradas como tal, em razão da sua indução comportamental à determinadas ações sociais em razão do bem-estar da sociedade ou em proteção ao meio ambiente por meio de incentivos fiscais. Estas podem ser configuradas a título de exemplo como a utilização do ISS como indutor de construções civis que aprimorem os serviços na medida de incorporar construções preocupadas com o meio ambiente.

A história da humanidade demonstra que a utilização do Direito Tributário como elemento indutor de comportamentos não consiste em uma novidade nascida no século XXI. Em 1672, na Rússia, o Czar Pedro criou o imposto sobre a barba, com vistas a desestimular a criação de barba pelos homens, pois seu desejo era que os cidadãos tivessem uma aparência mais ocidental. No século XVII, a França instituiu tributação incidente sobre sedas, porcelanas e cosméticos, com a finalidade de desincentivar a compra desses bens por se acreditar ser fúteis na época (LEÃO, 2014).

O tributo segundo Gonçalves e Reymão (2019) é uma criação do povo para atender os anseios e desejos da sociedade. E segundo Costa (2011) nada melhor do que utilizar uma ferramenta que interfere diretamente nas economias do contribuinte para modificar condutas prejudiciais ao meio ambiente. Uma vez que, como visto, a proteção ambiental precisa ocorrer em razão das exigências internacionais, além da escassez de matérias primas, das mudanças climáticas e suas conseqüências já evidentes, como estiagens, secas, inundações, e até as extinções de espécies de animais que são fatores que modificam a vida cotidiana e até a continuidade do ser humano na terra. Esta modificação de condutas pode ser induzida por meio dos tributos seja em razão da sua majoração ou por meio de políticas de minoração dos tributos (AZEVEDO, 2017, p. 123).

Para Pinto (2017) a tributação ambiental é toda a estratégia utilizada pelo ente tributante para estimular condutas direcionadas à tutela do meio ambiente. Esta que pode ser por meio da diminuição da carga tributária ou por intermédio de um aumento da exação para a repreensão de comportamentos nocivos ao meio ambiente. No entanto,

mesmo sendo para majorar ou minorar o valor pecuniário, a tributação ambiental é a possibilidade do tributo de almejar fins de proteção ambiental.

Gonçalves e Reymão (2019) e Pinto (2017) lembra que a tributação ambiental não tem uma conceituação bem definida, sendo caracterizada como uma política pública que leva em consideração aspectos ambientais. Isto porque, segundo as autoras, existem conceitos amplos que versam sobre tributação ambiental que divergem entre os autores.

Segundo Azevedo (2017, p. 105), o tributo é considerado um dos instrumentos econômicos mais significativos para a proteção ambiental. Conforme salienta Costa (2011) e Endo (2020), a tributação ecológica também chamada de ambiental ou *eco tax* possui duas finalidades intituladas. A primeira, é considerada fiscal. A receita arrecadada pelo tributo é utilizada para custear serviços públicos destinados a preservação ambiental. Já a finalidade extrafiscal pode ser considerada como a característica do tributo que para além da sua arrecadação, possui uma característica de orientar a sociedade ou a atividade econômica a realizar condutas de preservação do meio ambiente.

Sob outra ótica, Endo (2020, p. 54) lembra que a carga tributária brasileira é extremamente alta e sua majoração poderia impactar de modo negativo na economia e no desenvolvimento social. Ainda, lembra que o tributo não pode ser considerado como sanção. O art. 3º do CTN aduz que "tributo é toda prestação pecuniária compulsória, em moeda ou cujo valor nessa se possa exprimir, que não constitua sanção de ato ilícito, instituída em lei e cobrada mediante atividade administrativa plenamente vinculada" (Brasil, 1966). Ou seja, a majoração do tributo, mesmo que para fins de proteção ambiental, poderia ser considerada um sansão aos sujeitos passivos da obrigação.

Nesta esteira, a tributação voltada a proteção ambiental que será alvo deste trabalho está relacionada com a utilização da redução da carga tributária em razão da utilização da extrafiscalidade dos tributos, na medida de conduzir a sociedade na busca por comportamentos que diminuam os impactos no meio ambiente e consequentemente melhorem a vivência, saúde da sociedade e desenvolva a economia.

Segundo Pinto (2017, p. 114) incentivo fiscal refere-se a um estímulo por meio da exoneração ou um alívio no campo da tributação. Para a autora, incentivo fiscal seria toda a estratégia utilizada pelo ente tributante para estimular condutas direcionadas á tutela do meio ambiente.

Noutro giro, para Endo (2020, p. 56) com a redução da carga tributária de um determinado imposto, a aplicação da extrafiscalidade tributária para indução de condutas

voltadas à proteção ambiental, poderia ser um fato de incremento da receita pública. De acordo com a autora, em razão da incorporação de novas tecnologias capazes de reduzir os impactos causados pelas externalidades ao meio ambiente, seria introduzido no mercado produtos que utilizarão de inovações tecnológicas no seu processo produtivo, capazes de diminuir os impactos da produção causados ao meio ambiente e indiretamente cresceria a receita estatal. Nesta medida, o Estado utilizaria da mesma lógica de orientação do IPI sobre cigarros, na medida em que o desincentivo por meio da tributação de produtos cancerígenos auxilia com a redução de gastos na esfera da saúde. Do mesmo modo, com relação aos incentivos fiscais usados para a indução dos municípios a comportamentos voltados a proteção ambiental.

Em relação as características, a tributação ecológica, pode ter duas classificações. A primeira é chamada de tributação ambiental *lato sensu* ou improprio. A característica fiscal do tributo é latente, contudo, tem alguma conotação em prol do meio ambiente. A segunda vertente, a tributação ambiental *stricto sensu* ou própria, aborda um incentivo próprio característico do tributo, de modo que a própria hipótese de incidência é uma causa ambiental (GONÇALVES; REYMÃO, 2019; AZEVEDO, 2017)

Para Gordilho (2011, p. 107-108), os tributos ambientais podem ser conceituados como aqueles que possuem uma repercussão negativa no meio ambiente, e por isso, considera que as taxas de lixo, taxas municipais de esgoto, taxas de poluição sonora, taxas florestais e de visitação podem ser consideradas como tributações próprias. Este entendimento é também consentido por Nunes (2005). A título de exemplo, para o autor, a instituição da taxa ambiental instituída pelo Estado de Pernambuco em Fernando de Noronha, cobradas a todas as pessoas não residentes ou domiciliadas que estejam por caráter turístico, é um exemplo de tributação ambiental própria na medida em que há nitidamente o caráter de preservação ecológica do meio ambiente.

De acordo com Pinto (2017), além das taxas como tributação ambiental própria, ainda caberia a criação de impostos. Em razão da competência residual instituída pelo o art. 154 I da Constituição Federal, é de competência privativa da União, a criação de impostos que não tenha fato gerador ou base de cálculo igual há outros já criados na Constituição. Ou seja, seria possível a criação de impostos ambientais pela competência residual. No entanto, garantiria apenas à União, a criação de impostos próprios ambientais, reduzindo significativamente a atuação dos outros entes tributantes para conduzir por meios dos tributos condutas ambientalmente sustentáveis.

De acordo com Costa (2011), todas as espécies tributárias podem ser utilizadas para a proteção do meio ambiente. I) Impostos, II) taxas, III) contribuição de melhoria, IV) contribuições especiais, ou V) contribuições sobre o domínio econômico. Porém o imposto, na perspectiva da utilização da extrafiscalidade da tributação imprópria tem sua vantagem. É um tributo de arrecadação não vinculada, razão pela qual, a utilização extrafiscalidade imposta para a implementação de uma tributação ambiental imprópria seria mais facilitada e eficiente na medida que incentivaria variadas ações realizadas pelo contribuinte, principalmente aqueles que se inserem diretamente sobre atividade econômica.

#### IV. CARACTERÍSTICAS, CONCEITOS E FINALIDADES DA TRIBUTAÇÃO ECOLÓGICA

De acordo com Miguel (2020, p. 87) a Organização para cooperação e desenvolvimento econômico é o principal responsável acerca das discussões relativas à proteção ambiental por meio de instrumentos tributários. De acordo com o autor, é possível perceber o avanço das legislações dos países sobre a tributação voltada para a perspectiva ambiental principalmente no que concerne a utilização da extrafiscalidade para indução de condutas em prol do meio ambiente.

Nos Estados Unidos da América (EUA) há o incentivo ambiental incidente sobre o Imposto de Renda. O contribuinte terá direito a dedução de valores relativos ao imposto em razão de doações ou preservações de terrenos e matas com finalidades preservacionistas. Há neste país também impostos relativos a petróleo e desvirados, caça e pesca e produtos químicos nocivos ao meio ambiente. Ainda sobre os impostos indicados, há o instituto do *superfund*. Trata-se de um importante fundo público de receitas originadas do adicional arrecadado de atos poluidores, que tem por finalidade a recuperação de locais degradados. Ainda no país, há taxas de licenciamento ambiental e de recuperação do meio ambiente. (COSTA, 2011).

Na Alemanha, tem-se o imposto municipal sobre embalagens pratos e colheres plásticas. E o imposto para a prevenção de incêndios. Na Espanha existe a tributação por meio de impostos sobre tabacos, sobre licenciamento de veículos e instalações que tendam a agredir o meio ambiente. Na Holanda, tem-se a tributação por ruídos causados por aeronaves civis e combustíveis. Na França, há impostos sobre corte de matas, além de impostos para preservação de áreas naturais protegidas, ainda há impostos sobre edifícios urbanos cuja receita arrecadada tem por finalidade a produção de espaços urbanos verdes.

Em Portugal existe incentivos voltados a programas não governamentais que doam para a finalidade de proteção ao meio ambiente. (PINTO, 2017; COSTA, 2011).

Nesta medida, conclui-se que as experiências internacionais estão voltadas a utilização da extrafiscalidade tributária para incorporar no contribuinte condutas voltadas a preservação ambiental. Essas experiências fazem parte do alicerce para a justificativa de um olhar sistemático da tributação ecológica no Brasil. No entanto, não é possível criar os mesmos incentivos tributários dos países aqui elencados. A tributação ambiental no Brasil, precisa respeitar as regras estabelecidas pela Constituição Federal e a realidade social brasileira.

No Brasil, há alguns tributos voltados a preservação ambiental sejam elas *latu senso* ou *stricto senso*. O Imposto de Renda através da lei 5.106 de 1966 confere abatimentos de até 100% das declarações de rendimento aquilo que foi aplicada para o florestamento ou reflorestamento, caso seja pessoa jurídica, se for empregado o florestamento ou reflorestamento o limite que trata a lei é de 50%.

O Imposto Territorial Rural (ITR), isenta as áreas de reserva legal por meio da lei 9.393 de 1996. O IPI através do decreto 755 de 93 estabelece alíquotas diferenciadas a veículos movidos a álcool. Como lembra Polo (2017, p. 12), a criação deste incentivo não foi destinada a proteção ecológica como seu fundamento principal. No primeiro momento, havia a necessidade de equilíbrio da concorrência dos carros movidos a álcool para aqueles movidos a gasolina. No entanto, não se pode deixar de notar o nítido benefício ao meio ambiente neste incentivo fiscal.

No âmbito estadual tem-se o ICMS que de acordo com Sobral Neto (2020, p. 28) 18 estados da federação já implementaram este incentivo a proteção ambiental. Segundo o autor, trata-se de um incentivo aos municípios para incrementarem suas receitas tributárias como contrapartida a realização de condutas de proteção ao meio ambiente. De acordo com Gordilho (2011, p. 115) este incentivo de ICMS ocorreu primeiramente no Estado do Paraná pois tratava-se de locais dentro do Estado que sofriam com devastadores desmatamentos ilegais. Nesta esteira, como forma de incentivo, criou-se o ICMS ecológico para incentivar a manutenção das unidades de conservação.

No âmbito municipal existem as taxas, que são indicadas por Nunes (2005) e Gordilho (2011) como incentivos ao meio ambiente. A taxa de lixo, as taxas municipais de esgoto, as taxas florestais e as taxas de visitação outrora

exploradas na sessão anterior que são consideradas como tributação ambiental.

Quanto aos impostos, o IPTU para Azevedo (2017) é um imposto que incentiva a sustentabilidade ambiental no âmbito das cidades. É uma espécie de tributo que incide diretamente sobre o bem imóvel urbano e o contribuinte que realizar as ações sustentáveis dispostas na lei do seu respectivo município terá um desconto do imposto que varia de 10% a 100%.

Para Costa (2011) o ISS também pode ser caracterizado como um importante instrumento de preservação ambiental que poderá incidir sobre os serviços atrelados ao ecoturismo no município como orientação para práticas sustentáveis. Para Gonçalves; Reymão, (2019, p. 20) o ISS também pode ser usado na viabilização de construções e obras, em um processo educativo, voltados a aspectos de proteção ambiental por meio de incentivos fiscais.

## V. CONCLUSÃO

A tributação é um importante instrumento para a concretização da proteção ambiental para os demais países como para o Brasil. No entanto, mesmo constatando a sua importância, são poucas as efetivas aplicações de incentivos fiscais para a implementação de políticas públicas no Brasil para a proteção ambiental.

## AGRADECIMENTOS

O presente trabalho foi realizado com apoio da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Código de Financiamento 001 em conjunto com a Fundação de Amparo à Pesquisa do Estado da Bahia (FAPESB).

## REFERENCIAS

- [1] Aydos, E. D. L. P. (2012). Tributação ambiental no Brasil: fundamentos e perspectivas.
- [2] Azevedo, T. C. (2017). Tributação municipal como incentivo ao desenvolvimento sustentável nas cidades: o caso do “IPTU VERDE” de Salvador.
- [3] Bezerra, B. B., Papini, J. D. A. C., & Noda, R. K. (2021). Tributação ecológica e políticas públicas: uma avaliação diagnóstica do Programa IPTU Verde de Salvador (Doctoral dissertation).
- [4] Costa, R. H. (2005). Apontamentos sobre a tributação ambiental no Brasil. *Direito Tributário Ambiental. São Paulo: Malheiros*, 312.
- [5] Endo, E. A. (2019). *IPTU e ISS Ecológico: Proposta de Política Pública para o Município ed Curitiba-Paraná* (Doctoral dissertation, Instituto Politécnico de Braganca (Portugal)).

- [6] Federal, B. S. T. (1988). *Constituição da república federativa do Brasil*. Supremo Tribunal Federal.
- [7] Gordilho, H. J. D. S. (2009). Direito ambiental pós-moderno.
- [8] Jodas, N. (2015). Pagamento por serviços ambientais (PSA) no âmbito do projeto " Conservador das Aguas"(Extrema/MG): uma análise da efetividade socioambiental.
- [9] Montero, C. E. P. (2011). Extrafiscalidade e meio ambiente: O tributo como instrumento de proteção ambiental. Reflexões sobre a tributação ambiental no Brasil e na Costa Rica.
- [10] Neto, R. R. S. (2020). ICMS ecológico para além do tributo: estudo das potenciais transformações dos municípios baianos a partir de sua implementação.
- [11] PINTO, A. P. A. M. D. (2019). A tributação ambiental à luz do sistema constitucional brasileiro.
- [12] Nunes, C. S. (2005). *Direito tributário e meio ambiente. Dialética*.
- [13] Santana Gordilho, HJ, & Pimenta, PRL (2018). Fins do princípio do poluidor-pagador. *Revista Brasileira de Direito*.
- [14] Silva, V. G. D. Tributação ambiental: instrumento de desenvolvimento econômico sustentável e meio de proteção do meio ambiente.
- [15] SILVA, S. A. B. R. I. N. A. (2017). *A CONSTRUÇÃO DA CIDADANIA MERCOSULINA: UMA ANÁLISE SOB A PERSPECTIVA DO PROCESSO DE INTEGRAÇÃO DA UNIÃO EUROPEIA* (Doctoral dissertation, UNIVERSIDADE DO VALE DO ITAJAÍ).
- [16] SOUZA GONÇALVES, Amanda; REYMÃO, Ana Elizabeth Neirão. Tributação ambiental como indutora de políticas públicas no Brasil. *Revista Tributária e de Finanças Públicas*, v. 138, p. 1-25, 2019.

# Epidemiology and Risk Factors of Brucellosis in Veterinary Medicine Professionals and Academics in the Middle-North Region of Mato Grosso State, Brazil

Carolina De Carli Nogueira<sup>1</sup>, Karina da Silva Rodrigues<sup>1</sup>, Vanessa de Almeida Raia<sup>2</sup>, Bruno Gomes de Castro<sup>2</sup>

<sup>1</sup>Discentes de Mestrado do Programa de Pós-Graduação em Ciências em Saúde, Campus Universitário de Sinop, Universidade Federal de Mato Grosso, Brasil

<sup>2</sup>Docentes do Programa de Pós-Graduação em Ciências em Saúde, Campus Universitário de Sinop, Universidade Federal de Mato Grosso, Brasil

Received: 20 Aug 2022,

Received in revised form: 13 Sep 2022,

Accepted: 18 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Brucella sp.*, *Brucella abortus*,  
*Population study*, *Prevalence*, *Poisson  
regression*, *Veterinary Physicians*.

**Abstract**—The present study aimed to evaluate the seroprevalence of anti - *Brucella abortus* antibodies in Veterinary Medicine students at the Federal University of Mato Grosso (UFMT) - Sinop campus and Veterinary Physicians in the mid-north region of Mato Grosso, as well as the risk factors associated with its transmission. Blood samples were collected from the participants to assess the frequency of anti-*Brucella abortus* antibodies and sent to the Infectious Diseases Laboratory at UFMT Campus Sinop, where the samples were processed. The blood samples collected from indirect diagnostic methods, based on the detection of antibodies. This is an observational, cross-sectional, retrospective study, in which the results were evaluated through the analysis of the chi-square association by Fisher's exact test and for the identification of factors associated with the reagents for anti-*Brucella abortus*, it was carried out crude analysis using Poisson regression. Of the 213 volunteers, seven were tested for the Buffered Acidified Antigen (42.9%) and with a predominant range of age from 18 to 25 years (42.9%) (%). The variable "Frequent Laboratory that diagnoses Brucellosis" ( $p = 0.028$ ) was the only variable that remained significant after regression. It was concluded the lack of preparation and responsibility of some professionals when exercising the profession, not fulfilling the basics: protecting themselves and helping others to do the same, putting their health at risk and that of the population in general.

## I. INTRODUCTION

Brucellosis is an important zoonosis caused by *Brucella* species (Brucellaceae). The disease affects a wide range of domestic and wild animals as well as humans (PROCH et al., 2017). In livestock, it causes chronic disease with reproductive failures that contribute to production losses and, in humans, it causes an often chronic febrile illness that is underdiagnosed in many low-

and middle-income countries (LINDAHL et al., 2020). According to Ghanbari (2020), in the world, the number of unreported human cases that present unspecified clinical symptoms is ten times greater, therefore, it is one of the most significant public health concerns. It can affect all age and sex groups, and its control in humans depends on limiting infection in animals through vaccination and care programs.

Brucellosis is considered an occupational disease, in which professionals commonly infected are veterinarians, microbiologists, butchers, slaughterhouse workers and animal handlers (LAWINSKY et al.; 2010), as they are often exposed to infected animals, contaminated biological materials and live attenuated anti-*Brucella* spp vaccines capable of causing the disease in humans (MEGID, 2016). In addition, these professionals, as well as the general population, can also contract the disease through the ingestion of unpasteurized milk and dairy products (PEREIRA et al., 2020). Human-to-human transmission is rare, but has been reported following blood transfusion, bone marrow transplantation, and sexual intercourse (MEGID, 2016).

The National Program for the Control and Eradication of Animal Brucellosis and Tuberculosis - PNCEBT was established in Brazil by Ministerial Normative Instruction nº 02/2001 and regulated by Normative Instruction SDA nº 10/2017 with the objective of reducing the negative impacts of these zoonoses on human health and animal (BRASIL, 2006). The PNCEBT is mainly based on the mandatory vaccination of bovine females aged between 3 and 8 months with the B19 vaccine and the vaccination of bovine females that have not been vaccinated at this age with RB51, the program also includes transit control for breeding and slaughter of positive animals (PEREIRA et al., 2020). Vaccination against brucellosis in Brazil is only performed by veterinarians accredited by the PNCEBT or by vaccinators registered under their responsibility (BRASIL, 2006). Veterinarians and their assistants are among the most susceptible to human brucellosis, because in addition to dealing directly with infected animals, they are also exposed to a vaccine that has the live attenuated *Brucella* spp agent (PEREIRA et al, 2020). Unfortunately, there is no vaccine available for use in humans, largely due to safety concerns associated with potential residual virulence of live attenuated vaccines (KHALAF et al., 2020).

Brucellosis is distributed worldwide, being considered one of the main zoonoses by the World Health Organization (WHO). The countries with the highest occurrence of human brucellosis are Syria (1,603.4 cases per 1,000,000 individuals), Mongolia (391.0) and Tajikistan (211.9). According to the World Bank for Animal Health Information (WAHID), Mexico had the highest number of reported outbreaks, 5,514 in 2014. Followed by China (2,138), Greece (1,268) and Brazil (1,142). Most of these outbreaks are from *Brucella abortus*, the etiologic agent of bovine brucellosis (HULL, 2018).

Given the high prevalence of bovine brucellosis in underdeveloped and developing countries and its zoonotic

risk, several authors have evaluated the frequency of seropositivity in cattle and humans from different parts of Brazil and the world, generally in individuals whose profession is intrinsically related to contact with animals. . In Brazil, Carvalho et al. (2016) evaluated this relationship in the central region of the state of Maranhão and found seropositivity in 4.95% of dairy cows analyzed and 1.66% in seropositive computers.

Schneider et al. (2013) evaluated higher frequencies in their study carried out in a slaughterhouse in Cuiabá, Mato Grosso. In this study, a frequency of 7.5% and 4.5% of seropositivity was observed in slaughtered and slaughtered cows, respectively. Pereira et al. (2020), identified the epidemiological picture due to accidental exposure to the B19 and RB51 vaccine among veterinarians representing the PNCEBT in Minas Gerais, Brazil, where approximately one third of the professionals interviewed had already been accidentally exposed to the B19 and RB51 vaccines and observed that the adoption of measures of individual protection and knowledge about the disease were especially important factors in preventing occupational exposure to *B. abortus*.

However, published data from other countries show alarming results, as described by Madut et al. (2018) in several regions of Sudan, with average rates of 31% and 33% in seropositive cattle and rural producers, respectively, 31% and 33.3% in seropositive cattle and rural producers. Proch et al. (2017) specifically evaluated Veterinarians in India, according to the results of these authors, 21.9% of these professionals had seroagglutination in the Buffered Acidified Antigen Test and 24% in the Slow agglutination tube test. The authors stated that the intimate contact of these professionals with the animals is an important risk factor for infection.

In Brazil, there is a lack of literature relating to zoonotic brucellosis specifically in veterinarians, nor the possible risk factors for brucella infection. In this way, this study carried out an important approach in the relationship of brucellosis in academics of Veterinary Medicine and Veterinary Doctors in the north region of Mato Grosso State.

## II. MATERIAL AND METHODS

This is an observational, cross-sectional, retrospective study. The study is being carried out at the Universidade Federal de Mato Grosso – Sinop campus. It is located in a region of the State of Mato Grosso that stands out for its location close to the Amazon Basin. In addition to Sinop, collections were carried out in three more municipalities in the North region of Mato Grosso: Sorriso, Guarantã do Norte and Alta Floresta.

This is a cross-sectional observational study, in which students of the Veterinary Medicine course, Resident Veterinarians and Veterinary Physicians in the mid-north region of Mato Grosso were evaluated. It was estimated that there are around 2000 veterinarians in the aforementioned region and 500 students enrolled in the Veterinary Medicine course at the Universidade Federal de Mato Grosso Campus Sinop, the only university in the mid-north region of Mato Grosso that provides this course.

Questionnaires with information on age, sex and habits were applied prior to collection, in which all 213 participants agreed to answer a brief questionnaire applied before blood collection. The variables used in the elaboration of the questionnaire were based on the study by Tenório et al. (2008). In addition, all participants signed the Free and Informed Consent Form (ICF).

Blood samples were collected by intravenous puncture, using 25 x 8 mm needles and syringes with a capacity of 10 mL. Then, the blood was deposited in previously identified sterile test tubes, 5mL in each, one with the addition and the other without the addition of the anticoagulant ethylenediaminetetraacetic acid (EDTA). Then, serum was obtained from the blood aliquot without anticoagulant, by means of centrifugation at 3000 rpm for five minutes. The blood sample with the addition of EDTA and the serum obtained from the blood without anticoagulant, were aliquoted 0.5 mL in each previously identified polypropylene microtube, with two microtubes destined for serum and two for blood without anticoagulant. placed in specific boxes also already identified and kept frozen at -20 °C until analysis.

For the serodiagnosis of the samples, a buffered acidified antigen (AAT) test was performed to detect anti-*Brucella* antibodies as a screening test.

The characterization of the significance between the differences observed in the frequencies of seropositive individuals according to aspects related to risk factors was determined using the SPSS version 2.0 program. The significance level adopted was 5% (AZEVEDO et al., 2004). All 213 participants agreed to answer a brief questionnaire applied before blood collection. In order to extract better information from the descriptive approach, the chi-square association analysis was performed using Fisher's exact test. To identify factors associated with anti-*Brucella abortus* reagents, a crude analysis was performed using Poisson regression.

### III. RESULTS AND DISCUSSION

Of the 213 volunteers who underwent serodiagnosis for Brucellosis, seven individuals were reactive to the

Buffered Acidified Antigen (AAT) test. Of these individuals, four were inhabitants of the municipality of Sinop, two from Alta Floresta and one from Sorriso. The reagent population was mostly self-employed veterinarians (40.3%), male (85.7%) and predominantly aged between 18 and 25 years (42.9%). In the other occupations in the area of veterinary medicine, there were only two reactive individuals (28.6%) to the AAT, who were academics in veterinary medicine, reporting that the relationship of inherent veterinary practices during graduation is also a potential risk factor. in *Brucella abortus* infection.

Of the total population studied, 40.8% of the individuals were male and 59.2% were female, both with a predominant age group of 26 to 35 years (44.6%). Of the reactive individuals, only 1 (14.3%) was female and the other 6 (85.7%) were all male and the variable "Sex" ( $p=0.019$ ) was statistically significant. According to Soares et al. (2015) and other reports in the literature, portrayed that the disease is more common in adults aged between 55 and 64 years, however, in the present study the occurrence of contact with *Brucella abortus* was in a younger age group, which can be explained by the fact that human brucellosis is an occupational disease and consequently affects the population at an age considered productive for work.

The high proportion of women observed among the participants did not make them the majority among the reactive individuals, which may be due to the occupation profile described in the country, in which the average professional experience of the participants showed a predominance of male veterinarians among them, those who work with large animals. Therefore, veterinary services related to reproduction and vaccination against brucellosis are frequent in this area, which implies a greater possibility of contact with *B. abortus*, compared to professionals who work in other areas (PEREIRA et al., 2020). Some studies report the prevalence in females, but it cannot be said that brucellosis has a predilection for the female organism, precisely because women seek the health service more often than men (SOARES et al., 2015).

Among all the variables, the following were significant in the chi-square test: "Sex" ( $p=0.019$ ); "Contact with the B19 vaccine" ( $p=0.001$ ); "Contact with the RB51 vaccine" ( $p=0.008$ ) and "Attends a laboratory that diagnoses brucellosis" ( $p=0.008$ ). To identify the factors associated with the reagents for anti-*Brucella abortus*, a crude analysis was performed using Poisson regression of those variables that would reach a value of  $p<0.05$  in the chi-square test.

We must take into account that the vaccine used in animals has the characteristic of being live attenuated,

when accidentally inoculated in humans or improperly manipulated, forming aerosols, it can end up generating human brucellosis (LOURENCETTI et al., 2018; SOUSA et al., 2020). Poor knowledge about the symptoms of human brucellosis and lack of proper use of PPE are likely causes of unintentional contact with vaccine strains.

Pereira et al. (2020), carried out a study to determine the prevalence of accidental exposure to vaccine strains B19 and RB51 and occupational brucellosis among veterinarians registered with the PNCEBT in Minas Gerais, Brazil. Data were collected through an online questionnaire. Approximately one-third of veterinarians registered to administer bovine brucellosis vaccination in Minas Gerais, 32.83% (108/329), reported being accidentally exposed to vaccine strains B19 or RB51. Exposure factors associated with this outcome included a personal protective equipment (PPE) score at work (OR = 0.94; 95% CI: 0.89-0.98) and a knowledge score about symptoms of brucellosis, classified as poor (base category), intermediate (OR = 0.26; 95% CI: 0.07-0.87) or good (OR = 0.22; 95% CI: 0.07- 0.62).

The role of livestock vaccination in the prevention and control of brucellosis is very important and it is almost impossible to control and eradicate the disease without it (LINDAHL et al., 2020). Therefore, a high level of knowledge about the disease on the part of those who will handle the vaccine is extremely necessary, as it has a potential risk of human infection. Considering the large number of viable bacteria in the brucellosis vaccine, in addition to being highly contagious, it is believed that the use of prophylactic antibiotic therapy in cases of accidental exposure to the vaccine, as well as adequate clinical and laboratory monitoring of the injured person, are fundamental in reducing of the complications of this occupational risk (HYEDA et al., 2011).

Although the Poisson regression analysis the contact variables with the B19 and RB51 vaccines ( $p=0.256$ ;  $p=0.388$ ) did not give statistically significant, we must also take into account that not only individuals who have a routine of direct contact with animals are subject to being infected with the disease, but also those who are still in academic training are not taking adequate preventive measures during contact with animals or during the handling of vaccines. As the disease is chronic and has a low mortality rate, generally little attention is given to disease prevention measures in humans, unlike the attention given to bovine brucellosis, which causes great economic losses (GHANBARI et al., 2020).

The variable "Attends a laboratory that diagnoses Brucellosis" ( $p=0.028$ ) was the only one that remained significant (Table 3). *Brucella* spp. has a high potential to

be aerosolized and has an infective dose of 10 to 100 organisms, these agent characteristics contribute to the associated risk in a laboratory environment (TRAXLER et al., 2013; LOURENCETTI et al., 2018). It is considered one of the most common pathogens responsible for laboratory-acquired infections, along with *Shigella*, *Salmonella*, *Mycobacterium tuberculosis* and *Neisseria meningitides* (SINGH, 2009).

In 2013, Rodrigues et al. reported the first outbreak of *Brucella abortus* infection in a Brazilian laboratory, where exposure was a result of damage to a biological safety cabinet and failure of the unidirectional airflow ventilation system. The epidemiological investigation identified 3 seroconverted individuals, of whom 1 had clinical manifestations and laboratory results compatible with infection at the time of exposure ( $n = 11$ ; attack rate = 9.1%).

More recently, there was an outbreak caused by a leak at a Chinese biopharmaceutical company in 2019, where 3,245 people contracted brucellosis despite no deaths being recorded, according to the country's health authority (YEUNG and CHEUNG, 2020).

Of all the pathogens already mentioned in the literature, laboratory-acquired *Brucella* represents the greatest relative risk: one study found that the incidence of *Brucella* spp. was 641 cases per 100,000 laboratory technicians, compared to 0.08 cases per 100,000 people in the general population (SINGH, 2009). Although these professionals are generally well educated about the risk of contracting a zoonotic infection during work activities, many adopt attitudes that put their own health and that of their colleagues at risk, such as working outside the security booth and sniffing the plates containing samples of *Brucella* spp. (PEREIRA et al., 2020).

*Brucella* spp. should only be handled in laboratories with biosafety level 3 or higher. Contamination in laboratories can be associated with aspiration of bacteriological cultures, direct contact with the skin, formation of aerosols, mouth pipetting and spraying on the conjunctiva, nose and mouth. It should be noted that anyone who is in the laboratory during the work of identifying a pathogenic isolate of *Brucella* spp. is considered an exposed worker (LAWINSKY et al., 2010; PEREIRA et al., 2020).

In the work carried out by Langoni et al (2009), when evaluating knowledge regarding risk factors, it was verified, for some situations, equivocal knowledge of veterinary medicine students, mainly in relation to elimination routes and routes of agent transmission. Even though the majority indicated in the questionnaire that the use of gloves in hospital and laboratory procedures was



important, only 48% of them reported using them frequently in these procedures.

The “use of disposable gloves” ( $p=1.000$ ) was statistically proven to be a protective factor. What stands out is that only 2 (28.5%) of the reagent cases stated that they did not use gloves regularly, contradicting the variables, in which they stated that at some point they had “Contact with raw beef”; “Contact with bovine fetuses and abortion fluids”; “Contact with the B19 vaccine” and “Contact with the RB51 vaccine”. We can observe that despite the level of education and knowledge about the importance of prevention through the use of gloves, few were really aware of its importance as an individual protection measure at the time of practicing activities related to the profession. In addition, there was a bias when filling out the questionnaire, in which the participants probably omitted the lack of wearing gloves for fear of being judged, because it was applied in person by a professional colleague and there were few individuals at a time, the which led to being able to identify who had answered the questionnaire even though there was no identification name, only a number.

A greater relevance in relation to the risk factors related to the veterinary occupation and the symptoms of brucellosis in humans during graduation, perhaps, would bring their awareness to the use of adequate personal protective equipment during the practices inherent to the profession. As well as the importance of your role as a professional in spreading adequate information and being an example for others. Thus, it is important to carry out more studies addressing these factors in this academic and professional occupation, especially in regions that have a high prevalence of bovine brucellosis. With the proper use of PPE's during the practices inherent to veterinary medicine, it is believed that these individuals who were reagents probably would not be, taking into account the existing literature and the variables that were significant in this study.

#### IV. CONCLUSION

The veterinarian has as one of his professional responsibilities, as a health profession, to bring information to the general population, warning about the risks of direct contact of owners or caregivers with sick animals. Explaining how infection by zoonotic agents works and warning about the ingestion of food of animal origin when these have not been properly prepared and inspected. With this study, we can observe the lack of preparation and responsibility of some professionals when exercising the profession, not fulfilling the basics: protecting themselves and helping others to do the same,

putting their health at risk and that of the population in general.

#### REFERENCES

- [1] AZEVEDO, S.S.; ALVES, C.J.; ALVES, F.A.L.; CLEMENTINO, I.J.; BATISTA, C.S.A.; AZEVEDO A.S.; Ocorrência de anticorpos anti-Brucella ovis em ovinos procedentes de quatro municípios do estado do Rio Grande do Norte, Brasil. *Agropecuária Técnica*, v. 25, n.2, p. 45-50, 2004.
- [2] BRASIL. Ministério da Agricultura, Pecuária e Abastecimento. Manual Técnico do Programa Nacional de Controle e Erradicação da Brucelose e da Tuberculose PNCEBT. Brasília, 188 p, 2006.
- [3] CARVALHO, R. F. B.; SANTOS, H. P.; MATHIAS, L. A., PEREIRA, H. M.; PAIXÃO, A. P.; COSTA FILHO, V. M.; ALVES, L. M. C. Frequência de brucelose bovina em rebanhos leiteiros e em seres humanos na região central do estado do Maranhão, Brasil. *Arquivos do Instituto Biológico*, v. 83, p. 01-06, 2016.
- [4] GHANBARI, M.K.; GORJI, H.A.; BEHZADIFAR, M.; SANEE, N.; MEHEDI, N.; BRAGAZZI, N.L. One health approach to tackle brucellosis: a systematic review. *Trop Med Health*. Oct 20; p. 48-86, 2020.
- [5] HULL, N. C.; SCHUMAKER, B. A. Comparisons of brucellosis between human and veterinary medicine. Department of Veterinary Sciences, University of Wyoming, Laramie, Wyoming, USA. *INFECTION ECOLOGY & EPIDEMIOLOGY*, VOL. 8, p. 3-12, 2018.
- [6] HYEDA, A.; SBARDELLOTTO, F. Exposição acidental à vacina da brucelose. *Revista Brasileira de Medicina do Trabalho* · Julho 2011.
- [7] Instituto Brasileiro de Geografia e Estatística [IBGE]. Cidades e Estados 2020. Disponível em: <https://www.ibge.gov.br/cidades-e-estados/mt/sinop.html> . Acesso em: 18 de dezembro 2020.
- [8] KHALAF, O.H.; CHAKI, S.P.; GARCIA-GONZALEZ, D.G.; FICHT, T.A.; ARENAS-GAMBOA, A.M. The NOD-scid IL2rgamma(null) mouse model is suitable for the study of osteoarticular brucellosis and vaccine 288 safety. *Infect Immun* 87:e00901-18. 2019
- [9] LANGONI, H; VASCONCELOS, C. G. C; NITSCHKE, M. J. T; OLBRICH, S. R. L. R; CARVALHO, L. R; SILVA, R. C. Fatores de risco para zoonoses em alunos do curso de medicina veterinária, residentes e pós-graduandos. *Arq. Ciênc. Vet. Zool. UNIPAR, Umuarama*, v. 12, n. 2, p. 115-121, jul./dez. 2009.
- [10] LAWINSKY, M.L.J.; OHARA, P.M.; ELKHOURY, M.R.; FARIA, N.C.; CAVALCANTE, K.R.L.J. Estado da arte da brucelose em humanos. *Rev Pan-Amaz Saude*;1(4):75-84, 2010.
- [11] LINDAHL, J.F.; VRENTAS, C.E.; DEKA, R.P.; HAZARIKA, R.A.; RAHMAN, H.; BAMBAL, R.G.; et al. Brucellosis in India: results of a collaborative workshop to define One Health priorities. *Trop Anim Health Prod*. 10. 2020.

- [12] LOURENCETTI, M.P.S.; SOUZA, M.A.; GANDA, M.R. High Level of B19 strain detection in Brazilian cattle semen Trop Anim Health Prod, p. 50-433, 2018.
- [13] MADUT, N.A.; MUWONGE, A.; NASINYAMA, G.W.; MUMA, J.B.; GODFROID, J.; JUBARA, A.S.; et al. The sero-prevalence of brucellosis in cattle and their herders in Bahr el Ghazal region, South Sudan. PLoS Negl Trop Dis 12(6), 2018.
- [14] MEGID, JANE. Doenças infecciosas em animais de produção e de companhia. - 1. Ed. – Rio de Janeiro: Roca. 1294 p, 2016.
- [15] PEREIRA, C.R.; DE OLIVEIRA, I.R.C.; DE OLIVEIRA, L.F.; DE OLIVEIRA, C.S.F.; LAGE, A.P.; DORNELES, E.M.S. Accidental exposure to Brucella abortus vaccines and occupational brucellosis among veterinarians in Minas Gerais state, Brazil. Transbound Emerg Dis.; 00:1–14, 2020.
- [16] PROCH, V.; SINGH, B.B.; SCHEMANN, K.; GILL, J.P.S.; WARD, M.P.; DHAND, N.K. Risk factors for occupational Brucella infection in veterinary personnel in India. Transbound Emerg Dis.;65:791–798, 2018.
- [17] RODRIGUES, A.L.C; DA SILVA, S.K.L.; PINTO, B.L.A.; SILVA, J.B.; TUPINAMBÁS, U. Outbreak of laboratory-acquired Brucella abortus in Brazil: a case report. Rev. Soc. Bras. Med. Trop. vol.46 no.6 Uberaba Nov./Dec. 2013.
- [18] SCHNEIDER, R. C. ; SANTOS, M. D. ; LUNARDI, M. ; BENETTI, A. H. ; CAMARGO, L. M. ; FREITAS, S. H. ; NEGREIRO, R. L. ; COSTA, D. S. Prevalence of brucellosis and risk factors associated with its transmission to slaughterhouse employees in the Cuiaba metropolitan area in the state of Mato Grosso. Semina: Ciências Agrárias, Londrina, v. 34, n. 5, p. 2367-2374, set./out. 2013.
- [19] SINGH, K. Laboratory-Adquired Infections. Epidemiologia da Saúde, CID; 49: p. 142-147, 2009.
- [20] SOARES, C. P. O. C.; TELES, J. A. A.; SANTOS, A. F.; SILVA, S. O. F.; CRUZ, M. V. R. A.; SILVA-JÚNIOR, F.F. Prevalência da Brucella spp em humanos. Rev. Latino-Am. Enfermagem set.-out.;23(5):919-26, 2015.
- [21] SOUSA, N.F.; SANTOS, H. D.; ALMEIDA, K. S.; ALEXANDRINO, B. Perfil epidemiológico dos casos de brucelose humana notificados no município de Araguaína/TO, no período de 2010 a 2016. DOI: 10.18605/2175-7275/cereus.v12n1p117-136 Revista Cereus Vol. 12. N., 2020.
- [22] TENÓRIO, T.G.S.; MELO, L.E.H.; MOTA, R.A.; FERNANDES, L.M.; SÁ, L.M.; SOUTO, R.J.C., et al. Pesquisa de fatores de risco para a brucelose humana associados à presença de brucelose bovina no município de correntes, Estado de Pernambuco, Brasil. Arq Inst Biol. outdez;75(4):p. 415-21, 2008.
- [23] TRAXLER, R.M.; LEHMAN, M.W.; BOSSERMAN, E.A.; GUERRA, M.A.; SMITH, T.L. A literature review of laboratory-acquired brucellosis. J Clin Microbiol 2013.
- [24] YEUNG, J.; CHEUNG E. Brucelose: Surto infectou milhares de pessoas após vazamento de fábrica na China. CNN Brasil, 2020. Disponível em: <<https://www.cnnbrasil.com.br/internacional/2020/09/18/surto-to-bacteriano-infectou-milhares-de-pessoas-apos-vazamento-de-fabrica-na-china>>. Acesso em: 18 de maio, 2021. K. Elissa, “Title of paper if known,” unpublished.

## The Advantages and Challenges of Distance Learning

Liciania Dias da Silva<sup>1</sup>, Dionê Pereira de Souza<sup>2</sup>, Camila Karem de Oliveira Rodrigues<sup>3</sup>,  
Elizeth Gonzaga dos Santos Lima<sup>4</sup>, Jéssica Gonçalves de Matos<sup>5</sup>, Elen Caroline Tessaro<sup>6</sup>,  
Fernando Cezar Vieira Malange<sup>7</sup>

<sup>1</sup>Academic of the Public Administration course at the State University of Mato Grosso, DEAD/UNEMAT, Campus Vila Rica/MT

<sup>2</sup>Philosophy teacher. Graduated in Philosophy and Theology, specialist in Teaching in Higher Education and Master in Education

<sup>3</sup>Master's student of the postgraduate program in Environmental Sciences, at the University of the State of Mato Grosso

<sup>4</sup>Professor at the University of the State of Mato Grosso

<sup>5</sup>Student of the nursing course at the University of the State of Mato Grosso

<sup>6</sup>Graduated in physical education and master education

<sup>7</sup>Professor at the University of the State of Mato Grosso

Received: 29 Aug 2022,

Received in revised form: 19 Sep 2022,

Accepted: 25 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Advantages. Challenges.  
Academics. Distance.*

**Abstract**— *This study sought to describe the advantages and challenges of studying at a distance and has a general objective: to report the advantages and challenges of studying at a distance. It adopts as a type of research the quantity-qualitative approach. The methodological procedure took place in the first place to make a theoretical foundation to search in books, websites, magazines, etc., 7 closed and two open, and finally, the results sought to analyze the questions in order to seek the advantages and challenges of distance learning. The data revealed to us as an advantage, the opportunity to study at a time chosen by the academic, be it during the day or any time of the night, and the challenges are the difficulty of answers when there is a question at the time of study that often the time is not conventional. In this study, it showed that studying at a distance gives the possibility for some academics to study who live more than 100km away from the pole and also an opportunity for others who are in the day-to-day, working to support the home.*

### I. INTRODUCTION

Distance education (EAD) is an educational modality that has been rooted in the western world since the 1980s. In Brazil, the Federal University of Mato Grosso offered UFMT the first distance undergraduate course in 1995. Through Decree n° 5.800, on June 8, 2006, the Open University System of Brazil - UAB was established, aimed at the development of the distance education modality, with the purpose of expanding and internalizing the offer of courses and programs of education top in the country. It was the first major move by the Brazilian State in the search for greater coverage of higher education and the modernization of supply models.

At the Universidade do Estado de Mato Grosso – Unemat, the offer of distance courses began in 1999. As of 2010, the Distance Education Management Board – DEAD/Unemat – began to offer distance education linked to the system UAB.

The increase in vacancies and the availability of hard-to-reach places created opportunities for many people, but, at the same time, the diversification of the offer contributed to deepening a problem that was already affecting education at all levels. This work has as its theme: Distance Education: challenges and possibilities, with the general objective: to discover what are the advantages and challenges of studying at a distance.

In the specific objective: is to analyze what academics say about the Distance Public Administration course at the Vila Rica/MT campus.

To achieve our objectives, we used the quality-quantitative method, which is a research method that includes qualitative and quantitative research, because, even though they are different, they do not exclude each other, thus, the research may have a quantitative part., with data, collection and that can bring results in data becoming quality-quantitative research.

To achieve the results, a questionnaire was applied to the students of the Public Administration course of the Vila Rica/MT campus, to collect the opinion of the academics, to stimulate participation and transmit the opinion about the researched topic in a satisfactory manner. And so, a questionnaire was applied to 37 students, so that each one had the opportunity to report their experiences during these four school years.

This questionnaire was applied through google forms and sent to the 37 enrolled in the Public Administration course, where we obtained 20 answers, which we analyzed individually so that we could answer our objective of the advantages and challenges of studying online.

**II. THE HISTORY OF DISTANCE EDUCATION**

On a theoretical basis, we made a brief historical overview of EAD, in the world, Brazil, Unemat and in the Middle Araguaia Campus where the Vila Rica/MT hub is located.

2.1 The history of EAD in the world

Distance education dates back to a long history, and it is difficult to define the milestone of its beginning [3].

Some textbooks cite the epistles of São Paulo and the Christian communities of Asia Minor, recorded in the Bible, as the historical origin of Distance Education [2]. These epistles were written for the purpose of teaching people to live within Christian doctrines in unfavorable environments and would have been sent around the middle of the 1st century.

Considering the information above, it is possible to establish some historical landmarks that consider Distance Education in the world from the 18th century onwards [9][2].

The first date taken as the starting point is the year 1728 - this year a course is announced by the Boston Gazette, in the March 20 edition. Professor Caleb Philipps of Short Hand provided material for teaching and tutoring by correspondence. After private initiatives, which took place over a long period, and by several teachers, in the

19th century Distance Education began to exist institutionally (Chart I).

*Chart I - evolution of Distance Education in the 19th century*

| Year | Country        | Event                                                                                                        |
|------|----------------|--------------------------------------------------------------------------------------------------------------|
| 1829 | Sweden         | Líber Hermondes Institute (150,000 students)                                                                 |
| 1840 | United Kingdom | Sir Isaac Pitman College; first correspondence teaching school.                                              |
| 1892 | United States  | University of Chicago – Correspondence Teaching Division for faculty preparation in the Extension Department |
| 1922 | Soviet Union   | Correspondence teaching (350,000 students)                                                                   |
| 1948 | Norway         | First legislation for correspondence schools                                                                 |
| 1969 | United Kingdom | Foundation of Open University (200,000 students)                                                             |
| 1977 | Venezuela      | Foundation of National Open University                                                                       |
| 1978 | Costa Rica     | Distance State University                                                                                    |
| 1984 | Netherlands    | Open University implementation                                                                               |
| 1985 | Europe         | Foundation of the European Association of Distance Teaching Universities (EADTU)                             |
| 1985 | India          | Implementation of the National Open University Indira Gandhi (242,000 students).                             |
| 1987 | Europe         | European Parliament Resolution on Open Universities in the European Community.                               |
| 1987 | Europe         | Foundation of the European Distance Learning University Association.                                         |
| 1988 | Portugal       | Foundation of the Open University                                                                            |
| 1990 | Europe         | Implementation of the European Distance Education Network, based on the                                      |

|      |        |                                                                            |
|------|--------|----------------------------------------------------------------------------|
|      |        | Budapest Declaration                                                       |
| 1991 | Europe | Commission Report on Open and Distance Education in the European Community |

Source: Prepared by the author based on VASCONCELOS, 2010 and GOLVÊA and OLIVEIRA 2006

These events and institutions were important for the consolidation of Distance Education that was offered all over the world [2]. The five continents began to adopt Distance Education at all levels of education, in formal and non-formal programs, serving millions of students. From this brief account of distance education in the world context, we will see the Brazilian context.

2.2 The history of distance education in Brazil

It is possible that the first experiences in Distance Education in Brazil were not recorded, since the first known data are from the 20th century [1].

Distance Education began in Brazil in the 20th century, due to the industrialization process that generated a demand for educational policies that trained workers to work in industries [3]. And so, in Brazil, distance education appears as an alternative to meet the demand, mainly through radiophonic means, which allowed the training of rural workers without the need to travel to urban centers.

About EAD MACHADO (2015, p. 4) states that:

*We show that, in its historical context, distance education has always been focused on professional training in order to train people to perform certain activities or to master some skills required in the market. (MACHADO, 2015, p. 4).*

In the chart below we will report remarkable facts about the experiences carried out with distance learning in Brazil.

Chart 2 – some historical facts about distance learning in Brazil

| Year | Event                                                                                                                                                                                                                                                       |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1904 | In the first edition of the classifieds section, <i>Jornal do Brasil</i> registers an advertisement that offers professionalization by correspondence for typists.                                                                                          |
| 1923 | A group led by Henrique Morize and Edgard Roquette Pinto created the Radio Society of Rio de Janeiro, which offered courses in Portuguese, French, Forestry, French Literature, Esperanto, Radio Telegraphy and Telephony. Thus, Distance Education through |

|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | Brazilian radio began                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 1934 | Edgard Roquette-Pinto installed the Municipal Radio-School in Rio, a project for the then Municipal Department of Education of the Federal District. Students had prior access to brochures and lesson plans, and correspondence was also used to contact students.                                                                                                                                                                                                                                                   |
| 1939 | Emergence, in São Paulo, of the Monitor Institute, the first Brazilian institute to systematically offer distance professional courses by correspondence, at the time still under the name Instituto Rádio – Técnico Monitor.                                                                                                                                                                                                                                                                                         |
| 1941 | The Universal Brazilian Institute appears, the second Brazilian Institute to also systematically offer professional courses. Founded by a former partner of Monitor Institute, it has trained more than 4 million people. The Monitor Institute and the Universal Brazilian Institute were joined by other similar organizations, which were responsible for serving millions of students in distance professionalizing initiation courses. Still in 1941, the first Air University emerged, which lasted until 1944. |
| 1947 | The new University of the Air appears, sponsored by the National Service for Commercial Learning (SENAC), the Social Service of Commerce (SESC) and associated broadcasters. The purpose of this was to offer commercial radio courses. The students studied the handouts and corrected exercises with the help of the monitors. The experience lasted until 1961, however SENAC's experience with Distance Education continues to this day.                                                                          |
| 1959 | The Diocese of Natal, Rio Grande do Norte, creates some radio schools, giving rise to the Basic Education movement (MEB), a landmark in non-formal Distance Education in Brazil. The MEB, involving the National Conference of Bishops of Brazil and the Federal Government, initially used an educational radio system for the democratization of access to education, promoting literacy for young people and adults.                                                                                               |
| 1962 | The Ocidental School, of American origin, was founded in São Paulo, focused on the field of electronics                                                                                                                                                                                                                                                                                                                                                                                                               |

|      |                                                                                                                                                                                                                                                                                                                                                                                     |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1967 | The Brazilian Institute of Municipal Administration begins its activities in the area of public education, using correspondence teaching methodology. Also this year, the Padre Landell de Moura Foundation created its Distance Education hub, with a teaching methodology by correspondence and via radio.                                                                        |
| 1970 | The Minerva Project was born, through an agreement between the Ministry of Education, Padre Landell de Moura foundation and the Padre Anchieta Foundation, whose goals were the use of radio for education and the social inclusion of adults. The project was maintained until the early 1980s.                                                                                    |
| 1974 | The Padre Reus Institute emerges and on Ceará TV, the former 5th to 8th grade courses began, with television, printed material and monitors;<br>1976 - The National Tele-education System is created, with courses through instructional material.                                                                                                                                  |
| 1976 | The National Tele-education System is created, with courses through instructional material;                                                                                                                                                                                                                                                                                         |
| 1979 | The University of Brasília, a pioneer in the use of Distance Education in higher education in Brazil, created courses published by newspapers and magazines, which in 1989 was transformed into the Center for Open, Continuing, Distance Education (CEAD) and the Brazil EAD was launched.                                                                                         |
| 1981 | The International Center for Regular Studies (CIER) of the Colégio Anglo Americano was founded, which offered Elementary and High School at a distance. CIER's objective is to allow children whose families temporarily move abroad to continue studying through the Brazilian education system.                                                                                   |
| 1983 | SENAC developed a series of radio programs on professional guidance in the area of commerce and services, called "Abrindo Caminhos" that would translate to "Paving the way".                                                                                                                                                                                                       |
| 1991 | The program "Jornal da Educação – Edição do professor" (Educational Journal - Professor edition), conceived and produced by Fundação Roquete-Pinto, began and in 1995 with the name "Um Salto para o Futuro", was incorporated into TV Escola (educational channel of the Department of Distance Education from the Ministry of Education) becoming a landmark in national Distance |

|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | Education. It is a program for the continuous training and improvement of teachers, mainly in Elementary School and students of teaching courses. It reaches more than 250 thousand teachers throughout the country per year.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 1992 | The Open University of Brasília is created, a very important event in Distance Education in our country.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 1995 | The National Distance Education Center is created and in the same year, MultiRio (Rio de Janeiro) is also created at the Municipal Department of Education, which offers courses from the 6th to the 9th grade, through television programs and printed material. Also in 1995, the TV Escola Program was created by the MEC (Ministry of Education) Department of Distance Education                                                                                                                                                                                                                                                                                                             |
| 1996 | The Department of Distance Education (SEED) was created by the Ministry of Education, within a policy that privileges the democratization and quality of Brazilian education. It is also in this year that distance education officially appears in Brazil, with the legal bases for this type of education, established by the Law of Directives and Bases of National Education n° 9.394, of December 20, 1996, although only regulated on December 20, 1996. December 2005 by Decree No. 5,622 (BRASIL, 2005) which revoked Decrees No. 2,494 of 02/10/98, and No. 2,561 of 04/27/98, with regulation defined in Ministerial Ordinance No. 4,361 of 2004 (MINISTRY OF EDUCATION PORTAL, 2010). |
| 2000 | UniRede, the Distance Higher Education Network, is formed, a consortium that currently brings together 70 public institutions in Brazil committed to democratizing access to quality education, through Distance Education, offering undergraduate, graduate and extension courses. In that year, the Distance Education Center of the State of Rio de Janeiro (CEDERJ) was also born, with the signing of a document that inaugurated the partnership between the Government of the State of Rio de Janeiro, through the Secretariat of Science and Technology, public universities and city halls of the State of Rio de Janeiro.                                                               |
| 2002 | CEDERJ is incorporated into the Distance Higher Education Science Center Foundation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

|      |                                                                                                                                                                                                                                                                                                                  |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | of Rio de Janeiro (CECIERJ Foundation).                                                                                                                                                                                                                                                                          |
| 2004 | Several programs for the initial and continuing education of public school teachers, through distance learning, were implemented by MEC. Among them, ProLiteracy and Media in Education. These actions led to the creation of the Open University System of Brazil.                                              |
| 2005 | The Open University of Brazil is created, a partnership between MEC, states and municipalities; integrating courses, research and higher education programs at a distance.                                                                                                                                       |
| 2006 | Decree No. 5,773, of May 9, 2006, comes into force, which provides for the exercise of regulation, supervision and evaluation of higher education institutions and undergraduate and sequential higher education courses in the federal education system, including those of distance modality (BRASIL, 2006).   |
| 2007 | Decree No. 6,303, of December 12, 2007, comes into force, amending provisions of Decree No. 5,622, which establishes the Guidelines and Bases for National Education (BRASIL, 2007). Brazilian Association of Distance Education 90 RBAAD – Distance education: concepts and history in Brazil and in the world. |
| 2008 | In São Paulo, a law allows High School distance education, where up to 20% of the workload may be done remotely.                                                                                                                                                                                                 |
| 2009 | Ordinance No. 10, of July 2, 2009, enters into force, which sets criteria for the exemption of in loco assessment and gave other measures for Distance Education in Higher Education in Brazil (BRASIL, 2009).                                                                                                   |
| 2011 | The Department of Distance Education is extinct.                                                                                                                                                                                                                                                                 |

Source: prepared by the author based on: (MAIA & MATTAR, 2007; MARCONCIN, 2010; RODRIGUES, 2010; SANTOS, 2010).

It is worth mentioning that between the 1970s and 1980s, private foundations and non-governmental organizations began to disseminate rapid distance courses, along the lines of Tele-education, with classes via satellite, supplemented by printed materials, characterizing the second generation of Education. Distance in Brazil. It was from the 1990s onwards that most Brazilian Higher Education organizations joined together to adopt distance

learning with the use of new information and communication technologies.

In the Brazilian scenario, the more transparent the information about the organization and operation of distance courses and programs, and the students aware of their rights, duties, and attitudes towards study, the greater the credibility of the institutions and more successful will be the experiences in the distance modality [8].

We know that distance education has been growing gradually over the years in Brazil. The courses offered are in several areas of knowledge; these courses have facilitated access to studies for people who live in distant places in Brazil. For all this dynamism to occur, we will see in the next topic the legislation that regulates distance learning in Brazil.

### 2.3 The history of EAD at UNEMAT

In the State of Mato Grosso, teacher training understood as a public policy, had its expression in the Interinstitutional Program for Teacher Qualification, involving the University of the State of Mato Grosso (Unemat), the Federal University of Mato Grosso (UFMT), the State of Education (SEDUC), the Municipal Departments of Education and, still, the Union of Workers of Public Education of Mato Grosso (SINTEP).

It was from the effective participation in this program that the Distance Education Division (DEAD) of Unemat was created, aiming to implement activities of a distance education program for teachers in practice, to improve productivity rates and the quality of education offered.

Unemat sought, from March 1999, the approval of the merit of the "Administrative Political Project of the Distance Education Division (DEAD)", which defines the decisions for the organization, implementation, and implementation of its infrastructure to offer courses in EAD. This program gave rise to the Full Degree in Basic Education: 1st to 4th series in the distance modality, implemented at Unemat in 1999, an opportunity in which infrastructure was created to provide autonomy in the management of distance courses.

Offered on the university campus of Nova Xavantina/Pedagogical Center of Nova Xavantina and on the Campus of Pontes e Lacerda/Pedagogical Center of Jauru, 424 and 491 places were offered, respectively, in the period 2000-2004, for in-service teachers. The courses offered were both for teacher training: the Pedagogy Course: Degree in Pedagogy - Basic Education - 1st to 4th grade (Resolutions 9 and 10/2005-CONSUNI) and the Full Degree Course in Pedagogy: Teaching in Early Childhood Education ( Resolution No. 011/2005-CONSUNI), the

latter offered through the inter-institutional partnership signed by the Pró-Formar consortium.

The courses offered by UAB in 2009 (Physics and Biology) were proposals for distance education projects from other institutions. The first was a proposal developed by the University of the State of Mato Grosso (UFMT) and the second, by the Ministry of Education. In summary, actions in which CEAD/Unemat acts as the executor of the propositions mentioned in the EAD modality. The program of the UAB, like the regions of the UAB and proposed by UFTM, aims at a practical exercise for a modality of education and a reflective formation of the offer in different courses for a state of teachers.

Also in 2008, with the adhesion of Unemat to the Open University System of Brazil (UAB), on 10/1/08, the Coordinator of UAB-Unemat (Ordinance No. 379/2010 UAB-Unemat – 10/1/08) to 10/2/10). This adhesion to the UAB totally re-signified the EAD modality at Unemat, because, by signing the Term of Technical Cooperation and Commitment with UAB/Capes, DEAD had to adapt to the requirements of the Federal Government Program both in terms of the conditions of infrastructure, as well as personnel, so that it could receive the financial resources to invest in equipment and furniture and also in the degree courses in Physics and Biology, which Unemat was authorized to offer within the scope of the UAB in 5 on-site support centers of the UAB (Jauru, Barra do Bugres, Alto Araguaia, Nova Xavantina and Sorriso) – Selection Notice No. 01/2006-SEED/MEC/2006/2007.

In 2009, Unemat adhered to the National Public Administration Plan and, through Public Notice No. 01, of 4/27/09, was able to offer 5 face-to-face support centers (Jauru, Alto Araguaia, Juara, Guarantã do Norte, Cáceres, Tangará da Serra e Pontes e Lacerda) the bachelor's degree in Public Administration and specializations in Municipal Public Management, Public Management, and Health Management. Concomitantly with the work with UAB/Capes, activities related to the degree courses in child pedagogy and pedagogy in basic education - initial grades 1st to 4th grades were also developed, offered by DEAD, which was an agreement signed between 42 consortium municipalities of the nuclei pedagogical practices in Jauru, Nova Xavantina, and São Félix do Araguaia (SILVA, 2010).

In 2010, there was an administrative restructuring, changing CEAD to DEAD – Distance Learning Board. DEAD is a directorate linked to the Dean of Education and Graduation (PROEG) and became responsible for the elaboration of pedagogical projects and for the execution of programs of graduation and post-graduation Lato Sensu courses in the distance modality. In 2021, according to the

website (<https://dead.unemat.br/portal/Polos/>), the number of centers will be 27, with courses being offered in different regions of the state of Mato Grosso.

Then, the methodology used for this research.

### III. METHODOLOGICAL PROCEDURES

At this stage, we applied a questionnaire to the students of the Public Administration course at the Vila Rica-MT campus, there was the application of a questionnaire, for data collection, to encourage participation and convey the opinion about the researched topic in a satisfactory way. And so, a questionnaire was applied to 37 students, so that each one had the opportunity to report their experiences during these four school years. This research was carried out in a quantitative-qualitative way and [7] argues that: “the set of quantitative and qualitative data are not opposed, on the contrary, they complement each other, because the reality covered by them interacts, dynamically, excluding any dichotomy”. Therefore, this research sought to identify which were the greatest difficulties and facilities during the course period.

#### 1.1 The history of distance education at the Araguaia Middle Campus “Dom Pedro Casaldáliga”

It was after the Expansion Seminar held by Unemat in 1990 (December 11th to 13th) that the University began its work in the interior of the state, meeting social demand, especially the teacher training. A multi-campus structure was adopted and the philosophy of taking the university where it is needed, at the appropriate time for each community (Mato Grosso: 1999). Representatives from 30 municipalities with similar interests in terms of training their teachers to work in Basic Education participated in this seminar. The first campus was created in Sinop and then in Alta Floresta, Alto Araguaia, Pontes e Lacerda, Nova Xavantina and the Médio Araguaia campus on 9/23/91.

The Middle Araguaia University Campus has its headquarters in the city of Luciara, approximately 1,500 km away from the city of Cáceres, where the University is located. Initially, in 1992, three undergraduate courses were implemented on this campus: Licentiate in Pedagogy, Letters, and Mathematics. And in 1996, the degree courses were in History, Geography, and Biological Sciences. In 2004, with the objective of better serving the North Araguaia Microregion, the Pedagogical Centers of Confresa and Vila Rica were installed. Since then, this campus has been present with a permanent physical and administrative structure in these three locations: Luciara, Confresa, and Vila Rica.



Given this connection between these cities, some courses were brought to the city of Vila Rica, such as Bachelor's Degree in Public Administration, Information System, Degree in Pedagogy.

**IV. RESULTS AND DISCUSSIONS**

The data presented here regarding the Bachelor's Degree in Public Administration, Vila Rica/MT, DEAD/Unemat, is the result of a questionnaire applied by the researcher to graduating students, so that, in this way, it is possible to understand the advantages and challenges to study at a distance. To achieve the specific objectives of this research, the questionnaire applied to the subjects participating in this study was organized into two sections.

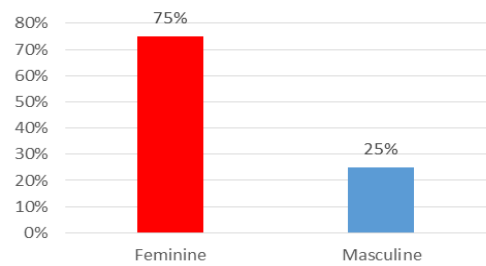
The first consisted of multiple-choice questions, which aimed to characterize the students graduating from the Public Administration course. For this, the variables are gender, age, marital status, how many members there are in the family if you have internet at home and how is the work to support yourself (the work you earn money) if you have another higher education, how much time you completed high school or your last graduation and how far you live from school.

The second section consisted of two open questions, intending to collect the subjects' perceptions about the positive and negative aspects of the course. The choice of open questions was intended to deepen the analysis of the advantages and challenges of studying at a distance.

In the following tables and graphs, we will see the multiple choice questions answered by students through google forms. It is worth mentioning that, before answering the questionnaire, the academics were able to read the informed consent form, and after reading about the research, choose the option of participating or not in the google forms questionnaire thus we obtained 20 academics who answered our questionnaire, a total of 37 who are currently enrolled in the course.

**4.1 Sex**

Considering that the object of study is the students who are enrolled in the 8th academic semester 2020/2, in the Bachelor's Degree in Public Administration, at the Vila Rica/MT campus, and who answered the researcher's questionnaire, it was found, that in the respondents relating to sex, that among the 20 who answered the questionnaire, 75% (15 academics) are female and 25% (05 academics) are male, as shown in Figure 1.



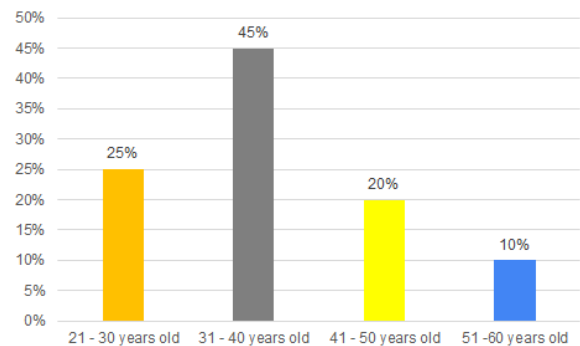
*Fig.1 – Percentage of female and male students in the DEAD/Unemat Public Administration course, in Vila Rica/MT.*

Source: prepared by the author according to research data.

In the graph above, it is possible to observe that the presence of females is predominant among the respondents.

**4.2 Age**

When analyzing the age variable of the respondents as shown in Figure 2, we found that the respondents with the highest percentage are between 31 and 40 years old, 9 respondents corresponding to 45%, and the age between 51 and 60 years old were chosen by two respondents, aged 61 or older was not chosen by any respondent as well as those under 20 years old who had no choice.



*Fig.2 - Age of respondents*

Source: prepared by the author according to research data.

According to the Census of Higher Education 2016, the average enrollment age of on-site students is 21 years old, while distance education students are 28 years old. The entry age for face-to-face students is 18 years old, while for distance education it is 27 years old. As for those graduating from face-to-face education, they are on average 23 years old, in distance education, they are 34 years old.

Data from the Vila Rica/MT hub correspond to data from the 2016 Higher Education Census in which the highest percentage of respondents from the distance Public Administration course chose the option of being between 31 and 40 years old.

4.3 Marital Status

Regarding marital status, 55% said they were married, another 40% said they were single and 5% chose the option that they are separated, as can be seen in Figure 3.

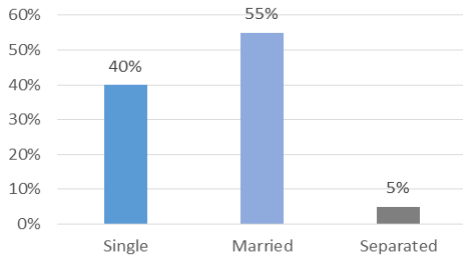


Fig.3. Marital Status of Respondents.

Source: prepared by the author based on research data.

It is possible to observe according to the chart that we do not have academics who are widowed.

1.2 How many family members do you live with?

According to the respondents, 40% say they live with 03 people, 20% say they live with 04 people, as you can see in figure 4 below:

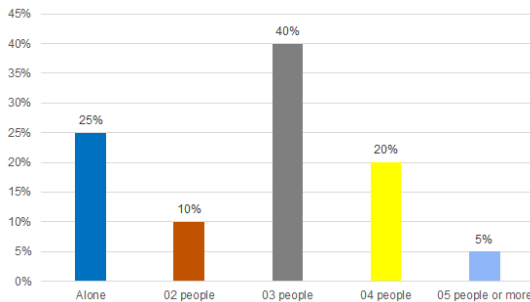


Fig.4- number of family members

Source: prepared by the author based on research data.

It is possible to note according to figure 4, that academics who live with 05 or more are the minority, 5%, accompanied by 2 people 10%.

4.4 Do you have internet at home?

In this question, 100% of respondents said they have internet at home. Although 100% say they have internet at home, the internet is slow and often makes it difficult to attend a class and post activities (emphasis added).

4.5 What do you do for a living?

About work, it is possible to see in figure 6 that 60% of the respondents are civil servants, and 25% work in a private company, and 15% are self-employed working on their own.

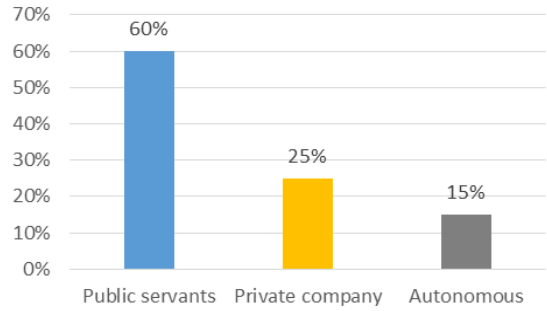


Fig.6 - Paid activity performed.

Source: prepared by the author based on research data.

It is possible to see in figure 6 that public servants are the largest number of respondents, corresponding to 60%.

4.6 Do you have a college degree? If yes, which one?

To this question, 50% said they did not have a college, and 50% answered that they had a college or more, to contemplate the answers of the respondents, a table was created, so that it is possible to understand the research data.

Table 1- Demonstration of answers regarding whether you already have a higher education course, if the answer is yes, which course

|     | Number of responses | Percentage | Which course                                                   | Percentage |
|-----|---------------------|------------|----------------------------------------------------------------|------------|
| Yes | 10                  | 50%        | Physical Education                                             | 5%         |
|     |                     |            | Veterinary Medicine                                            | 10%        |
|     |                     |            | Accounting Sciences                                            | 5%         |
|     |                     |            | Degree in computing                                            | 5%         |
|     |                     |            | Degree in Pedagogy                                             | 5%         |
|     |                     |            | Degree in Pedagogy and Physical Education                      | 5%         |
|     |                     |            | Three answered yes but did not describe the name of the course | 15%        |

|    |    |     |                                               |
|----|----|-----|-----------------------------------------------|
| No | 10 | 50% | 50% Does not have another higher level course |
|----|----|-----|-----------------------------------------------|

Source: prepared by the author based on research data.

Chart I shows that 50% of respondents do not have a higher education course, and another 50% say they do. The courses are very varied, among the variations 10% say they have veterinary medicine, the other courses only 5%. It is also possible to notice that among the respondents 5% (corresponding to 01 academic) have two higher courses, namely, Licentiate in Pedagogy and the Course of Physical Education.

4.7 How long ago did you complete high school or last graduation?

About the time they completed high school or the last graduation, those who answered up to 05 years old were 30%, and those who completed high school or the last graduation at 16 years old or more corresponds to 35%.

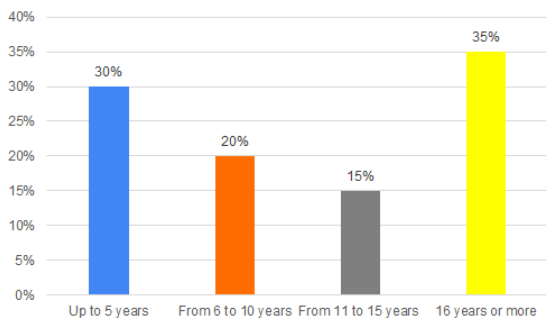


Fig.7 – Time to complete high school or last graduation.

Source: prepared by the author based on research data.

In Figure 7, it is possible to understand that most respondents stayed away from the classroom benches before starting the Public Administration course.

4.8 The distance you live from the campus.

In addition to the multiple-choice, because it understands that the Vila Rica/MT location covers a large dimension, it left the other option so that the respondent could say how far they live from the pole, so the answers were grouped according to the answers obtained from the subjects.

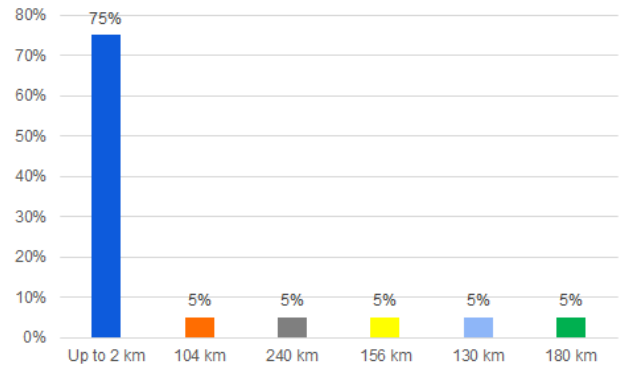


Fig.8 - Distance from the campus in kilometers.

Source: prepared by the author based on research data

According to the responses visible in the figure, it can be concluded that 25% of the students of the Public Administration Course at the Vila Rica/MT location travel more than 100 km to reach the face-to-face support center.

The following two questions were open so that the students could express their opinions about the course. The analyzes of the responses collected from the research subjects were first systematized and then read and grouped by proximity, which I highlight. The first open question was about the negative aspects of the course. And the answers of the academics were:

Problems with the internet. Answers from two academics.

Delay in service when questions arise. Faster responses in AVA.

Reports of the difficulty in the internship because of the pandemic.

Doubt clearing sessions to be more comprehensive.

There are also reports of difficulties by some academics regarding the discipline to study alone.

The second open question, I wanted to know from academics about the "good" things, the advantages of studying at a distance, these answers are about the possibility of being able to choose a study schedule according to the academic's needs, the material offered is good, most of the time the professors are committed to the academics, which collaborates in the learning process, it is possible to build friendships with other people throughout the course, and in the middle of the tasks, it is possible to fulfill my dream, which is to graduate.

Given the information above, flexibility in study hours is highlighted, and the answers collected demonstrate that students of the distance public administration course, in addition to academic commitment, are concerned with being with their family and with the job market, whether

him in the public service, in the private company or the self-employed service, and the flexibility of being able to study at home, the practicality of access to the AVA - the virtual learning environment, makes it possible to complete the undergraduate course.

## V. FINAL CONSIDERATIONS

This study aimed to analyze the advantages and challenges of studying at a distance, to achieve this objective, we sought to know the socioeconomic profile of the academics of the Public Administration course of the Vila Rica / MT campus, through a questionnaire applied by the author and answered through google forms.

In the analysis of the questions answered by the subjects, it was observed that, concerning gender, 75% are female and 25% are male.

Regarding age, the highest percentage is between 31 and 40 years old, 45%, and there are no people under 20 years of age who answered the questionnaire.

Regarding paid activity, 60% are civil servants, and only 15% are self-employed.

Regarding the number of family members, 40% say they have 3 people and 55% say they are married.

A relevant fact that caught our attention is the distance that some academics live from the campus, with 25% living above 100 km from it, the furthest being 240 km from the support unit.

Regarding the aspects of studying at a distance, positive and negative points can be observed. About the difficulties of studying at a distance, the subjects reported problems with the internet, it is worth mentioning that they all responded that they had internet at home, but when it comes to the quality it is possible to see that the internet leaves something to be desired. Another aspect is the delay in answering questions. The problem seems to be caused by the distance education academic being able to study at any time and often this time found for studying is only at night, at unconventional times, which ends up causing doubts that will often be answered only during business hours.

On the advantages of studying at a distance, these answers are about the possibility of being able to choose a study time according to the student's need, the material offered is good, most of the time the professors are committed to the academics, which collaborates in the learning process. It is possible to build friendships with other people throughout the course, and during daily tasks, it is possible to fulfill my dream, which is to graduate.

Considering the above, it is worth mentioning that despite some problems, it can be said that the result in the researchers' view is quite positive because, despite the difficulties, academics are ending 04 years of challenges faced daily to obtain the degree of Bachelor in Public Administration.

Throughout this study, we understand the need to develop research in order to understand what should be done in the view of academics to make the course better and gather suggestions on how to implement improvements in the distance course.

## REFERENCES

- [1] Alves, L. (2011). Educação à distância: conceitos e história no Brasil e no mundo. *Revista Brasileira de Educação à Distância*. Vol. 10. DOI: <https://doi.org/10.17143/rbaad.v10i0.235>.
- [2] Gouvêa, G; Oliveira, C. I. (2006). Educação à Distância na formação de professores: viabilidade, potencialidades e limites. Rio de Janeiro: Vieira & Lent. ISBN-10 : 8588782340.
- [3] Guarezi, R. C. M; Matos, M. M. (2009). Educação a distância sem segredos. Curitiba: Ibpex.
- [4] Machado, L. C. (2016). Cenários da EaD no mundo, no Brasil e na ENFAM: alguns apontamentos. EaD/ENFAM.
- [5] Marconcin, M. A. Desenvolvimento Histórico da Educação à Distância no Brasil. 2006.
- [6] Maia, C.; Mattar, J. (2007). ABC da EAD: educação à distância hoje. São Paulo: Pearson Prentice Hall.
- [7] Minayo, M. C. Pesquisa social: teoria, método e criatividade. (2002). 17ed. Petrópolis: Vozes.
- [8] MEC. Ministério da Educação. Instituto Nacional de Estudos e Pesquisas Educacionais (INEP). (2016). Censo da Educação Superior.
- [9] Preti, O. (2005). (Org.). Educação à distância: Ressignificando práticas. Brasília, DF: Liber Livro.
- [10] Schmitt, V.; Macedo C. M. S.; ULBRICHT V. R. (2008). A Divulgação de cursos na modalidade a Dis-tância: uma análise da literatura e do atual cenário brasileiro. *Revista Brasileira de Aprendizagem Aberta e à Distância*, Rio de Janeiro, v. 7.
- [11] Vasconcelos, S. P. G. (2010). Educação a Distância: histórico e perspectivas. *Universidade do Estado do Rio de Janeiro (UERJ)*, v. 8, n. 01.

## There is no Candomblé Without Leaves: The importance of nature in the religion's rites

## Não Existe Candomblé Sem Folhas: A importância da natureza nos ritos da religião

Ricardo Carneiro Bastos<sup>1</sup>, Jorge Luiz Schirmer de Mattos<sup>2</sup>, Wagner Lins Lira<sup>3</sup>, José Nunes da Silva<sup>4</sup>

<sup>1</sup>Doutorando do Programa de Pós-graduação em Agroecologia e Desenvolvimento Territorial da Universidade Federal Rural de Pernambuco (UFRPE), Brasil.

<sup>2</sup>Doutor em Zootecnia. Coordenador do Programa de Pós-Graduação em Agroecologia e Desenvolvimento Territorial da Universidade Federal Rural de Pernambuco (UFRPE), Brasil.

<sup>3</sup>Doutor em Antropologia. Professor Colaborador do Programa de Pós-Graduação em Agroecologia e Desenvolvimento Territorial da Universidade Federal Rural de Pernambuco (UFRPE), Brasil.

<sup>4</sup>Doutor em Sociologia. Professor do Programa de Pós-Graduação em Agroecologia e Desenvolvimento Territorial da Universidade Federal Rural de Pernambuco (UFRPE), Brasil.

Received: 30 Aug 2022,

Received in revised form: 21 Sep 2022,

Accepted: 25 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Candomblé, Disenchantment, Environment, Nature.*

**Palavras-chave**— *Candomblé, Desencantamento, Meio Ambiente, Natureza.*

**Abstract** — *We are living through an environmental crisis unprecedented in human history. This problem highlights the ethical and moral crisis and the environmental imbalance that affects the quality of life on the planet, such as global warming and the current global health situation. In this sense, the starting point of this discussion involves understanding the society-nature relationship, that is, understanding at what point in civilizational history this relationship was broken. This distancing of society from nature is related to the emergence of capitalism and, therefore, to the process of disenchantment of the world and nature. Thus, the present article, based on a bibliographical research, relates religion, through Candomblé, with the environmental issue, and the dialectics of the practice of religious rites with the environment, starting from the premise that Candomblé and its practitioners share the ecological vision.*

**Resumo** — *Vivemos uma crise ambiental sem precedentes na história da humanidade. Destaca-se nessa problemática, a crise ética e moral e a o desequilíbrio ambiental que atinge a qualidade de vida no planeta, tal como o aquecimento global e da atual conjuntura sanitária mundial. Nesse sentido, o ponto de partida dessa discussão passa pelo entendimento da relação sociedade-natureza, isto significa, entender em que momento da história civilizacional essa relação foi rompida. Esse distanciamento da sociedade com a natureza é concernente ao surgimento do capitalismo e, portanto, ao processo de desencantamento do mundo e da natureza. Assim, o presente artigo, a partir de uma pesquisa bibliográfica, relaciona a religião, através do Candomblé, com a questão ambiental, e a dialética da prática dos ritos religiosos com o meio*

ambiente, partido da premissa que o Candomblé e os seus praticantes comungam da visão ecologista.

## I. INTRODUÇÃO

*“Euá, Euá  
É uma moça cismada  
Que se esconde na mata  
E que não tem medo de nada  
Euá, Euá  
Não tem medo de nada  
O chão, os bichos  
As folhas, o céu.”*

(Gilberto Gil & Caetano Veloso)

Refletir sobre as questões ambientais, a necessidade de proteção do meio natural e da sustentabilidade da biodiversidade são essenciais para a preservação dos territórios e dos povos que neles convivem. Com as religiões afro-brasileiras não é diferente, uma vez que apresentam fortes ligações com a natureza.

Nesse sentido, após revisão bibliográfica, percebe-se que alguns autores colocam as religiões afro-brasileiras com um *status* de ecológica. No presente artigo, apontamos a evolução histórica da ecologia como movimento ambientalista, em consonância com o conceito de sustentabilidade. Portanto, a visão apresentada ressalta a ecologia política, linha que tende a considerar não apenas o território, mas a própria socionatureza como a base do processo produtivo e como palco de conflitos (Jatobá, Cidade & Vargas, 2009).

Para Santos (2011), nos deparamos com afirmações do tipo que as práticas ecológicas dessas religiões precedem os movimentos ecológicos, haja vista que a reverência aos elementos da natureza, corporificados nos orixás, fazem parte do bojo da sua experiência religiosa. O autor também reforça que, essas religiões são intrinsecamente preservacionistas, em virtude da utilização de espaços naturais (rios, matas, cachoeiras e outros) como locais de cultos e, por último, considera que a visão ecológica é uma das heranças da tradição africana preservada nessas religiões.

Para Pereira (2013, p. 02), muitos acreditam

em um Deus imutável, ou em Deuses imutáveis, não sujeitos à ação do tempo, nem à evolução dos seres viventes. Quanto a isso, tenho que é possível desconfiar que Ele ou Eles vivem em constantes mudanças, apenas o fazem antes de nós, pois são mais ligeiros, mais velozes, feito a correnteza de um rio raso, bem diferentes dos rios profundos, que

correm devagar, lentos, quase preguiçosos, como se não quisessem chegar ao mar ou a lugar algum. É possível que estas e outras questões semelhantes tenham contribuído para o contínuo afastamento de tantos religiosos e religiosas das questões relativas ao meio ambiente e a sustentabilidade do planeta.

Nesse contexto, em virtude da dissonância entre a questão ambiental e as práticas entre sociedade e a natureza, esse artigo intenta estabelecer uma discussão dialógica entre religião e meio ambiente. Conforme preconiza Martins (2015), nas práticas do Candomblé, a natureza é o sagrado, onde acontece a comunhão entre o mundo espiritual e o material que deve ser reverenciado e bem cuidado. Esta convicção alinha as práticas herdadas das religiões africanas e incorporadas ao Candomblé a uma das maiores inquietações da atualidade: a preservação da biodiversidade.

Estamos diante de duas temáticas atuais e imperiosas: o crescimento das religiões através da busca pela religiosidade em função das vicissitudes contemporâneas, que coloca a religião como fenômeno social. E a crise ambiental que atinge a qualidade de vida no planeta, a exemplo do desmatamento, uso indiscriminado de agrotóxicos, mudanças climáticas, entre outros.

Assim, a utilização da natureza nos ritos religiosos pelo candomblé, nos remete ao cerne dessa discussão. No primeiro momento, a falta de áreas naturais nas proximidades dos terreiros e, depois, a utilização de Unidades de Conservação para os rituais da religião.

O interesse por essa pesquisa surgiu na disciplina *Cultura, Identidade e Território*, após leitura e discussão do texto “Colonização, quilombos: modos e significado” de Antônio dos Santos Bispo. No referido texto, Bispo (2015) ao falar sobre povos quilombolas e religiosidade ressalta que, nos terreiros, em momentos de celebrações, é compartilhada a sabedoria da ancestralidade e a força viva da natureza, de acordo com a situação de cada pessoa da comunidade.

Enfatiza-se, por último, a contribuição dessa pesquisa para o Candomblé e para os seus praticantes no sentido de, conforme Murad (2013), qualificar uma experiência religiosa que favoreça uma relação social desses credos com tolerância e liberdade religiosa.

## II. METODOLOGIA

A pesquisa é considerada um procedimento formal com método de pensamento reflexivo que requer tratamento científico. Debruça-se na perspectiva de encontrar respostas a questões propostas utilizando métodos científicos (Lakatos & Marconi, 2003).

Nesse contexto, uma das primeiras etapas de uma investigação científica é a pesquisa bibliográfica (Lakatos & Marconi, 2003). Fase em que o pesquisador realiza a busca minuciosa de obras já publicadas, dentre as quais: livros, periódicos, artigos científicos, revistas, dissertações, teses, internet, entre outras, para melhor conhecer e analisar o objeto de estudo a ser pesquisado.

Desse modo, trata-se de uma etapa imprescindível que consiste em identificar os principais trabalhos já realizados capazes de fornecer dados atuais e relevantes relacionados com o tema da pesquisa. Com isso, é importante ressaltar que, a pesquisa realizada servirá como fundamentação teórica para um novo olhar sobre o tema proposto.

Isto posto, em concordância com Lakatos e Marconi (2003), a pesquisa bibliográfica não é mera recorrência do que já foi dito ou escrito sobre alguns temas, mas traz a possibilidade de um novo enfoque, propiciando conclusões inovadoras.

Assim, o procedimento metodológico adotado no presente artigo, consiste na tipologia pesquisa bibliográfica, partindo do pressuposto teórico dos temas: ecologia, natureza e candomblé. Espera-se, portanto, que essa discussão traga novos horizontes para a pesquisa científica.

## III. DO CAPITALISMO NASCENTE AO DESENCANTAMENTO DA NATUREZA

Vivemos hoje uma crise civilizatória sem precedentes. Destaca-se nessa problemática a crise ética e moral e a crise ambiental que atinge a qualidade de vida no planeta, a exemplo do aquecimento global e da atual conjuntura sanitária mundial, da vivência da pandemia da COVID-19. Diante de um panorama tão estarrecedor cabe-nos uma pergunta e uma reflexão: como chegamos nesse cenário?

O ponto de largada dessa discussão passa pelo entendimento da relação sociedade-natureza, ou seja, entender em que momento da história civilizacional essa relação foi rompida. Para muitos pensadores esse distanciamento da sociedade com a natureza é concernente ao surgimento do capitalismo. Nesse sentido, Unger (1991), fala em desencantamento do mundo, portanto, o desencantamento da natureza. Para a autora, “no caso do

capitalismo nascente, há uma necessidade de realizar o que Weber chamou de desencantamento do mundo” (Unger, 1991, p. 52), ou seja, a natureza precisa estar desprovida de encantos e reduzida aos seus aspectos produtivos.

De acordo com Pierucci (2003, p. 30), ao originar o termo desencantamento do mundo, Weber procurou inspiração em outra descrição do poeta e filósofo Friedrich Schiller, em que “para condensar numa única expressão os impactos da modernidade sobre a mãe natureza, Schiller teria pensado num efeito de ‘desdivinação’, ou, dizendo-a aqui de outra forma também possível em português, um efeito de ‘desendeusamento da natureza’”.

Assim, o âmbito do processo de desencantamento do mundo, segundo Ramalho (2019, p. 06) “está na naturalização deste, naturalização significando o inverso do que é divino, sagrado, ou seja, o mundo perde seu caráter sagrado, em particular o mundo natural”. Dessa forma, a dessacralização levada pelo desencantamento do mundo é marcada na relação ser humano-natureza através da separação e desvalorização entre ambos.

Na tradição judaico-cristã isso ocorre, particularmente, devido, particularmente, à negação da imanência, do dualismo metafísico e do antropocentrismo. A negação da imanência é a rejeição à existência de divindades ou forças anímicas que habitam ou são parte deste mundo, prevalecendo apenas a crença num deus distante e desconectado deste plano; o dualismo metafísico separa tudo em binômios – sendo um deles cultura-natureza – e lhes impõe valores positivos e negativos, o que, em última instância, implica na rejeição deste mundo por associação ao mal, à tentação; o antropocentrismo – o qual não exclui a concepção teocêntrica judaico-cristã – põe o ser humano como exterior e superior à natureza (Ramalho, 2019, p. 06).

Dessa forma, o desencanto do mundo e o desencanto da natureza estão intrinsecamente relacionados ao antropocentrismo e ao processo de dessacralização impulsionada pelo capitalismo. Assim, Silva e Tavares de Lima (2018) ressaltam a importância de salientar que a maneira hegemônica de compreender o mundo, oriunda de uma perspectiva eurocêntrica e colonialista, é agravada, sobretudo, nas sociedades capitalistas.

No mundo ocidental, conforme Soffiati (2008), é a partir do início do ano de 1970 que se percebe uma crise ambiental planetária exteriorizada pelo esgotamento dos recursos naturais não-renováveis, principalmente os fósseis.

Nesse contexto, instalada uma crise ambiental e civilizacional, cabe aqui apresentar uma breve linha histórica do movimento ecológico, apontando alguns marcos referenciais dessa trajetória.

O vocábulo Ecologia foi citado pela primeira vez, segundo Barbosa e Silveira (2018), em 1866 pelo biólogo alemão Ernest Heinrich Haeckel em sua obra “*Generelle Morphologie der Organismen*”. Na obra, Haeckel a define como sendo a ciência capaz de compreender a relação do organismo com seu ambiente.

Não obstante, de acordo com Kato e Martins (2016, p. 194), o botânico inglês Arthur George Tansley introduziu o conceito de Ecossistema.

Mas me parece que a concepção fundamental, o sistema inteiro (no sentido da física), inclui não apenas o organismo complexo, mas também o complexo dos fatores físicos como um todo, constituindo o que chamamos de meio ambiente do bioma – os fatores do habitat no sentido amplo (Kato; Martins, 2016, p. 194).

Dessa forma, ele enfatizou a integração dos fatores bióticos e abióticos, isto é, ampliou na sua definição uma visão sistêmica.

De certo, a definição desses conceitos foram fundamentais para o embasamento da ecologia. Porém, outras passagens ao longo do curso histórico/civilizacional foram imperiosas nessa trajetória. Nesse sentido, ressalta-se a publicação do livro “Primavera Silenciosa” da jornalista Rachel Carson em 1962. Na publicação, a jornalista denuncia ao mundo o abuso de produtos químicos na agricultura e suas consequências para o meio ambiente e sociedade.

Igualmente, também na década de 1960, inicia-se um movimento chamado de contracultura que se coloca na contramão dos padrões estabelecidos socialmente, inclusive questionando os padrões de consumo dos países do Primeiro Mundo. O ápice dessa contestação deu-se nos Estados Unidos, com o movimento *hippie*. Outros movimentos estiveram associados à contracultura a exemplo do feminismo, a cultura de paz em objeção a guerra, a exemplo do Conflito do Vietnã, além de contestações políticas contra opressão social, por classe social, gênero ou cor.

Os movimentos ambientais e sociais apresentados acima, sinalizam para a importância da discussão do paradigma ecológico diante de uma crise ambiental sem precedentes na história. A partir da segunda metade do século XX o mundo pôde acompanhar e vivenciar as sequelas de um sistema remanescente da Revolução Industrial que, por visar apenas a produtividade com foco no crescimento econômico, não atentou pela qualidade do ambiente e a consequente saúde da população (Matos; Santos, 2018).

Assim, as consequências sobre o meio ambiente são de proporções catastróficas a exemplo de contaminações de rios, poluição do ar, vazamento de produtos químicos nocivos, a perda de milhares de vidas e, impactado inclusive negativamente nos biomas brasileiros. A crise ambiental que vivenciamos provoca na sociedade a reflexão sobre a necessidade de novos paradigmas de ordem ideológica e de valores da própria sociedade, levando a repensar a ética do progresso que orienta a técnica, ao menos desde o início da modernidade (Matos; Santos, 2018). Fica, portanto, perceptível que tal crise é evidenciada, por inerência, como um fenômeno da crise da própria modernidade e do processo de modernização, embasados na separação do homem da natureza e na racionalização e no progresso como desenvolvimento.

### 3.1 Candomblé: natureza e religião

Nessa trajetória, algumas sociedades tradicionais, a exemplo dos povos quilombolas mantém uma relação mais harmoniosa com a natureza, a partir das suas práticas culturais e religiosas.

No entanto, antes de avançar na discussão, Silva e Tavares de Lima (2018, p. 2) fazem uma ressalva sobre as variedades de “práticas de matrizes africanas que poderiam, através de rápidas generalizações, ser chamada de candomblé”. Eles creditam essa disseminação ao fato de, historicamente, os candomblés no Brasil, surgirem da associação de diversas práticas e crenças que tiveram origem em variados locais do continente africano.

Assim, busca-se uma reflexão acerca da relação religião e natureza. Para Hora Filho (2016, p. 41) “a mística do Candomblé é manifestada por seus praticantes através de incorporações e oferendas nas quais acreditam canalizar as forças presentes na natureza”.

O aspecto que mais se destaca dessas religiões com relação à questão ambiental está no fato de a natureza ser um elemento central no seu modo de perceber o divino, pois é nos rituais e cultos aos Orixás que as matrizes africanas se revelam mais intensamente. Para Martins, (2015, p. 269):

A consciência ambiental é primordial para os seguidores e seguidoras dos Orixás. A cosmovisão Africana e Afro-Brasileira identifica os Orixás como sendo a natureza, assim é natural que nos Candomblés, se aprenda a conservar e conviver com a natureza, tornando cada Ilê (templo), um polo de resistência aos descuidos com o Meio ambiente, e no qual, cada habitat ou elemento natural está relacionado a um Orixá, que por sua vez, tem como uma de suas características, preservar o planeta com a sua natureza e a humanidade.



Dessa forma, a utilização e a identificação com os elementos da natureza são fundamentais para a ritualística do Candomblé. Prandi (2001) destaca que o Candomblé conserva a ideia de que as plantas são fontes de axé, a força vital sem a qual não existe vida ou movimento, que sem esta, o culto não pode ser realizado.

Nas religiões afro-brasileiras, a exemplo do candomblé, é comum combinar diferentes ervas ou folhas a diferentes entidades ou espíritos. Muitos são os orixás, e cada um possui o seu domínio; aqueles mais ligados ao domínio da mata são Oxóssi, Ossaim ou Ogum, onde o sincretismo com os elementos vegetais é comum (Silva & Silva, 2019).

Além desses elementos, ressalta-se o uso das folhas sagradas que se usa em suas iniciações e magias, uma vez que, reconhecer as folhas faz parte do fundamento religioso e da ligação homem-natureza-divindade. Sendo assim, conforme Soares Filho e Rocha (2019), vale ressaltar que em todo ritual do Candomblé há a presença constata de folhas e isso evidencia a importância da questão ambiental para os praticantes do culto já que é atribuída às folhas, valores que atestam a vinculação entre a ritualística das religiões afro-brasileiras e os elementos naturais.

Dessa maneira, nos terreiros de Candomblé, a convergência entre natureza e religião, na qual estes elementos estão intimamente ligados, estabelece um terreno fértil ao processo de respeito e conservação ambiental. Ressalta-se que, quando os Candomblés se localizavam em territórios rurais, existia a manutenção de espaços de vegetação no próprio terreiro. No entanto, atualmente a maioria dos terreiros estão localizados em grandes centros urbanos, ou seja, tornou essa aproximação com a natureza mais limitada. distante.

Nos centros urbanos, ou em áreas adjacentes, existem matas que são preservadas por leis ambientais. A Lei 9.985/2000, que instituiu no Brasil o Sistema Nacional de Unidades de Conservação (SNUC), apresenta duas categorias de manejo para Unidades de Conservação (UCs): as de Proteção Integral e de Uso Sustentável.

As Unidades de Conservação (UCs) foram criadas para proteger ecossistemas e biomas em acelerado processo de degradação ambiental, em virtude dos impactos sofridos por esses ambientes naturais no processo de colonização do nosso país.

No Brasil, os ciclos econômicos como a civilização do açúcar, a mineração, a borracha, e o processo de urbanização concentrados, especialmente, na zona litorânea, contribuíram para o processo acelerado de desmatamento dessas áreas naturais, tendo como consequência a drástica diminuição desses espaços, a

exemplo da Mata Atlântica, que hoje conta com 5% a 7% da área natural.

Nesse sentido, as oferendas do Candomblé devem, inevitavelmente, serem realizadas junto a natureza, como em cachoeiras, árvores, rios de água limpa. Exemplo dos rituais umbandistas e candomblecistas na cidade do Rio de Janeiro, que tradicionalmente realizam essas práticas em duas Unidades de Conservação: O Parque Nacional da Tijuca e o Parque Estadual da Pedra Branca (Santos Júnior, Machado & Vilani, 2021).

Desse modo, o Candomblé é reconhecido como uma religião que apresentam fortes ligações com a natureza:

O elemento natural compõe parte intrínseca e fundamental nas suas práticas religiosas. Mais do que presente na natureza, os Orixás no panteão africano seriam transfigurações dos elementos naturais, razão mais que suficiente para que os seus praticantes se voltem para a proteção do meio ambiente como forma de preservar as suas divindades, garantir condições para que as oferendas, preceitos e a ritualística se mantenha como ligação entre o indivíduo e o sagrado (Soares Filho & Rocha, 2019, p.08).

Contudo, Boaes e Oliveira (2011) afirmam que, para alguns ecologistas, os praticantes do Candomblé podem ser vistos tanto como protetores do pensamento ecológico, quanto como poluidores da natureza, em virtude das suas práticas religiosas – particularmente o sacrifício animal e a entrega de oferendas às divindades em áreas verdes ou em áreas de preservação ambiental. Assim, as religiões afro-brasileiras e seus praticantes ora são vistos como “ecologistas espirituais” ora como “degradadores do meio ambiente”, dependendo da ótica pela qual estão sendo analisadas.

No entanto, a tradição do culto tem cedido lugar aos apelos ambientais, a partir de acusações de degradação do meio ambiente por adeptos das religiões afro-brasileiras. As queixas são referentes aos ritos com oferendas que são oferecidas nas matas, rios, mares, além de outros ambientes naturais. Tais imputações, são relativas a mudanças incorporadas pelas facilidades do mundo moderno, a exemplo das velas que antes eram produzidas com cera de abelhas e atualmente são substituídas pelas fabricadas com parafina.

Além disso, a utilização do plástico e do vidro nas oferendas, ou seja, a troca de materiais biodegradáveis por outros não-biodegradáveis. Nesse ponto, assevera Soares Filho e Rocha (2019), se instala uma situação de conflitos entre seus praticantes e outros atores da sociedade, tal

como de proibições do acesso das comunidades religiosas a espaços de preservação ambiental.

Nesse contexto, Belém (2008, p. 46) assegura que, “em um meio ambiente devastado, não há a menor chance dessa tradição religiosa sobreviver”. Nesse mesmo sentido, conforme preconiza Botelho (2011, p. 10), a continuidade dos “ritos feitos para Ossaim é fundamental a manutenção e preservação da natureza, uma vez que o Orixá se afasta quando o elemento revelador de sua força se acaba. Não existe Candomblé sem esse Orixá, porque não há Candomblé sem folha”. Assim, diante do exposto, salienta-se a importância que a religião atribui às folhas, ressaltado no título desse trabalho como uma relação que sinaliza o uso delas com a questão ambiental e a vinculação entre a ritualística do candomblé com os elementos da natureza.

Dessa forma, essa discussão nos remete a relação entre a crise ambiental e o futuro dessas práticas religiosas. Para Matos e Santos (2018) o que se deve evidenciar, sem sombra de dúvidas, é a subsistência de uma interlocução que busque harmonizar os interesses dessas duas vertentes aparentemente antagônicas: a preservação ambiental e a manutenção dos ritos religiosos. Nesse sentido, alguns resultados começam a se desenhar a exemplo da criação de leis específicas, a exemplo:

Decreto Federal 3551/00, que institui o registro de bens culturais de natureza imaterial que constituem patrimônio cultural brasileiro e cria o Programa Nacional do Patrimônio Imaterial; do Decreto nº 6.040/2007, que institui a Política Nacional de Desenvolvimento Sustentável dos Povos e Comunidades Tradicionais; da criação de espaços especialmente destinados ao uso pela comunidade religiosa de matriz africana, denominados ‘zonas especiais de interesse social’, de acordo com a Lei 10.257/01, já existentes em Salvador (Matos & Santos, 2018, p. 29).

Também, de acordo com Matos e Santos (2018), merece menção a criação de espaços sagrados reservados adotado pelo estado do Rio de Janeiro, denominado “Espaço Sagrado”, que consiste na criação de espaços reservados para cultos e práticas religiosas. No entanto, o mapeamento desses territórios merece ressalva e um olhar mais atento, em virtude da possibilidade de aumentar a segregação desses territórios afroreligiosos.

#### IV. CONCLUSÃO

Há concordância entre os estudiosos sobre a existência de uma crise ambiental mundial, reflexo do processo de degradação do meio ambiente. Como consequência, pode-se citar, entre outros, o aquecimento

global e as mudanças climáticas do planeta. Também compreendem que o crescimento do capitalismo e do consumo foram responsáveis pelo atual quadro de degradação ambiental.

Com o capitalismo nascente, percebe-se um afastamento entre sociedade e natureza que leva ao desencantamento do mundo e no desencantamento da natureza, ou seja, ao processo de dessacralização. No entanto, reconhece-se que algumas sociedades tradicionais, como os povos quilombolas, têm uma relação mais harmoniosa com a natureza, simbolizada na relação com a terra, com a ancestralidade, com o território e com o meio ambiente.

Assim sendo, Unger (1991) ressalta que esse desencantamento do mundo é na verdade o desencantamento do nosso olhar que se torna frio e opaco ao nos distanciarmos da natureza. Portanto, reencantar o mundo é reencantar o nosso olhar.

Nesse sentido, o Candomblé é relacionada como uma religião voltada para o meio ambiente, em virtude dos seus rituais ligados a natureza, rios, mares e matas. Também creditam a importância das folhas nos ritos sagrados.

Diante do exposto, percebe-se que em um momento a religião recebe uma conotação preservacionista e, em outras referências relacionam o Candomblé a uma religião conservacionista. Faz-se, portanto, imperioso destacar que se trata de dois conceitos diferentes. Segundo Brito, Brito e Souza (2015), os principais atributos do conservacionismo provêm da sobrecarga imposta à natureza e o modo de se organizar a sociedade, é a maneira como a sociedade utiliza os recursos naturais.

O preservacionismo também conhecido como ecologia profunda ou *deep ecology* (Diegues, 2008), tem sua base na conservação dos recursos naturais e tem uma essência conceitual romântica. Os principais mentores desta corrente são os ecologistas radicais que defendem o homem como parte intrínseca da natureza.

Por fim, destaca-se a preocupação da religião candomblé com a prática conservacionista, em virtude de um uso racional da natureza como garantia da perpetuação dos seus rituais religiosos.

#### REFERÊNCIAS

- [1] Barbosa, L. L. P., Silveira, A. (2018) Representações do conceito de Ecologia: análise de livros didáticos e concepção de alunos de ciências biológicas. *Tear: Revista de Educação Ciência e Tecnologia*, 7(1), 1-20. Recuperado de <https://periodicos.ifrs.edu.br/index.php/tear/article/download/2577/2020>.

- [2] Belém, I. C. C. (2008). *Mitos pantaneiros e africanos nos círculos de aprendizagens ambientais*. (Dissertação de Mestrado). Universidade Federal de Mato Grosso, Cuiabá, Brasil. Recuperado de <https://onedrive.live.com/view.aspx?cid=17DC7D667214610D&resid=17DC7D667214610D%21349&app=WordPdf>.
- [3] Bispo, A. S. (2011). *Colonização, quilombos: modos e significado*. Universidade de Brasília: Brasília.
- [4] Boaes, A. G., Oliveira, R. S. (2011). Religiões Afro-Brasileiras e Ética Ecológica: ensaiando aproximações. *Revista Brasileira de História das Religiões*, 3(9). Recuperado de <http://www.dhi.uem.br/gtreligiao>.
- [5] Botelho, P. F. EWÉ AWO: o segredo das folhas no candomblé da Bahia. (2011). *Educação, Gestão e Sociedade*, São Paulo, 1(4), p. 1-13. Recuperado de [http://uniesp.edu.br/sites/\\_biblioteca/uploads/20170427132906.pdf](http://uniesp.edu.br/sites/_biblioteca/uploads/20170427132906.pdf).
- [6] Brito, B. L., Brito, D. M. C., Souza, E. A. (2015). Pressupostos teóricos de proteção da natureza. *Planeta Amazônia: Revista Internacional de Direito Ambiental e Políticas Públicas*. Macapá, 7, p. 141-147. Recuperado de [file:///C:/Users/ricar/Downloads/2240-9338-1-PB%20\(3\).pdf](file:///C:/Users/ricar/Downloads/2240-9338-1-PB%20(3).pdf).
- [7] Diegues, A. C. S. (2008) *O Mito Moderno da Natureza Intocada*, 6a ed., São Paulo: HUCITEC.
- [8] Hora Filho, E. A. (2016). *Ecopedagogia no Terreiro de Candomblé Angola*. (Dissertação de Mestrado). Universidade Federal de Pernambuco, Recife, Brasil. Recuperado de <https://repositorio.ufpe.br/handle/123456789/19463>.
- [9] Jatobá, S. U. S., Cidade, L. C. F., Vargas, G. M. (2009). Ecologismo, Ambientalismo e Ecologia Política: diferentes visões da sustentabilidade e do território. *Sociedade e Estado*, Brasília, 24(1), p. 47-87. Recuperado de <https://www.scielo.br/j/se/a/CSrVxYphhYvHrgcZgRNF8WF/?format=pdf&lang=pt>.
- [10] Kato, D. S., Martins, L. A. P. (2016). A sociologia de plantas: Arthur George Tansley e o conceito de ecossistema (1935). *Filosofia e História da Biologia*, 11(2), p. 189-202. Recuperado de [https://www.abfnhb.org/FHB/FHB-11-2/FHB-11-2-Danilo-S-Kato\\_Lilian-A-C-P-Martins.pdf](https://www.abfnhb.org/FHB/FHB-11-2/FHB-11-2-Danilo-S-Kato_Lilian-A-C-P-Martins.pdf).
- [11] *Lei 9.985, de 18 de julho de 2000*. (2000). Institui o Sistema Nacional de Unidades de Conservação da Natureza e dá outras providências. Brasília: Casa Civil. Recuperado de [http://www.planalto.gov.br/ccivil\\_03/leis/19985.htm](http://www.planalto.gov.br/ccivil_03/leis/19985.htm).
- [12] Marconi, M. A., Lakatos, E. M. (2003). *Fundamentos da Metodologia Científica*. 5a ed., São Paulo: Atlas.
- [13] Martins, F. R. (2015). *Candomblé e Educação Ambiental: uma possível e construtiva relação*. 2015. (Dissertação de Mestrado). Universidade Federal do Pará, Belém, Brasil. Recuperado de <https://www.ppgcma.propesp.ufpa.br/index.php/br/teses-e-dissertacoes/dissertacoes/50-2015>.
- [14] Martins, F. R. (2015). Educação Ambiental e Candomblé: afro-religiosidade como consciência ambiental. *Paralellus - Revista Eletrônica em Ciências da Religião*, Recife, 6(12), p. 265-278. Recuperado de <http://www.unicap.br/ojs/index.php/paralellus/article/view/353/pdf>.
- [15] Matos, S. M. S., Santos, A. C. (2018). Modernidade e crise ambiental: das incertezas dos riscos à responsabilidade ética. *Trans/Form/Ação*, Marília, v. 41(2), p. 197-216. Recuperado de <https://www.scielo.br/j/trans/a/K8Cj5mFky7B39SpVpHWt34F/?lang=pt>.
- [16] Murad, A. T. (2013) Consciência planetária, sustentabilidade e religião: consensos e tarefas. *Horizonte - Revista de Estudos de Teologia e Ciências da Religião*, Belo Horizonte, 11(30), p. 443-475. Recuperado de <http://periodicos.pucminas.br/index.php/horizonte/issue/view/340>.
- [17] Pereira, P. C. (2013). Religião e sustentabilidade: meio ambiente e qualidade de vida. *Paralellus - Revista Eletrônica em Ciências da Religião*, Recife, 4(8), p. 131-135. Recuperado de <http://www.unicap.br/ojs/index.php/paralellus/article/view/312/320>.
- [18] Pierucci, A. F. (2003). *O desencantamento do mundo: todos os passos do conceito em Max Weber*. São Paulo: Editora 34.
- [19] Prandi, R. (2001). *Mitologia dos Orixás*. São Paulo: Companhia das Letras.
- [20] Ramalho, E. (2019). A relação ser humano-natureza no desencantamento religioso do mundo. *Último Andar*, São Paulo, 33, p. 02-18. Recuperado de <https://doi.org/10.23925/1980-8305.2019.i1p2-18>.
- [21] Santos Júnior, V. J., Machado, C. J. S., Vilani, R. M. (2021). Turismo e práticas afrorreligiosas em unidades de conservação: uma relação conflituosa? *Revista Iberoamericana de Turismo - RITUR*, 11, p. 297-321. Recuperado de <file:///C:/Users/ricar/Downloads/12763-Texto%20do%20Artigo-50835-1-10-20211016.pdf>.
- [22] Santos, R. O., Gonçalves, A. G. B. (2011). A natureza e seus significados entre adeptos das religiões afro-brasileiras. *Revista Brasileira de História das Religiões*, Maringá, 3(9). Recuperado de <http://www.dhi.uem.br/gtreligiao/pub.html>.
- [23] Silva, J. N., Tavares De Lima, J. R. (2018). Povos de Terreiros e construção do conhecimento agroecológico: notas para um debate. *Cadernos de Agroecologia*, São Paulo, 13(1). Recuperado de <http://cadernos.aba-agroecologia.org.br/index.php/cadernos/issue/archive>. Acesso em: 22 abr. 2022.
- [24] Silva, M. C., Silva, V. (2018). Um bosque de folhas sagradas: o santuário da umbanda e o culto da natureza. *Interagir: pensando a extensão*, Rio de Janeiro, 26, p. 11-33. Recuperado de <https://www.e-publicacoes.uerj.br/index.php/interagir/article/view/39594/29233>.
- [25] Soares Filho, V., Rocha, J. D. T. (2019). Candomblé: tradição e resiliência rumo a sustentabilidade, há espaço na agenda ODS 2030? In *Anais do 21o Encontro Internacional sobre Gestão Empresarial e Meio Ambiente*. São Paulo: ENGEMA. Recuperado de <http://engemausp.submissao.com.br/21/anais/arquivos/118.pdf>.
- [26] Soffiati, A. As religiões diante da crise ambiental da atualidade. (2008). *Educação, ambiente e sociedade: ideias e práticas em debate*. Serra: Companhia Siderúrgica de Tubarão.
- [27] Unger, N. M. (1991). *O encantamento do humano: ecologia e espiritualidade*. São Paulo: Loyola.

## Problem-based learning: A teaching-learning strategy for teaching “Extensão Rural” in the “Medicina Veterinária” graduate course

### Aprendizagem baseada em problemas: Uma estratégia de ensino-aprendizagem para o ensino da Extensão Rural no Curso de Medicina Veterinária

Anderson Fernandes de Alencar<sup>1</sup>, Óscar Emerson Zúñiga Mosquera<sup>2</sup>, José Nunes da Silva<sup>2</sup>, Julia Figueredo Benzaquen<sup>2</sup>, Tarcísio Augusto Alves da Silva<sup>2</sup>, Walter Santos Evangelista Júnior<sup>2</sup>, Luis Claudio Monteiro de Mattos<sup>2</sup>, Laeticia Medeiros Jalil<sup>2</sup>, Maria Rita Ivo de Melo Machado<sup>2</sup>, Francinete Francis Lacerda<sup>3</sup>, Marcos Antonio Bezerra Figueiredo<sup>2</sup>, Ana Maria Dubeux Gervais<sup>2</sup>, Jorge Luiz Schirmer de Mattos<sup>2</sup>

<sup>1</sup>Professor da Universidade Federal do Agreste de Pernambuco, Brazil.

<sup>2</sup>Professor da Universidade Federal Rural de Pernambuco, Brazil.

<sup>3</sup>Pesquisadora do Instituto Agrônomo de Pernambuco, Brazil.

Received: 27 Aug 2022,

Received in revised form: 20 Sep 2022,

Accepted: 25 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>)

**Keywords**— *active methodologies, herbal medicines, veterinarian and tutor relationship*

**Abstract**— *The PBL methodology has been widely used in teaching-learning processes. This has been more frequent in cases in which the entire structure of the course starts to fully comply and operate under the guidance of the ABP. However, the PBL due to its applicability can be adapted to educational processes of a more restricted scope involving disciplines. This is the case of the present experience that put the PBL into practice in the “Extensão Rural” discipline in two classes of the Medicina Veterinária graduate course at UFRPE. The “problems” were introduced to classes SV1 and SV2 by the professor of the discipline and related to the “effectiveness of herbal medicines in controlling worms” and “conflicts in the relationship between the veterinarian and the animal tutor”, respectively. The students were divided into groups of 8 up to 10 members, with their respective coordinators and secretaries. 4 up to 5 meetings were held weekly, except for individual research and assessment and application of new knowledge to the problem, which took two to three weeks. The studies of the ABP groups revealed that the control of verminoses can be effective with the use of herbal medicines, as long as they are under correct hygienic management. They also revealed that it is up to the veterinarian to prepare himself to deal with conflicts that may occur with the tutors, something that can be resolved with the introduction of a discipline in the area of psychology in the curriculum of the course. Finally, it is worth noting that the experience was considered pedagogically positive by both*

students and specialist teachers.

**Resumo**— A metodologia ABP tem sido amplamente usada em processos de ensino-aprendizagem. Isso tem sido mais frequente em casos nos quais a estrutura do curso passa a obedecer na íntegra e operar sob orientação da ABP. Contudo, a ABP em função de sua aplicabilidade pode ser adaptada a processos formativos de âmbito mais restritos envolvendo disciplinas. Este é o caso da presente experiência que colocou em prática a ABP na disciplina de Extensão Rural em duas turmas do curso de Medicina Veterinária da UFRPE. Os “problemas” foram lançados às turmas SV1 e SV2 pelo professor da disciplina e versaram sobre a “efetividade dos fitoterápicos no controle de verminoses” e “conflitos na relação do veterinário e o tutor dos animais”, respectivamente. Os estudantes foram divididos em grupos de 8 a 10 integrantes, com seus respectivos coordenadores e secretários. As reuniões em número de 4 a 5 foram realizadas semanalmente, exceto quando se tratou da pesquisa individual e avaliação e aplicação de novos conhecimentos ao problema, demandaram duas a três semanas. Os estudos dos grupos de ABP revelaram que o controle de verminoses pode ser efetivo com o uso de fitoterápicos, desde que sob manejo higiênico correto. Também revelaram que cabe ao veterinário preparar-se para lidar com os conflitos que porventura ocorram com os tutores, algo que pode ser resolvido com a introdução de uma disciplina da área da psicologia na matriz curricular do curso. Por fim, vale salientar que a experiência foi considerada positiva pedagogicamente tanto pelos alunos quanto pelos professores especialistas.

## I. INTRODUÇÃO

“Não há educador tão sábio que nada possa aprender, nem educando tão ignorante que nada possa ensinar”.

(Becker, 1997).

A aprendizagem baseada em problemas (ABP) tem sua origem no movimento da Escola Nova (Escola Ativa ou Progressista), mais precisamente nos estudos de John Dewey (1859 – 1952) e na pedagogia cognitiva do psicólogo Jerome Seymour Bruner (Costa, 2011; Corinthians & Toralles-Pereira, 2004; Cambi, 1999).

O movimento das “escolas novas” teria surgido em Abbotsholme na Inglaterra com Cecil Reddie (1858 – 1932), espalhando-se para outros países da Europa, Estados Unidos e daí para o mundo. Para Reddie a escola deveria se tornar um pequeno mundo real, prático e coligar sistematicamente a inteligência e a energia a vontade, a força física, a habilidade manual e agilidade. Na base dessa consciência educativa inovadora estava o movimento da emancipação de amplas massas populares nas sociedades ocidentais, que vinha inovar profundamente o papel da escola e o seu perfil educativo, rejeitando decisivamente o seu aspecto exclusivamente elitista. As “escolas novas” foram também uma voz de protesto, porém tardia, contra a

sociedade industrial e tecnológica. Elas se nutrem predominantemente de uma ideologia democrática e progressista, inspirada em ideais de participação ativa dos cidadão na vida social e política, de desenvolvimento no sentido libertário das próprias relações sociais, ainda que ligada a uma concepção fundamentalmente individualista do homem, segundo a qual as relações de comunicação com os outros são certamente essenciais, mas sem que venham prejudicar a autonomia da consciência e a liberdade pessoal da escolha (Cambi, 1999).

No Brasil o movimento da escola nova tem como suas figuras mais ilustres Anísio Teixeira, Fernando Azevedo, João Roberto Moreira, Luis Alves de Mattos, Lourenço Filho, Cecília Meireles, Darci Ribeiro (Chaves, 2006 & Cunha, 1999).

Na proposta educativa de Dewey a aprendizagem parte de problemas ou situações que intencionam gerar dúvidas, desequilíbrios ou perturbações intelectuais (Cambi, 1999).

Dewey nasceu em Burlington, Vermont (EUA), filósofo e pedagogo, dirigiu o Departamento de Filosofia, Psicologia e Educação da Universidade de Chicago. A filosofia de Dewey articula-se em torno da “teoria da experiência”, vista como o âmbito de intercâmbio entre sujeito e natureza. Intercâmbio ativo, que transforma ambos os fatores e que permanece constantemente aberto,

já que caracterizado por uma crise, por um desequilíbrio sobre o qual intervém o pensamento como meio de reconstrução de um equilíbrio (novo e mais orgânico), mas submetido por sua vez a novas crises e a novas buscas de equilíbrio (Cambi, 1999).

Já “a proposta educacional de Bruner, denominada de Aprendizagem pela Descoberta, consiste em essência, no confronto de estudantes com problemas e na busca de sua solução por meio da discussão em grupos” (Costa, 2011). Contudo, a ABP é, antes de tudo, um método que valoriza experiências concretas e problematizadoras, com forte motivação prática e estímulo cognitivo para a busca de escolhas e soluções criativas.

Segundo Berbel (1998) a ABP tem também como base de inspiração “os princípios do método científico, de um ensino integrado e integrador dos conteúdos, dos ciclos de estudo e das diferentes áreas envolvidas, em que os alunos aprendem a aprender e se preparam para resolver problemas relativos à sua futura profissão”. Todavia, para Walsh (2005) a ABP difere da “resolução de problemas”, ou seja, o objetivo da aprendizagem não é necessariamente resolver o problema que foi apresentado. Pelo contrário, o problema é utilizado para ajudar os alunos a identificar as suas próprias necessidades de aprendizagem que surgem ao tentar compreender o problema. E não se trata de simplesmente entregar um problema aos alunos e esperar que eles espontaneamente deem conta de compreendê-lo, mas se trata, isto sim, de definir e seguir objetivos claros de aprendizagem, que são essenciais para estes alunos atingirem os conhecimentos necessários à sua formação profissional.

Segundo Araújo e Sastre (2009), não obstante as suas diferentes variações as perspectivas da ABP:

[...] deslocam o aluno para o núcleo do processo educativo, dando a ele autonomia e responsabilidade pela própria aprendizagem, por meio da identificação e análise de problemas; da capacidade de elaborar questões e procurar informações para ampliá-las e respondê-las; e, daí, para recomeçar o ciclo levantando novas questões e novos processos de aprendizagem e problematização da realidade. Por trás de tais processos educativos está a mudança de foco no ensino superior, que deixa de se centrar no ensino e passa a priorizar os processos de aprendizagem (Araujo & Sastre, 2009).

Essa metodologia exige uma reestruturação da organização curricular e da instituição, que demandam infraestrutura adequada e um número significativo de professores especialistas para atuar nas tutorias onde acontece o processo de ensino-aprendizagem. Os grupos

tutoriais, formados por grupos de 8 a 10 alunos, constam de um coordenador e um secretário e são mediados pelos professores tutores, também chamados de orientadores ou supervisores (Costa, 2011). As questões-problemas são elaboradas por uma comissão constituída para tal ou pelos professores tutores.

Walsh (2005) elencou sete passos necessários à aprendizagem baseada em problemas, que constam de atividades individuais e coletivas:

1. Identificação do problema: ler e discutir sobre o problema. Não se trata de “diagnosticar” o problema de imediato, mas pensar mais profundamente sobre os “porquês, os como e os quando”.

2. Exploração do conhecimento prévio: começar por compreender o significado dos termos do problema com base no conhecimento prévio dos alunos fazendo-se a interpretação crítica destes conhecimentos pelo grupo.

3. Geração de hipóteses e possíveis mecanismos: gerar hipóteses sobre a natureza do problema e identificar os possíveis mecanismos envolvidos, de modo a identificar o ponto-chave do problema. As hipóteses geradas podem ser relacionadas aos objetivos de aprendizagem dos problemas.

4. Identificação dos problemas de aprendizagem: fazer uma sondagem cuidadosa para identificar as questões (problemas de aprendizagem) que não podem ser respondidas pelo conhecimento atual do grupo. Essas questões devem ser bem formatadas de modo a não se perder o foco do problema, pois serão os objetos da pesquisa.

5. Estudo individual: concentrar os estudos individuais em todas as questões de aprendizagem levantadas no grupo. O desenho da atividade deve contemplar um tempo privilegiado para essa etapa, dado a sua importância crucial para a compreensão do problema.

6. (Re)avaliação e aplicação de novos conhecimentos **ao problema:** aplicar os novos conhecimentos ao problema original e a novas e diferentes situações. Evitar “mini-palestras” dos alunos ou do professor. Antes disso, deve-se estimular o questionamento e o debate entre os alunos de modo a explicitar e compreender os conceitos-chave e sua pertinência relativa ao problema.

7. Avaliação e reflexão sobre a aprendizagem: oportunizar a cada aluno e ao grupo um espaço para refletir sobre o processo de aprendizagem. Isso inclui uma revisão da aprendizagem alcançada, mas também de um *feedback* das contribuições de cada um e de como o grupo está trabalhando em conjunto. Esse é o momento adequado para se fazer os ajustes necessários para o bom

andamento do grupo. Ademais, um resumo do aprendizado é providencial para consolidá-lo e para aplicações futuras.

Na opinião de professores e alunos, que se sentem mais estimulados em se envolver no processo de ensino-aprendizagem, a ABP também é mais atraente que os métodos tradicionais, uma vez que se sentem desafiados a compreender problemas relacionados a realidade concreta da vida profissional (Walsh, 2005).

No sentido pedagógico a ABP é vista como alternativa consistente para a aplicação integral do conhecimento, na medida em que o currículo é estruturado por temas que favorecem o desenvolvimento de atitudes e atividades interdisciplinares.

A ABP tem sido objeto de várias experiências de cursos de graduação em diferentes áreas do conhecimento mundo afora. O currículo destes cursos está organizado de forma integral para operar o processo formativo de com base na ABP. O presente artigo faz uma descrição e reflexão sobre o uso da ABP na disciplina de Extensão Rural no curso de Medicina Veterinária da Universidade Federal Rural de Pernambuco, Brasil, no período da pandemia da Covid-19.

### 1.1 Disciplina de extensão rural do Curso de Medicina Veterinária

A disciplina de Extensão Rural consta de carga horária de 75 h e faz parte do rol de disciplinas obrigatórias no currículo do curso de graduação de Medicina Veterinária da Universidade Federal Rural de Pernambuco. A seguir é apresentado o ementário da disciplina, bem como seus objetivos e conteúdo programático.

#### 1.1.1 Ementa da disciplina

- Extensão Rural do século XX ao século XXI: alguns conceitos, as práticas extensionistas governamentais e não governamentais e as novas perspectivas de ação;

- As políticas de ATER;

- Globalização e reorganização do espaço agrário;

- As questões que desafiam o desenvolvimento rural na contemporaneidade: as novas ruralidades, as questões tecnológica e ambiental, a exclusão nos contextos populares rurais - da agricultura familiar, da mulher e do jovem – o cooperativismo e associativismo;

- Elaboração de projetos de gestão do desenvolvimento local sustentável nos espaços rurais em contextos populares.

#### 1.1.2 Objetivos da disciplina de Extensão Rural

Objetivo Geral:

Possibilitar um ambiente de reflexão e operacionalização da prática extensionista, de forma

ecológica, dentro de novos referenciais teórico-metodológicos e políticos que permeiam o desenvolvimento rural.

Objetivos específicos:

- Analisar o conceito de Extensão Rural na relação global/local, particularizando a região Nordeste.

- Analisar as novas políticas de ATER no Brasil, contemplando a diversidade cultural.

- Instrumentalizar os alunos com subsídios para a elaboração de projetos de intervenção para o desenvolvimento local dos contextos populares.

- Analisar as contribuições dos movimentos sociais na promoção do desenvolvimento local sustentável.

### 1.1.3 Conteúdo programático da disciplina de Extensão Rural

Unidade I - Extensão Rural do século XX ao século XXI.

1. Conceitos, objetivos, diretrizes da extensão rural americana e seus desdobramentos no Brasil;
2. Principais modelos de comunicação que orientam as diferentes práticas da extensão rural: o difusionismo tecnológico e a comunicação participativa;
3. Políticas de assistência técnica e extensão rural contemporâneas.
4. Consumo cultural, novas tecnologias da informação e da comunicação e sua repercussão nos contextos populares rurais;
5. O novo perfil do profissional das ciências agrárias para atender às demandas de um novo espaço agrário brasileiro na produção agrícola e não agrícola.

Unidade II – Agricultura camponesa e o novo espaço agrário.

1. Globalização e a reorganização do espaço agrário: aspectos políticos, econômicos, ambientais e tecnológicos; a gestão do desenvolvimento local sustentável.
2. Políticas públicas: reforma agrária, crédito, assentamento, comercialização e assistência técnica;
3. A questão da agricultura camponesa e familiar, enquanto atividade econômica, política, social, ambiental e tecnológica;
4. Novas relações de trabalho, movimentos sociais e formas associativas;

5. Gênero, jovens e adultos, etnias: temas transversais para a construção do desenvolvimento local.
6. Agricultura urbana.

Unidade III – Extensão Rural e gestão de projetos de desenvolvimento local sustentável

1. Elaboração de projetos para o desenvolvimento sustentável;
2. Elaboração de diagnóstico participativo;
3. Identificação de ações a serem desenvolvidas;
4. Metodologias e instrumentos;
5. Articulação de parcerias institucionais;
6. Elaboração de plano de ação;
7. Execução de uma atividade piloto.

## II. MATERIAL E MÉTODOS

O presente trabalho compreende um estudo de caso. Nessa estratégia os alunos analisam as variáveis, levantam as hipóteses e avaliam as suas consequências (Abreu & Masetto, 1985). Para Yin (2005), o estudo de caso diz respeito a uma investigação empírica sobre um fenômeno num contexto da vida real, quando seus limites não estão claramente definidos.

A metodologia utilizada seguiu a orientação dos sete passos da ABP propostos por Walsh (2005): identificação do problema, exploração do conhecimento prévio geração de hipóteses, identificação dos problemas de aprendizagem, estudo individual, (re)avaliação e aplicação de novos conhecimentos ao problema, avaliação e reflexão sobre a aprendizagem. O professor da disciplina lançou dois temas – problemas para serem estudados pelos alunos de duas turmas de Medicina Veterinária: 1) Uso de fitoterápicos na saúde animal e 2) Conflitos na relação tutores e profissionais de Medicina Veterinária. Ambos os temas resultaram de “inquietudes cognitivas” que afloraram durante as aulas da disciplina quando temas correlatos estavam sendo tratados na turma SV1 e SV3, respectivamente.

O primeiro tema surgiu quando foi tratado em sala “O conceito de tecnologia como mercadoria”, capítulo de livro de Francis Maria Gontijo Coelho na obra ‘A arte das orientações técnicas no campo: concepções e métodos’, publicada pela editora Suprema em 2014. O tema despertou interesse da turma por ser uma opção no tratamento de algumas doenças que acometem os animais.

O segundo tema apareceu no debate acerca da dicotomia entre comunicação e extensão da obra de Paulo Freire e da necessidade de se estabelecer uma relação

dialógica e mais horizontal entre o extensionista e o agricultor. Para dar conta desses dois temas foram formados dois grupos de 8-10 alunos em cada turma, sendo que cada grupo escolheu um coordenador para coordenar as reuniões e um secretário, para fazer o registro das falas durante o debate. A cada reunião se escolhia novo coordenador e novo secretário, com vistas a uma divisão equitativa das tarefas do grupo. As reuniões dos grupos ocorreram semanalmente, exceto quando se tratou da pesquisa individual, avaliação e aplicação dos novos conhecimentos ao problema, que ocorreram a intervalos de duas a três semanas, totalizando cinco encontros. A metodologia adotada nos grupos obedeceu a uma dinâmica na qual o primeiro momento da reunião tinha sempre a presença do professor, ocasião em que se retomava os aspectos registrados no passo anterior, com correção de rumos quando necessário. Mas, em geral, cada grupo tinha autonomia para seguir em frente e avançar nos passos seguintes.

### 2.1 Caderno de Problematização

O caderno de problematização de cada grupo constou de um formulário com os nomes da equipe, datas de reunião, nome de coordenador e secretário de cada reunião e os passos da ABP: 1. Identificação do problema, 2. Exploração do conhecimento prévio 3. Geração de hipóteses e possíveis mecanismos, 4. Identificação dos problemas de aprendizagem: 5. Estudo individual, 6. (Re)avaliação e aplicação de novos conhecimentos ao problema, e 7. Avaliação e reflexão sobre a aprendizagem. As anotações e registros no caderno de problematização eram transcritas para um formulário do *Google Forms* de modo que todos pudessem acompanhar o relato do secretário e sugerir correção no texto.

### 2.2 Análise da experiência do uso da ABP na disciplina de Extensão Rural

Os resultados desta experiência com ABP na disciplina de Extensão Rural foram sistematizados e analisados por uma equipe de professores especialistas de Extensão Rural, acompanhados por agrônomos, sociólogos e pedagogos das Universidades Federal Rural de Pernambuco e do Agreste de Pernambuco. A análise dos especialistas foi realizada como base em quatro critérios: o nível de dificuldade no uso da ferramenta, o grau de interdisciplinaridade alcançado, a aceitação da metodologia pelos alunos e os ganhos em termos de aprendizagem.



### III. RESULTADOS E DISCUSSÕES

#### 3.1 Uma adaptação da ABP para o ensino de extensão rural

O caráter interdisciplinar da disciplina de Extensão Rural permitiu, com o aporte da metodologia da aprendizagem baseada em problemas uma abordagem em sala de aula de dois temas que são caros ao exercício profissional do Médico Veterinário e que têm tudo a ver com a nova concepção de Assistência Técnica e Extensão Rural: o conhecimento sobre o uso de plantas medicinais das populações originárias que vem sendo testadas via tentativa e erro por várias gerações com resultados positivos e a baixo custo de tratamentos de várias doenças e pragas que acometem os animais, e os princípios éticos

*Fig.1 Aspectos abordados no passo a passo da metodologia de aprendizagem baseada em problema em turmas de Medicina Veterinária*

| Passos                                   | Temas de estudo                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                          | Uso de fitoterápicos na saúde animal.                                                                                                                                                                                                                                                                                                                                         | Conflito entre tutores e veterinários.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Identificação do problema</b>         | Os fitoterápicos são efetivos no controle de verminoses?                                                                                                                                                                                                                                                                                                                      | Relações conflituosas entre tutores e veterinários em atendimentos clínicos.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Exploração do conhecimento prévio</b> | <p>A fitoterapia é uma das mais antigas formas de tratamento, com ação de vermífugo.</p> <p>Os fitoterápicos são medicamentos produzidos a base de partes de plantas (raízes, folhas, sementes, frutos).</p> <p>As verminoses são enfermidades mais comuns entre os animais.</p> <p>A fitoterapia é uma especialidade geralmente utilizada de forma adjuvante à alopatia.</p> | <p>Na rotina dos veterinários são atendidos os mais variados tipos de clientes, diferentes classes sociais, temperamentos, educação e até com distúrbios psicológicos, o que muitas vezes é refletido na saúde dos seus animais de estimação.</p> <p>O curso de graduação não está voltado para o social e ao retorno à sociedade, mas pautado para o crescimento profissional com fins meramente econômicos, o que torna vulnerável e fragiliza o quesito relacionamento tutor-veterinário, no exercício profissional, que prescinde de uma visão mais humanitária.</p> <p>Os médicos veterinários recém-formados não sabem lidar com essas situações conflituosas e reagem, principalmente sob estresse, com agressividade e falta de empatia.</p> <p>O médico veterinário deve ter uma saúde emocional preparada para compreender a necessidade do outro, não apenas pensando no paciente em atendimento, mas também, no que esse animal representa para o seu tutor.</p> |
| <b>Geração de hipóteses</b>              | Os fitoterápicos são efetivos no controle de verminoses desde que sejam seguidas as                                                                                                                                                                                                                                                                                           | Há falta de uma educação humanitária e de pensamento crítico, que deve ser construída ao longo da vida para que o relacionamento entre                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

procedimentais que devem reger a relação entre os extensionistas / veterinários e o público beneficiário / tutor / paciente. A seguir são apresentados os resultados dos estudos dos alunos da disciplina de Extensão Rural do curso de Medicina Veterinária (Figura 1).

Para o estudo dos fitoterápicos na saúde animal foram consultados os seguintes autores: Lans et al. (2000); Fujimoto et al. (2012); Brasil (2019); Ozaki e Duarte (2006); Albuquerque e Andrade (2002). Para o estudo dos conflitos entre veterinário e tutor, os autores consultados foram: Cavalcante (2013); Tavolaro e Cortez (2017); Paloski (2017); Yamamoto et al. (2007), Niederauer e Pöpl (2020); Borges et al.(2013).

|                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                    | <p>recomendações de uso.</p> <p>A não efetividade dos fitoterápicos no controle de verminoses está associada ao cultivo e manipulação das plantas e princípios ativos: variação na concentração dos princípios ativos de acordo com tipo de solo, época de colheita; processamento incorreto na extração do princípio ativo, falta de pesquisa, dificuldade de extração do princípio ativo.</p> <p>A não efetividade dos fitoterápicos no controle de verminoses está associada a administração do medicamento: dosagem inadequada, forma incorreta de aplicação, princípios ativos inadequados, falta de planejamento no uso.</p> <p>Os fitoterápicos são efetivos no controle de verminoses desde que sob manejo higiênico-sanitário e administrados com medicamentos alopáticos.</p> | <p>médico veterinário e tutor, se dê com base na empatia.</p> <p>O curso não oferece uma disciplina da área psicossocial para compreender os diferentes tipos de tutores e saber lidar com eles com vistas a um atendimento humanitário.</p> <p>Os alunos aprendem a lidar com os tutores na prática durante os estágios na universidade e em clínicas particulares, observando quem já atua no ramo, o que os leva a reprodução de erros, e comportamentos tidos como certos e normais.</p> <p>Os alunos novatos não passam segurança nos primeiros atendimentos, causando a desconfiança por parte dos tutores, gerando conflitos a ponto de questionarem e até rejeitarem os procedimentos sugeridos.</p> <p>A relação conflituosa decorre da postura dos tutores que medicam de forma aleatória seus animais e que reagem de forma agressiva, arrogante diante do estado de coalescência os animaizinhos.</p> <p>A relação conflituosa não está relacionada aos tutores, como é passado, mas no <i>deficit</i> educacional e a falta de sensibilidade social devido a formação tecnicista e simplória, que não ensina a lidar com a diversidade psicossocial dos clientes/tutores.</p> |
| <b>Identificação dos problemas de aprendizagem</b> | <p>Quais plantas fitoterápicas têm efeito vermífida?</p> <p>Qual a quantidade adequada dos produtos fitoterápicos vermífidas?</p> <p>Quais as formas de aplicação corretas dos fitoterápicos vermífidas?</p> <p>Quais os princípios ativos adequados para controlar verminoses?</p> <p>Qual o manejo higiênico-sanitário correto?</p> <p>Como o uso de fitoterápicos é visto na legislação?</p>                                                                                                                                                                                                                                                                                                                                                                                         | <p>Como tratar os clientes de quatro patas e duas pernas de forma humana (empática) e com qualidade?</p> <p>Quais são os diferentes tipos de tutores que existem?</p> <p>O currículo do curso de Medicina Veterinária de outras instituições possui disciplina específica que oriente os alunos a desenvolverem um atendimento harmonioso com os tutores e seus animais?</p> <p>Quais seriam os conteúdos a serem tratados numa disciplina com enfoque psicossocial?</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Estudo individual</b>                           | <p><b>Plantas vermífidas:</b> lírio (<i>Melia azedarach</i>), bucha-paulista (<i>Luffa operculata</i>), batata-de-purga (<i>Operculina</i> sp.), maria-mole (<i>Senna alata</i>), pinhão-branco (<i>Jatropha curcas</i>), melão-de-são-caetano (<i>Momordica charantia</i>) e velame (<i>Croton</i> sp.), fruta-de-conde (<i>Anona squamosa</i>) e a erva lombrigueira</p>                                                                                                                                                                                                                                                                                                                                                                                                              | <p>Na UFRPE não há na matriz curricular do curso de Medicina Veterinária uma disciplina que associe aspectos psicológicos com temas filosóficos voltados para relações de consumo na medicina veterinária. Tem-se uma disciplina de filosofia e ética no ciclo básico e deontologia na</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

(*Spigelia anthelmia* L.), neem (*Azadirachta indica*), tabaco (*Nicotiana tabacum*), guandu (*Cajanus cajan*), mamão (*Carica papaya*), abóbora (*Cucurbita spp.*), noqueira (*Juglans regia* L.), grama (*Agropyron repens* L.).

**Quantidade de fitoterápicos:** lírio (via oral de 1 - 3g de frutos secos moídos/kg de peso vivo/7dias), fruta-de-conde (dose de 1g/kg de suco de folhas e talos triturados em liquidificador e passados na peneira com gaze) erva lombrigueira e a batata-de-purga (2g/kg P.V. de folhas trituradas em infusão e 4g/kg dos tubérculos, respectivamente), pó de neem 1 g/dia/animal misturado à alimentação, para cães e gatos até 15 kg. Cães acima de 15 kg, fornecer 2 gramas por animal por dia.

**Aplicação:** via oral de anti-helmínticos.

**Princípio ativo do alho:** ajoeno (ajocisteína) e dialliltrisulfeto.

**Manejo higiênico sanitário:** limpeza do local, descarte dos dejetos, evitar superlotação, quantificar a carga parasitária, alimentação adequada, imunidade.

finalização do curso. No entanto, a matriz curricular carece de uma disciplina que unifique, que atue de forma a demonstrar ao futuro médico veterinário que ele precisa de habilidades e ferramentas para lidar com seu público.

É necessário que a formação profissional reforce os aspectos éticos e saúde mental, pois é crescente o índice de enfermidades mentais de cunho depressivo entre veterinários, que os levam ao suicídio.

Sugere-se a implantação de uma disciplina de aspectos psicológico, filosóficos e éticos da medicina veterinária:

Nome da disciplina: Psicologia aplicada à veterinária, carga horária: 45h, assuntos a serem abordados:

ética profissional, relação de consumo entre tutores e serviços veterinários, psicologia e o contexto profissional, mercado de trabalho e seus desafios.

A disciplina possibilitaria ao aluno a lidar melhor com o estresse, eutanásia, sobrecarga, competição profissional, esgotamento mental.

Existem hospitais veterinários privados onde há descaso com o animal, maus-tratos, negligência e imperícia de profissionais, estagiários mal supervisionados e enfermeiros mal treinados

**(Re)avaliação e aplicação de novos conhecimentos ao problema**

O controle de verminoses com fitoterápicos não pode ser visto isoladamente, mas associado a tratamento preventivo como manejo higiênico-sanitário (limpeza das instalações diariamente, desinfecção das instalações uma vez por mês, utilizando produtos como: formol comercial a 5%, cal virgem a 40%, iodophor a 1% e hipoclorito de sódio a 2%, remoção e manutenção das fezes acumuladas em locais distantes, vermifugação do rebanho ao trocar de área, rotação de pastagens, controle da superlotação nas pastagens e incorporação ao rebanho de animais adquiridos em outros locais, somente após a sua vermifugação) e alimentar, idade e estágio fisiológico dos animais.

O clima tropical favorece a sobrevivência das larvas durante todo ano, os ovos e as larvas são resistentes aos raios solares. Os vermes desenvolvem resistência aos princípios ativos.

Os fitoterápicos atuam sobre outras enfermidades

É cultural o tutor desenvolver uma *noção de posse sobre a vida animal* e assim achar que sabe o que é melhor para o animal independente de sua saúde. Ao impor sua vontade e fazendo o animal reproduzir seus hábitos de natureza humana torna sua vida desnaturalizada e artificial, a exemplo da tentativa de “humanizá-los”.

Alguns tutores que medicam aleatoriamente seus animais, levam a clínica o animal somente quando está em um estágio de convalescença, de difícil retorno ao estado saudável, tornando o clima tenso e pesado, e doloroso diante do sofrimento do “membro da família”.

Em atendimento profissional e ético, mas que o tutor passa já no início uma imagem de pessoa negligente e irresponsável a tendência é receber julgamento de forma negativa pelo veterinário, mas quando o relato é feito com sinceridade,

que acometem os animais e podem ser aplicados de diversas formas: a folha de tabaco com álcool pode ser passada com um algodão no nariz do cachorro eliminando os parasitas, o guandu manipulado com sal e mel, ou apenas a sua decocção é dado ao cachorro para eliminar parasitas internos, o óleo da erva-santa é usado contra *Toxascaris* e *Toxocara* em cachorros, a casca do mamão e suas folhas são usadas em cães contra vermes. a grama e a noqueira são anti-helmínticos, a mistura de grama com óleo de oliva e sal obtêm-se um líquido que é dado ao cachorro, a decocção dos galhos do algodão que é fornecido ao cão para beber com leite ou misturado em sua comida. A dose frequentemente descrita é de 1 ou 2 folhas. Duas folhas para um cachorro de porte pequeno, com até 16 kg, e 4 ou 5 folhas para um cachorro grande, com mais de 25 kg. A dose é feita de meia colher de chá ou 2,5 ml. Os cachorros devem ser amarrados por muitas horas após administração desse remédio, pois ele possui forte efeito purgativo.

O alho (*Allium sativum*) tem ação imunoestimulante, anticancerígena, hepatoprotetora, antioxidante, antiviral, antifúngica e antiparasitária. Por exemplo: atividade antiparasitária *in vitro* da allicina, principal constituinte do alho, em protozoários parasitas (*Entamoeba histolitica*, *Ascaris lumbricoides*, *Giardia lamblia*, *Trypanosoma brucei brucei*, *T. b. rhodisiense*, *T. b. gambiense*, *T. evansi*, *T. congolense* e *T. equiperdum*

humildade e de forma emotiva o veterinário conduz a consulta com respeito, paciência e atenção ao tutor, criando um laço empatia entre ambos.

A neurose da sociedade atual desencadeia vários problemas mentais, de modo que muitos indivíduos buscam na companhia animal uma fuga para a solidão, tristezas, angústias, ansiedades que acabam refletindo sobre o comportamento de seus e animais.

Em casos de humanização de espécies, que geram enfermidades, o veterinário precisa ter talento para detectar a causa no tutor e ter habilidade para demonstrar-lhe tal aspecto, ou seja, criar uma linha de raciocínio para ter acesso a esse tutor para encaminhá-lo a resolução dos seus próprios problemas, na tentativa de solucionar os problemas do animal.

Situações que ocorrem no atendimento clínico: nervosismo, má índole, chantagem emocional, pessoas sensíveis, irresponsabilidade, críticas, medos e angústias. Nessas situações as relações que já conflituosas por natureza se agravam, se aprofundam e não são harmoniosas.

#### **Avaliação e reflexão sobre a aprendizagem**

A ABP é uma metodologia que desafia os alunos a buscarem os conhecimentos para desvendar o problema proposto pelo professor. Os conhecimentos sobre fitoterápicos são pouco explorados no curso, dando-se maior ênfase ao tratamento alopático. Os fitoterápicos são mais baratos e acessíveis a todas as camadas sociais, porém existem poucas pesquisas científicas sobre o seu uso. Os fitoterápicos, ao contrário da maioria dos alopáticos, possuem inúmeras propriedades que lhes confere ação sobre várias enfermidades, ainda que sua ação não seja 100% efetiva no controle. O que pode ser resolvido usando-se conjuntamente princípio ativo de diferentes plantas.

A depender das diferentes informações acima fica patente que os medicamentos fitoterápicos podem ter lugar nas estratégias de controle de verminoses e embora sua ação prescindida de resultados mais consistentes cientificamente não é de se menosprezar as informações sobre o seu amplo uso no âmbito

A aplicação da metodologia do ABP foi efetiva na identificação do problema, bem como na detecção das possíveis causas e soluções para o problema. Isso tudo feito de forma coletiva e buscando os consensos, com destaque a experiência da equipe que já havia vivenciado nos estágios situações de conflitos entre veterinários e tutores.

O veterinário não tem preparo psicológico e humano para receber os mais diversos tipos de tutores com diferentes personalidades em seu consultório. Mas ele está alí para tratar o animal, ele não deve e não pode mudar o outro - o tutor - mas deve saber reconhecer, aceitar e saber encaminhar a situação da forma mais harmônica possível visando o bem do animal. O grupo trabalhou a contento, porém com certos conflitos que foram sendo resolvidos ao longo do trabalho. Na opinião de todos o grupo se superou quando identificou que todos os

popular por causa da facilidade no acesso as plantas fitoterápicas que são patrimônio da humanidade. Ademais não é de se estranhar o fato de que as grandes empresas de alopatícos não tenham se apropriado desses conhecimentos e transformado-os em mercadoria.

O grupo trabalhou de forma harmônica e conseguiu perceber as vantagens da metodologia no final dos trabalhos, ou seja, quando olharam para traz e visualizaram o caminho percorrido logo perceberam a potência da metodologia para do ponto de vista pedagógico.

integrantes já tinham vivenciado situações nos estágios em que presenciaram conflitos entre o veterinário e o tutor.

O grupo aprovou a metodologia e destacou a sugestão do ementário da disciplina de psicologia como o ponto alto do trabalho em equipe.

Fonte: Os autores, 2022.

A depender das diferentes informações no quadro acima fica patente que os medicamentos fitoterápicos podem ter lugar nas estratégias de controle de verminoses, e embora sua ação prescindida de mais validações consistentes cientificamente, não é de se menosprezar as informações sobre o seu amplo uso no âmbito popular por causa da facilidade no acesso as plantas fitoterápicas e no preparo, pois podem ser cultivadas e usadas e que, acima de tudo, são um patrimônio da humanidade. Por isso não é de se estranhar o fato de que as grandes empresas de alopatícos tenham se apropriado desses conhecimentos e transformado-os em mercadoria.

Da mesma forma, vale destacar que a função do veterinário é de se preparar para lidar com situações delicadas com os tutores, mesmo que em geral muitos dos conflitos se devam a um despreparo e falta de sociabilidade tanto dos veterinários quanto dos tutores, cujos motivos são bem conhecidos pois estão atrelados ao baixo nível cultural e educativo. E cabe a academia cuidar dessa preparação dos futuros médicos veterinários seja oportunizando estágios, cursos e até mesmo uma disciplina no ramo da psicologia para orientar como se postar e agir diante de situações conflituosas.

A metodologia baseada em problemas significou algo bastante novo para os alunos, que se sentiram em um primeiro momento surpresos, inseguros e receosos de dar conta da atividade, pois ao contrário de receberem os conteúdos de forma sistematizada e organizada em uma sequência lógica se depararam com algo aparentemente “mais complexo”, segundo depoimento de uma das alunas e ficaram “sem chão”, segundo outra aluna, com tamanha a “sensação de impotência, sem saber por onde começar”, disse um dos alunos. Na opinião dos alunos a “ideia de buscar e produzir conhecimento teria que ser algo possível somente para os professores/pesquisadores e não para alunos de graduação”. Mas, a despeito desse estranhamento inicial todos os óbices foram sendo

vencidos, um a um, à medida que as equipes passaram a trabalhar juntas e as etapas cumpridas. Mas não sem antes refletir criticamente sobre a caminhada, ou seja, olhando para as etapas seguintes sem deixar de considerar a referência do ponto de partida. E, por isso, os resultados não poderiam ter sido outros senão momentos de muita troca de conhecimento, participação, ausências, conflitos, bom senso, acordos e consensos perante o desafio posto à coletividade. E “nada se compara a sensação e a certeza do dever cumprido, com emoção e crescimento de todos”, sentenciou a aluna de uma das turmas. Fato é que, como resultado do interesse e envolvimento dos alunos, os temas continuaram sendo tratados na disciplina, ocasiões em que especialistas nas áreas de fitoterápicos e psicologia foram convidados para aprofundar os temas na sala de aula.

## 2.2 Análise crítica das experiências pelos especialistas

A metodologia de ABP tem sido pensada e experimentada com sucesso em diferentes cursos, mas envolvendo a estrutura curricular como um todo, as disciplinas e equipes de professores. Contudo, a presente experiência foi desenvolvida no âmbito da disciplina de Extensão Rural. Isso foi possível graças ao caráter interdisciplinar e flexibilidade na dinâmica da disciplina. Mas, sobretudo, por causa do engajamento das equipes de alunos que, no primeiro caso se demonstraram interessados em compreender melhor as formas alternativas de controle de enfermidades. E, no segundo caso, o fato dos alunos terem vivenciado durante os estágios situações conflituosas entre o profissional de veterinária e os tutores, fato que os levou a irem a fundo das causas e buscar formas de resolver a questão colocada como problema. Isso equivale a dizer que a escolha dos temas também foi satisfatória, atraente e envolvente, talvez porque surgiu das próprias discussões da disciplina. Não obstante, necessidade de envolver professores de outras disciplinas

O curso de Medicina Veterinária possui um caráter convencional, pois está estruturado numa matriz curricular cujas disciplinas estão separadas em “caixinhas”, não comunicantes, na qual a transmissão do conhecimento é a regra, excetuando-se a viagem técnica que foi realizada no final do período letivo e que contou com professores de diferentes disciplinas cursadas no semestre, com algum grau de integração entre elas na feitura do relatório. Independente disso, os alunos estão tradicionalmente acostumados em receber o conhecimento disciplinar, na forma de aulas expositivas, que são cobrados nas provas, as quais têm a função de verificar o nível de aprendizagem. Ou seja, a lógica é os alunos receberem os conhecimentos organizados em disciplinas e aplicarem tais conhecimentos nas provas ou quando estiverem vivenciando o exercício profissional depois de formados. A metodologia da ABP inverteu essa lógica, isto é, os alunos foram desafiados a “resolver” um problema que precisou ser desvendado coletivamente a partir do conhecimento prévio da equipe, mas principalmente através de uma busca sistemática de informações via literatura. No primeiro caso os alunos recebem um “prato feito” e no segundo caso, precisam “montar o prato” com ingredientes e cores respeitando certos critérios. Dito de outra forma, no primeiro caso ocorreu a transmissão do “conhecimento pronto” e, no segundo, caso tratou-se de participar coletivamente da construção de um “novo conhecimento”. E, isso, faz toda diferença do ponto de vista formativo, pois não só potencializa a capacidade do indivíduo extensionista resolver problemas concretos ao ser confrontado com fenômenos também concretos da realidade, mas que acima de tudo confere autonomia ao exercício profissional. Não obstante, é digno de nota o fato de que no início os alunos apresentaram alguma resistência para executar a metodologia da ABP, mas que desapareceu a medida que os passos seguintes foram sendo dados e os resultados foram aparecendo.

Vale salientar que a ABP propiciou uma real oportunidade para os alunos entenderem o percurso de aprendizagem desde o conhecimento prévio até a (re)avaliação do conhecimento novo, ou seja, em última análise refletir sobre sua prática comparando “o antes com o depois” em termos de apropriação e acúmulo de conhecimento.

Por fim, mas não menos importante, é admitir que aquilo que poderia ser considerado um fator limitante no uso da metodologia da aprendizagem baseada em problemas é o fato de ser adaptada para situações que não exijam ou proporcionem intervenção com presença a campo, a exemplo do período da Covid-19, cujos riscos eram ainda presentes.

#### IV. CONCLUSÕES

Os problemas levantados e trabalhados nas turmas surgiram da discussão de temas correlatos que fazem parte dos assuntos que compõe o conteúdo programático da disciplina de Extensão Rural, mas que adquiriram relevância substantiva ao serem tratados sob a batuta da metodologia de aprendizagem baseada em problemas. Isso porque a (re)introdução dos temas tecnologia, via abordagem sobre fitoterápicos, e comunicação horizontal, via conflitos veterinário – tutor, puderam ser tratados para além dos aspectos meramente teóricos e superficiais e passaram a ser abordados com a devida importância na sala de aula, pois de alguma maneira eles sempre estiveram presentes na formação prática dos alunos nos estágios no hospital veterinário da UFRPE e nas clínicas particulares, mas que sempre foram mencionados, quando tratados, de forma marginal e tangencial ao longo do processo formativo do curso. Fato é que ambos os temas surgiram da inquietude dos próprios alunos que os trouxeram para o debate exatamente quando a tecnologia era problematizada enquanto mercadoria e a necessidade de uma relação horizontal e dialógica extensionista – agricultor era abordada como condição *sine qua non* para o sucesso da prática extensionista. E como resultado da ABP os alunos puderam reelaborar suas visões e concepções sobre o processo formativo que está pautado numa visão mercadológica, no tecnicismo, na parceria velada com a grande indústria de fármacos alopáticos e no compromisso voltado para atender as demandas de um público composto pelos mais abastados da sociedade, ou seja, aqueles que podem pagar. Ou, pelo menos, puderam despertar para a possibilidade de uso dos fitoterápicos como alternativa aos medicamentos alopáticos seja pela sua eficiência e eficácia comprovada, desde que sob manejo higiênico-sanitário adequado, seja pelo baixo custo na sua obtenção e facilidade de uso. Da mesma forma a ABP fez aflorar nas bocas e nas mentes dos estudantes uma das grandes deficiências do processo formativo que carece de base psicossocial para qualificá-los no trato com os tutores e pacientes. Mais do que isso, os estudantes foram ousados a ponto de proporem mudanças na matriz curricular do curso com a criação de uma disciplina na área da psicologia. O que pode ser interpretado como sinais claros de protagonismo por parte dos estudantes, graças à oportunidade criada pela metodologia ABP. E sendo isso verdadeiro a metodologia ABP cumpriu com a sua função que nada mais é do que preparar as mentes para serem críticas e ousadas no trato com o conhecimento que, por não estar dado a priori como “verdade absoluta” (porque é sempre provisória), pode ser construído e reconstruído, evidenciando outras verdades.

E se essa experiência com a ABP na disciplina de Extensão Rural foi suficiente para despertar nos alunos um sentido protagonista, com reflexos positivos na formação dos novos médicos veterinários não seria demais especular sobre os impactos positivos caso o curso de medicina Veterinária ousasse incorporar no seu funcionamento tal metodologia, envolvendo mais disciplinas e mais professores.

Ademais, um destaque precisa ser feito a metodologia ABP quanto a sua aplicabilidade e adaptabilidade, pois ela se adequa bastante bem a situações em que se deseja trabalhar temas concretos, porém o acesso físico a realidade concreta não é possível por algum motivo, seja pela falta de recurso, pela distância ou mesmo em situações de risco como foi o período de quarentena devido a Covid-19.

### REFERENCES

- [1] Abreu, M. C., & Masetto, M. T. (1985). *O professor universitário em aula: Práticas e princípios teóricos* (4a. ed.). MG Ed. Associados.
- [2] Albuquerque, U. P., & Andrade, L. H. C. (2002). Uso de recursos vegetais da caatinga: O caso do agreste do estado de Pernambuco (nordeste do Brasil). *Interciência*, 27(7), 336-345.
- [3] Almeida, J. L. (2015). *Comparação entre bem-estar psicológico do tutor e problemas comportamentais no seu animal de companhia*. [Dissertação de Mestrado]. Universidade Lusófona de Humanidades e Tecnologias, Faculdade de Medicina Veterinária. <http://recil.grupolusofona.pt/handle/10437/6794>.
- [4] Araújo, U. F., & Sastre, G. (2009). Apresentação. In U. F. Araújo & G. Sastre (Orgs.), *Aprendizagem baseada em problemas no ensino superior* (pp.7-16). Sumus.
- [5] Ausubel, D. P. (1963). *The psychology of meaningful verbal learning*. Grune and Stratton.
- [6] Becker, F. (1997). *Da ação à operação: O caminho da aprendizagem em Jean Piaget e Paulo Freire* (2a ed.). D P & A Editora.
- [7] Berbel, N. A. N. (1998). A problematização e a aprendizagem baseada em problemas: Diferentes termos ou diferentes caminhos? *Interface - Comunicação, Saúde, Educação*, 2(2).
- [8] Berbel, N. A. N. (2011). As metodologias ativas e a promoção da autonomia de estudantes. *Semina: Ciências Sociais e Humanas*, 32(1).
- [9] Borges, T. D. et al. (2013, fev.). Ensino de bem-estar e dor animal em cursos de medicina veterinária no Brasil. *Arq. Bras. Med. Vet. Zootec.*, 65(1), 29-36. <http://dx.doi.org/10.1590/S0102-09352013000100005>. [http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0102-09352013000100005&lng=en&nrm=iso](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0102-09352013000100005&lng=en&nrm=iso).
- [10] Brasil. Diário do Comércio e Indústria. *Fitoterápico chega a hospitais e veterinária*. [http://www.sebrae-sc.com.br/novos\\_destaque/opportunidade/mostrar\\_materia.asp?cd\\_noticia=7190](http://www.sebrae-sc.com.br/novos_destaque/opportunidade/mostrar_materia.asp?cd_noticia=7190).
- [11] Cambi, F. (1999). *História da pedagogia*. UNESP.
- [12] Cavalcante Filho, L. de A. et al. (2013). Acumuladores de animais: Promotores de bem estar animal? [Apresentação em evento]. Décima terceira jornada de Ensino, Pesquisa e Extensão, Recife, PE, Brasil.
- [13] Chaves, M. W. (2006). Desenvolvimentismo e pragmatismo: O ideário do MEC nos anos 1950. *Cadernos de Pesquisa*, 36(129).
- [14] Clemente, S. M. M. Metodologias problematizadoras: Um caminho para a autonomia. In C. R. S. Dourado, I. A. Oliveira, & W. L. S. Santos. (2013). *Diálogos entre a epistemologia e a educação* (p.131-136). CCSE-UEPA.
- [15] Costa, V. C. I. (2011). Aprendizagem baseada em problemas (PBL). *Revista Tabela Online*. <http://nucleotavola.com.br/revista/aprendizagem-baseada-em-problemas-pbl/>.
- [16] Cunha, M. V. (1999). Três versões do pragmatismo deweyano no Brasil dos anos cinquenta. *Educação e Pesquisa*, 25(2), 39-55.
- [17] Cunha, M. I. (2005). *O professor universitário na transição de paradigmas* (2a ed, 118 p.). Junqueira e Marin.
- [18] Cyrino, E. G., & Toralles-Pereira, M. L. (2004). Trabalhando com estratégias de ensino-aprendizado por descoberta na área da saúde: a problematização e a aprendizagem baseada em problemas. *Cadernos de Saúde Pública*, 20(3), 780-788.
- [19] Enemark, S., & Kjaersdam, F. (2009). A ABP na teoria e na prática: A experiência de Aalborg na inovação do projeto no ensino universitário. In U. F. Araújo, & G. Sastre (Orgs.). *Aprendizagem baseada em problemas no ensino superior* (pp.17-41). Sumus.
- [20] Fujimoto, R. Y., Costa, C. H. C., & Ramos, F. M. (2012). Controle alternativo de helmintos de *Astyanax cf. zonatus* utilizando fitoterapia com sementes de abóbora (*Cucurbita maxima*) e mamão (*Carica papaya*). *Pesq. Vet. Bras*, 32(11), 5-10.
- [21] Hoeller, S. C. (2006). Princípios norteadores para a estruturação de um projeto político pedagógico para a formação de profissionais na área de Agroecologia. [Dissertação de Mestrado]. Universidade Federal do Paraná.
- [22] Lans, C., Harper, T., Georges, K., & Bridgewater, E. (2000). Medicinal plants used for dogs in Trinidad and Tobago. *Preventive Veterinary Medicine*, 45, 207 – 210, 213-214.
- [23] Lesnau, G. G., & Santos, F. S. (2013, mar.-abr). Formação dos Acadêmicos de Medicina Veterinária no Processo de morte e morrer. *Bioscience Journal*, 29(2), 429-433. <https://docplayer.com.br/11146042-Formacao-dos-academicos-de-medicina-veterinaria-no-processo-de-morte-e-morrer.html>.
- [24] Niederauer, A. L. O. & Pöppel, A. G. *Estudo sobre as percepções na relação médico veterinário, tutor e estudante de medicina veterinária em relação à clínica veterinária de pequenos animais no Hospital de Clínicas Veterinárias da UFRGS*. [https://www.lume.ufrgs.br/bitstream/handle/10183/153822/Poster\\_46069.pdf?sequence=2](https://www.lume.ufrgs.br/bitstream/handle/10183/153822/Poster_46069.pdf?sequence=2).

- [25] Ozaki, A. T., & Duarte, P. C. (2006). Fitoterápicos utilizados na medicina veterinária, em cães e gatos. *Infarma*, 18(11/12).
- [26] Paloski, L. H. et al. (2017). Animal hoarding disorder: A systematic review. *Psico.*, 243-249.
- [27] Saviani, D. (2008). *A escola e democracia* (112 p., Coleção Educação Contemporânea). Autores Associados.
- [28] Silva, A. A. da, & Alcântara, M. A. (2015, maio-ago). Acumuladores de animais e ou objetos. *Biociências, Biotecnologia e Saúde*, 12.
- [29] Tavolaro, P., & Cortez, T. L. (2017, jan.-dez.). A Acumulação de animais e a formação de Veterinários. *Atas de Saúde Ambiental*, (5), 194-211.
- [30] Vermivet, & Biovet. (2018). *Saiba quais são as principais verminoses em cães e gatos*. <http://www.biovet.com.br/imprensa/saiba-quais-sao-as-principais-verminoses-em-caes-e-gatos/20180828-135931-r273>
- [31] Vigotski, L. S. *A formação social da mente: O desenvolvimento das funções*.
- [32] Walsh, A. (2005). *The tutor in problem based learning: A novice's guide* (36p.). Mc Master University.
- [33] Yamamoto, M. E. et al. (2007). *Comportamento animal* (2a ed., 520p.). [s. n.]
- [34] Yin, R. K. (2010). *Estudo de caso: Planejamento e métodos* (4a ed.). Bookman.
- [35] Zabala, A. (2002). *Enfoque globalizador e pensamento complexo*. Artmed.



## Human Embryology teaching mediated through a virtual environment room

## Ensino de Embriologia Humana mediado por sala ambiente virtual

Lidiane de Fátima de Oliveira Souza<sup>\*</sup>, Carlos Alberto Sanches Pereira, Brian França dos Santos

Professional Master's Degree in Health and Environmental Science Teaching - UniFOA / Volta Redonda, Brazil

\*Corresponding author

Received: 25 Aug 2022,

Received in revised form: 16 Sep 2022,

Accepted: 21 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**—Fetal development, Education, Ludicity, Virtual reality.

**Palavras-Chave**—Fetal development, Education, Ludicity, Virtual reality.

**Abstract**— Difficulties linked to the way of how we understand and present Human Embryology contents are aggravated by traditionalist characteristics still identified in the educational field. The way this science is taught must be based on interactive didactic resources, enhancing the best visualization of its phenomena. In this context, guided by the David Ausubel's Meaningful Learning Theory, the Human Embryology Virtual Environment Room was developed strengthening this content's teaching-learning process through a virtual game resource that dynamically represents Human Embryonic Development main phases. This resource was submitted to appreciation by Basic Education expert teachers, validating it as an educational product, assessing didactic, methodological and other issue related aspects through an electronic validation form. The quantitative results analysis and interpretation was carried out using Likert's Scale Median Ranking calculation; qualitative data was analyzed under Lefèvre & Lefèvre's Discourse of Collective Subject precepts. The results demonstrate that the educational product has been validated by expert teachers and it is possible to infer that it does constitute a potentially significant product for Human Embryology teaching.

**Resumo**— Dificuldades atreladas a forma de compreensão e apresentação do conteúdo de embriologia humana, são agravadas por características tradicionalistas que ainda se identifica na educação. O ensino desta ciência deve ser pautado em recursos didáticos interativos, que potencialize melhor visualização de seus fenômenos. Neste contexto, norteado pelos pressupostos da aprendizagem significativa de David Ausubel, foi desenvolvido a Sala Ambiente Virtual de Embriologia Humana, com objetivo de fortalecer o processo de ensino-aprendizagem deste conteúdo por meio de recurso lúdico virtual que represente, dinamicamente, as principais fases do desenvolvimento embrionário humano. Este recurso foi submetido à apreciação de docentes

*especialistas em ensino, com trajetória consubstanciada na Educação Básica, para validá-lo como um produto educacional, avaliando aspectos didático metodológicos e de representação do tema através de um formulário eletrônico de validação de produto educacional. A análise e interpretação dos resultados quantitativos foram efetuadas por meio do cálculo do Ranking Médio, a partir da escala Likert; os dados qualitativos, foram analisados sob preceitos do discurso do sujeito coletivo de Lefèvre e Lefèvre. Os resultados demonstram que o produto educacional foi validado pelos docentes especialistas. Infere-se que o mesmo se constitui como um produto potencialmente significativo no ensino de embriologia humana.*

## I. INTRODUCTION

Certain traditional teaching characteristics can still be identified in the educational field, such as a strong technicist tendency, where knowledge possession and task execution remain as the sole teacher responsibility, whilst students exercise a passive memorizer role. Another sign of this is found in the disjointed pedagogical activities limited to the use of conventional didactic resources avoiding incorporation of alternative methods that could motivate and assist the students in grasping new contents [1, 2, 3].

Historical paradigms shifts usually don't happen out of a sudden, becoming therefore a process in itself where some excelling professionals face certain difficulties. But teachers are the main responsables for changing this scenario. Taking care of the students' learning process is one of their main tasks, acting as the teaching-learning process Manager taking care of its individual preparation, creatively elaborating the class and providing the right conditions motivating the students to have an active role in this process. Well-planned and well-managed classes, with a dynamic and innovative profile, have better chances of success [4, 5].

Human Embryology studies is a part of Developmental Biology that integrates Morphological Sciences. Their studies develop all knowledge related to the beginning of human life – cells, tissues, organs and systems' origins. Therefore, these studies elucidate several biological mechanisms that determine the shifts occurring from fertilization, antenatal development until birth. It also clarifies the anatomy and explains how normal and abnormal relationships are developed in human structures. Embryonic development is a part of the human species perpetuation process; maintaining its genome and variability [6, 7, 8].

Human development and embryology are some of the most important subjects in all of Natural History [9]. Teaching this science cannot be limited to ineffective didactic models such as theoretical classes centralized in

textbooks as its main resources. This traditionalist model establishes a deficient teaching-learning process, failing to provide the proper visualization of embryonic processes that can possibly be too abstract for the students' mental representation [10, 11].

Innovations in information and communication technologies have triggered structural and functional changes in society, offering these very elements in the educational area, contributing to content mediation and enriching its learning. [12]. Souza; Oliveira [13] also affirm that information and communication technologies are related with the student's reality, with teenagers increasingly involved in virtual environments and becoming their main potential users.

The Brazilian National Curriculum Parameters for High Schools instructs that with the information technologies dissemination in products and services, these elements also need to find their own space in regular school learning and they should be seen as part of its teaching process. Natural Sciences need to identify the technological elements that are essential for their development with live contents, targeted as educational means [14].

Based on these premises, the availability of alternative tools for mediating Human Embryology contents is essential for teachers (that eventually have no access to different materials for teaching this subject); as well as for students (that demand adequate resources according to their cognitive structure, enhancing their interest for complex subjects). This cognitive emphasis can be established by a non-arbitrary and substantive interaction between previous subjects and new contents, following David Ausubel's Meaningful Learning key elements. According to Moreira [15], this kind of interaction provides new meanings for previous subjects, turning them into a more elaborate and richer knowledge, bestowing them with new meanings.

Considering this context, anchored on David Ausubel's Meaningful Learning premises, the "Human Embryology

Virtual Environment Room" educational product was developed in order to contribute to this subject's teaching-learning process reinforcement through a virtual ludic resource dynamically representing Embryonic Development main phases.

**II. METHODOLOGY**

This study is an Action Research that, according to Picheth et al. [16], can be understood as a knowledge strategy and an investigation methodology associated with an action and / or problem solving.

The educational product was initially developed focusing on High School students as its target audience. However, before their access, it's paramount to obtain an assessment from the teachers encharged with the students' routine education, validating the ludic resource. Therefore, experienced Biology Sciences teachers (hereby denominated as Expert Judges) also constitute this study's target audience. Consent was obtained through the Free and Informed Consent Form. The study was approved by the "Centro Universitário de Volta Redonda Ethics Committee for Research with Human Beings", following the protocol of the "Brazilian Certificado de Apresentação de Apreciação Ética" number 37107220.0.0000.5237.

The study's structure is organized in four main stages, ranging from initial content preparation to educational product validation (Fig. 1).

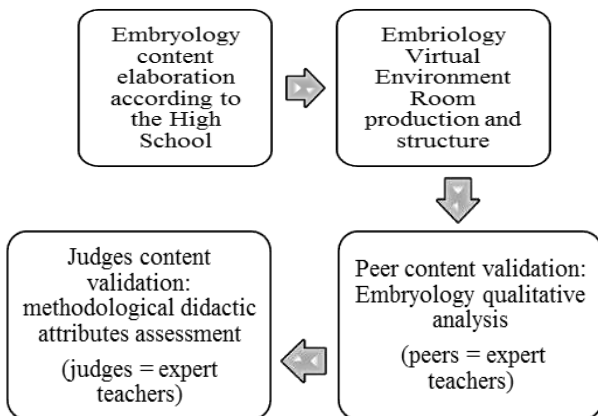


Fig. 1. Study stages synthesis. Source: Elaborated by the authors (2020).

**2.1 Data collection and analysis techniques**

Teachers were electronically invited receiving an email containing the instructions, a download link for the Human Embryology Virtual Environment Room and an access link to the Educational Product Validation Form. This electronic instrument was used to collect data, using

Google Forms with the following structure: the educational product title and the study objective are presented on the first page. The second page contains the Free and Informed Consent Form assuring the process safety by a signature, enabling the option to proceed to the next stage, comprised of 11 questions concerning the Expert Teacher profile. And in the last section, the educational product validation form is presented with its analytical dimensions, comprised of 15 questions, 11 of those with optative answers and 4 of those with discursive answers.

These dimensions were based and adapted following the "Coordination for Higher Education Personnel Improvement - Educational Product Working Group" guidelines, proposing a series of concepts (denominated as "dimensions") subsidizing the analysis of educational products coming from several stricto sensu graduation programs [17].

The form's optative questions follow a Likert-type scale of five possible answers increasing in their order of value. According to Bonici; Junior [18] for each Likert scale numerical element, a qualitative meaning is attributed reflecting the participant's attitude towards the assessed dimensions.

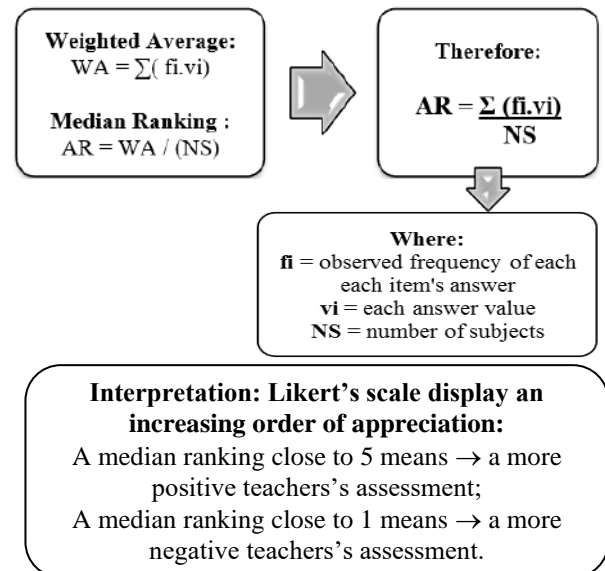


Fig. 2. Strategy to estimate the Median Ranking for each dimension and interpretation. Source: Organized by the authors (2020) based on Bonici; Junior [18] and Almeida Júnior [19].

The quantitative results analysis and interpretation (Fig. 2) was performed according to Almeida Júnior's Median Ranking calculation [19, p. 209], that being "an attributed value between 1 to 5 assigned to each answer allowing the weighted arithmetic mean calculation, based on the answers frequency".

Analysis and interpretation of qualitative results were carried out based on Lefèvre & Lefèvre's [20] Discourse of Collective Subject, meaning that for each question, the content of similar opinions presented by different teacher's statements are aggregated between themselves. This association is described by the synthesis and assimilations that tend to reconstruct the social representation of each teacher involved in the study.

## 2.2 The Making of Human Embryology Virtual Environment Room

This educational product has a simple technological structure and it is fairly easy to handle. Microsoft PowerPoint 2016 was adopted to structure the virtual environment and also to create all the animations, including dynamic graphical presentations interconnected by links that organize the stages of embryonic development in chronological order.

The virtual environment room initial presentation occurs through an animation culminating in the screen displayed at Fig. 3. This educational product comes in two languages, both in English and in Portuguese. The initial screen contains a button displaying the word "Portuguese" allowing the players to access the same game with all translated contents.

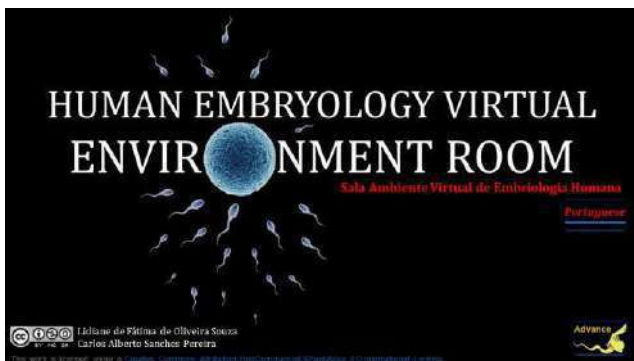


Fig. 3. Educational product initial screen. Source: Authors' file collection (2020).

In next screen, the character "Silas" (exclusively designed for this game by a professional designer) is presented to the players, placed in a setting that simulates the school environment (Fig. 4). In this screen's the upper corner, it's possible to find a button with direct recommendations for teachers regarding the educational product application.

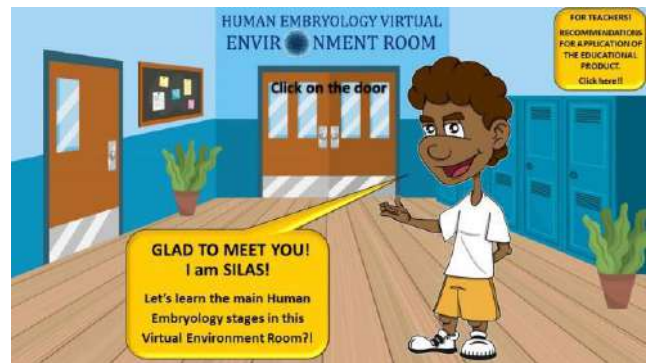


Fig. 4. Virtual Environment Room front door representation. Source: Authors' file collection (2020).

By clicking on the door, the student can access the virtual environment room designed as a floor plan detailing the Human Embryology stages, working as a summary with active links that redirect the player to each stage (Fig. 5).



Fig. 5. Virtual room route designed as a floor plan. Source: Authors' file collection (2020).

After this, "Silas" provides some explanation about the standard layout structure of each stage's main screen (i.e. those that display the studied stage functioning as the proposed teaching tools command centre) as seen on Fig. 6. The game is comprised of 15 main screens chronologically organizing the Human Embryology study.

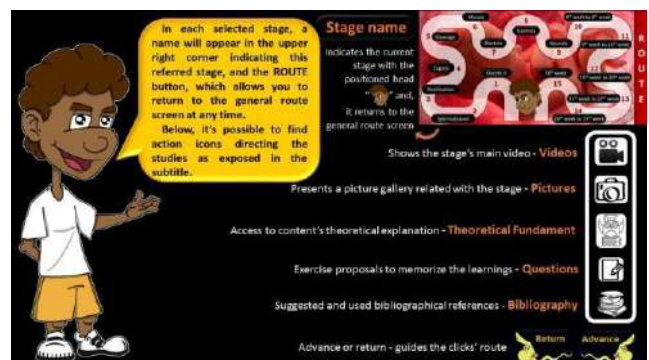


Fig. 6. "Silas" explains the standard layout of each stage's main screen. Source: Authors' file collection (2020).

After the layout explanation, the player will be instructed to click on the animated pulsating button marked as “Next”, starting the journey through the Embryonic Development stages. And after passing through all the 15 phases, Silas sends the following final message to the players, saying: “Thanks for your company! Our life is a gift, our most precious good! Enjoy it with love!”. At last, moving to the final credits.

### 2.3 Product contributions to the teaching area: educational implications

This study’s relevance, considering its main contributions and educational implications, is comprised of three essential dimensions:

a) for teachers, it allows the incorporation of ludic subsidized ideas in a potentially significative material with a pedagogical and didactic methodology that aggregates value in its formative process. This educational strand suggests that using a resource such as the Human Embryology Virtual Environment Room during the classes can be performed in different ways according to the teachers' choice, reality and creativity. The next session brings some suggestions on how to implement it;

b) for the educational and scientific community, this study provides an addition to scientific production and experimentation of innovative ludic resources used for Sciences and Biology teaching;

c) for students, the interaction and contextualization established by the product tries to contribute with the integral shaping of cognitive aspects (i.e. improving the assimilation of new meanings about Embryology, processing information and critical thinking considering contemporary Embryology issues); of socioemotional aspects (i.e. providing critical reflection to improve attitudes towards life, incentivizing positive social relationships, responsible decision making and shaping the student's behaviour as a transformation agent facing Embryology related concepts); and of physical aspects (i.e. encouraging good habits by addressing issues such as self-medication, illegal drugs consumption, teratogens, smoking habits, et al.) therefore, helping to build up promising future life prospects for the students.

Considering these points, the product complies with the established guidelines of the Brazilian Law 9394/96, Article 35-A, § 7º affirming that: "High school curriculum should consider the students' broad formation, adopting a working routine targeting their life prospects improvement and their physical, cognitive and socioemotional formation." [4].

## III. RESULTS AND DISCUSSION

### 3.1 Content validation: qualitative analysis of Embryology subjects represented in the educational product

In this first content validation stage, it was noticed that even with the vast content and structure, few specific observations were made regarding the theme's representation and the teachers' appraisals were abundant. Based on these appraisals, it is possible to assume that the educational product follows adequate purposes for Basic Education Embryology teaching, since this analysis was carried out by teachers working with this subject, confirming Oliveira's [21] statement that a teachers' vision is a crucial part of the study, enriching it in all dimensions, since they are the agents of paramount importance in the teaching-learning process.

As for the Human Embryology subjects' suitability and representation in the educational product, Costa Segundo et al. [7], states that Embryology teaching mediated by virtual didactic resources is an efficient strategy, allowing students to interact through a dynamic and easily accessible tool.

And according to Pereira [22], ludic elements, when used for teaching, make theorization better elucidated fitting into the individual's daily practice. This happens mostly because the student can interact in this new knowledge construction, enhancing curiosity and critical spirit.

### 3.2 Educational product validation by judges: methodological didactic attributes assessment

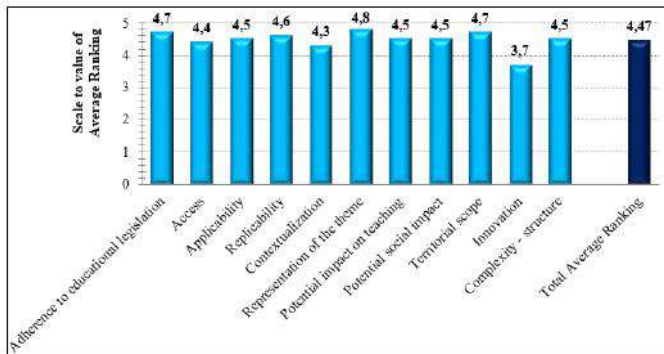
When crossing the academic credentials data with time and teaching segment activity, the target audience prevalence was obtained, constituted mostly by PhDs (60%) with extensive teaching experience for more than 20 years (50%) and 90% of the teachers have professional experience in the “High School general education modality” segment, converging with the period intentionally chosen for this educational product in its initial development stages.

The multiple-choice questions included in the educational product validation form present the analytical dimensions assessed by the teachers (Graphic 1).

The educational product compliance to the Brazilian Law 9394/96 and to the National Common Curricular Basis regards the way on how the educational product meets contributive premises and purposes on the foundations of national education legislation. From the median ranking of 4.7, it can be inferred that from the teachers' perspective, the educational product contains enough attributes to consider the students' comprehensive

education in physical, cognitive and socio-emotional aspects according to Article 35-A § 7, contributing to the final High School stages attributing the students with “I – command over scientific and technological principles presiding over modern production and II - knowledge of contemporary forms of communication”, as described in items I and II of Article 35, § 8 of the Brazilian Law 9394/96. As well as working on various skills related to the specific competences contained in the fields 2 and 3 in the Brazilian Common National Curricular Basis [4, 23].

Graphic 1. Educational product validation ranking.



Source: Elaborated by the authors (2020).

The access dimension obtained a 4.4 median ranking, configuring the educational product as an easily accessible one. Costa Segundo et al. [7] found in his study that virtual didactic contents presented by easily accessible tools represented an efficient strategy allowing better student interaction levels.

Applicability and replicability requirements obtained 4.5 and 4.6 grades, respectively. In view of this positive appreciation, it's possible to infer that the Human Embryology Virtual Environment Room is an easily adaptable resource both for partial and integral use. This content corroborates with Rizzatti et al. [17] stating that teachers are free to partially or fully use and reuse products deriving from professional Master's degrees, even combining them with other materials. In other terms, it's possible to adapt these products in accordance to their didactic needs, to the reality applied upon them and in different social groups.

It's possible to infer from the median 4.3 ranking regarding the contextualization dimension that the educational product succeeds in contextualizing with the students' reality upon presenting the content in a technological format that is currently becoming increasingly present young people's lives [13].

In the Embryology issue representation dimension, a median ranking of 4.8 was obtained. It is possible to understand that the Human Embryology knowledge is

properly incorporated into the educational product in a logical and dynamically represented sequence. According to the Brazilian Common National Curricular Basis, this is necessary to develop and explore different software resources that represent the contents, enabling phenomena and process simulation and the consequent knowledge grasping by the students [23].

Both the average ranking in the teaching potential impact dimension and the potential social impact resulted in a 4.5 score. It shows that the Human Embryology Virtual Environment Room has the potential to generate promising results for the teaching-learning process, a fact that corroborates a similar study developed by Pereira; Lima [5] when teachers change and update their way of teaching, a new opportunity arises for students to take on a new role inside and outside their classrooms, deconstructing standards of social and cultural stigmas and reconstructing them, having the very students as active subjects in this process.

In terms of territorial coverage, a median ranking of 4.7 was observed. Therefore, it can be considered that the educational product has the potential for regional, national and international outreach since it is structured in the vernacular Portuguese language, a fact that expands the possibility of reaching Portuguese-speaking countries, as well as widespreading it internationally with its English translated version.

The innovation dimension obtained the lowest median ranking, scoring 4.3. But even with this mark, 50% of the teachers indicated that the educational product has a highly innovative content. It's possible to believe that the low median ranking value may be due to the usage of a broadly known program (i.e. Microsoft PowerPoint) but the intention was to revisit it with an innovative proposal. According to Rizzatti et al. [17, p. 11], “innovation doesn't only derive from the educational product itself, but from its methodology development, from the usage of techniques and resources, making it more accessible and from using it in a social context”.

The last analyzed dimension considered the complexity – structure aspect, with a median ranking of 4.5. Most teachers (60%) rated this item as “without complexity” allowing us to infer that, in the structural sense, the educational product content format and organization is appropriate both for the teachers' professional practice and for its use by students, based on different linguistic resources, i.e., verbal, visual, audio, digital, as well as in the fields of artistic and scientific languages, “expressing and sharing information, experiences, ideas and feelings in different contexts and producing meanings that lead to mutual understanding”, following the recommendations

established by the fourth general competence of Basic Education described in the Brazilians Common National Curricular Basis [23].

When analyzing the total median ranking, it is possible to highlight that ten out of eleven analyzed dimensions obtained a median ranking value above 4.3. There is an oscillation in the dimensions median ranking varying between 3.7 (lowest median ranking obtained in the innovation dimension) and 4.8 (highest median ranking obtained in the issue representation dimension). And the end result was a total median ranking of 4.47.

Based on these dimensions median ranking results and the total median ranking score, those teachers' analysis can be considered as extremely positive, substantiating the Human Embryology Virtual Environment Room validation as a potentially significant ludic resource for the Biology teaching learning process in High Schools. Corroborating with authors such as Wong; Subramaniam [24] and Bain; Meagher; Barker [25], in examining the literature on the technology usage and infusion in the scientific college teaching learning process, it is clear that they are effective because they enrich this process by innovating Life Sciences studies.

It's also worthy to notice that all assessed dimensions provide a detailed discussion about the educational product. This fact, according to the Coordination for Higher Education Personnel Improvement working group report, can lead to a higher qualification of the product in question. And it creates an opportunity for other professional Master's research products to have direct impacts in Basic Education improvements [17].

### 3.3 Educational Product teachers' recommendations

The last validation form questions were formulated in a discursive design where expert teachers were able to freely include their contributions, later associated between themselves observing similar opinions. Based on these, some inferences were established according to Lefèvre's principles; Lefèvre [20].

90% of the teachers demonstrated some interest in using the educational product as a didactic resource in their pedagogical practice. And all of them (100%) stated that they would recommend it to other professional colleagues. In their justifications, key similar concepts stood out:

The product's quality was considered clear, objective, with a dynamic approach and easy to be used and adapted;

The product presented a new narrative enhancing the player's interest;

The product has a potential to make the teaching learning process become easier;

It improves content understanding in a non-literal and arbitrary way (i.e. through explanation and visualization);

Spreading this product can represent a good access opportunity for several students and teachers.

Rizzatti et al. [17] reports that educational products propagation can contribute to a higher visibility of these very resources potentializing the inclusion of differentiated methodologies that, according to Vlnieska [26], guarantees a more meaningful, participatory, dynamic and attractive learning. The author also points out that caring for constant search of meaningful and effective learning must be at the heart of teachers' motivation and inspiration and that "pedagogical action" is based on trusting that education is a transformation source.

Both feedbacks referring to these appraisals and the limitations are constructive criticisms that make it possible to recognize the teachers' vision, since they are the ones in the teaching front line. And according to Ruiz et al. [27], it is crucial that they share what they think, their expectations and knowledge adding some value to the proposed material. This author, working as researcher at University of Buenos Aires, mentions that the material validation process, which occurs whenever a teaching resource is completed, needs to be done in a participatory manner by a representative group carrying out a final assessment with specialized and impartial views.

## IV. CONCLUSION

Based on the concept that meaningful learning principles can enhance Human Embryology teaching-learning, the perceived results are promising considering the achieved median ranking grades and the teachers' feedback contents, justifying the Human Embryology Virtual Environment Room validation as a potentially significant ludic educational product, contributing to this content's teaching innovation presenting the main Embryonic Development phases in a dynamic and pleasant way, also involving the students in experiencing this phenomenon.

On that account, the proposed educational product displays enough potential characteristics to reduce difficulties associated to the way of how Embryology contents are presented and understood, enhancing and strengthening this science's teaching-learning process.

Considering this, it's expected that the Human Embryology Virtual Environment Room will be used as a subsidy for Biology teachers and as an additional resource to the students in assimilating and building up new meanings about Embryology in their cognitive structure,

developing critical thinking regarding these issues in their social contexts and also acting as a transformation agents.

## REFERENCES

- [1] Nicola, J. A., Paniz, C. M. (2016). The importance of using different teaching resources in Biology teaching. *Innovation and Training*, NEAd-Unesp, São Paulo, v. 2, n. 1, p. 355-381. Available at: <<https://ojs.ead.unesp.br/index.php/nead/article/view/InFor2120167>> A Accessed in: 25 May 2020.
- [2] Schuhmacher, V. R. N., Alves Filho, J. P., Schuhmacher, E. (2017). Barriers of teaching practice in the use of information and communication technologies. *Science and Education*, Bauru, v. 23, n. 3, p. 563-576.
- [3] Pereira, C. A. S., Guedes, M. R. A., Rodrigues, D. C. G. A., Pereira, A. P. C., Souza, L. F. O. (2019). Construction of an ambient room as an alternative methodology for teaching anatomy and physiology of the human digestive system. *Pedagogy in Focus*, v. 14, n. 12, p. 101-119.
- [4] Brasil. Lei nº 9.394, de 20 de dezembro de 1996. (1996) Law guidelines and bases of national education. *Federative Republic of Brazil*. Brasília, DF, 20 dez. Available at: <[http://www.planalto.gov.br/ccivil\\_03/LEIS/L9394.htm](http://www.planalto.gov.br/ccivil_03/LEIS/L9394.htm)>. Accessed in: 07 Apr. 2020.
- [5] Pereira, W. O., Lima, F. T. (2018). Challenge, Discussion and Answers: active teaching strategy to transform lectures into collaborative ones. *Instituto Israelita de Ensino e Pesquisa Albert Einstein*. São Paulo; vol. 16, nº 2, p. 1-4.
- [6] Moore, Ke. L., Persaud, T. V. N., Torchia, M. G. (2012). *Basic Embryology*. 8ª ed. Rio de Janeiro: Elsevier, 348p.
- [7] Costa Segundo, C. N. et al. (2015). Didactic strategies integrated in the teaching of Embryology and Developmental Biology. *Monitoring Notebook*, nº 2, p. 214-231.
- [8] Montanari, T. (2017). Mobile devices and modeling in the teaching of Embryology. *New Technologies in Education*, v. 15, n. 2.
- [9] Darwin, C. (2009). *A origem das espécies através da seleção natural ou a preservação das raças favorecidas na luta pela sobrevivência*. Trad. Ana Afonso, Portugal: Multiponto, S.A. 442 p. Tradução da 6ª edição original e última revista por Darwin: *The Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*. 6th Edition, London, 1876.
- [10] Bernardo, J. M. P., Tavares, R. O. (2017). Development of auxiliary didactic models in the teaching-learning process in Human Embryology. *Debate Education*. Ano 39, n. 74, p. 87-105.
- [11] Souza, L. F. O., Pereira, C. A. S., Carvalho, M. A., Pereira, A. P. C. (2020). The importance of teaching Human Embryology in High School: an analysis of Biology textbooks recommended by the PNLD 2018. *Revista Eletrônica Pesquiseduca*, v. 12, n. 26, p. 208-225.
- [12] Vieceli, D., Moraes, M. F. (2016). The use of educational technologies by the regent teacher at school (UTE). *Notebooks PDE*. Paraná, vol. 1, 18p. Available at: <[http://www.diaadiaeducacao.pr.gov.br/portals/cadernospde/pdebusca/producoes\\_pde/2016/2016\\_artigo\\_mat\\_unioeste\\_domingosvieceli.pdf](http://www.diaadiaeducacao.pr.gov.br/portals/cadernospde/pdebusca/producoes_pde/2016/2016_artigo_mat_unioeste_domingosvieceli.pdf)> Accessed in: 10 Oct. 2019.
- [13] Souza, D. A., Oliveira, J. A. M. (2016). Use of digital technologies by children and adolescents: potential threats in their interrelationships. *XIII Symposium of excellence in management and technology*. Available at: <<https://www.aedb.br/seget/arquivos/artigos16>> Accessed in: 10 Oct. 2020.
- [14] Brazil. Ministry of Education. (2000). Secretary of Middle and Technological Education. National Curriculum Parameters: High School. *Brasília: Ministry of Education*. 58p. Available at: <<http://portal.mec.gov.br/seb/arquivos/pdf/ciencian.pdf>> Accessed in: 10 Oct. 2020.
- [15] Moreira, M. A. (2016). Theoretical Subsidies for the Research Professor in Science Teaching. *Collection of brief monographs on theories of learning as a subsidy for the research teacher, particularly in the area of science*. Porto Alegre, Brazil. 2ª revised edition, 64 p.
- [16] Picheth, S. F., Cassandre, M. P., Thiollent, M. J. M. (2016). Analyzing action research in the light of interventionist principles: a comparative look. *Revista Educação*, Porto Alegre, v. 39, p. 3-13.
- [17] Rizzatti, I. M., Mendonça, A. P., Mattos, F., Rôças, G., Silva, M. A. B. V., Cavalcanti, R. J. S., Oliveira, R. R. (2020). The educational products and processes of professional graduate programs: propositions from a group of collaborators. *ACTIO Science Teaching*, Curitiba, v. 5, n. 2, p. 1-17.
- [18] Bonici, R. M. C., Junior, C. F. A. (2011). Measuring student satisfaction with the online discipline of probability and statistics. In: 17th International Congress on Distance Education n. XVII, 2011 (online). Manaus: ABED. *Brazilian Association of Distance Education*, 10p.
- [19] Almeida Júnior, R. C. V. (2017). Study on the degree of satisfaction of users of the public transport service provided by the company viação cidade corumbá to the municipality of Corumbá/MS. *Revista GeoPantanal*. Universidade Federal de Mato Grosso do Sul (UFMS). Search group Pantanal Vivo/AGB Corumbá, n. 23, p. 215-230.
- [20] Lefèvre, F., Lefèvre, A. M. C. (2014). Collective subject discourse: social representations and communicative interventions. *Text Nursing Context*, Florianópolis, v. 23, n. 2, p. 502-507.
- [21] Oliveira, C. T. F., Ovigli, D. F. B., Silva, M. I., Simões, R. M. R. (2018). The use of technologies in high school: what do the articles say? *Evidence*, v. 14, n. 14, p. 225-236.
- [22] Pereira, C. A. S., Souza, L. M., Guedes, M. R. A., Albuquerque, G. G., Fonseca, M. C. V. (2014). Learning from the experience of a room-environment. *Revista de Educação, Ciências e Matemática*, v. 4, n. 2.
- [23] Brazil. Ministry of Education. (2018). Secretary of Basic Education. Common National Curriculum Base. Education is the basis. *Brasília: Ministry of Education*, Secretariat of Basic Education. 600p. Available at: <<http://basenacionalcomum.mec.gov.br/>> Accessed in: 10 Oct. 2020.



- [24] Wong, C. P., Subramaniam R. (2020). Use of technology in biology education – case of infrared thermal imaging, *Journal of Biological Education*, DOI: 10.1080/00219266.2020.1808510.
- [25] Bain, S. A., Meagher, T. R., and Barker D. (2020). Design, delivery and evaluation of a bioinformatics education workshop for 13-16-year-olds, *Journal of Biological Education*, DOI: 10.1080/00219266.2020.1858932.
- [26] Vlnieska, V. (2013). Applying different teaching resources: an assessment of learning in embryology. *Completion of course work. Graduate in Biological Sciences at the Federal University of Paraná*. Curitiba. Available at: <<https://acervodigital.ufpr.br/bitstream/1884/31593/1/Monografia%20Vanessa%20Vlnieska.pdf>> Accessed in: 14 Dec. 2020.
- [27] Ruiz, L., Motta, L., Bruno, D., Demonte, F., Tufro, L. (2014). *Producción de materiales de comunicación y educación popular*. Buenos Aires: Departamento de Publicaciones de la Facultad de Derecho y Ciencias Sociales de la Universidad de Buenos Aires. 1ª ed., 15 p. Available at: <<http://www.sociales.uba.ar/wp-content/blogs.dir/219/files/2015/07/2-Prod-Materiales-B.pdf>> Accessed in: 06 Aug. 2020.

# Geoconservation: Research and extension in the context of the Iron Quadrangle, Brazil

José Alves Ferreira Neto, Igor Henrique Fernandes Silva, Juscelina Rosiane Ferreira, Rafael Aldighieri Moraes

Department of Applied Engineering and Environmental Technologies, State University of Minas Gerais, Minas Gerais, Brazil

Received: 15 Aug 2022,

Received in revised form: 13 Sep 2022,

Accepted: 20 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Iron Quadrangle, research, extension, geoconservation, geoeducation*

**Abstract**— *Brazil has a great geological potential, however there are only three geoparks recognized by UNESCO: Araripe, Seridó and Caminhos dos Cânions. Several studies show the potential of the Brazilian region, located at Minas Gerais state, named Iron Quadrangle to be incorporated in the Global Geopark Network, where its conservation has importance in the geological, historical and social scene. The State University of Minas Gerais (UEMG), through its trajectory, has developed extension and research projects linked to the history of each region, with themes related to geodiversity, geoeducation, environmental preservation. This paper aims to demonstrate how the academy, especially the UEMG, can promote the conservation of the Iron Quadrangle. The city of João Monlevade has received special attention since this city integrates the Iron Quadrangle and it has important geological sites as Areão Park and Serra do Seara. João Monlevade city has an economy around the steel industry, metallurgy and mining, activities that interpose intensively in the landscape. Research and extension works in these domains are essential, since they represent an important tool for its conservation. The institution can extend to the society the scientific knowledge about geological historical, economic heritage, space alteration and environment preservation as a whole creating an important way for local and regional sustainability.*

## I. INTRODUCTION

Geodiversity can be defined simply as the natural range (diversity) of geological (rocks, minerals, fossils rocks, fossils), geomorphological (land form, physical processes) and soil features. It includes their assemblages, relationships, properties, interpretations and systems (Gray, 2005).

Geopark is a geographical area where geological heritage sites are parts of a holistic concept involving conservation, education and sustainable development. It aims to protect the geodiversity, to promote geological heritage to the public, as well as to support sustainable economic development of geopark territories, primarily

through the development of geological tourism, the geotourism. Geopark should take into account the whole geographical setting of the region, and shall not solely include sites of geological significance. The synergy between geodiversity, biodiversity and culture, in addition to both tangible and non-tangible heritage are such that nongeological themes must be highlighted as an integral part of each geopark, especially when their importance in relation to landscape and geology can be demonstrated to the visitors. For this reason, it is necessary to also include and highlight sites of ecological, archaeological, historical and cultural value within each geopark (UNESCO, 2014).

The Global Geoparks Network (GGN) is a non-profit International Association developed under the umbrella of UNESCO and serves to develop models of best practice and set quality-standards for territories that integrate the protection preservation of Earth heritage sites in a strategy for regional sustainable economic development.

Brazil has one of the greatest geological potential of the planet, with large geodiversity, however there are only three geoparks recognized by UNESCO: Araripe, Seridó and Caminhos dos Cânions do Sul, with the last two recognized in 2022. Several studies (Ruchkys 2006, 2007; Silva 2007; Mantesso-Neto et al. 2010; Castro et al. 2011; Ruchkys et al. 2012; Gomes et al. 2019; Carmo 2020; Castro et al. 2020; Santos et al. 2021) show the potential of the Iron Quadrangle, an important Brazilian heritage site, to be incorporated in the GGN.

The Iron Quadrangle geographically corresponds to an extension of the area, with about 7000 km<sup>2</sup>, located in the southern region of Serra do Espinhaço, integrating 35 cities of Minas Gerais state. It is inserted as headwaters of important watersheds such as the São Francisco river, Rio Doce and Rio Grande ones (Ruchkys et al. 2012).

João Monlevade that integrates the northeast end of the Iron Quadrangle has important geological sites, such as Areão Park and Serra do Seara, that deserve to be considered from the point of view of geoconservation. The State University of Minas Gerais (UEMG -- acronyms for Universidade do Estado de Minas Gerais), located in João Monlevade city, offers the undergraduate courses in civil, metallurgical, environmental, mining and mechanical engineering. These courses are very important to the development of the country, but they interpose extensively in the landscape. For this reason, the academy takes over an important role, extending to the society the scientific knowledge about geographical, historical, economic heritage, space alteration and its natural environment as a whole, creating an important way for regional sustainability.

The aim of this paper is to demonstrate the role of the academy as a promoter of conservation activities of the Iron Quadrangle, especially in the João Monlevade city. The Iron Quadrangle has great importance in the history of mining in Brazil and relevance in the geological context and tectonic evolution for understanding the geological history of Earth.

## II. GLOBAL GEOPARK NETWORK (GGN)

The Global Geoparks Network (GGN) is a legally constituted not-for-profit organization. It is a dynamic network where members are committed to work together,

exchange ideas of best practise, and join in common projects to raise the quality standards of all products and practises of a UNESCO Global Geopark. UNESCO Global Geoparks are single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development.

According to UNESCO the number of sites in the Global UNESCO Geoparks Network, at april 2021 was 169 distributed in 44 countries, as presented in Fig. 1, demonstrating the diversity of the planet's geology. Europe is the continent with the most geoparks, 87. Then; Asia has a total of 67 geoparks, where China has 42. There are thirteen geoparks on the American continent and only two geoparks on the African continent.

Brazil has one of the greatest geological potential of the planet, with large geodiversity, however there are a unique geopark recognized by UNESCO. The Araripe UNESCO Global Geopark was created in 2006, holds one of the largest and deposits of fossils from Lower Cretaceous in Brazil and in the world. The Araripe UNESCO Global Geopark is located in the Araripe Basin (Ceará state), which is considered the largest sedimentary basin in the brazilian northeast. The geological heritage of the geopark is characterized by important geological records from the lower cretaceous period between 90 and 150 million years ago, especially in its paleontological content. The preservation of this vast and rich heritage of fossils in the region was caused by unique conditions during the geological evolution of Araripe Basin, especially in the Cretaceous. Sedimentary deposits preserve a great diversity of rocks (limestones, claystones, sandstones, thick deposits of gypsum) that are a record of geological environments that existed in this region (UNESCO, 2020).

The geoparks project of the Geological Survey of Brazil, created in 2006, represents an important inductive role in the establishing of geoparks in Brazil. In 2012, this organization presented 35 proposal of creation of geoparks in the Brazil (CPRM, 2018; SCHOBENHAUS and SILVA, 2012). Despite of the existence of these proposals, the most advanced projects are the Bodoquena-Pantanal, the Campos Gerais, the Alto Ribeira Valey, Iron Quadrangle (GUIMARÃES et al. 2009), Pathways of the Southern Canyons, and Seridó Geopark (UNESCO, 2022).

The potential of the Iron Quadrangle for understanding earth science and mining history is widely accepted (RUCHKYS 2006, 2007; SILVA 2007; MANTESSO-NETO et al. 2010; CASTRO et al. 2011; RUCHKYS et al. 2012; GOMES et al. 2019; CARMO 2020; CASTRO et al. 2020; SANTOS et al. 2021). Its mineral wealth, scenic

landscapes, geological features and human history reveal particularities that reinforce the need to include the Iron

Quadrangle Geopark in the GGN.

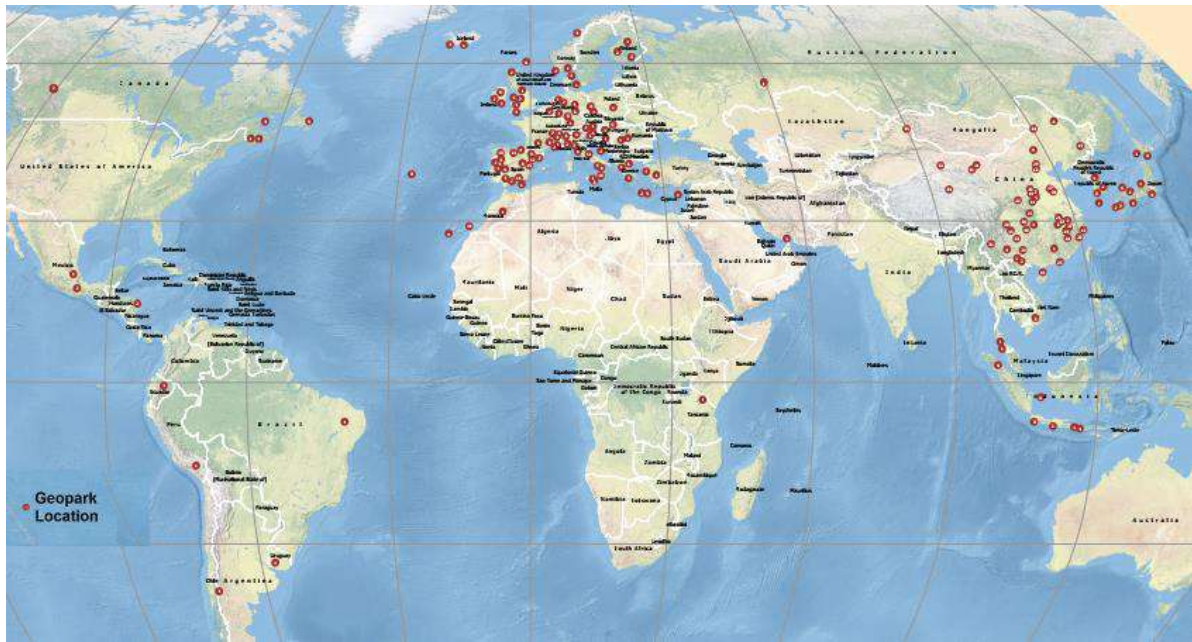


Fig. 1: Distribution of GGN Members (UNESCO, 2021).

### III. IRON QUADRANGLE GEOPARK

The central region of Brazil is so rich in minerals that it was named, General Mines, in portuguese Minas Gerais. Gold was found in this region in the end of the 17th century and its extraction declined progressively in the end of the 18th century (MACHADO 2009, CASTRO et al. 2011). However, gold is still mined, and since early the 19th century, iron ore is heavily extracted. A high percentage of Brazil's mineral production, (approximately 60%) comes from an area called Iron Quadrangle, located in the central-southeastern part of the Minas Gerais State (MANTESSO-NETO et al. 2010).

The Iron Quadrangle played an essential role in the development of the portuguese empire and in the evolution of the brazilian nation. The history and occupation of Iron Quadrangle were determined by the conditions of the exploration of the gold and other minerals. During the colonial period, several hundred tons of gold produced from the rich placer deposits of the region formed a large part of the financial foundation for rapid expansion of the portuguese empire and the influence of that nation in world affairs (DORR, 1969).

Over time, the Iron Quadrangle diversified its mineral production, being one of the most important mining districts in Brazil, standing out for the production of iron

ore, manganese, gold, steatite (soapstone), gemological minerals, among others (SILVA 2007).

The Iron Quadrangle is the subject matter of a project for the creation of a geopark. According to [8], the proposed area for the limits of the geopark, covers: i) to the north, the Serra do Curral (from the Serra do Rola Moça to the Serra da Piedade); ii) to the west, the Serra da Moeda; iii) to the south, the Serra do Ouro Branco, the Serra da Itatiaia and the Itacolomi peak; iv) to the east, the Frazão peak, the Serra do Caraça, the Serra do Tamanduá, the Serra do Brucutu, the Serra das Cambotas and the Serra da Piedade, as presented in Fig. 2.

Rock formations in Iron Quadrangle date from the Archean to the Paleo-proterozoic, and represent meaningful processes in the Earth evolution. Briefly, its geodiversity includes some intrusives and three extensive complexes: i) Archean metamorphics; ii) Archean greenstone belt-type rocks, some gold-bearing; iii) Paleo- and meso-proterozoic metasedimentary sequences, with bodies of banded-iron formation (alternating layers of hematite and silicates); this world-known itabirite is the main local iron ore, and, along with the quartzites, forms the mountain ranges that surround and characterize the Iron Quadrangle (FARINA et al., 2016). Fig. 3 presented the simplified geological map of the Iron Quadrangle with the location of main geological formations.

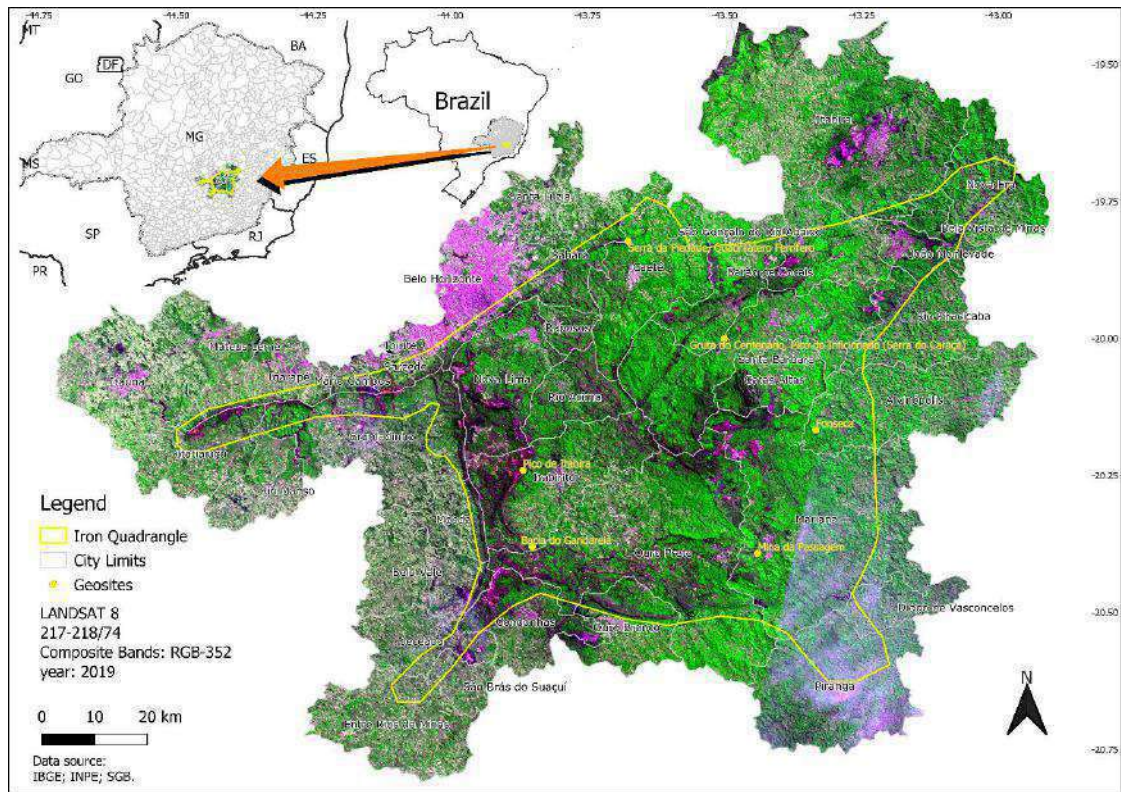


Fig. 2: Location and limits of the proposed Iron Quadrangle Geopark (Adapted from Ruchkys et al. 2012).

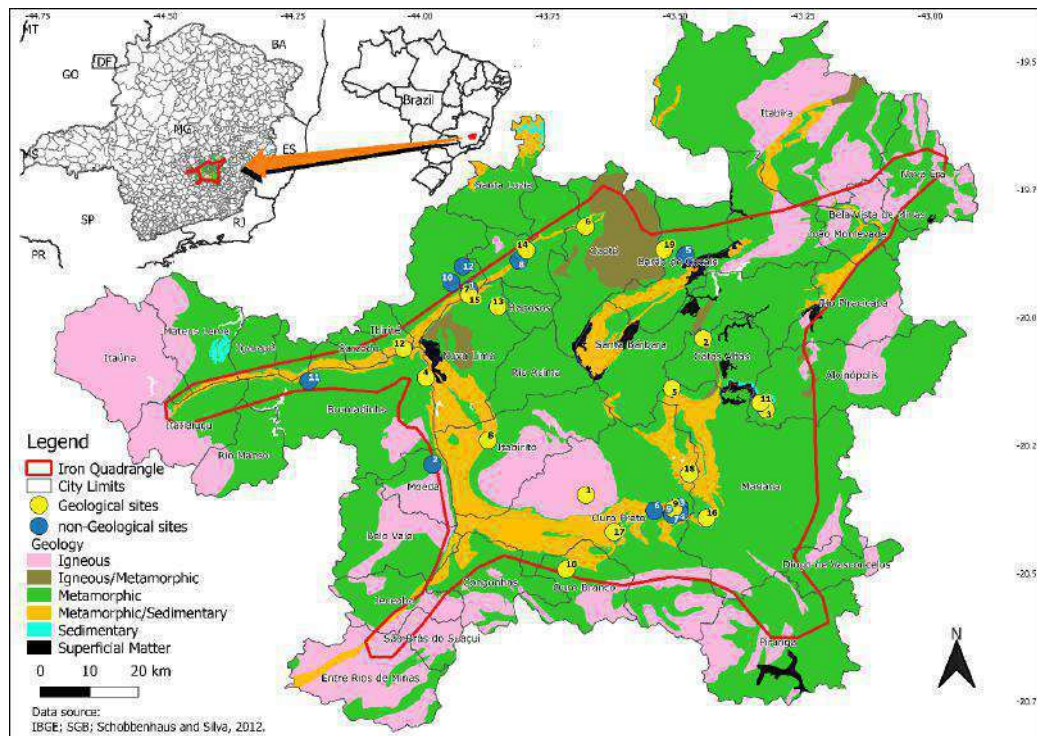


Fig. 3: Simplified geological map of the Iron Quadrangle (Adapted from Ruchkys et al. 2012).

Table 1 presents the identification of the geological sites and non-geological sites of the Iron Quadrangle.

Table.1: Geological and non-geological sites of the Iron Quadrangle (Ruchkys et al. 2012)

| GEOLOGICAL SITES     |                                                                                               |
|----------------------|-----------------------------------------------------------------------------------------------|
| 1                    | Cachoeira do Campo (Cachoeira do Campo)                                                       |
| 2                    | Rio das Velhas supergroup metavolcanics and Bicame de Pedra Aqueduct (Catas Altas)            |
| 3                    | Metarenites of Andaime peak (Itabirito)                                                       |
| 4                    | Quartzite and basal conglomerate of the Moeda formation (Moeda)                               |
| 5                    | Natural Park of Caraça (Catas Altas and Santa Bárbara)                                        |
| 6                    | Itabirites from Serra da Piedade (Caeté and Sabará)                                           |
| 7                    | Curral moutain range (Belo Horizonte and Nova Lima)                                           |
| 8                    | Itabira peak (Itabirito)                                                                      |
| 9                    | Itacolomi peak (Ouro Preto and Mariana)                                                       |
| 10                   | Ouro Branco mountain range (Ouro Branco)                                                      |
| 11                   | Fonseca (Alvinópolis)                                                                         |
| 12                   | Rola-Moça moutain range (Belo Horizonte, Nova Lima, Ibirité and Brumadinho)                   |
| 13                   | Morro Velho mine (Nova Lima)                                                                  |
| 14                   | Córrego do Meio mine (Sabará)                                                                 |
| 15                   | Águas Claras mine (Nova Lima)                                                                 |
| 16                   | Passagem village (Mariana)                                                                    |
| 17                   | Capão do Lana (Ouro Preto)                                                                    |
| 18                   | Nossa Senhora da Lapa grotto (Ouro Preto)                                                     |
| 19                   | Cambotas mountain range (Barão de Cocais)                                                     |
| NON GEOLOGICAL SITES |                                                                                               |
| 1                    | Mangabeiras park (Belo Horizonte)                                                             |
| 2                    | ruins of clandestine gold smelting house (Moeda)                                              |
| 3                    | ruins of Patriótica iron factory (Congonhas and Ouro Preto)                                   |
| 4                    | Queimada hill (Ouro Preto)                                                                    |
| 5                    | Pedra Pintada archaeological site (Barão de Cocais)                                           |
| 6                    | Tripuí ecological station (Ouro Preto)                                                        |
| 7                    | Science and technology museum of mines school – Federal University of Ouro Preto (Ouro Preto) |
| 8                    | gold museum (Sabará)                                                                          |
| 9                    | House of Contos (Ouro Preto)                                                                  |
| 10                   | Mines and metal museum (Belo Horizonte)                                                       |
| 11                   | Inhotim (Brumadinho)                                                                          |
| 12                   | Geological heritage reference center – Federal University of Minas Gerais (Belo Horizonte)    |

The geological context of the Iron Quadrangle is characterized by a basal metamorphic complex, the supracrustals of the Rio das Velhas Supergroup and metasedimentary sequences paleo and mesoproterozoic represented by the Minas Supergroup and Espinhaço Supergroup and their respective petrographic formations as presented in the Fig. 3.

The Minas Supergroup, which in terms of stratigraphy, it can be divided into two main megasequences: (i) a sequence between delta fluvial and platform marine that includes the Caraça, Itabira and Piracicaba Groups and (ii) immature marine deposits of the Sabará Group. Grupo Itabira, where the itabirites are, the name given to Banded Iron Formations, a predominantly marine sequence from shallow to deep (DORR, 1969).

#### IV. RESEARCH, EXTENSION AND TEACHING IN THE CONTEXT OF IRON QUADRANGLE

##### 4.1 Importance of Geoconservation

The conservation of the geological heritage for future generations depends of an adequate use of the land, where everyone is responsible. This conservation imposes new challenges for all sectors of society: politicians, businessmen, educators, media, etc. In this way, it is urgent to improve the methods of exploration of geological resources enabling and promoting their sustainable use. Changes in citizen's unsustainable consumption rates are required in order to mitigate current problems affecting society, namely those emerging from the fragility of the physical environment (HENRIQUES et al. 2011).

The deep transformation of the land surface is one of the major environmental impacts associated with the industrialization. The intense transformation of the earth's surface has a negative impact on the conservation of the geological heritage.

In Brazil, native forests -- that includes areas of native vegetation in rural properties, integral conservation units, indigenous lands and native vegetation in vacant and unregistered lands -- occupy 66.3% of the land surface. Agriculture and cattle raising correspond to 30.2%, distributed in native and planted pasture; agriculture; and planted forest. Other purposes, including settlements and infrastructure totalize 3.5% (EMBRAPA, 2018). In this way, these activities result in significant modifications of the surface and consequently, inevitable destruction of geological heritage of the country. Figure 4 shows the occupation of the land surface of the Brazilian territory with more details.

Furthermore, Brazil is one of the richest countries in minerals on the planet, being the second largest producer of iron ore in the world, according to IBRAM 2021. This abundance of raw material makes Brazilian mining, as well as the steel industry, stand out in the international market in the production and export of iron ore and steel, where Minas Gerais and Iron Quadrangle are the biggest representatives of these activities. Relative to the steel industry, João monlevade was one of the pioneers cities in the implementation of this segment in Minas Gerais.

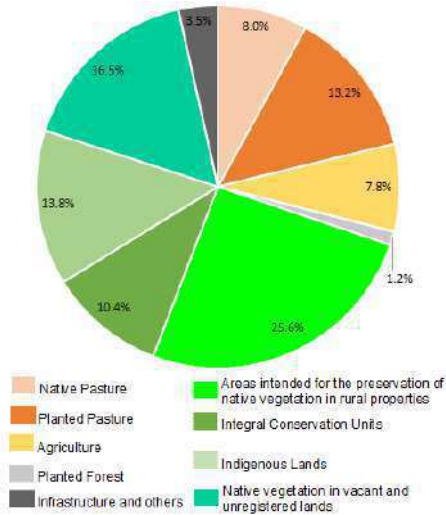


Fig. 4: Occupation of the land surface of the Brazilian territory (Adapted from EMBRAPA, 2018).

#### 4.2 The context of João Monlevade

João Monlevade city is located at the northeast end of the Iron Quadrangle, in the region named Steel Valey. Its economy turns around to the steel industry, metallurgy and mining. Thus, the city and the region have concentration of companies related to these sectors and educational institutional that offers courses in these areas. Important geological sites of the city that must to be considered from the point of view of geoconservation are Areão Park and Serra do Seara. Figure 5 displays the limits of João Monlevade with the location of the important places of the region from the point of view of geoconservation i. e. Arcelor Mittal, Andrade Mine, Areão Park, Serra do Seara and UEMG.

Arcelor Mittal, the largest steel conglomerate in the world, has an integrated production unit in the city of João Monlevade that includes production processes from the use of iron ore -- extracted at the Arcelor Mittal Andrade Mine (MG) that produces sinter feed -- through sintering, reduction in blast furnace, steel refining, up to rolling (ARCELLOR MITTAL 2020).



Fig 5. Limits of João Monlevade city (Google Earth).

Areão Park corresponds to an important conservation unit representative of the Iron Quadrangle, specifically in the extreme northeast in contact with other geological environments. The name Areão refers to the intensive extraction of sand, (areia in portuguese) which began in the mid-60s and ended in the 90s of the 20th century. Figure 6 shows the rocky blocks (boulders) and quartzite outcrops that represent the characteristic rocky landscapes of Areão Park.

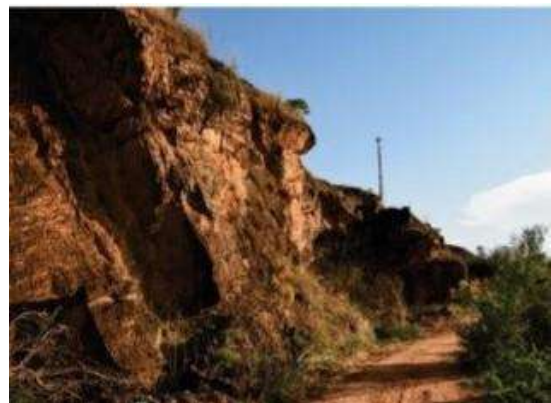


Fig. 6. Coarse quartzite outcrops in the central area of Areão Park (Silva and Ferreira Neto 2020).

Serra do Seara is the highest point in the region reaching 1330 meters of absolute altitude. It is part of a group of topographic highs of the Iron Quadrangle that served as a geographical reference for the displacement of people heading to the central region of Minas Gerais after the discovery of gold in the surroundings of Sabará and Ouro Preto (Castro et al. 2020). Figure 7 presents the cliff and the outcrops features of the relief of Serra do Seara. Important geological sites of the city that must to be considered from the point of view of geoconservation are Areão Park and Serra do Seara.



Fig. 7. Outcrops of the Serra do Seara.

Silva and Ferreira Neto (2020) analyzed outcrops in Areão Park, identified metamorphic lithologies such as gneisses, amphibolites, metagranitoids and supracrustal metasedimentary rocks. The predominant lithology in the outcrops of the walls of the park is sericitic quartzite, a metamorphic rock.

Serra do Seara is part of a group of topographic highs of the Iron Quadrangle that served as a geographical reference for the displacement of people heading to the central region of Minas Gerais after the discovery of gold in the surroundings of Sabará and Ouro Preto (CASTRO et al. 2020). This mountain has a predominance of metamorphic rocks of the quartzite type.

Fig. 5 presents the limits of João Monlevade with the location of the important places of the region from the point of view of geoconservation i. e. Arcelor Mittal, Andrade Mine, Serra do Seara, Areão Park and State University of Minas Gerais (UEMG).



Fig. 5: Limits of João Monlevade city.

#### 4.2 The State University of Minas Gerais

The UEMG is a university located in João Monlevade city and it offers the undergraduate courses in civil, metallurgical, environmental, mining and mechanical

engineering. These courses are very important to the development of the country, but they interpose extensively in the landscape.

The UEMG, through its trajectory, has developed extension activities linked to the history of each unity. Therefore, since the great areas of origin of UEMG as arts, education and technology until the expansion for the engineering, public politics, physical, exact and social sciences, the emphasis in teacher formation and the search of solutions to the problems of the reality of Minas Gerais and Brazil always were present in the extension practices.

Therefore, the institution can stimulate the development of scientific research at the undergraduate and postgraduate level with important themes in the scientific, technological and social fields related to the conservation of the geological patrimony. Creation of extension and research specific projects turned over geodiversity, geoeducation, environmental preservation are necessary. These projects can be directed to the local reality, emphasizing characteristics of the region, such as the natural sites of the Areão Park and Serra do Seara.

Silva and Ferreira Neto (2020) analyzed outcrops in Areão Park, identifying metamorphic lithologies such as gneisses, amphibolites, metagranitoids and supracrustal metasedimentary rocks. The predominant lithology in the outcrops of the walls of the park is sericitic quartzite, a metamorphic rock.

Serra do Seara mountain has a predominance of metamorphic rocks of the quartzite type. Rocks from the Minas supergroup, typical of the Iron Quadrangle, such as sericitic quartzites and quartz-muscovite-schist from the Caraça group represent the geology of the mountain range (Reeves 1966). Figure 8 presents the geological contact of the gneiss-granitic sequence of the basement (outcrop in the center of the image) with quartzite and quartzite-sericite schist from Serra do Seara.

It is important to study these places from the point of view of geoethics and geological heritage, making a parallel with the local economic scenario that has mining and steel industries (e.g. Arcelor Mital) generating a demand for professionals of in this areas (presence of higher and technical institutions that offer courses focused on engineering and related areas).





Fig. 8: Gneiss-granitic sequence in contact with quartzite and quartzite-sericite schist, in the Serra do Seara.

Relative to the extension projects, events to the students and society in general, such as seminars, technical visits and excursions for the connecting geo-education with the local context, highlighting the importance of their geological heritage inter-related to the biodiversity and local cultural heritage. Relative to research projects to the geological mapping of the area, characterization of the soil and environmental preservation are of some importance.

Alterations in the Course Pedagogical Projects creating mandatory and optional disciplines with subject related to Iron Quadrangle according to the features of each region and each course. For example, disciplines linked to the geoconservation and geoethics; principles of interpretation of geodiversity; geological heritage, can contribute to the geological preservation of the natural sites Serra do Seara and Areão Park.

In this way, universities could be contributing in the social and cultural transformation of the state, especially in Minas Gerais, emphasizing important scenarios of the substantiality of the region.

## V. CONCLUSION

This paper presented the importance of the geopark Iron Quadrangle to the Brazil due to its mineral wealth, scenic landscapes, and geological and human history. João Monlevade city – that integrates the northeast end of Iron Quadrangle -- has received special attention, since it has an economy around the steel industry, metallurgy and mining, activities that interpose intensively in the landscape. These activities generate a demand for educational institutions that offer training related to these areas, for example engineering courses.

In this context, the UEMG is involved, since the academy has the function to the preserve the region, especially institutions that offer courses that modified severely the natural landscape. In this way, important geological sites of the João Monlevade city such as Areão

Park and Serra do Seara must to be considered from the point of view of geoconservation. Creation of extension and research specific projects turned over geodiversity, geoeeducation, environmental preservation can be contribute for the geoconservation of these areas.

Relative to extension, events to the students and society in general, such as seminars, technical visits and excursions for the connecting geo-education with the local context, highlighting the importance of their geological heritage to the biodiversity and local cultural heritage. Relative to research projects, the geological mapping of the area, characterization of the soil and environmental preservation are of some importance.

Alterations in the Course Pedagogical Projects creating disciplines with subject applied to local reality related to the geoconservation and geoethics, principles of interpretation of geodiversity, and geological heritage can contribute to the preservation of region.

Then, the academy can extend to a society the scientific knowledge about geographical, historical, economic heritage, space alteration and its natural environment as a whole, creating an important way for regional sustainability. highlighting the importance that Iron Quadrangle represents for the history of mining in Brazil, especially in Minas Gerais state, and the relevance of its geological context and tectonic evolution for understanding the geological history of Earth.. Thus, projects and programs with groups and sectors of civil society and the state can possibility transformations in the pedagogical process, in which students, teachers, managers and technicians-administrative are participants, knowledge producers, expressing a position of the university towards the society in which it operates, intervening in the concrete reality.

The theme addressed in this article also contributes to geological sites such as Areão park and Serra do Seara being contemplated by research and extension projects of UEMG, João Monlevade unit, and by other segments of education, especially due to the proximity of these sites and their riches, when considered from the point of view of geoconservation.

## REFERENCES

- [1] Gray M. (2005). Geodiversity and Geoconservation: what, why, and how. *The George Wright Forum*. 22 (3):4-12
- [2] UNESCO United Nations Educational, Scientific and Cultural Organization. (2014). Draft proposed operational guidelines for Unesco Global Geoparks. [Accessed in jan 2021]. <https://unesdoc.unesco.org/>
- [3] Ruchkys UA, Noce CM, Schobbenhaus C, Magalhães-Gomes BP. (2006). *Quadrilátero Ferrífero, Minas Gerais*:

- Um potencial candidato a Geoparque. [Iron Quadrangle, Minas Gerais: a potential candidate for a geopark]. Proceedings of the 43th Brazilian Congress of Geology.
- [4] Ruchkys UA. (2007). Patrimônio geológico e geoconservação no Quadrilátero Ferrífero, Minas Gerais: potencial para a criação de um geoparque da UNESCO. [Geological heritage and geoconservation in the Iron Quadrangle, Minas Gerais: potential for the creation of a UNESCO geopark]. [dissertation]. Federal University of Minas Gerais. Portuguese.
- [5] Silva FR. (2007). A paisagem do Quadrilátero Ferrífero, MG: potencial para o uso turístico da sua geologia e geomorfologia. [The landscape of Quadrilátero Ferrífero, MG: potential for tourist use of its geology and geomorphology] [master's thesis] Federal University of Minas Gerais. Portuguese.
- [6] Mantesso NV, Ruchkys U, Nascimento MA, Beato D, Castro PT, Liccardo A, Guimarães RL. (2010). Quadrilátero Ferrífero, MG, Brasil: regional characteristics justify application for global geoparks network. VI Congreso Uruguayo de Geología. Minas-Lavalleja. Geología Siglo XXI: llave para el desarrollo de nuestros recursos naturales 1:1-6.
- [7] Castro PT, Nalini Junior HA, Lima HM. (2011). Understanding mining around the Quadrilátero Ferrífero. Ecológico Consultoria Ambiental.
- [8] Ruchkys UA, Machado MM, Castro PT, Renger FE, Trevisol A, Beato DA. (2012). Geoparque Quadrilátero Ferrífero (MG) - Proposta [Iron Quadrangle Geopark - Proposal]. In: Schobbenhaus C, Silva CR. Geoparques do Brasil-Propostas. [Geopark proposals]. Rio de Janeiro: Serviço Geológico do Brasil-CPRM, v. 1, p. 183-220.
- [9] Gomes M, Ferreira LR, Ruchkys UA. (2019). Landscape evolution in ferruginous geosystems of the Iron Quadrangle, Brazil: a speleological approach in a biodiversity hotspot. Appl. Sci. 1:1102
- [10] Carmo ME. (2020). Gestão e organização da memória organizacional: geoparque Quadrilátero Ferrífero em Minas Gerais [dissertation] [Management and organization of memory: Iron Quadrangle geoparque, in the Minas Gerais state]. Federal University of Minas Gerais. Portuguese.
- [11] Castro PT, Endo I, Gandini AL, editors. (2020). Quadrilátero Ferrífero: avanços do conhecimento nos últimos 50 anos. [Iron Quadrangle: advances in knowledge in the last 50 years]. 3i Editora.
- [12] Santos DJ, Ruchkys UA, Travassos LE. (2021). The educational potential of geodiversity in ferruginous geosystem: the example of the Quadrilátero Ferrífero, Minas Gerais, Brazil. Geoheritage. 13:1-18.
- [13] UNESCO United Nations Educational, Scientific and Cultural Organization. (2021). UNESCO Global Geoparks, 2021. [Accessed in fev 2021]. <https://unesdoc.unesco.org/>.
- [14] UNESCO United Nations Educational, Scientific and Cultural Organization. (2020). Araripe Unesco Global Geopark (Brazil). [Accessed in fev 2021] <https://en.unesco.org/global-geoparks/araripe>.
- [15] CRPM Geological Survey of Brazil. (2012). Propostas de Geoparques Vol. 2 [Geopark proposals]. [Accessed in out 2021]. <http://www.cprm.gov.br/>.
- [16] Schobbenhaus C, Silva CR. (2012). Geoparques do Brasil Propostas. Vol. 1 [Geopark proposals]. CPRM Geological Survey of Brazil. (GUIMARÃES et al. 2009)
- [17] UNESCO United Nations Educational, Scientific and Cultural Organization. (2022). Nomination of new UNESCO Global Geoparks: details of the nominations. [Accessed in april 2022]. <https://unesdoc.unesco.org/>
- [18] Machado MM. (2009). Construindo a imagem geológica do Quadrilátero Ferrífero: conceitos e representações. [Constructing the geological image of the Iron Quadrangle: concepts and representations]. [dissertation]. Federal University of Minas Gerais. Portuguese.
- [19] Dorr, JVN. (1969). Physiographic, stratigraphic, and structural development of the Quadrilátero Ferrífero, Geological survey professional paper.
- [20] Farina F, Albert C, Martinez Dopico C, Aguilar Gil C, Moreira H, Hippert JP, Cutts K, Alkmin FF, Lana C. (2016). The archean–paleoproterozoic evolution of the Quadrilátero Ferrífero (Brasil): Current models and open questions. J. S. Am. Earth Sci. 68:4–21.
- [21] Henriques MH, Reis RP, Brilha J, Mota T. (2011). Geoconservation as an emerging geoscience. Geoheritage. 3(2): 117-128.
- [22] EMBRAPA Brazilian Agricultural Research Corporation. (2018). Summary: Occupation and land in Brazil. [Accessed in nov 2021]. <https://www.embrapa.br/>
- [23] IBRAM Brazilian Mining Association. (2021). [Accessed in fev 2021]. <https://ibram.org.br/>
- [24] ARCELORMITTAL Brazil Institutional Presentation 2020. [Accessed in jan 2021]. <https://brasil.arcelormittal.com/en/pressroom/publications-reports>.
- [25] Silva, IH; Ferreira Neto JA. (2020). Geologia do parque natural do Areão em João Monlevade (MG) sob a perspectiva da geoconservação do Quadrilátero Ferrífero. [Geology of the Areão Natural Park in João Monlevade (MG) from the perspective of the geoconservation of the Quadrilátero Ferrífero]. Res., Soc. Dev. 9(8):1-15.
- [26] Reeves RG. (1966). Geology and mineral resources of the Monlevade and Rio Piracicaba quadrangles, Minas Gerais, Brazil. US Government Printing Office.

# Healthy eating through an alternative food network at Agricultural Fair

## Alimentação saudável Através de uma rede alimentar alternativa em feira Agroecológica

Ariandeny Silva de Souza Furtado<sup>1</sup>, Wagner Lins Lira<sup>2</sup>, Tania Maria Sarmiento Silva<sup>3</sup>

<sup>1</sup>Programa de Pós-Graduação em Agroecologia e Desenvolvimento Territorial da Universidade Federal Rural de Pernambuco, UFRPE, PE, Brasil

<sup>2,3</sup>Universidade Federal Rural de Pernambuco, UFRPE, PE, Brasil

Received in Received: 22 Aug 2022,

Received in revised form: 15 Sep 2022,

Accepted: 22 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

<https://creativecommons.org/licenses/by/4.0/>.

**Keywords** — *Rede Alimentar Alternativa, Alimentação Saudável, Soberania Alimentar, Segurança Alimentar e Nutricional.*

**Palavras-chave** — *Rede Alimentar Alternativa, Alimentação Saudável, Soberania Alimentar, Segurança Alimentar e Nutricional.*

**Abstract**— *The Alternative Food Network (RAA) works collaboratively from the production to the consumption of healthy food from the countryside to the city, unlike the Industrial Agrifood System. Through the RRA, socio-productive inclusion occurs in the promotion of Territorial Agro-Food Systems (SAT) with emphasis on ecological practices, social technologies and Short Circuits (CC). This cooperation network leads to the promotion of healthy eating with Sovereignty and Food and Nutrition Security (SSAN). In this sense, the objective of the research was to analyze the execution of the FIAV Virtual Agroecological Interinstitutional Fair during the year 2021 as a strategy to promote healthy eating, through the methodology of existential/integral action research that started due to the COVID-19 pandemic. The methodology chosen was the existential/integral action research, carried out in 2021 and 2022 with the family farmers involved. FIAV demonstrated the potential of the agroecosystems in the municipalities of Vianópolis, Silvânia, Campestre and Palmeiras (Goiás-Brasil) in offering regional, seasonal foods with nutritional value and produced with ecological practices by family farmers. There were ten editions held at the Federal Institute of Goiás (IFG), the Federal Institute of Goiás (IF Goiano) and the Federal University of Goiás (UFG). FIAV promotes healthy eating with SSAN, however, among the challenges encountered, there is that of family farmers resisting the socio-environmental impacts of the Industrial Agrifood System.*

**Resumo** — *A Rede Alimentar Alternativa (RAA) funciona de forma colaborativa desde a produção até o consumo de alimentos saudáveis do campo para a cidade diferentemente do Sistema Agroalimentar Industrial. Através da RRA ocorre a inclusão socioprodutiva no fomento aos Sistemas Agroalimentares Territoriais (SAT) com ênfase nas práticas ecológicas, tecnologias sociais e Circuitos Curtos (CC). Esta rede de cooperações leva a promoção da alimentação saudável com Soberania e Segurança Alimentar e Nutricional (SSAN). Neste sentido o objetivo da pesquisa foi analisar a execução da Feira Interinstitucional Agroecológica Virtual*

*FIAV durante o ano de 2021 como estratégia de promoção da alimentação saudável, pela metodologia da pesquisa-ação existencial/integral que iniciou devido a pandemia COVID-19. A metodologia escolhida foi a pesquisa-ação existencial/integral, realizada em 2021 e 2022 com os agricultores familiares envolvidos. A FIAV demonstrou o potencial dos agroecossistemas dos municípios de Vianópolis, Silvânia, Campestre e Palmeiras (Goiás-Brasil) na oferta de alimentos regionais, sazonais, com valor nutricional e produzidos com as práticas ecológicas pelas agricultores familiares. Foram dez edições realizadas no Instituto Federal de Goiás (IFG), Instituto Federal Goiano (IF Goiano) e na Universidade Federal de Goiás (UFG). A FIAV promove a alimentação saudável com SSAN, contudo entre os desafios encontrados, há o dos agricultores familiares resistirem aos impactos socioambientais do Sistema Agroalimentar Industrial.*

## I. INTRODUÇÃO

A produção e oferta dos alimentos na Feira Interinstitucional Agroecológica Virtual seguem as orientações da alimentação saudável preconizadas pelo Guia Alimentar para a População Brasileira, porém, para a presente pesquisa o foi levado em consideração a recomendação “faça de alimentos *in natura* ou minimamente processados a base de sua alimentação” e do princípio “alimentação adequada e saudável deriva de sistema alimentar socialmente e ambientalmente sustentável” [1].

Os alimentos *in natura* ou minimamente processados são a base para a alimentação saudável (MS, 2014) sendo fator de proteção para todos os tipos de doenças, por apresentarem alto valor nutricional dada às quantidades significativas de vitaminas, minerais e fibras [2]. Mas, ser exclusivamente um alimento *in natura* ou minimamente processado é o suficiente para caracterizá-lo como saudável? Não necessariamente, visto que toda a cadeia produtiva, precisa caminhar para os Sistemas Agroalimentares Territoriais (SAT) [3]. De acordo com Altieri (2009) [4] os alimentos saudáveis, são aqueles que no processo de produção seguem os princípios, métodos e as técnicas da ciência agroecológica, com o enfoque na oferta de alimentos regionais e sazonais de forma contínua.

Os alimentos saudáveis está em consonância com os alimentos cultivados nos Quintais Produtivos e com os sistemas de produção desenvolvidos no ambiente domiciliar com práticas ecológicas, levando em consideração o saber popular, cultura, identidades alimentares regionais, tecnologias sociais, técnicas geracionais entre outros [5].

Ao contrário do Sistema Agroalimentar Industrial, a variedade e riqueza dos agroecossistemas com ênfase na sabedoria popular e nas tecnologias sociais utilizadas nos Quintais Produtivos, promovem os agricultores familiares

a guardião da sociobiodiversidade, além de serem referência na apresentação de formas alternativas de produção, distribuição, oferta e consumo de alimentos como apresenta o High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security – HLPE (2017a) [6] e 2017b [7], Darolt, Lamine, Brandenburg e Alencar, (2016) [8].

O desenvolvimento econômico e social [9] de sistemas agrolimentares mais equânimes [6, 7, 10, 11], “são capazes de contemplar a sustentabilidade ecológica, e a justiça social [12]. Desde modo os agricultores familiares assumem protagonismo principalmente a partir do engajamento com os movimentos populares, que permitem as trocas de experiências [11] e permitem o acesso, modo de produção e a distribuição dos alimentos para Soberania, Segurança Alimentar e Nutricional (SSAN) [4, 6, 7, 13] junto com a agroecologia [4,14].

Os gricultores familiares utilizam arranjos comunitários eficientes de uso e manejo dos recursos naturais [15] e esta forma de produzir é determinante para a valorização da sociobiodiversidade, o fortalecimento da identidade regional e para a soberania alimentar nos Quintais Produtivos levando a preservação da sociobiodiversidade [14], maior potencial agrícola, consumo de ervas, plantas medicinais e animais, além de potencializar o acesso aos alimentos saudáveis [5].

A Soberania e Segurança Alimentar e Nutricional leva a implementação, acompanhamento das políticas públicas e estratégias que contemplam todas as etapas da cadeia produtiva, Direito Humano a Alimentação Adequada (DHAA) e ao acesso regular e permanente da alimentação saudável pela população [16], além de levar em consideração as práticas agroecológicas e sustentabilidade [4]. A forma de atuação de forma colaborativa e com troca de experiências permite a identificação dos desafios e potencialidades das técnicas,

métodos e as tecnologias sociais utilizadas na produção de alimentos [17].

De acordo com Giordani et al. [10] é primordial que a sociedade civil organizada e a academia avancem na proposição de novas estratégias fortalecedoras da agroecologia enquanto ciência-prática-movimento. No estímulo às práticas e técnicas da agricultura familiar, dos circuitos curtos de produção (CC), distribuição e consumo e na promoção do acesso a uma dieta de baixo custo, diversificada e adequada em termos nutricionais (Maluf, et al., 2015, p. 2303) [14].

O binômio “diversidade de hábitos alimentares” em consonância com as “práticas ecológicas” são referências para a promoção da alimentação saudável no estímulo ao consumo dos alimentos *in natura* regionais que apresentam valor nutricional o fomentam os SAT descentralizados pelos circuitos curtos de produção [18].

As Feiras Agroecológicas além de constituírem-se como uma Rede Alimentar Alternativa [19] promovem a alimentação saudável e iniciativas opostas ao Sistema Agroalimentar Industrial [22] com promoção da justiça social, práticas agroecológicas, saúde comunitária e a democracia [23] bem como a intersecção em toda a cadeia produtiva com solidariedade, ética, equidade e sustentabilidade [8].

O abastecimento das RAA se dá pelos Circuitos Curtos os quais se caracterizam pela venda direta do agricultor familiar para o consumidor e/ou venda indireta com apenas um único intermediário que pode ser outro agricultor familiar, associação, cooperativa, lojas especializadas, pequenos mercados, entre outros. Os CC potencializam o regionalismo, a identidade alimentar e a localização geográfica, levando ao desenvolvimento territorial e estabelece relações dos modos de produção, trocas e consumo com preços mais justos [24], sendo ressaltadas as características locais das comunidades, com as tradições, o modo de vida, a valorização do saber - fazer” [8]. Em todo contexto a Feira Interinstitucional Agroecológica Virtual, vêm se consolidando com êxito no município de Goiânia, Goiás, então o objetivo da pesquisa foi analisar a execução durante o ano de 2021 pandêmico, como estratégia para a promoção de alimentação saudável.

## II. MÉTODO

Para a consecução da pesquisa optou-se pela metodologia da pesquisa-ação existencial/integral [25] no ano de 2021, a partir da aprovação pelo Sistema do Comitê de Ética em Pesquisa e Comissão Nacional de Ética em Pesquisa (CEP-CONEP) da Plataforma Brasil, sob o Parecer Consubstanciado nº 4.460.948 do Comitê de Ética em Pesquisa (CEP) da Universidade Federal Rural de Pernambuco (CEP-UFRPE), em dezembro de 2020.

A pesquisa foi realizada no Estado de Goiás, nos municípios de Goiânia, Silvânia, Vianópolis, Campestre e Palmeiras conforme o Mapa Geográfico abaixo (Figura 1), com 20 lideranças dos agricultores familiares participantes da FIAV.



Fig.1 - Mapa Geográfico de localização dos municípios dos agricultores familiares.

Em janeiro de 2021 foram criados quatro grupos com as lideranças e agricultores familiares. A coleta de dados ocorreu no período de janeiro a dezembro em quatro etapas de acordo com a Figura 2, sendo os Grupos 1, 2 e 3 do Assentamento Canudos do Movimento de Trabalhadores Rurais Sem Terra (MST), Grupo Mulheres Guerreiras de Canudos e a Unidade Colmeia, dos municípios de Palmeiras e Campestre. O Grupo 4 era dos Agricultores Familiares da Estrada de Ferro, dos municípios de Silvânia e Vianópolis.

Na 1ª Etapa (janeiro de 2021) – Planejamento: cada grupo escolheu uma liderança. O método utilizado foi o Diagnóstico Rápido Participativo Emancipador (DRPE) [26] que foi adaptado ao formato virtual em virtude do contexto da pandemia do COVID-19, sendo uma das recomendações cruciais o distanciamento social no intento de evitar aglomerações que poderiam potencializar a disseminação do vírus [1, 27, 28). A pesquisa foi realizada através do mapeamento histórico, chamada de vídeo via *WhatsApp*® e entrevista semiestruturada. Foram desenvolvidas fichas agroecológicas de acordo com as tecnologias apropriadas para a produção orgânica do Ministério da Agricultura Pecuária e Abastecimento (MAPA) [34] e a construção do Calendário Sazonal [36].

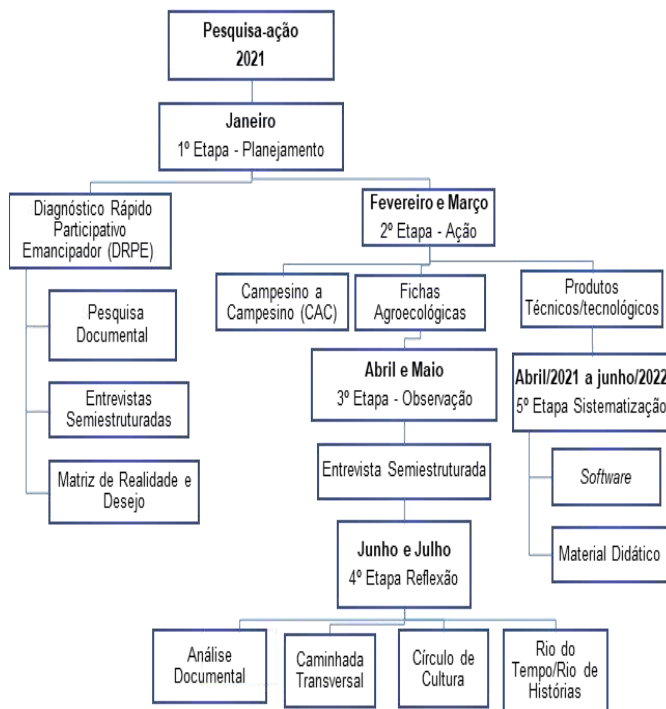


Fig.2 – Fluxograma do Diagnóstico Rápido Participativo Emancipador de janeiro a dezembro de 2021.

### III. RESULTADOS

Em 2021 foram realizadas 10 edições da FIAV com 20 agricultores familiares atuando na FIAV e na pesquisa, sendo 9 homens e 11 mulheres, todos alfabetizados, porém, só uma agricultora familiar tinha concluído o curso de Graduação e um agricultor familiar, além da Graduação, tinha concluído a Pós-Graduação. A média de idade dos agricultores familiares oscila dos 45 e 64 anos, são de nacionalidade brasileira, das Regiões do Norte, Nordeste, Sul e Centro-Oeste; residentes na Região Metropolitana de Goiânia, nas áreas rurais dos municípios de Palmeiras, Campestre, Silvânia e Vianópolis.

As 10 edições da FIAV, seguiram o Protocolo para a prevenção, o controle e a mitigação do contágio do COVID-19 na Feira Interinstitucional Agroecológica [37]. A média de pedidos foi de 36 por edição. A operacionalização em 2021 seguiu os 12 passos abaixo:

- 1) Mapeamento dos alimentos pelos Agricultores Familiares e encaminhamento da Lista de Alimentos para o GRIEFA, por edição da FIAV;
- 2) Unificação da Lista de Alimentos, desenvolvimento do Catálogo dos Alimentos ou Cadastro de Alimentos Sazonais, no site oficial (<http://feiraifesgo.cestaagroecologica.com.br/>);

- 3) Elaboração da arte pela Equipe de Comunicação Social do IFG, IF Goiano e UFG e divulgação;

- 4) Acesso ao Formulário Virtual do *LimeSurvey*<sup>®</sup> (de fevereiro a outubro) ou realização do cadastro no site oficial (novembro e dezembro), para a realização da compra, o pagamento, a escolha do horário e espaço da retirada dos pedidos;

- 5) Tabulação dos dados e sistematização da Lista de Alimentos, por instituição e grupo e/ou agricultor familiar;

- 6) Preparação dos alimentos pelos agricultores familiares, conforme a Lista de Alimentos enviada pelo GRIEFA. A lista era sistematizada pelas informações obtidas no Banco de Dados do do *LimeSurvey*<sup>®</sup> ou pelo Site Oficial;

- 7) Deslocamento dos agricultores familiares para cada um dos espaços institucionais, deixando os alimentos, no turno matutino;

- 8) Em cada um dos espaços, um grupo (definido de forma colaborativa) foi responsável pela organização e conferência de todos os alimentos e anotação das intercorrências com auxílio das EOD e GRIEFA;

- 9) Distribuição dos alimentos para os consumidores no turno vespertino, pelo GRIEFA e as EOD, conforme o cronograma de horários e espaços, escolhidos por cada consumidor;

- 10) Envio das intercorrências para o Grupo de *WhatsApp*<sup>®</sup> da Organização Geral da Feira pelas lideranças, responsáveis em cada um dos espaços, para serem solucionadas por cada agricultor familiar e/ou grupo, sob a mediação da coordenadora financeira, EOD, GRIEFA e demais agricultores familiares;

- 11) Reunião de avaliação (virtual) com o GRIEFA, as EOD e os agricultores familiares;

- 12) Organização financeira, prestação de contas e distribuição dos valores para cada agricultor familiar pela coordenadora financeira da FIAV [28].

Dentre os agricultores familiares, participantes da pesquisa, detectamos que as fontes de renda além da FIAV, vinham de programas governamentais de assistência social, aposentadoria, na participação do Programa Nacional de Alimentação Escolar (PNAE), Programa de Aquisição de Alimentos (PAA), venda do leite, aluguel de imóveis, arrendamento de parte do território rural e atuação em períodos específicos nas atividades que versam o agronegócio local, com destaque para as colheitas de monoculturas.

Na FIAV houve a oferta de 97 alimentos *in natura* ou minimamente processados e 71 alimentos processados, totalizando 168 alimentos. A maior produção e oferta estão representados na Figura 2 – Alimentos mais

comercializados na FIAV por grupo de agricultores familiares; sendo as frutas desidratadas, frutas *in natura*, verduras, legumes, doces, ervas/folhas e farinhas em Palmeiras pelo MST.

Já as frutas, verduras, legumes e conservas predominaram em Campestre pelo MST; queijo, mel e quitandas em Silvânia pelo Grupo de Agricultores da Estrada de Ferro e polpa de frutas, leite, sucos, ovos, doces, geleias em Vianópolis pelo Grupo de Agricultores da Estrada de Ferro.



Fig.2 - Alimentos mais comercializados na FIAV por grupo de agricultores familiares

Dos alimentos mais vendidos, destacam-se os alimentos do Bioma Cerrado, sendo a cagaíta, o jatobá do cerrado, o pequi, o buriti e o baru compõem o Bioma Cerrado e são ofertados *in natura* e/ou utilizados como matéria prima para os alimentos processados. Destes, prevalece a cagaíta e o pequi em todos os territórios, conforme apresentado pela Figura 3.

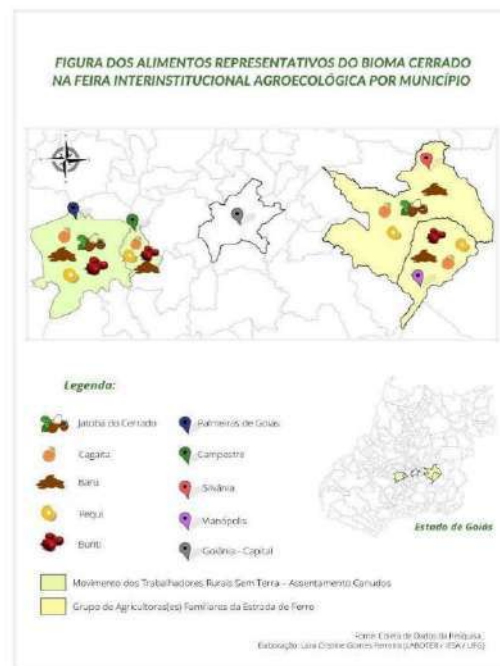
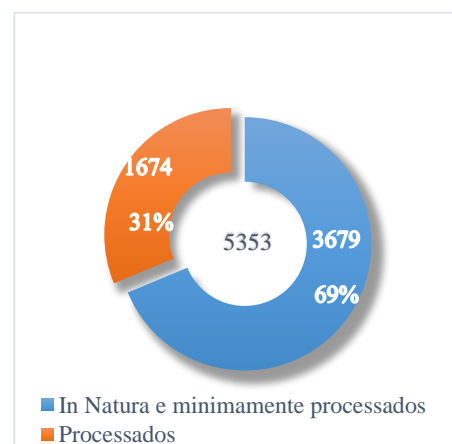


Fig.3 - Alimentos representativos do Bioma Cerrado na Feira Interinstitucional Agroecológica, por município

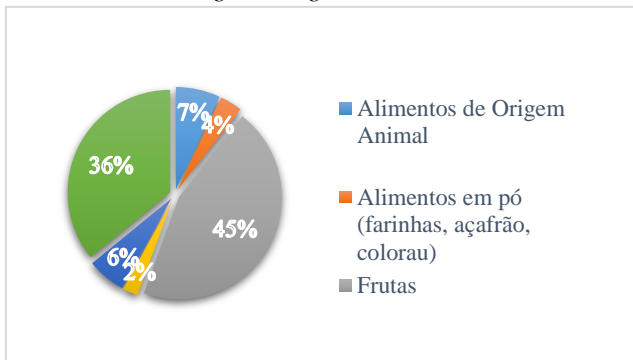
Na FIAV foram comprados a quantidade de 5.353 alimentos em 2021, destes, 3.679 (69%) foram dos alimentos *in natura* ou minimamente processados e 1.674 (31%) de alimentos processados, conforme o Gráfico 1.

Gráfico 1 - Alimentos In Natura ou Minimamente e Processados e Alimentos Processados da Feira Interinstitucional Agroecológica de 2021



Dos alimentos *in natura* ou minimamente processados o maior consumo (45%) foi das frutas *in natura*, frutas congeladas e polpas, conforme apresentado no Gráfico 2.

Gráfico 2 - Divisão dos Alimentos In Natura e minimamente processados da Feira Interinstitucional Agroecológica de 2021



#### IV. DISCUSSÃO

De acordo com Barbier (2002) [25] as etapas da pesquisa-ação existencial/integral se dão na abordagem espiral e não apresentam um delineamento imutável, pois a construção é processual e parte da problematização. Durante o contexto de construção, as etapas se complementaram e no contexto da FIAV, foram utilizadas para potencializar a intersecção com o conhecimento científico e a cultura popular; consolidando-se como a base para o aperfeiçoamento dos resultados identificados nas etapas anteriores, corroborando para operacionalização da FIAV de forma transversal com a informação, interação e colaboração na promoção da alimentação saudável.

Os resultados apontam que pelas experiências individuais e coletivas, foram traçadas intervenções colaborativas com o protagonismo dos agricultores familiares, corroborando para a emancipação dos territórios rurais com geração de renda e inclusão socioproductiva, em articulação com as instituições públicas e/ou movimentos populares. [8, 38]. O acesso à informação em linguagem acessível e que reconheça as culturas dos diferentes territórios são pontos-chaves para as trocas de conhecimentos com as instituições de ensino, a gestão pública com a sociedade civil organizada e os agricultores familiares [39] para avançar nos SAT [18] na confluência pesquisa - assistência técnica - políticas públicas [3].

Após a análise de conteúdos de todas as etapas da coleta de dados foi possível compreender que os agricultores familiares fomentam os SAT pelas práticas tradicionais, modos de viver, organizar e produzir os alimentos saudáveis. Além de superar ao Sistema Agroalimentar Industrial e as mazelas históricas, políticas, culturais e socioeconômicas que refletem no cotidiano [3, 18].

O Sistema Agroalimentar Industrial vem sendo considerado um dos maiores fatores de desequilíbrio ambiental em decorrência da erosão, desmatamento, poluição dos recursos naturais, perda da biodiversidade [15]. O Dossiê sobre o Cerrado da Universidade Federal de Brasília (UNB) em 2019, aborda que aproximadamente 60% do Cerrado sofreu devastação e/ou desmatamento em sua biodiversidade, pelo uso indiscriminado de fertilizantes e calcário, com destaque para a monocultura de soja e de pastagens plantadas e as queimadas, que ocasionaram a, “fragmentação de habitats, extinção da biodiversidade, invasão de espécies exóticas, erosão dos solos, poluição de aquíferos, degradação de ecossistemas, alterações nos regimes de queimadas e possivelmente modificações climáticas regionais [41]. Como consequência deste Sistema é que todas as comunidades rurais encontram-se ilhadas pelo agronegócio com destaque para as monoculturas de soja, sorgo e milho, como ressalta um dos agricultores e diz que o assentamento está passando por um período difícil com a monocultura e o agronegócio e que existem muitos insetos na plantação, pois nas proximidades tem a soja que bate veneno e todos os insetos vão para o milho e as culturas ecológicas.

Há um paradoxo, pois, mesmo os agricultores familiares apresentando consciência e olhar crítico e reflexivo [32], a vulnerabilidade socioeconômica somada a falta de oportunidades de empregos nos municípios, não vêm outras alternativas que não seja trabalhar para o agronegócio, mesmo sem direitos trabalhistas e compreendendo os riscos para a saúde como observado coceiras e até mortes por intoxicação por agrotóxicos

Esta realidade foi apresentada pelos estudos realizados por Maluf et al. [14], Bezerra e Anjos [16], Giordani [10] e Leef [11]; pelo Grupo de Expertises em SAN [6, 7], os quais enfatizam a correlação com a modernização tecnológica, que naturaliza a negação dos Direitos Humanos (em todos os âmbitos), a não implementação das políticas públicas na área rural e o risco à saúde.

Analisando os CC do Brasil e da França os agricultores familiares de base ecológica participam de dois a três canais de comercialização com destaque para as feiras, entrega de alimentos e compras governamentais [23]. A FIAV é um CC e condiz com as estratégias sustentáveis e participativas de produção, comercialização e consumo de alimentos, respeitando-se as múltiplas características culturais do país [41].

Estes resultados também foram encontrados nesta pesquisa, pois, além da FIAV, os agricultores familiares tem a fonte de renda oriunda de programas governamentais



de assistência social, na participação do Programa Nacional de Alimentação Escolar (PNAE), Programa de Aquisição de Alimentos (PAA), venda do leite, aposentadoria, aluguel de imóveis, arrendamento de parte do território rural e atuação no agronegócio.

Para reverter este cenário são urgentes iniciativas alternativas ao Sistema Agroalimentar Industrial que corroborem para a promoção da alimentação saudável e a exigibilidade do DHAA [6, 7, 10, 14, 42]. A abertura dos espaços institucionais em âmbito intersetorial e transdisciplinar [42] podem proporcionar maior acesso e consumo de alimentos saudáveis [10]. Neste sentido, a FIAV é um espaço institucional, porém, com especificidades além do econômico-mercantil e culmina para potencializar o SAT, com geração de renda e inclusão socioprodutiva no abastecimento de alimentos produzidos diante as práticas ecológicas, com ênfase na promoção da alimentação saudável em consonância com o conhecimento dos agricultores familiares.

O processo de produção dos alimentos ofertados na FIAV utiliza práticas ecológicas, utiliza a produção artesanal, preserva os ecossistemas nativos e cuida do solo. Os agricultores são protagonistas na utilização de arranjos comunitários eficientes de uso e manejo de recursos naturais [6, 7, 15] e das técnicas agrônômicas.

As técnicas agrônômicas utilizadas nos territórios rurais dos agricultores familiares da FIAV, estão descritas nas Fichas Agroecológicas [34]. Os quintais produtivos permitem a troca de conhecimentos científicos e populares, técnicas utilizadas na produção dos alimentos [43] na identificação do potencial agrícola e do calendário sazonal.

Todos os agricultores familiares da FIAV e dos estudos realizados na África, Madagascar, Oceano Índico, Ásia e América Latina encontravam-se em processo de transição agroecológica e o desenvolvimento territorial e agriculturas mais sustentáveis [44]. A variedade dos 168 alimentos ofertados na FIAV em 2021 demonstra o potencial dos agroecossistemas do Estado de Goiás, pró eficiência, diversidade, auto-suficiência, auto-regulação e resiliência [4]. Esta forma de produzir é determinante para a valorização da sociobiodiversidade, o fortalecimento da identidade regional.

A referência de abastecimento alimentar são vendas locais dos agricultores familiares diretamente para os consumidores pelos CC e neste contexto o GRIEFA e as EOD tecem esta mediação. De acordo com Maluf et al. [14] as experiências agroecológicas, educação e a intersetorialidade, são os caminhos para a SAN, sendo os espaços institucionais locais estratégicos no mercado de abastecimento de alimentos regionais e autoconsumo.

Os CC corroboram para os hábitos de consumo mais saudáveis [8]. Analisando os CC do Brasil e da França os agricultores familiares de base ecológica participam de dois a três canais de comercialização com destaque para as feiras, entrega de alimentos e compras governamentais [23]. A FIAV é um CC e condiz com as estratégias sustentáveis e participativas de produção, comercialização e consumo de alimentos, respeitando-se as múltiplas características culturais do país [42].

A diversidade cultural está presente nas regiões e um exemplo foi a oferta de 168 variedades de alimentos na FIAV, sendo a maioria alimentos *in natura* ou minimamente processados. Estes alimentos mantêm o valor nutricional, são sazonais, *in natura*, possuem maior validade, menor toxicidade e conservam as características organolépticas [46]

As instituições assumem a corresponsabilidade potencial neste processo, mediação de espaços que versam pela cultura, valores e outros modos de vida [9] pró racionalidade aberta, dialógica, intuitiva e global.

## V. CONCLUSÃO

A FIAV figura na prática um dos caminhos possíveis para o cumprimento da função das IPES, respaldadas no compromisso com a transformação social com interação, interlocução, intercâmbio, experiências e vivências na produção e oferta de alimentos saudáveis, valorização da sociobiodiversidade, o fortalecimento da identidade regional.

## AGRADECIMENTOS

Às agricultoras e os agricultores familiares da Feira Interinstitucional Agroecológica que são a base e a motivação para seguir na busca incessante pela promoção da Soberania e Segurança Alimentar e Nutricional. E ao GRIEFA, IFG, UFG, IF Goiano e o movimento sindical, por disponibilizarem os meios necessários para a execução da pesquisa bem como o respeito e a cumplicidade neste caminhar colaborativo.

## REFERENCES

- [1] Brasil. Ministério da Saúde (2014). Guia alimentar para a População Brasileira. Brasília: Secretaria de Atenção à Saúde.
- [2] Oliveira, T. C., Abranches, M. V., Lana, M. (2020). (In)Segurança alimentar no contexto da pandemia por SARS-CoV-2. *Cadernos de Saúde Pública*, 36(4), p.p. 1-6.
- [3] Moity-Maizi, P., De Sainte Marie, C., Geslin, P., Muchnik, J., Sautier, D. (2001). Systèmes agroalimentaires localisés. Terroirs, savoir faire, innovations. Etudes et Recherches

- sur les systèmes agraires et le développement. Paris: INRA.
- [4] Altieri, A. M. (2009). A dinâmica produtiva da agricultura sustentável. Porto Alegre: UFRGS, p.p. 1-120.
- [5] Silva, A. C. G. F., Rosa dos Anjos, M. C., Dos Anjos, A. (2016). Quintais produtivos: para além do acesso à alimentação saudável, um espaço de resgate do ser. *Revista Guaju*, 2(1), p.p. 77-101. Recuperado de: <https://revistas.ufpr.br/guaju/article/view/46738/29197>.
- [6] High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (2017a). Nutrition and food systems. Roma: HLPE, p.p. 1-151.
- [7] High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (2017b). Uma actividade forestal sustentável em favor de la seguridad alimentaria y la nutrición. Roma: HLPE, p.p. 1-155.
- [8] Darolt, R. M. et al. (2016). Redes Alimentares Alternativas e novas relações produção-consumo na França e no Brasil. *Ambiente & Sociedade*, (2), p.p. 1-22. Recuperado de: <https://www.scielo.br/j/asoc/a/KgSQNgpc5gF5Tx65N9H7DGd/?format=pdf&lang=pt>.
- [9] França Filho, G. C. Definindo Gestão Social. (2007). In I Encontro Nacional de Pesquisadores em Gestão Social (I ENAPEGS), Anais [...], 1(8), p.p 1-248.
- [10] Giordani, R., Bezerra, I., Anjos, M. C. (2017). Semeando agroecologia e colhendo nutrição: Rumo ao bem e bom comer. In: Sambuichi, R. H. R.O. et al. A política nacional de agroecologia e produção orgânica no Brasil: uma trajetória de luta pelo desenvolvimento rural sustentável. Brasília: Ipea, p.p 433-453.
- [11] Leff, E. (2022). Agroecologia e saber ambiental. *Agroecologia e Desenvolvimento Rural Sustentável*. Porto Alegre: EMATER, 3(1), p.p. 36-51.
- [12] Goodman, D., Michael, K. G. (2012). Place and space in alternative food networks: Connecting production and consumption. Abingdon: Routledge, p.p. 1-308.
- [13] Oliveira, T. C., Abranches, M. V., Lana, R. M. (2020). (In)Segurança alimentar no contexto da pandemia por SARS-CoV-2. *Cadernos de Saúde Pública*, 36(4), p.p. 1-6.
- [14] Maluf, R. S. et al (2014). Nutrition-sensitive agriculture and the promotion of food and nutrition sovereignty and security in Brazil. *Ciência & Saúde Coletiva*, 20(8), p.p. 2303-2312. Recuperado de: <https://www.scielo.br/j/csc/a/zX6jzv68DVxPVZSkfsVf7FR/?lang=en>.
- [15] Azevedo, E; Rigon, S. A. (2010). Sistema Alimentar com base na sustentabilidade. Rio de Janeiro: Rubio.
- [16] Bezerra, I., Schneider, S. (2012). Produção e consumo de alimentos: o papel das políticas públicas na relação entre o plantar e o comer. *Revista Faz Ciência*, 14(19), p.p. 35-61. Recuperado de: <https://e-revista.unioeste.br/index.php/fazciencia/article/view/8026>.
- [17] Altieri, A. M. (2010). Agroecologia, agricultura camponesa e soberania alimentar. Rio de Janeiro: NERA.
- [18] Lacombe, P., Muchnik, J. (2007). L'essor des systèmes agroalimentaires localisés. *La recherche, Économies et Sociétés*, (29), p.p. 1465-1484. Recuperado de: [https://www.researchgate.net/publication/263782098\\_Dossier\\_Systemes\\_agroalimentaires\\_localises](https://www.researchgate.net/publication/263782098_Dossier_Systemes_agroalimentaires_localises).
- [19] Martindale, L., Matacena, R., Beacham, J. (2017). Varieties of Alterity: Alternative Food Networks in the Uk, Italy and China. *Sociologia urbana e rural*, 115, p.p. 27-41.
- [20] Barbera, F., Dagnes, J. (2016). Building alternatives from the Bottom-up. The case of alternative food networks. *Agriculture and Agricultural Science Procedia*, 8, p.p. 324-331. Recuperado de: <https://www.sciencedirect.com/science/article/pii/S2210784316300274>.
- [21] Breih, J. (2016). Hacia una redefinición de la soberanía agraria: Es posible la soberanía alimentaria sin cambio civilizatorio y bioseguridad? In: Bezerra, I.; Perez-Cassarino, J. Soberania alimentar (Sobal) e segurança alimentar e nutricional (SAN) na América Latina e Caribe. Curitiba: UFPR.
- [22] Forssell, S., Lankoski, L. (2017). Navigating the tensions and agreements in alternative food and sustainability: a convention theoretical perspective on alternative food retail. *Agriculture and Human Values*, 34(3), p.p. 513-527.
- [23] Chaffotte, L., Chiffolleau, Y. (2007). Vente directe et circuits courts: évaluations, définitions et typologie. *Les Cahiers de l'Observatoire CROC*. (1), p.p. 1-8.
- [24] Levkoe, C. (2006). Learning democracy through food justice movements. *Agriculture and Human Values*, 23, p.p. 89-98. Recuperado de: <http://hdl.handle.net/10.1007/s10460-005-5871-5>.
- [25] Barbier, R. (2002). A pesquisa-ação. Brasília: Plano.
- [26] Pereira, R. (2017). Diagnóstico Participativo: o método DRPE. 1, Santa Catarina: Perito.
- [27] Brasil. (2020). Secretaria de Atenção Especializada à Saúde, Departamento de Atenção Hospitalar, Domiciliar e de Urgência. Protocolo de Manejo Clínico da Covid-19 na Atenção Especializada. Brasília: Ministério da Saúde.
- [28] Furtado, A. S. S., et al., (2021). Collaborative construction of a virtual agroecological fair between family farming and federal higher education institutions in the state of Goiás-Brazil. *Research, Society and Development*, 10(6), p.p. 1-14. Recuperado de: <https://rsdjournal.org/index.php/rsd/article/view/15513>.
- [29] Ruckstadter, F. M. M., & Ruckstadter, V. C. M. (2011). Pesquisa com fontes documentais: Levantamento, seleção e análise. In C. A. Arnaut de Toledo & M. T. C. Gonzaga (Orgs.). Metodologia e Técnicas de Pesquisa nas Áreas de Ciências Humanas. Maringá, PR: EDUEM, pp.101- 120.
- [30] Associação Brasileira de Agroecologia. (2017). Caderno de Metodologias: inspirações e experimentações na construção do conhecimento agroecológico. Viçosa: Universidade Federal de Viçosa.
- [31] Manzini, E. J. (1991). A entrevista na pesquisa social. São Paulo: Didática.
- [32] Freire, P. (1996). Pedagogia da Autonomia. Saberes-fazeres necessários à prática educativa. São Paulo: Paz e Terra.
- [33] Giménez, E. H. (2008). Campesino a campesino: voces de latinoamérica Movimiento Campesino para la agricultura Sustentable. Managua: SIMAS.

- [34] Brasil. Ministério da Agricultura Pecuária e Abastecimento. (2016). Fichas Agroecológicas: tecnologias apropriadas para a agricultura orgânica. Brasília: MAPA.
- [35] Lewgoy, A. M. B., Arruda, M. P. (2004). Novas tecnologias na prática profissional do professor universitário: a experiência do diário digital. *Revista Textos & Contextos*, (2), p.p. 115-130.
- [36] Verdejo, M. E. (2006). Diagnóstico Rural Participativo: um guia prático. Brasília: Secretaria da Agricultura Familiar – MDA.
- [37] Instituto Federal de Educação, Ciência e Tecnologia de Goiás. (2021). Protocolo para a prevenção, o controle e a mitigação do contágio do Covid-19 na Feira Interinstitucional Agroecológica. Goiânia: IFG.
- [38] Conte, I. L., Ribeiro, M. (2016). Saberes-fazer que atravessam a educação do campo. *UNOESC*, 42(1), p.p. 201-222. Recuperado de: <https://www.redalyc.org/journal/3519/351964715012/html/#fn3>.
- [39] LAMINE, C. (2012). Changer de systeme: une analyse des transitions vers l'agriculture biologique á l'échelle des systemes agrialimentaires territoriaux. *Terrains et Travaux*, 20, p.p. 139-156. Recuperado de: [https://lea.univ-tours.fr/medias/fichier/tt-020-0139\\_1353057957020-pdf?INLINE=FALSE?INLINE=FALSE](https://lea.univ-tours.fr/medias/fichier/tt-020-0139_1353057957020-pdf?INLINE=FALSE?INLINE=FALSE).
- [40] Universidade Federal de Brasília. (2019). Dossiê Cerrado sob Ameaça. *Darcy*: UNB, 21, p.p. 1-68.
- [41] Ministério da Saúde. (2006). Lei n. 11.346, de 15 de setembro de 2006a. Cria o Sistema Nacional de Segurança Alimentar e Nutricional – SISAN com vistas em assegurar o Direito Humano à Alimentação Adequada e dá outras providências. Brasília: MS.
- [42] Nicolescu, B. (2020). Um novo tipo de conhecimento – Transdisciplinaridade. In: COLL, A. N. et al. (Org.). Educação e Transdisciplinaridade II. Guarujá: Triom.
- [43] Oklay, E. (2004). Quintais Domésticos: uma responsabilidade cultural. Rio de Janeiro: Agriculturas.
- [45] Pleog, V. D. J. D. et al (2000). Rural development: from practices and policies towards theory rural development: from pracices abd policies toward theory. *Europa: Sociologia Ruralis*, 40(4).
- [46] Muchnik, J. L., Dejardins, D. R., Touzard, J. M. (2007). Dossier Systèmes agroalimentaires localisés. *La recherche, Economies et Sociétés*, 29(29), p.p. 1465-1484. Recuperado de: [https://www.researchgate.net/publication/263782098\\_Dossier\\_Systemes\\_agroalimentaires\\_localises](https://www.researchgate.net/publication/263782098_Dossier_Systemes_agroalimentaires_localises).

## Teaching and Practices in Higher Education in Agroecology from the Interdisciplinary Viewpoint

Luciana Souza de Oliveira, Lucia Marisy Souza Ribeiro de Oliveira, Bruno Cezar Silva, Hesler Piedade Caffé Filho, Maria Auxiliadora Tavares da Paixão, Andrea Reis de Souza Ribeiro, Valmir Nogueira de Souza

Received: 25 Aug 2022,

Received in revised form: 16 Sep 2022,

Accepted: 21 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— Agroecology;  
Interdisciplinarity; Rural Women; Cultural  
diversity; teacher training

**Palavras-Chave**— Agroecologia;  
Interdisciplinaridade; Mulheres Rurais;  
Diversidade Cultural; Formação docente

**Palabras llave**— Agroecología;  
interdisciplinarietà; Mujeres Rurales;  
Diversidad cultural; formación de  
profesores.

**Abstract**— This article considers the origins and historical evolution of agroecology and its connection with the multi and interdisciplinarity, highlighting the main theoretical concepts and their epistemological and methodological bases built by classical and postmodernist thinkers through their formulations on the themes, where, despite the diversified views, agroecology in a hegemonic way is pointed out as a science under construction that seeks alternative and sustainable models for the socioeconomic, cultural, environmental and ethical development of the farmer with respect to the environment. It also brings the discussion of agroecology and interdisciplinarity into the academy in undergraduate and graduate courses in agroecology, highlighting the importance of continuing education for teachers and students, with a view to building new approaches that recognize the importance of cultural diversity and exchanges between scientific and popular knowledge. Women are identified here as protagonists of advances in the transition from conventional to agroecological agriculture, either for their participation or for the struggles undertaken in the consolidation of this system, which, in addition to production, constitutes a way of life and work.

**Resumo**— Este artigo tece considerações sobre as origens e evolução histórica da agroecologia e a sua vinculação com a multi e a interdisciplinaridade, ressaltando as principais concepções teóricas e suas bases epistemológicas e metodológicas construídas por pensadores clássicos e pós-modernistas através das suas formulações sobre os temas, onde, a despeito das visões diversificadas, a agroecologia de forma hegemônica é apontada como ciência em construção que busca modelos alternativos e sustentáveis para o desenvolvimento socioeconômico, cultural, ambiental e ético do agricultor com respeito ao meio ambiente. Traz ainda a discussão da agroecologia e da interdisciplinaridade para dentro da academia nos cursos superiores de graduação e de pós-graduação em agroecologia, destacando a importância da formação continuada para os docentes e discentes, na perspectiva da construção de novas abordagens que reconheçam a importância da diversidade cultural e das trocas entre os saberes científicos e populares. As mulheres são aqui apontadas como protagonistas dos avanços na transição da agricultura convencional para a agroecológica, quer pela sua participação, quer pelas

*lutas empreendidas na consolidação desse sistema, que para além da produção, constitui - se forma de vida e de trabalho.*

**Resumen**— *Este artículo considera los orígenes y la evolución histórica de la agroecología y su conexión con la multi e interdisciplinariedad, destacando los principales conceptos teóricos y sus bases epistemológicas y metodológicas construidas por pensadores clásicos y posmodernistas a través de sus formulaciones sobre los temas, donde, a pesar de las visiones diversificadas, la agroecología de manera hegemónica se señala como una ciencia en construcción que busca modelos alternativos y sustentables para el desarrollo socioeconómico, cultural, ambiental y ético del campesino con respecto al medio ambiente. También trae la discusión de la agroecología y la interdisciplinariedad a la academia en los cursos de pregrado y posgrado en agroecología, destacando la importancia de la educación continua para profesores y estudiantes, con miras a construir nuevos enfoques que reconozcan la importancia de la diversidad cultural y los intercambios entre científicos y estudiantes. conocimiento popular. Las mujeres se identifican aquí como protagonistas de los avances en la transición de la agricultura convencional a la agroecológica, ya sea por su participación o por las luchas emprendidas en la consolidación de este sistema, que además de la producción constituye una forma de vida y de trabajo.*

## I. AGROECOLOGY IN THE MAT OF TIME

Although the term Agroecology emerged as a science in the 1970s of the last century, its assumptions in defense of man's relationship with the earth are very old. In the Paleolithic period (2.5 million years to 250 thousand years a.C), the land was a provider and offered to man as hunter and extractive what it naturally produced. Already in the Neolithic period (7000 a.C to 2500 a.C), man had learned to use it and, thus, it was possible to produce what was of interest to him. In antiquity (4000 a.C), land meant power, and whoever owned the most acquired greater importance. In the Middle Ages (5th to 15th century), the land continued to be a symbol of nobility and those who did not own it were socially excluded, becoming servants or vassals of their lords. In modernity (from the 16th century onwards), with maritime and commercial expansion, land began to be overvalued not only for people, but for countries and, finally, in post-modernity (from the 18th century onwards). land becomes capital, either as a form of accumulation for speculation, in the form of exploitation of natural resources, or in the form of production and consumption.

When agriculture started to depend on the industry for the production of chemical inputs, with the objective of producing more in less time in order to meet the market logic, between the 1960s and 1970s a movement emerged in the United States and throughout Europe called "Green Revolution", being soon disseminated in other countries, including Brazil.

According to Azevedo and Netto (2015: 643), it was the beginning of the problems that have been causing environmental degradation and the social exclusion of family farmers, in the logic of being inexhaustible natural resources. In parallel, alternative agricultural movements to the predatory production model emerged, based on agroecological principles and characterized by different currents of thought, in the understanding that it is possible to develop sustainable agriculture that meets human needs and is not destructive of biodiversity.

Despite being a term that emerged from the different currents of alternative agriculture, agroecology should not be understood as an agricultural practice. She is so much more. It is a science that uses different interactions in the functioning of complex agroecosystems, adopting as principles the least dependence on external inputs; conservation of natural resources; use of natural nutrients and energy, incorporating social, political, cultural, energetic, environmental and ethical issues into the production system. As Azevedo and Pelicione (2011:715) say, "Agroecology is an intersectoral strategy to promote health, sustainability and food and nutrition security." It is also important to remember that the great interest aroused by society on the subject is due to consumers who are cautious with their health and well-being, who increasingly demand healthy foods, and it is worth clarifying the difference between organic and agroecological, although in the market they can often be taken as synonyms.

In the 1920s, Rudolf Steiner (1993:18), when presenting the postulates of biodynamic agriculture and Sir Albert Howard (1947:69), when establishing the bases for organic agriculture, already emphasized the importance of soil fertility conservation for the growth of healthy plants. Britto (2020:36), contributing to the subject, clarifies that organic products are those that do not use pesticides or synthetic fertilizers, however, they are not always linked to social and fair contexts, and may even use middlemen to market their products from the perspective of higher profits and even, in some cases, disrespect labor rights.

With the expansion of the movement, the International Federation of Organic Agriculture Movements - IFOAM was created in 1972, which implemented a system to guarantee the quality of organic products for its consumers and started to establish international standards for this type of agriculture. , creating the Organic Guarantee System - OGS (IFOAM, 2016).

According to Darnhofer et al. (2010:67), several studies carried out in different parts of the world observed a tendency in organic agriculture, to give emphasis on products and not on processes, reducing it to a simple substitution of chemical inputs for organic ones, contrary to its original principles that are the appreciation of health, ecology, equity and care for the population. To correct these distortions, IFOAM adopted the PGS - Participatory Guarantee Systems, in which the organized producers themselves can create a Participatory Conformity Assessment Body - OPAC, based on social control and joint responsibility (CÉSAR, BATALHA AND PIMENTA, 2008:91).

In 2003, Law 10,831 was passed, which institutes organic agriculture in Brazil, covering different types of alternative systems – ecological, biodynamic, natural, regenerative, biological, agroecological, permaculture and others –, provided that they meet the general principles established in your art. 1, allowing direct sales without certification to family farmers inserted in their own processes of organization and social control registered with the Ministry of Agriculture, Livestock and Supply - MAPA, in order to facilitate their access to the market and insert them into the production system (BRAZIL, 2003).

The regulation of the law took place through Decree No. 6,323, of December 27, 2007, formulated with the participation of civil society, which created the only official seal of the Brazilian System of Organic Conformity Assessment (SISOrg) and the SPG, not considered in the previous regulations. (FONSECA, 2009: 77). This Decree enabled access to government purchase

programs for groups of farmers who opted for SPGs, however, the Brazilian system admits three control mechanisms: certification, traditionally used throughout the world, based on external auditing; the SPGs; and the mechanisms of social control in direct sales (KARAM ET AL., 2006: 86).

In 2004, MAPA created the Organic Agriculture Development Program (Pró-orgânico), through Ordinance No., as well as promoting and promoting the production and marketing of products. (SAMBUICHI ET AL., 2012: 49).

Meanwhile, Agroecology, in addition to being concerned with economic, social, cultural, environmental, ethical issues, among other areas related to the strengthening of family farming, offers healthy food at affordable prices to the entire population. Therefore, more than a production system, it is a way of life. For Gliessman (2001:79), agroecology seeks to use the most advanced in terms of science and technology to create sustainable and high-productivity agroecosystems that present characteristics more similar to those of natural ecosystems.

Agroecology has, in its origins, Klaus Klages, a scientist who investigated and wrote about agricultural activities emphasizing the social point of view (KLAGES, 1928:16). Another scientist who dedicated many studies to the subject was the geographer Susanna Hecht, bringing the idea of political ecology, strengthening the concept of Agroecology (HECHT; COCKBURN, 1990). More recently, several authors such as Miguel Altieri, Stephen Gliessman, Eduardo Sevilla-Guzmán, Francisco Caporal and José Antônio Costabeber, among others, explain their definitions of what Agroecology is in scientific texts, each with its specific characteristics. (ALTIERI; HECHT, 1998).

The term agroecology has existed since the 1930s, however, its scientific importance dates back to the last forty years, with the deepening of theoretical reflection on the management of agroecosystems and the criticism of the agricultural development model, where it has become an important strategy for analysis of the socio-environmental impacts of production systems, interrelating the knowledge of different areas (MOREIRA E CARMO, 2004:12).

## II. AGROECOLOGY IN THE VIEW OF THE MAIN THEORISTS

For Gliessman (2001:79), agroecology is derived from ecology and agronomy, with a strong influence from traditional farming systems, especially indigenous and peasants in developing countries, and seeks

to use the most advanced in terms of science and technology. to create sustainable, high-productivity agroecosystems that have characteristics more similar to those of natural ecosystems.

Sevilla-Guzmán (2006: 33), conceptualizes agroecology as the ecological management of natural resources through forms of collective social action, which presents an alternative to the current civilization crisis, including the participation of farmers, community organization and the relationship of societies. rural activities articulated at the local level.

For Altieri (1998:6), Agroecology is a science that presents principles and methodologies to study, analyze, direct, design and evaluate agroecosystems and states: “Agroecology is, therefore, a science, with a series of principles; not a practice or a system of production”. In another publication, the same author describes Agroecology “as a holistic study of agroecosystems, including all environmental and human elements, with more attention to the form, dynamics and function of the interrelationships and the processes in which they are involved” (ALTIERI, 2001:56).

Primavesi (2016: 9), states that the objective of agroecology is to restore balance with the environment, producing in quantity and with quality, in a process that, consciously, is not brief. With the same vision, Caporal and Costabeber (2004:39) emphasize that one of the main axes of agroecology is the need to produce food in quantity and quality for the whole society, in an innovative and multidisciplinary perspective. Azevedo and Neto (2015:643), on the other hand, report that the strategy of agroecology is to transform a disciplinary approach into a theme “by changing the use of inputs and/or redesigning the agroecosystem, seeking technological formats that benefit social inclusion, supporting the heterogeneity of strategies for the use and management of natural resources”.

Paul Wojtkowski, understands agroecology as something bigger, outside the strict domains of agronomy. For him, agroecology is the part of ecology responsible for understanding land use, with human beings as the primary governing force for this (WOJTKOWSKI, 2002:29).

As stated by Wezel et al (2009:36), the term Agroecology can be understood in several ways: as a science, as a movement and as a practice. Regardless of how it is seen, it is a proposal for socially fair, economically viable and ecologically sustainable family farming, which does not exist in isolation, as it is always integrating knowledge from other sciences, in addition to adding popular and traditional knowledge of populations. not educated (CAPORAL et al, 2006). Another important

reference is the Brazilian Association of Agroecology (ABA), which in its statute, Art. 3, has the following definition:

[...] Agroecology is understood as a scientific, theoretical, practical and methodological approach, based on several areas of knowledge, which proposes to study development processes from an ecological and sociocultural perspective and, from a systemic approach, adopting the agroecosystem as the unit of analysis, support the transition from conventional models of agriculture and Rural Development to sustainable styles of agriculture and rural development (ASSOCIAÇÃO BRASILEIRA DE AGROECOLOGIA, 2004, art.3°).

For Azevedo and Pelicione (2011:720), agroecology is a sociopolitical movement to strengthen agriculture in search of its identity and cultural roots, in addition to its autonomy, decision-making power and participation in the production process.

The importance of valuing agriculture, especially family agriculture, is that, according to the Food and Agriculture Organization of the United Nations (FAO), “family farmers produce 80% of the world’s food and are important drivers of sustainable development” (FAO BRASIL:2020). In 2018, as a result of the Second International Symposium on Agroecology, held in Rome, Italy, FAO started to fight intensive agriculture, defending agroecology as a perennial food system and allied to the SDGs – Sustainable Development Goals, which aim to the realization of human rights, balancing the three dimensions

of sustainable development: economic, social and environmental (UN, Agenda 2030), breaking with the traditional paradigm of production in agriculture, due to its interdisciplinary character.

Among the principles that underlie agroecological practice is also food sovereignty, which recognizes the right of peoples and communities to define their strategies for the production and consumption of the food they need (MALUF, REIS E MAGALHÃES, 2013:71). On the subject, FAO states:

Food security is a shared responsibility. Governments, regional economic bodies, United Nations organizations, development agencies, trade organizations, consumer and producer groups, academic and research institutions and private sector entities must work together on issues that affect us (UNITED NATIONS: FAO, 1978).

Even with the obstacles found in several areas, making it difficult to implement public policies in general, it is not possible to fail to recognize that Brazil has advanced in this food security agenda. The approval of Organic Law 11,947/2009, which deals with Food and Nutritional Security - LOSAN, regulated school meals, expanded access to all students enrolled in the public network and allocated 30% of the value to the purchase of family farming production, having as one of its guidelines the “promotion of supply and structuring of decentralized, agroecologically based and sustainable food production, extraction, processing and distribution systems” (BRASIL, 2010).

This guideline emphasizes agroecology as “a concept for designing future agricultural systems, as it is strongly rooted in both science and practice and because it has strong connections with the principles of the right to adequate food” (SCHUTTER, 2012:9). The PAA was created as a structuring action of the Zero Hunger Program

and its guidelines include: encouraging family farming, promoting its economic and social inclusion through consumption and appreciation of food produced by farmers; to promote access to food for people in situations of food and nutritional insecurity; promote food supply, through government purchases and school meals; and encourage the formation of public food stocks by family farmers, their cooperatives and their associations, strengthening local and regional food marketing circuits; in addition, to promote food assistance in schools, day care centers, popular restaurants, nursing homes, hospitals and food banks, as well as for families in situations of social vulnerability (SCHMITT E GUIMARÃES, 2008). Another aspect to be highlighted in the relationship between PAA and agroecology is the acquisition and valorization of native seeds, by allowing this operation to be carried out fully with local varieties, no longer being a marginal purchase (PORTO, 2014).

Another strong component in agroecological practice is gender equity, which is based on the recognition of the relevant role that women have played in the expansion of the movement, taking care of vegetable gardens, productive backyards, raising small animals, transforming products, contributing with their work to expand the household budget, and their care for the house and family, especially children and the elderly, must also be taken into account.

### **III. THE IMPORTANCE OF WOMEN IN ADVANCES FOR THE CONSOLIDATION OF AGROECOLOGY**

Agroecologically-based family farming gains relevance in the Brazilian scenario, from the moment it becomes recognized as a strategic sector for income redistribution, for guaranteeing the country's food sovereignty and for the construction of sustainable territorial development. Peasant women have always been related to food production, as a result of a historical and cultural situation of the sexual division of labor, which is why they acquired a vast knowledge about the agroecosystems they manage, playing an important role as administrators of the flow of biomass, conservation of biodiversity and plant domestication, a key point for the defense of family farming based on agroecology.

According to Hereda & Cintrão (2006), in the 1980s, rural women's movements contributed significantly to the construction of public policies such as the struggle for land, rural credit, the union and social security movement, aimed at reducing inequalities in gender in agriculture, mainly in northeastern Brazil. In agroecology, the organization and participation of women has expanded,



especially in experiments with alternative agriculture; in the creation of training centers for the provision of ATER – Technical Assistance and Rural Extension services; in the commercialization of products via agroecological fairs and, more recently, with the experience of agroecological books, which allow them to leave their productive invisibility, through the systematic records of their accomplishments on the property, as a strategy to force governments to make these actions public policies of the state (SILIPRANDI:2009:33).

Initially created in Minas Gerais, the use of agroecological notebooks has been expanded to other regions of the country, having already been implemented together with projects supported by IFAD – International Fund for Agricultural Development since 2019, in partnership with Projetos Dom Távora in Sergipe; Paulo Freire in Ceará; Dom Helder Câmara II in Alagoas Ceará and Pernambuco; Sustainable Development Project for Cariri, Seridó and Curimataú in Paraíba; Project Viva o Semiárido in Piauí and Project Pró-Semiárido in Bahia.

In the beginning, the agroecological booklet was created as a political-pedagogical instrument for the training of women, with the aim of empowering them by raising awareness of the importance of their work, having as a starting point their participation in production and income. familiar.

Currently, it constitutes an efficient instrument for monitoring their production, when defining their contribution to the family budget, since they are responsible for the acquisition and preparation of food for the family; those who take care of the house, children and the elderly; those who are responsible for the health of family members, taking medicines from the plants to cure diseases, in addition to encouraging agroecological practices (SILIPRANDI, 2013; LIMA et al., 2016). As the authors Mesquita and Mendes (2012) state:

Women farmers are not only primarily responsible for the maintenance of the family nucleus, but also play a fundamental role in the work related to crops and animal husbandry. Therefore, they have a significant importance in the dynamics of the production unit,

directly interfering in the different spheres of productive and reproductive performance (MESQUITA; MENDES, 2012: 2).

Agroecology requires new forms of relationships, linked to solidarity and cooperation, including the issue of gender, that is, expanding the participation of women in these processes of resistance and change. As a result, they transformed, reconfigured their personal, family and community relationships, affirming their collective identity as a political subject in the social construction of agroecology. The Political Charter of the III ENA – National Meeting of Agroecology, held in Juazeiro – Bahia, on the UNIVASF campus, recognizes that:

(...) without feminism there is no agroecology” because they understand that the construction of agroecology is based on an ethical vision of social and environmental justice that presupposes the sharing of domestic work and care and production management, a life without violence, governed by respect and equality. This implies guaranteeing women's right to full participation in social and political life in their communities, as well as guaranteeing their access to land, water, seeds and production and

marketing conditions with autonomy and freedom.

By organizing themselves and placing themselves on the public scene, these women remake their own history and that of the movements to which they belong, at the same time as they build themselves as new subjects, who make their voices, their desires, their subjectivities heard, the cry for their rights and the recognition of their ability to transform the earth.

As can be seen, what Agroecology provides to women as active political actors, as emphasized by Siliprandi (2013:54), is that they do not remain isolated, discussing among themselves “women's issues”. On the contrary, in the agroecological movement, they assume the role of questioners of public policies and international agreements, they position themselves in relation to the problems generated by the monopolization of transgenic seeds, the use of pesticides, industrialized food, the exploitation of land in the production of commodities, among other problems that affect society as a whole.

Even with the advances that have allowed women to flourish in their insertion in the market, overcoming policies that concentrate wealth, favoring inequality and the devastation that the hegemonic model produces, requires new actions that alter the current dominant logic. It is necessary to change this paradigm focused on profit at any price, putting the care of human life and the environment in the foreground, expanding opportunities for women, historical guardians of biodiversity in their living and working spaces.

#### **IV. THE NATIONAL POLICY OF AGROECOLOGY AND ORGANIC PRODUCTION IN BRAZIL: LIMITS AND POSSIBILITIES**

The National Policy on Agroecology and Organic Production – PNAPO, was created in 2012, through Decree No. combining territorial development with the conservation of natural resources and the appreciation of the knowledge of traditional peoples and communities (BRASIL, 2012). For the construction of this public policy, representatives of the various government and civil society institutions were called for decision-making, strengthening the spaces for discussion, participation and articulation provided by the councils and commissions of social participation (IPEA, 2017).

The institution of this policy came in response to the claim made by women from the countryside and the

forest during the 4th Marcha das Margaridas, held in 2011, but the struggle and mobilization that resulted in its proposal began in the 1970s, with the Ecclesiastical Communities of Base and alternative agriculture movements, as a form of resistance to the agricultural modernization model disseminated by the Green Revolution (MOURA, 2016; SAMBUICHI ET AL., 2017).

The agricultural modernization promoted by the Green Revolution, intensively promoted in Brazil since the 1960s, although it contributed to the increase in the production of commodities and to the growth of the gross domestic product - GDP, and of Brazilian exports, presenting itself as very profitable for agribusiness and the financial system, since its implementation, has had a negative impact on the well-being of society, in addition to not having promoted inclusive and fair development for rural populations. On the contrary, it favored land concentration, poverty and exodus, leaving farmers considered to have low productivity and incapable of competing in the market led by those who used the recommended technologies on the sidelines of the production process (SILVA, 1982). From then on, the rural population began to decrease, with Brazil going from a predominantly rural population to a mostly urban population, as rural people, seeking better conditions for survival, made the decision to abandon their lands, or sell them for insignificant values, starting to swell the slums and urban peripheries, giving up their lives.

Almost a decade after the enactment of Law No. 10,831 of 2003, which provided for organic agriculture, Brazil instituted a broader policy aimed at promoting the production systems covered by this law and thus making official the promotion of the agroecological transition and production organic and ecologically based as a strategy focused on sustainability, having family farmers as a priority audience, with an emphasis on women, young people and traditional peoples and communities, in the perspective that new actions could be developed in a transversal way, boosting development .

Despite the advances brought by the legislation, its fragility with regard to the topic of pesticides is notorious, which were not regulated there as expected, since Article 225 of the Federal Constitution of 1988, in § 1, item V This article provides that it is the responsibility of the public authorities to control the production, marketing and use of techniques, methods and substances that pose risks to the quality of life and the environment.

## V. THE TEACHING OF AGROECOLOGY IN THE ACADEMY: AN INTERDISCIPLINARY PROPOSAL UNDER CONSTRUCTION

The theme of agroecology in the academy is recent and has gradually emerged, from the emergence of alternative agriculture that constituted the embryo for its introduction in teaching, research and extension through specific actions of some more progressive professors (ABA - Agroecology, 2013). The state and international agroecology seminars, held in Rio Grande do Sul, since 1999, played an important motivating role. Later, from 2003 onwards, the Brazilian agroecology congresses - CBA came.

A relevant fact was the creation of the ABA - Associação Brasileira de Agroecologia in the second CBA in 2003, to be a space for discussion and articulation of agroecological knowledge in the academic-scientific environment, integrating the National Articulation of Agroecology - ANA, which contributed to, from that date, more than one hundred agroecology courses or with an agroecological focus will be created in Brazil, requiring the MEC – Ministry of Education and Culture to include training in agroecology in its high school and higher level course catalogs (LUZZI, 2007; BALLA, MASSUKADO AND PIMENTEL, 2014; CAPORAL AND PETERSEN, 2012). Government notices began to include this line in their calls and the then MDA – Ministry of Agrarian Development, now extinct, proposed to federal public universities the implementation of Agroecology Nuclei, in order to carry out studies and research in this area.

In the Framework of Reference for the construction of a new ATER policy in 2004, the PNATER – National Policy for Technical Assistance and Rural Extension proved sensitive to include the theme of agroecology as a guiding axis of its actions, with a view to rural development and the strengthening of family agriculture, aiming at improving the quality of life of the rural population (BRASIL, 2007:9). However, according to Diesel, Dias and Neumann (2015:61), it was the first time that the word agroecology appeared in a public policy for Brazilian rural extension workers, however, this ideal was not materialized, prevailing until 2010, the diffusionist approach by extension professionals. rural area, given the strong influence of the multinationals that dominated the agrochemical market here in Brazil.

Despite these advances in the educational area at technical and higher levels, agricultural science courses, with rare exceptions, continue to train professionals to meet the technological standard of conventional agriculture, following, most of the time, productivist

technical models, committed to the agribusiness. Among the most progressive institutions and attuned to the demands of the new paradigm for agriculture, it is already possible to observe the internalization of the agroecological perspective in formal agroecology courses, both undergraduate and graduate, which in an attempt to overcome the dominant ideology teaching-learning process, exercises pedagogical processes based on critical-reflexive, cultural, humanistic, political, generalist training and committed to valuing family farmers and traditional populations, from the perspective of sustainability in all dimensions.

In these graduate courses, *lacto et strictu sensu*, there is a concern with the holistic training of educators, where new epistemological bases are discussed with them that can contribute to the construction of knowledge that presents insertion in socioeconomic and environmental realities through practices interdisciplinary, which enable the democratization of knowledge. In these public institutions, the interdisciplinary dimension of studies on agroecology involves the various areas of knowledge, such as: in the social sciences, the sustainability of agroecology is discussed (GÓMEZ et al, 2015; SANTOS et al, 2014); in the human sciences, these are constructs focused on research strategy and values (NODARI; GUERRA, 2015); in the agricultural sciences, the focus is on agroecology as a form of development in small rural properties (MEJÍA, 2011; SOUZA, 2011).

Higher education, previously structured in isolated knowledge, in a disciplinary way, over the years, has directed the gaze of professors/researchers to interdisciplinarity. For Brügger (2006), knowledge needs to recover the totality of knowledge. According to Yared (2013), interdisciplinarity means a relationship between disciplines in a cooperative and coordinated way in the teaching-learning system, involving political, technical, cultural, social, ethical, environmental dimensions, between the relationships of two or more disciplines from the point of view of from the point of view of knowledge, methods and learning. For Fazenda (2013:44), interdisciplinarity enables a new posture of knowledge in the face of the act of learning, characterized by an action in constant movement in the face of social, scientific and environmental uncertainties.

Thinking interdisciplinary, in the view of Fazenda (2013:46), consists of facing the problem with the competence of those who have knowledge about the facts, the ability to act and attitude towards the difficulties presented during the resolution. For Antiseri (1975:17), cited by Yared (2013:9), from a psychosocial point of view, interdisciplinarity will be effective when carried out

through work in groups formed by professors and students, reducing the aspect of competition and increasing the collaboration among group members through exchanges and integration between different forms of knowledge.

The interdisciplinary area of the Capes Higher Education Personnel Improvement Coordination states that:

“interdisciplinarity is where the relationship between knowledge is made, the meeting between the theoretical and the practical, the philosophical and the scientific, science and technology, thus presenting itself as a knowledge that responds to the challenges of complex knowledge. . In this way, there is an advance beyond disciplinary boundaries, establishing bridges between the different levels of knowledge reality”.

From this perspective, interdisciplinarity is an alternative, complementary and innovative proposal to the disciplinarity of knowledge, between the human, social and technological sciences, playing a mediating role between them. So much so that, since the second half of the 20th century, the Center National de la Recherche Scientifique - CNRS in France, which is a world reference on the subject, has made interdisciplinarity the main purpose of this research institution for the resolution of complex phenomena that challenge the science today. Like the CNRS in France, Capes also accepted the challenge of implementing interdisciplinary knowledge in Brazil as a way of solving complex problems.

In agroecology graduate courses, as a rule, the practice of interdisciplinary research is still more an intention than a reality, if we take its basic assumptions as a parameter: the dialogic relationships between the actors involved in the process and the exchanges between them.

the various knowledge of the subjects for a better understanding of the researched object, without departing from the concepts and methods of each area.

In an interdisciplinary process, in the view of Philippi Júnior (2000:76) it is important to have participation, union, group spirit, engagement, communication and action. In the same direction, Melo; Cardoso (2011:55), state that it is necessary to work in an integrated way throughout the teaching-learning process, in order to have unity in diversity. Certainly, such a procedure is not easy, considering that both agroecology and interdisciplinarity entered the university world recently and the entire academic community is in the process of learning and adapting to the new counter-hegemonic model of teaching and learning, in the construction of knowledge. In this logic, agroecology, as well as other sciences, raises social, economic, political, cultural, environmental demands, which, when met, impact on the formation of subjects from the university, being able to develop advanced technologies, capable of solving society's problems.

When advancing into the university, agroecology faces challenges for its construction in this environment, as it demands from higher education a commitment that goes beyond the ingrained structures of teaching and research in the formation of agricultural sciences, but, for its consolidation, the determination is key.

As Costa (2010:26) highlights:

[...] the biggest obstacle to the internalization of the precepts of Agroecology in the fields of traditional Agronomy is that the theoretical-conceptual and analytical framework adopted in Agronomy is of a Cartesian, specialist, compartmentalized nature, while Agroecology prioritizes a holistic theoretical matrix, interdisciplinary, generalist and totalizing.

As can be seen, developing education in agroecology in an interdisciplinary perspective is a challenge for all those involved in the construction of this model of agriculture, where the formation of a generation capable of understanding and equipping themselves with this new matrix of knowledge and using them is the key expression of this challenge.

The articulation for agroecological production and interdisciplinary training in agroecology to meet this proposal that is ideal for the sustainability of the planet and the life of biodiversity, constitutes the centrality of the agenda that should guide the strategies for the training of professionals and the production of knowledge and technology necessary for their support.

Interdisciplinary approaches by presenting an integrative line of action, enable the transformation of contents into tangible objects of knowledge, as they overcome disciplinary barriers, allow reflection of contents involving theory and practice and the exchange of knowledge not only between different areas and/or disciplines within of the university, but also with society (PÉREZ POMPA, ET AL., 2017; NOVO, 2017; CAMPOS, 2019; HAMMES, ET AL., 2020).

Therefore, it is desirable to train professionals who have the ability and Skills; balance between reason and emotion; critical-reflective awareness; social and interdisciplinary awareness; in order to fit into the context of the real needs of the farmer and the environment.

## VI. METHODOLOGY

For the writing of this article, a bibliographic review was carried out to analyze the publications of scientific works on agroecology and interdisciplinarity with a focus on family farming, in the databases of the Brazilian scientific field: Google Scholar; Spell - Scientific Periodicals Electronic Library; Scielo - Scientific Electronic Library Online and, as a complement, the most recent Agricultural Research Database.

The research was carried out between August 1st and September 10th, 2022, using words related to the researched topic. A publication period was not defined for analysis, therefore, a high number of articles with the themes, agroecology, family farming, interdisciplinarity, teacher training in agroecology and national policy in agroecology and organic production were found.

After a detailed analysis of the four databases, selections of articles were made that would help in the expected objective. For that, an excel spreadsheet was created with the main data of the articles such as: year of publication, keywords and qualis of the journals, with the

information contained therein guiding the studies for the preparation of this text.

## VII. SOME FINAL CONSIDERATIONS

Agroecology is a science for the sustainable future because, from a transdisciplinary approach, it integrates knowledge from different sciences and allows for the understanding, analysis and criticism of the current model of development and agriculture for the promotion of sustainable development. Over time, it has become the matrix for a new paradigm of knowledge, generated in different disciplines, both scientific and the knowledge of traditional populations, which recognizes the unsustainability of the current model.

The new paradigm under construction recognizes the unsustainability of capitalist agriculture, due to its dependence on externalities to agroecosystems, causing environmental destruction and promoting the social exclusion of traditional rural populations. The economic rationality of the hegemonic model of agriculture transformed food production into a business and the countryside into a sector of the economy, justifying its advances in the need to increase productivity to meet the demands of the growing human population. However, contrary to this discourse, this productive matrix only generated the loss of natural fertility of the soil and of the genetic diversity of the crops due to the excessive use of artificial inputs, also compromising the health of the consumers of the food produced in this logic.

The academy has only recently included in its undergraduate and postgraduate courses, disciplines that discuss the reality of the countryside in a contextualized way, within a global vision of the agrarian and agricultural space, in the perspective of development that transforms the life of the population. countryside population. This change, as it is a social dynamic and depends on human intervention, implies not only economic-productive rationalization, but also a change in attitudes and values of social actors in relation to the management and conservation of natural resources, hence the need to have education professionals with technical capacity in the bases of agroecology, when training students, considering that the complexity of agroecosystems does not fit in the compartment only of agronomy, which requires an interactive dialogue with social, political, cultural and environmental sciences, to the much-desired revolution brought about by agroecology.

In the field of action, Agroecology has been sown in all regions of the country through the efforts of rural social movements that appropriate their interdisciplinary approach to address issues that are

generally ignored by conventional agriculture. Here, it is worth emphasizing how sociocultural problems and gender inequality in rural areas constitute a permanent agenda of rural women, who point out the importance of Agroecology for their empowerment and financial independence, considering that they are important subjects in the discussion about sovereignty. of the peoples; the maintenance of culture and respect for life and the environment, as they are the group most affected by the weight of the current agri-food system, which increasingly makes their role in society and their contribution to development and life invisible.

The knowledge discussed here requires reflection and openness on the part of professors, researchers, farmers, apprentices, in order to overcome the paradigm of disciplinary fragmentation, which is no longer able to explain the phenomena resulting from the hegemonic model of production. Thus, the interaction of knowledge through theoretical, practical and methodological exchanges generates new concepts and methodologies, aiming to better understand complex phenomena.

Expanding the dialogue between disciplines is a task that the university cannot evade, as it is a barrier to be broken and a fundamental step towards the advancement of knowledge, whether in terms of its academic structure or in terms of the composition of their research groups, whether in new courses they offer, as a guarantee of the effectiveness of an intellectual production that is more innovative and more suited to current times.

## REFERENCES

- [1] ABA- ASSOCIAÇÃO BRASILEIRA AGROECOLOGIA. Estatuto da Associação Brasileira Agroecologia, 2004. Disponível em: <http://abaagroecologia.org.br/Estatuto-ABA.pdf>.
- [2] ABA-AGROECOLOGIA – ASSOCIAÇÃO BRASILEIRA DE AGROECOLOGIA. I SEMINÁRIO NACIONAL DE EDUCAÇÃO EM AGROECOLOGIA: CONSTRUINDO PRINCÍPIOS E DIRETRIZES, 2013, Recife, Pernambuco. Anais... Recife: ABA-Agroecologia, 2013.
- [3] ALTIERI, M. A. Agroecologia - a dinâmica produtiva da agricultura sustentável. Porto Alegre: Editora da Universidade Federal do Rio Grande do Sul, 1998. 110 p.
- [4] ALTIERI, M. A.; HECHT, S. B. Agroecology and small farm development. Michigan: CRC Press, 1990.
- [5] ALTIERI, Miguel. Agroecologia: bases científicas para uma agricultura sustentável. Guaíba: editora agropecuária, 2002. 592 p.
- [6] ANTISERI, Dario. História da Filosofia, vol. 7. De Freud à Atualidade. São Paulo: Paulus, 1975.
- [7] AZEVEDO, E. & PELICIONE, M. C. F. Promoção da saúde, sustentabilidade e agroecologia: uma discussão intersectorial. Saúde Soc., São Paulo, v. 20, n. 3, 2011, p. 715-729.
- [8] AZEVEDO, L. F. & NETTO, T. A. Agroecologia: o “caminho” para o desenvolvimento rural sustentável no processo de extensão rural. In Revista Eletrônica em Gestão, Educação e Tecnologia Ambiental, Santa Maria, v. 19, n. 3, set.-dez. 2015, p. 639- 645.
- [9] BALLA, João Vitor Quintas; MASSUKADO, Luciana Miyoko; PIMENTEL, Vania Costa. Panorama dos cursos de agroecologia no Brasil. Revista Brasileira de Agroecologia, v. 9, n. 2, p. 3-14, 2014.
- [10] BRASIL. PNAPO – Política Nacional de Agroecologia e Produção Orgânica. Decreto Lei no 7.794, de 20 de agosto de 2020.
- [11] BRASIL. Lei nº 11.326, de 24 de julho de 2006: Estabelece as diretrizes para a formulação da Política Nacional da Agricultura Familiar e Empreendimentos Familiares Rurais. Diário Oficial da União. Brasília, DF.
- [12] BRASIL. Instrução Normativa Nº 7, DE 17 de maio de 1999, revogada e substituída pela Lei no 10.831, de 23 de dezembro de 2003. Dispõe sobre a Agricultura Orgânica. Brasília: Congresso Nacional, 2003.
- [13] BRASIL. Decreto nº 7.272, de 25 de agosto de 2010. Regulamenta a Lei nº 11.346, de 15 de setembro de 2006, que cria o Sistema Nacional de Segurança Alimentar e Nutricional – SISAN, com vistas a assegurar o direito humano à alimentação adequada, institui a Política Nacional de Segurança Alimentar e Nutricional – PNSAN, estabelece os parâmetros para a elaboração do Plano Nacional de Segurança Alimentar e Nutricional, e dá outras providências. Brasília: Presidência da República, 2010.
- [14] BRASIL, Constituição da República Federativa do Brasil : texto constitucional promulgado em 5 de outubro de 1988, com as alterações determinadas pelas Emendas Constitucionais de Revisão nos 1 a 6/94, pelas Emendas Constitucionais nos 1/92 a 91/2016 e pelo Decreto Legislativo no 186/2008. – Brasília : Senado Federal, Coordenação de Edições Técnicas, 2016.
- [15] CAPORAL, Francisco Roberto, PETERSEN, Paulo. Agroecologia e políticas públicas na América Latina: o Caso do Brasil. Agroecología, n.6, p.63-74, 2012.
- [16] CAPORAL, F. R. Superando a Revolução Verde: a transição agroecológica no estado do Rio Grande do Sul, Brasil. In: CAPORAL, F. R.; COSTABEBER, J. A. Agroecologia e extensão rural: contribuições para a promoção do desenvolvimento rural sustentável. Brasília: MDA, 2004. p. 121-137.
- [17] CAPORAL, F.R; COSTABEBER, J.A; PAULUS G. Agroecologia: Matriz Disciplinar ou novo paradigma para o desenvolvimento rural sustentável. In: Agroecologia: uma ciência do campo da complexidade. Brasília, 2006.
- [18] CAPORAL, Francisco; COSTABEBER, José Antônio; PAULUS, Gervásio. Agroecologia: matriz disciplinar ou novo paradigma para o desenvolvimento rural sustentável. In.: CAPORAL, Francisco Roberto; AZEVEDO, Edisio Oliveira (Orgs.). Princípios e perspectivas da agroecologia. Curitiba: Instituto Federal de Educação, Ciência e

- Tecnologia do Paraná - Educação a distância, 2011. pp. 45-82.
- [19] CESAR, Aldara da Silva; BATALHA, Mario Otavio; PIMENTA, Marcio Lopes. A Certificação Orgânica como Fator Estratégico na Governança das transações no Mercado de Alimentos. Revista Organizações Rurais & Agroindústrias. Volume 10, n.3, 2008.
- [20] DARNHOFER, I., et al. Adaptiveness to Enhance the Sustainability of Farming Systems. A Review. *Agronomy for Sustainable Development*, 2010. 30, 545-555. <https://doi.org/10.1051/agro/2009053>.
- [21] DIESEL, V.; DIAS, M. M.; NEUMANN, P. S. PNATER (2004-2014): da concepção à materialização. In: GRISA, C.; SCHNEIDER, S. (Orgs.). Políticas públicas de desenvolvimento rural no Brasil. Porto Alegre: Editora da UFRGS, 2015. p. 107-128.
- [22] FAO BRASIL. Celebrando a contribuição dos agricultores familiares para o Fome Zero e dietas mais saudáveis. 2020. Disponível em: <http://www.fao.org.pdf>.
- [23] FAZENDA, Ivani. (org.). O que é interdisciplinaridade? - 2 ed. São Paulo: Cortez, 2013.
- [24] FONSECA, M. F. A. C. Agricultura orgânica: regulamentos técnicos para acesso aos mercados dos produtos orgânicos no Brasil. Niterói: Pesagro-Rio, 2009.
- [25] GLIESSMAN, Stephen R. Agroecologia: processos ecológicos em agricultura sustentável. 2. ed. Porto Alegre: Ed. UFRGS, 2001.
- [26] GOMEZ, L.F.; RIOS-OSORIO, L.A.; ESCHENHAGEN DURAN, M.L. The Concept of Sustainability in Agroecology. *Revista U.D.C.A Actualidad & Divulgacion Científica*. Dez, 2015. Volume 18 n.2, pag. 329-337.
- [27] Hammes, L. J., Karpinski, R., Rambo, R. A., Zitkoski, J. J., Hammes, I. L., & Fetter, S. A. (2020). A interdisciplinaridade como desafio na formação docente. *Brazilian Journal of Development*, 6(10), 76054-76065.
- [28] HECHT, Suzanna & COCKBURN, Alexander. The Fate of the Forest Developers: Destroyers and Defenders of the Amazon. Editora Penguin Books. Belo Horizonte – MG, 1990.
- [29] HEREDA, B. M. A. de; CINTRÃO, R. P. Gênero e acesso a políticas no meio rural brasileiro. *Revista Nera, Presidente Prudente*, n. 9, p. 1-28, jan/jun. 2006.
- [30] HOWARD, Albert. Um Testamento Agrícola. Oxford University, Londres, 1947. Traduzido pela Editora Expressão Popular, São Paulo, 2002.
- [31] IFOAM International Federation of Organic Agriculture Movements. *The IFOAM Norms for Organic Production and Processing*, 2016.
- [32] IPEA - INSTITUTO DE PESQUISA ECONÔMICA APLICADA. Análise da construção da política nacional de agroecologia e produção orgânica no Brasil. Brasília: Ipea, 2017.
- [33] KARAM, D.; MELHORANÇA, A. L.; OLIVEIRA, M. F. Plantas Daninhas na Cultura do Milho. Ministério da Agricultura, Pecuária e Abastecimento. Sete Lagoas, 2006.
- [34] KLAGES, K. H. W. Crop ecology and ecological crop geography in the agronomic curriculum. *J. Amer. Soc. Agron.* v. 20, p. 336-353, 1928.
- [35] LIMA, A. C. de O. et al. Gênero feminino, contexto histórico e segurança alimentar. *Demetra: Alimentação, Nutrição e Saúde*, v. 11, n. 3, p. 789-802, 2016.
- [36] LUZZI, N. O debate agroecológico no Brasil: uma construção a partir de diferentes atores sociais. 2007. 182f. Tese (Doutorado) – Programa de Pós-Graduação de Ciências Sociais em Desenvolvimento, Agricultura e Sociedade, Universidade Federal Rural do Rio de Janeiro, 2007.
- [37] MALUF, R. S; REIS, M. C. Segurança alimentar e nutricional na perspectiva sistêmica In: ROCHA, C.; BURLANDY, L.; MAGALHÃES, R. Segurança alimentar e nutricional: perspectivas, aprendizados e desafios para as políticas públicas. Rio de Janeiro: Editora Fiocruz, 2013. p. 43-67.
- [38] MEJIA, M.F. Rural School in the Tenza Valley, rural education and agroecology reflection on rural development. *Revista Agronomia Colombiana*, jun. 2011. Volume 29, n. 2, pag. 501-506.
- [39] MESQUITA, L. A. P. DE, MENDES, E. de P. P. Mulheres na agricultura familiar: a comunidade Rancharia, Campo Alegre de Goiás (GO). Disponível em: <https://www.lagea.ig.ufu.br.pdf>.
- [40] MOURA, Iracema. Agroecologia na Agenda Governamental Brasileira: Trajetórias no Período 2003-2014. Doutorado em Ciência Tecnologia e Inovação em Agropecuária Instituição de Ensino: Universidade Federal Rural do Rio de Janeiro, Seropédica, Biblioteca Depositária: Biblioteca Central da UFRRJ, 2016.
- [41] PÉREZ Pompa, N.; BORRERO Alarcón, J. & GUTIÉRREZ Guevara, O. (2017). La enseñanza aprendizaje de la agronomía. una experiencia didáctica para la formación de los estudiantes de agronomía em la universidad de Las Tunas. *Opuntia Brava*, 9, 79-87.
- [42] PHILIPPI JR, Arlindo. A Interdisciplinaridade como atributo da C&T. Interdisciplinaridade em Ciências Ambientais. São Paulo : Signus Editora, 2000.
- [43] PORTO, S. I. Programa de Aquisição de Alimentos (PAA): política pública de fortalecimento da agricultura familiar e da agroecologia no Brasil. 2014. 131f. Dissertação (Mestrado) – Programa Oficial de Pós-graduação em Agroecología, Universidad Internacional de Andalucía, Baeza, 2014.
- [44] PRIMAVESI, A. Manual do solo vivo: solo sadio, planta sadia, ser humano sadio. 2. ed. São Paulo: Expressão Popular, 2016. 205 p.
- [45] SAMBUICHI, R. H. R. et al. A sustentabilidade ambiental da agropecuária brasileira: impactos, políticas públicas e desafios. Brasília: Ipea, 2012. p. 1-47.
- [46] SANTOS, G. T. dos ; MARCHI, F. E. de ; DAMASCENO, J. C. ; ALCALDE, C. R. ; BRANCO, A. F. ; JOBIM, C. C. ; CECATO, U. ; SANTOS, F. S. dos , 2014. Digestibility of canola seeds treated by autoclaving and/or condensed tannins. *Rev. Colombiana Cienc. Pec.*, 27 (1): 29-36
- [47] SCHIMITT, Cláudia Job e GUIMARÃES, Leonardo Alonso. O mercado institucional como instrumento para o fortalecimento da agricultura familiar de base ecológica. *Revista Agriculturas* - v. 5 - no 2 - junho de 2008.

- [48] SCHUTTER, O. Agroecologia e o direito humano à alimentação adequada. Brasília: MDS, 2012.
- [49] SEVILLA-GUZMÁN, E.; MOLINA, M. G. Sobre a evolução do conceito de campesinato. Trad. GUTERES, E.; CARVALHO, H. M. 3 ed., São Paulo: Expressão Popular, 2006.
- [50] SILIPRANDI, Emma Cademartori. Mulheres e Agroecologia: a construção de novos sujeitos políticos na agricultura familiar. 2009. 291f. Tese (Doutorado em Desenvolvimento Sustentável) – Centro de Desenvolvimento Sustentável, Universidade de Brasília, Brasília-DF, 2009.
- [51] SILIPRANDI, Emma. Alimentação como um tema político das mulheres. In: Rocha, C. (Org.). Segurança alimentar e nutricional: perspectivas, aprendizados e desafios para as políticas públicas. Rio de Janeiro: Fiocruz, 2013.
- [52] SILVA, J.G. da. (Org.). Estrutura agrária e produção de subsistência na agricultura brasileira. São Paulo: Hucitec, 1982. 2ª Ed. 240p.
- [53] WEZEL, A.; BELLON, S.; DORÉ, T.; FRANCIS, C.; VALLOD, D.; DAVID, C. Agroecology as a science, a movement or a practice. A review. *Agronomy for Sustainable Development*, v. 29, p. 503-515, 2009.
- [54] WOJTKOWSKI, P. A. Agroecological perspectives in agronomy, forestry and agroforestry. Enfield: Science Publishers Inc., 2002.
- [55] YARED, Ivone. Prática educativa interdisciplinar: limites e possibilidades na reverberação de um sonho. 2009. 257 f. Tese (Doutorado em Educação) - Pontifícia Universidade Católica de São Paulo, São Paulo, 2009.



# Experimental study of pervious concrete

Priya Jagtap, Oshin Victor, Rakesh Verma

Department of Civil Engineering, SVVV University, India

Received: 25 Aug 2022,

Received in revised form: 16 Sep 2022,

Accepted: 21 Sep 2022,

Available online: 27 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**—Pervious concrete, porosity,  
strength, super plasticizer.

**Abstract**— In the construction sector, concrete is a widely utilized building material. Pervious concrete is a high-porosity concrete used for concrete flatwork applications that allows water from precipitation and other sources to pass directly through, decreasing runoff and permitting groundwater recharge. The main objective is to determine the strength of pervious concrete by introducing admixture. The results of an experimental inquiry on pervious concrete are given and analysed in this overview. The amount of general-purpose water in pervious concrete has been minimized by utilizing super plasticizer to enhance the strength of pervious concrete and to develop inexpensive pervious concrete. The mix design for pervious concrete was prepared, concrete specimen samples were manufactured, and tests were performed on pervious concrete specimens to determine the strength of pervious concrete and compare it to conventional concrete.

## I. INTRODUCTION

The Pervious concrete, also known as permeable or porous concrete, is characterized by high water permeability and porosity. Pervious concrete is composed of cement, aggregates, water, and admixtures (if required). Pervious concrete's high water permeability absorbs rainfall and allows it to soak into the earth. Pervious concrete has a significant impact on groundwater recharging and storm water discharge.

Other benefits of pervious concrete include reduced road puddles, improved water quality through percolation, and heat absorption. Furthermore, pervious concrete is used as a sound absorber in European nations and to safeguard river banks in Japan.

The most common applications of pervious concrete are light traffic volume highways such as parking lots, residential roads, driveways, walkways, and so on.

The frequently stated range of porosity for pervious concrete is 15 to 30%, and this relies on the compaction process used as well as the combination proportions. However, due to its porosity, the material's strength is quite poor.



Fig. 1: Pervious concrete

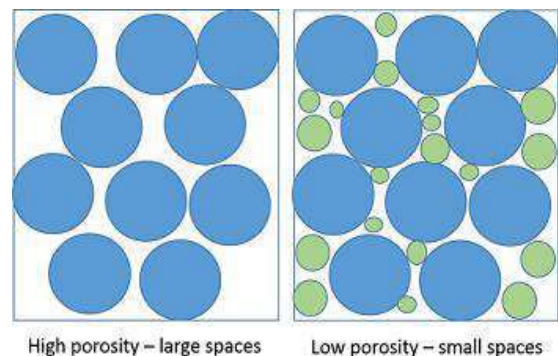


Fig. 2: Schematic representation of pervious concrete

The compressive strength of the material is just 20 to 30 MPa. Pervious concrete has a poor strength due to its large void content, which not only limits its application in cold weather zones but also causes different distresses and failures of the connected construction.

Pervious concrete pavements have grown in popularity in recent years as an efficient storm water management technology in locations that get regular and occasionally heavy rainfall.

Following are the environmental benefits of pervious concrete are as follows:-

1. Replenishes water table and aquifers.
2. Allows for more efficient land development.
3. Reduce storm water runoff.
4. Minimizes flash flooding and standing water.
5. Mitigates surface pollutants.
6. Prevents warm and polluted water from entering streams.
7. Light reflectivity is higher than asphalt surfaces, reducing any island effect.

**II. METHODOLOGY**

Following the acquisition of locally accessible materials, a mix design has been produced. Different material proportions were used for different mixtures, as

Specified in the experimental program Cement, sand, and aggregate were tested in laboratories. We conducted cement tests such as fineness of cement, specific gravity, and setting time. In this work, PPC 43 Grade (J K Super cement) cement was employed, as well as super plasticizer (CICO PLAST SUPER p190A) with a specific gravity of 1.20. The coarse aggregate, with a maximum size of 20mm and a specific gravity of 2.70, was procured from a local provider and certified to IS: 383. After the trial mix, the water-cement ratio is set to 0.5 to improve the overall workability of the experiment. Fresh water was acquired through a bore hole. Concrete cubes were cast and cured for 7, 14, 21 and 28 days, respectively, while beams for flexural strength testing were cast and cured for 7 and 14 and 21 days, respectively.

For each hydration period (7, 14, 21 and 28 days), three cubes were evaluated for compressive strength and three beam specimens were examined for flexural strength. Following the completion of the testing and the achievement of the results, we continued through discussion and ultimately ended this work.

**III. EXPERIMENTAL PROGRAM**

The compressive and flexural strengths of pervious concrete were determined through experimental investigation.

To investigate further into the main features of pervious concrete with a super plasticizer (CICO PLAST SUPER P190-A).

The exploratory approach is followed by the table below.

*Table.1: Experimental Program*

| S. No | Mix    | W/C | Cement % | Admix -ture | Fine Aggre-gate% | Coarse Aggre-gate% |
|-------|--------|-----|----------|-------------|------------------|--------------------|
| 1     | MIX -1 | 0.5 | 100      | 0%          | 1.6              | 2.84               |
| 2     | MIX -2 | 0.5 | 100      | 1%          | 1.8              | 3.2                |
| 3     | MIX -3 | 0.5 | 100      | 2%          | 2.2              | 3.8                |



*Fig. 1: Super plasticizer (CICO PLAST P190-A)*

The Concrete mixtures were developed. For the compressive strength test, a number of typical 150mm cubes (shown in Figure) were formed in steel moulds.



Fig. 2: pervious concrete with super plasticizer



Fig. 3: A typical pervious concrete specimen used in this investigation



Fig. 3: Curing of Pervious concrete specimens

#### IV. RESULT & DISCUSSION

Cement, fine aggregate, and coarse aggregate were obtained locally for this project. The cement used was PPC 43 (J K Super), and the mix proportions were designed for M20 grade concrete. For this investigation, river sand with a specific gravity of 2.56 and coarse aggregates with a specific gravity of 2.70 were used. For all of the mixes in this study, tap water is utilized for mixing, and the water-cement ratio is set at 0.5. In various percentages, CICO PLAST SUPER P190-A (Super plasticizer) was utilized as an admixture. Slump test, Compressive and flexural strength tests were performed. The following tests are below-



Fig. 4: Slump cone test



Fig. 4: Compressive strength test



Fig.5: Flexural strength test

The results of the laboratory tests are listed below.

Table.2: Cement test result

| Characteristics  | Obtained values for cement | Requirement as per IS 1489(Part 1) :2015 |
|------------------|----------------------------|------------------------------------------|
| Fineness         | 377.1                      | 300 min.                                 |
| Setting time     |                            |                                          |
| Initial setting  | 140                        | 30 minutes min.                          |
| Final setting    | 190                        | 600 minutes max.                         |
| Specific gravity | 3.10                       |                                          |

Table.3: Slump cone test result

| S.No. | Grade | MIX   | Percentage of super plasticizer | Workability (mm) |
|-------|-------|-------|---------------------------------|------------------|
| 1     | M20   | MIX-1 | 0%                              | 40               |
| 2     | M20   | MIX-2 | 1%                              | 45               |
| 3     | M20   | MIX-3 | 2%                              | 50               |

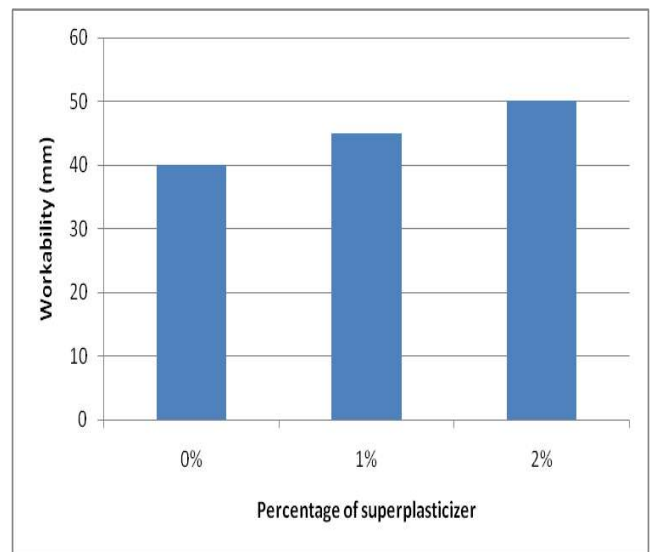


Chart.1: Slump cone test result

Table.4: Compressive strength result for MIX-1

| S.No. | Grade | Percentage of super plasticizer | Curing period | Compressive strength (N/mm <sup>2</sup> ) |
|-------|-------|---------------------------------|---------------|-------------------------------------------|
| 1     | M20   | 0%                              | 7 days        | 8.89                                      |
|       |       |                                 |               | 8.0                                       |
|       |       |                                 |               | 9.77                                      |
| 2     | M20   | 0%                              | 14 days       | 16.8                                      |
|       |       |                                 |               | 17.7                                      |
|       |       |                                 |               | 18.6                                      |
| 3     | M20   | 0%                              | 21 days       | 20                                        |
|       |       |                                 |               | 20.5                                      |
|       |       |                                 |               | 21.02                                     |
| 4     | M20   | 0%                              | 28 days       | 24                                        |
|       |       |                                 |               | 22.22                                     |
|       |       |                                 |               | 23.1                                      |

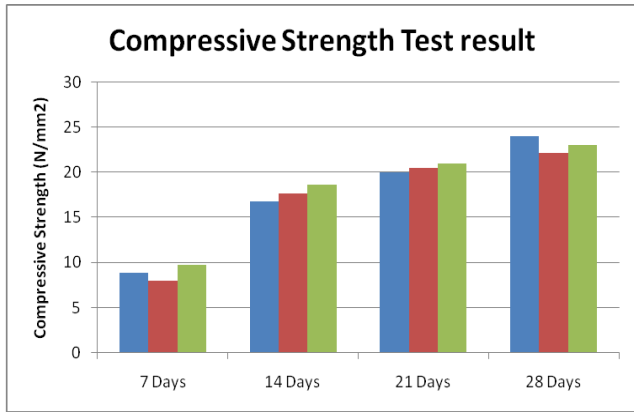


Chart2: Compressive strength test result for MIX-1

Table.5: Compressive strength result for MIX-2

| S.No. | Grade | Percentage of super plasticizer | Curing period | Compressive strength (N/mm <sup>2</sup> ) |
|-------|-------|---------------------------------|---------------|-------------------------------------------|
| 1     | M20   | 1%                              | 7 days        | 10                                        |
|       |       |                                 |               | 10.2                                      |
|       |       |                                 |               | 10.4                                      |
| 2     | M20   | 1%                              | 14 days       | 18.4                                      |
|       |       |                                 |               | 18                                        |
|       |       |                                 |               | 18.8                                      |
| 3     | M20   | 1%                              | 21 days       | 19.7                                      |
|       |       |                                 |               | 20.2                                      |
|       |       |                                 |               | 21.8                                      |
| 4     | M20   | 1%                              | 28 days       | 23.5                                      |
|       |       |                                 |               | 23.11                                     |
|       |       |                                 |               | 24                                        |

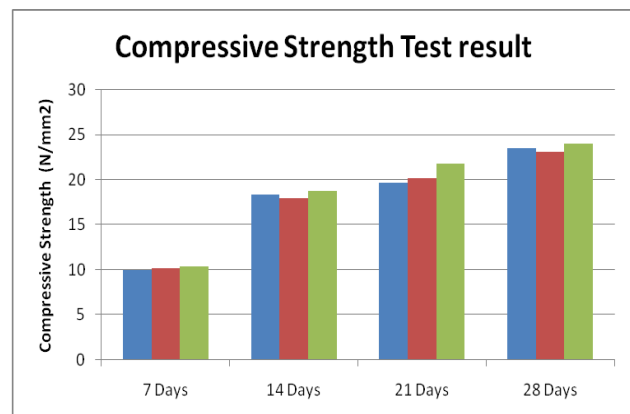


Chart3: Compressive strength test result for MIX-2

Table.6: Compressive strength result for MIX-3

| S.No. | Grade | Percentage of super plasticizer | Curing period | Compressive strength (N/mm <sup>2</sup> ) |
|-------|-------|---------------------------------|---------------|-------------------------------------------|
| 1     | M20   | 2%                              | 7 days        | 11.5                                      |
|       |       |                                 |               | 12                                        |
|       |       |                                 |               | 11.11                                     |
| 2     | M20   | 2%                              | 14 days       | 19.33                                     |
|       |       |                                 |               | 19.11                                     |
|       |       |                                 |               | 19.5                                      |
| 3     | M20   | 2%                              | 21 days       | 22.4                                      |
|       |       |                                 |               | 22                                        |
|       |       |                                 |               | 22.9                                      |
| 4     | M20   | 2%                              | 28 days       | 24.2                                      |
|       |       |                                 |               | 24                                        |
|       |       |                                 |               | 24.4                                      |

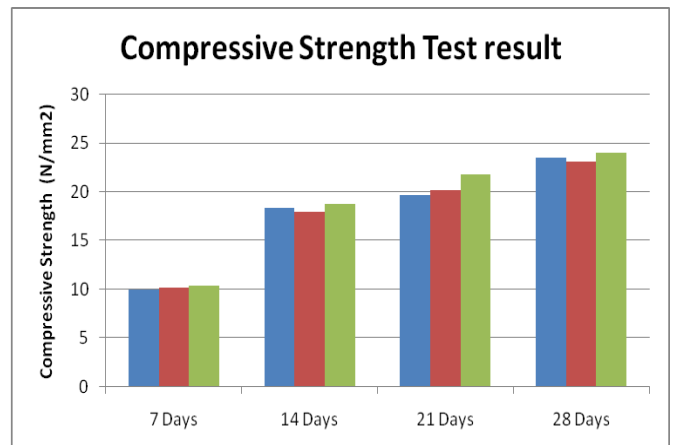


Chart4: Compressive strength test result for MIX-3

Table.7: Flexural strength result for MIX-1

| S.No. | Grade | Percentage of super plasticizer | Curing period | Flexural strength (N/mm <sup>2</sup> ) |
|-------|-------|---------------------------------|---------------|----------------------------------------|
| 1     | M20   | 0%                              | 7 days        | 1                                      |
|       |       |                                 |               | 1.2                                    |
|       |       |                                 |               | 1.1                                    |
| 2     | M20   | 0%                              | 14 days       | 1.6                                    |
|       |       |                                 |               | 1.5                                    |
|       |       |                                 |               | 1.8                                    |
| 3     | M20   | 0%                              | 21 days       | 1.8                                    |

|   |     |    |         |     |
|---|-----|----|---------|-----|
|   |     |    |         | 2   |
|   |     |    |         | 2.2 |
| 4 | M20 | 0% | 28 days | 2   |
|   |     |    |         | 2.4 |
|   |     |    |         | 2.2 |

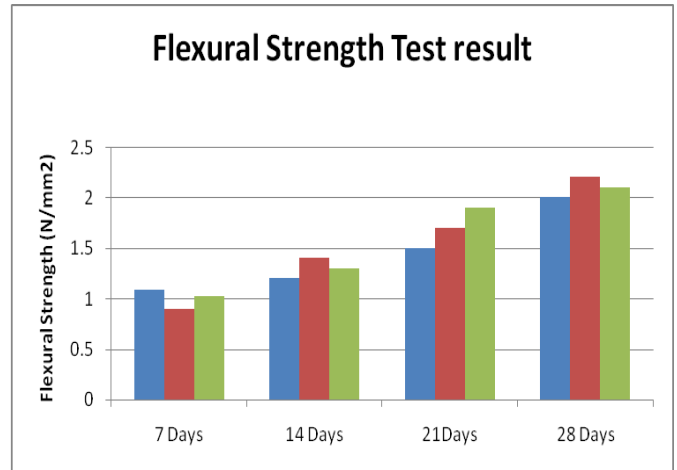


Chart6: Flexural strength test result for MIX-2

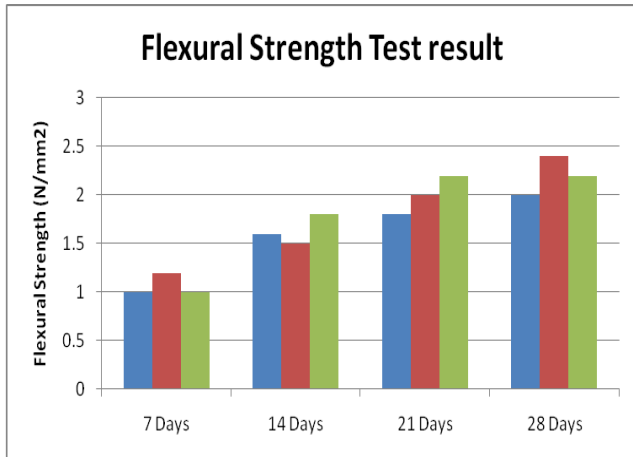


Chart5: Flexural strength test result for MIX-1

Table.8: Flexural strength result for MIX-2

| S.No. | Grade | Percentage of super plasticizer | Curing period | Flexural strength (N/mm <sup>2</sup> ) |
|-------|-------|---------------------------------|---------------|----------------------------------------|
| 1     | M20   | 2%                              | 7 days        | 1.08                                   |
|       |       |                                 |               | 0.9                                    |
|       |       |                                 |               | 1.09                                   |
| 2     | M20   | 2%                              | 14 days       | 0.8                                    |
|       |       |                                 |               | 1.2                                    |
|       |       |                                 |               | 1.3                                    |
| 3     | M20   | 2%                              | 21 days       | 1.2                                    |
|       |       |                                 |               | 1.3                                    |
|       |       |                                 |               | 1.4                                    |
| 4     | M20   | 2%                              | 28 days       | 1.4                                    |
|       |       |                                 |               | 1.4                                    |
|       |       |                                 |               | 1.5                                    |

Table.9: Flexural strength result for MIX-3

| S.No. | Grade | Percentage of super plasticizer | Curing period | Flexural strength (N/mm <sup>2</sup> ) |
|-------|-------|---------------------------------|---------------|----------------------------------------|
| 1     | M20   | 1%                              | 7 days        | 1.09                                   |
|       |       |                                 |               | 0.9                                    |
|       |       |                                 |               | 1.02                                   |
| 2     | M20   | 1%                              | 14 days       | 1.2                                    |
|       |       |                                 |               | 1.4                                    |
|       |       |                                 |               | 1.3                                    |
| 3     | M20   | 1%                              | 21 days       | 1.5                                    |
|       |       |                                 |               | 1.7                                    |
|       |       |                                 |               | 1.9                                    |
| 4     | M20   | 1%                              | 28 days       | 2                                      |
|       |       |                                 |               | 2.2                                    |
|       |       |                                 |               | 2.1                                    |

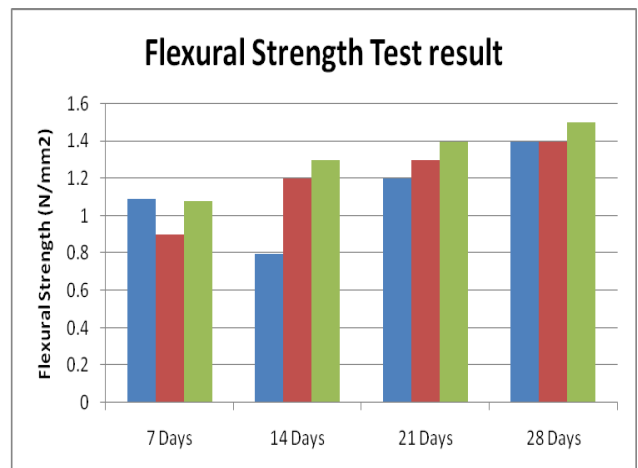


Chart7: Flexural strength test result for MIX-3

## V. CONCLUSION

The compressive strength of M20 grade pervious concrete for 28 days is enhanced by adding a 2% super plasticizer and the flexural strength is lowered by adding 2% super plasticizer.

## REFERENCES

- [1] Is-456:2000 Code of practice for plain and reinforced concrete. New Delhi, India.
- [2] Is-10262:2019 Guidelines for concrete mix design proportioning. New Delhi, India.
- [3] Is-516:1959 Method of Tests for Strength of Concrete. New Delhi, India.
- [4] Patil, V. R., A. K. Gupta, and D. B. Desai. "Use of pervious concrete in construction of pavement for improving their performance." *IOSR Journal of Mechanical and Civil Engineering* 4 (2010): 54-56.
- [5] Bhutta, M. Amer Rafique, K. Tsuruta, and J. Mirza. "Evaluation of high-performance porous concrete properties." *Construction and Building Materials* 31 (2012): 67-73
- [6] Rakesh, S., M. Ashok, and A. Devi Prasad. "An Experimental Study On Performance Of Permeable Concrete."
- [7] Kumar, S. Rajesh. "Characteristic study on pervious concrete." *International Journal of Civil Engineering and Technology (IJCIET)* 6.6 (2015).
- [8] Swe, Than Mar, Pitcha Jongvivatsakul, and Withit Pansuk. "Properties of pervious concrete aiming for LEED green building rating system credits." *Engineering Journal* 20.2 (2016): 61-72
- [9] Aoki, Y., R. Sri Ravindrarajah, and H. Khabbaz. "Properties of pervious concrete containing fly ash." *Road materials and pavement design* 13.1 (2012): 1-11
- [10] Rahangdale, Sourabh, et al. "Study of pervious concrete." *Int. Res. J. Eng. Technol* 4.06 (2017): 2563- 2566
- [11] Murthy, B. V. R., and G. Rajeswari. "Study on strength improvement of pervious concrete." *International Journal of Engineering Science Invention (IJESI)* 7 (2018): 29-31.
- [12] Vikram, Mahla RP, and R. P. Mahla. "Experimental study of pervious concrete pavement." *International Journal for Research in Applied Science & Engineering Technology (IJRASET)* 3.7 (2015): 40-48
- [13] Shah, Darshan S., Jayeshkumar Pitroda, and J. J. Bhavsar. "Pervious concrete: New era for rural road pavement." *Int J Eng Trends Technol* 4.8 (2013): 3495-3499

# Modeling Volatility for High-Frequency Data of Cryptocurrency Bitcoin Price using Generalized Autoregressive Conditional Heteroskedasticity (GARCH) Model

Nashirah Abu Bakar<sup>1</sup>, Sofian Rosbi<sup>2</sup>

<sup>1</sup>Islamic Business School, College of Business, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia

<sup>2</sup>Faculty of Business & Communication, Universiti Malaysia Perlis, 01000 Kangar, Perlis, Malaysia

Received: 28 Aug 2022,

Received in revised form: 20 Sep 2022,

Accepted: 24 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Cryptocurrency, Bitcoin, Volatility, GARCH Model, High-Frequency Data.*

**Abstract**— *The cryptocurrency namely Bitcoin is a decentralized cryptocurrency considered a type of digital asset that uses public-key cryptography to record, sign and send transactions over the Bitcoin blockchain. All transaction processes are performed without the oversight of a central authority. The time series data for Bitcoin price movement exhibit time-varying volatility and volatility clustering. This study aims to evaluate the time-varying volatility of Bitcoin price using the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. This study uses daily share prices starting from July 2017 until July 2022. The mean equation was developed using the ARMA (1,1) for Bitcoin return. Next, this study evaluated OLS, GARCH, GARCH-M, and E-GARCH models. The result shows the EGARCH (1,1) model exhibits its lowest error of AIC with a value of 5.5984. The autocorrelation test was performed using Q-statistics indicating EGARCH (1,1) model is free from the autocorrelation problem. In addition, ARCH-LM test indicates EGARCH (1,1) is free from heteroscedasticity problems. The EGARCH (1,1) shows there is a leverage effect for volatility clustering. This explained the behavior of bad news effect more than positive news. The finding of the study can act as a guideline to help investors to analyze their investment behavior. At the same time, the finding of this study helps investors to understand the cryptocurrency dynamics behavior.*

## I. INTRODUCTION

The increasing demand for Bitcoin cryptocurrency investment was attract more research to investigate the expected return and volatility of Bitcoin investment. This is due to the high demand from investors to invest in Bitcoin portfolios. As reported by coinmarketcap.com (2022), the market capitalization for Bitcoin cryptocurrency exceeds more than USD\$372 billion, which is higher than other cryptocurrencies such as

Ethereum cryptocurrency, which is USD\$167 billion, and Tether cryptocurrency, which is USD\$67 billion.

This pattern shows the aggressive demand for Bitcoin cryptocurrency investment. Bitcoin cryptocurrency is used as an investment class asset to earn profits. Bitcoin also considers a commodity because it can be traded in the spot as well as in the futures market like any other physical commodity (Dubey, 2022).



According to Lee and Rhee (2022), the price of Bitcoin cryptocurrency was rise since the mining process of Bitcoin cryptocurrency started in the early year of 2009. Since the year 2022, the demand for Bitcoin cryptocurrency was increased and attracted more investors to participate in Bitcoin cryptocurrency investments (Abu Bakar, et al., 2020). Cryptocurrencies are recognized by investors as an alternative asset or diversification option for reducing the exposed risk of their portfolios (Hung, 2022).

However, many researchers found that investments in Bitcoin cryptocurrency face high volatility and risk (Abu Bakar, et al., 2019a). According to Diniz, et al., (2022), the year of 2017 marks a new period of high volatility and appreciation in the cryptocurrency markets. The market price of Bitcoin rose more than 1,700% in the year 2017, bringing further discussions of the existence of a bubble.

Therefore, this study performs to investigate the time-varying volatility of Bitcoin price using the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. Abu Bakar, et al., (2019b) develop forecasting cryptocurrency price movement using the moving average indicating that the comparison among prediction methods shows the 2-day moving average method is the best prediction method with the lowest mean absolute error percentage for all observation periods of Bitcoin cryptocurrency price. Thus, this study used the GARCH model to evaluate the time-varying volatility of Bitcoin prices from July 2017 until July 2022.

## II. LITERATURE REVIEW

Bitcoin exceeded a market capitalization of US\$372 billion in September 2022, thereby attracting the interest among investors and corporations to invest in the cryptocurrency market. However, Bitcoin cryptocurrency is involved in high volatility indicating this investment is considered a high-risk investment (Benlagha and Hemrit, 2022; Grira, et al., 2022).

Many types of research are conducted to investigate the volatility of Bitcoin cryptocurrency investment. Cryptocurrency defines as a digital currency in which encryption techniques are used to regulate the generation of units of currency and verify the transfer of funds, operating independently of a central bank.

The study by Abu Bakar, et al., (2017) mentioned that Bitcoin is a type of cryptocurrency. Balances are kept using public and private keys which are long strings of numbers and letters linked through the mathematical encryption algorithm that was used to create. The public key (comparable to a bank account number) serves as the

address published to the world and to which others may send Bitcoins.

Besides that, Dubey, (2022) found that oil price, bitcoin supply, trading volume, and market capitalization significantly influence the price of bitcoin in the long run. While in the short run investors, market capitalization, S&P 500 returns, and trading volume significantly affect the Bitcoin returns.

The other study that compares Bitcoin with other investments also suggests that Bitcoin cryptocurrency are risk investment. Therefore, a study by Kamran, et al., (2022) show Bitcoin offered a weak safe haven and hedging benefits when combined in a portfolio with S&P/ASX 200 Financials index, S&P/ASX 200 Banks index, or S&P/ASX 300 Banks index. Concerning the S&P/ASX All Ordinaries Gold index, Bitcoin is a risky investment with inconsistent safe haven and hedging benefits.

Currently, investors have the option to invest in various investment platforms such as the stock market, gold market, crude oil market, and other platforms. Various investment platform including the cryptocurrency market shows the dynamic behavior of price and risk give an impact on the return of investment. In addition, investors and companies have opportunities to select the best portfolio investments. As the main objective of investors is to generate a good return, thus, they need to choose a good investment portfolio that can generate a good return and low risk.

Therefore, much research conducted to investigate the performance of the stock market, gold market, cryptocurrency market, and other markets. A study by Kumar, et al., (2022) indicate that positive changes in Bitcoin do not the affected stock market in the long term (Kumar, et al., 2022). Thus, they concluded that each investment has its own dynamic behavior in generating a good return and managing the risk of investment.

Nowadays, the spread of the Covid-19 virus gives an impact on all investment portfolios worldwide. The infection of Covid-19 is not only considered become a public health crisis but also affected the global economy at a critical level. A significant economic impact has already occurred across the globe due to reduced productivity, loss of life, business closures, trade disruption, and decimation of the tourism industry (Abu Bakar and Rosbi, 2022; Abu Bakar, et al., 2022; Abu Bakar and Rosbi, 2021a; Abu Bakar and Rosbi, 2021b; Abu Bakar and Rosbi, 2020a).

Hence, a study by Kakinuma, (2022) regarding empirical evidence on the return and volatility spillover effects between Southeast Asian stock markets, Bitcoin, and gold in the periods before and during the Covid-19

pandemic shows the stocks in Southeast Asia, Bitcoin and gold become interdependent during the pandemic. While during turbulent times, the contagion effect is inevitable regardless of region and asset class.

In addition, a study by Abu Bakar and Rosbi, (2020b) regarding the impact of Covid-19 on the equity market and currency exchange indicates a negative value. Therefore, Covid-19 happened in the year 2019 and contributed to a huge impact on the economy worldwide.

### III. RESEARCH METHODOLOGY

This study uses generalized autoregressive conditional heteroscedasticity (GARCH) to evaluate time-varying volatility. Therefore, this study started with evaluating data normality distribution using Jarque -Bera test. Then, the analysis continues to the unit root test namely ADF, PP, and KPSS. Next, this study performed modeling selection where the ARMA model is selected. Then, this study performed autocorrelation problem checking and heteroscedasticity problem checking. After that, GARCH models were implemented to model the data.

#### 3.1 Normality testing using Jarque-Bera test.

An assessment of the normality of data is a prerequisite for many statistical tests because normal data is an underlying assumption in parametric testing. The normal distribution is a continuous probability distribution that is symmetrical around its mean, most of the observations cluster around the central peak. Normal distribution, also known as the Gaussian distribution, is a probability distribution that is symmetric about the mean, showing that data near the mean are more frequent in occurrence than data far from the mean.

In statistics, the Jarque-Bera (JB) test is a goodness-of-fit test of whether sample data have the skewness and kurtosis matching a normal distribution. The test statistic is always non-negative. If it is far from zero, it signals the data do not have a normal distribution. The JB statistic test is represented using Equation (1).

$$JB = \frac{n}{6} \left( S^2 + \frac{1}{4} K - 3 \right)^2 \dots\dots\dots(1)$$

The parameters in Equation (1) are described as follows.

- $n$  : Number of observations for sample.
- $S$  : Value of sample skewness.
- $K$  ; Value of sample kurtosis.

#### 3.2 Unit root test using ADF, PP, and KPSS

In statistics, a unit root test tests whether a time series variable is non-stationary and possesses a unit root. An Augmented Dickey-Fuller test (ADF) tests the null hypothesis that a unit root is present in a time series sample. The augmented Dickey-Fuller (ADF) statistic, used in the test, is a negative number. The more negative it is, the stronger the rejection of the hypothesis that there is a unit root at some level of confidence. The ADF test is represented by Equation (2).

$$\Delta y_t = \delta y_{t-1} + \sum_{i=1}^k \beta_i \Delta y_{t-i} + \varepsilon_t \dots\dots\dots(2)$$

Hypothesis:

- $H_0 : \delta = 0$  , series has unit root characteristics.
- $H_0 : \delta < 0$  , series is a stationary data set.

Next, the second test for unit root is Philips and Perron (PP). The PP test proposes an alternative to the unit root test as a nonparametric method of controlling for serial correlation. The null hypothesis for the PP test shows series has a unit root. Meanwhile, the alternative hypothesis shows series is stationary.

Then, the third unit root test is The Kwiatkowski-Phillips-Schmidt-Shin (KPSS). The KPSS test figures out if a time series is stationary around a mean or linear trend or is non-stationary due to a unit root. A stationary time series is one where statistical property are considered the mean and variance values are constant over time. The null hypothesis for the test is that the data is stationary. The alternate hypothesis for the test is that the data is not stationary.

#### 3.3 Autoregressive Moving Average (ARMA) model.

ARMA is a model of forecasting in which the methods of autoregression (AR) analysis and moving average (MA) are both applied to time-series data that is well behaved. In ARMA it is assumed that the time series is stationary and when it fluctuates, it does so uniformly around a particular time.

The ARMA process is represented by using Equation (3). This equation was developed for ARMA (1,1) model.

$$y_t = \mu + \phi_1 y_{t-1} + \theta_1 \varepsilon_{t-1} + \varepsilon_t \dots\dots\dots(3)$$

Where:

- $y_{t-1}$  : past value of  $y_t$  at lag one, and
- $\varepsilon_{t-1}$  : past shock at lag one.

For Equation (3), the mean value is zero and has constant variance. The variable  $y_{t-1}$  represented the AR portion and  $\varepsilon_{t-1}$  represented MA portion.

3.4 Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model.

The formula for GARCH (1,1) is represented by using Equation (4).

$$\sigma_t^2 = \omega + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \dots \dots \dots (4)$$

In Equation (4), the variables are explained as below:

$\varepsilon_{t-1}^2$  : past news about conditional variance, and

$\sigma_{t-1}^2$  : past conditional variance.

**4 RESULT AND DISCUSSION**

This section describes four components: data selection procedure, unit root testing, ARMA model specification, and GARCH analysis.

4.1 Data selection procedure

This study uses daily Bitcoin prices starting from 17th July 2017 until 17th July 2022. There are 1827 daily observations involved in this analysis. Figure 1 shows the movement of Bitcoin prices over 5 years. The value for Bitcoin on the 1<sup>st</sup> observation is USD 2229.4 for one unit. The maximum value of Bitcoin is USD 67566.8 on the 7<sup>th</sup> November 2021 (1576<sup>th</sup> observation). The last observation exhibits Bitcoin price is USD 21228.2.

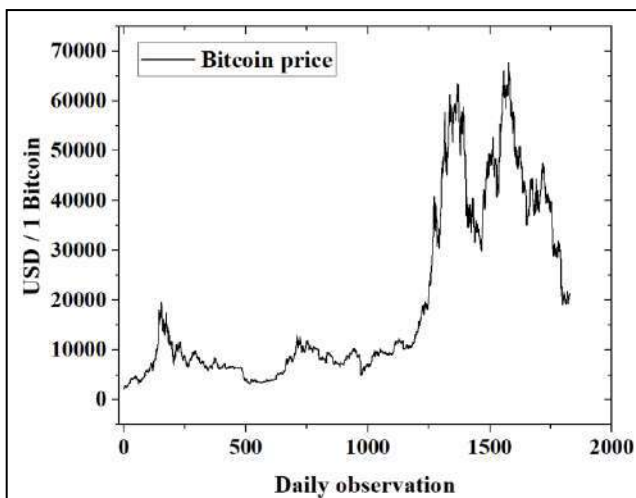


Fig. 1: Bitcoin price for over 5 years

Next, Figure 2 shows the value of the return rate for Bitcoin. The dynamic behavior of the Bitcoin return rate shows the volatility characteristics with clustering. Therefore, the ARCH effect exists in data.

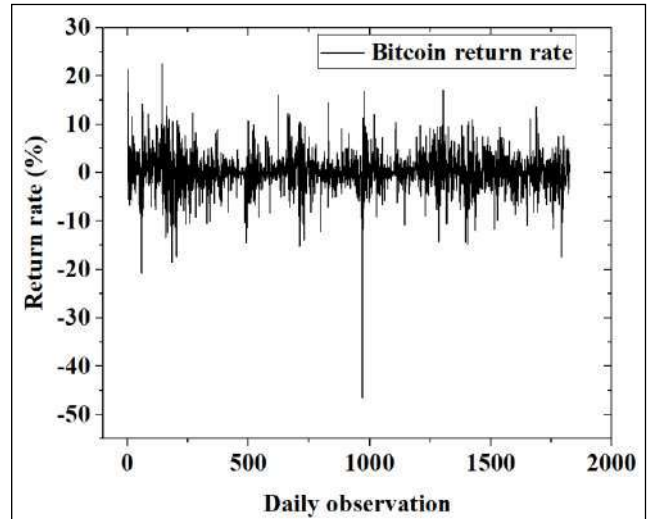


Fig. 2: Volatility rate for Bitcoin return

Table 1 shows descriptive statistics for the Bitcoin return rate. The mean value for Bitcoin return is 0.123442 %. The maximum value for the Bitcoin returns rate is 22.51190 % at 144<sup>th</sup> daily observation. Meanwhile, the minimum value for Bitcoin return is -46.47302 % at 970<sup>th</sup> daily observation. As shown in Table 1, the value of the statistics for kurtosis indicates the data distribution follows the non-normal distribution. It is supported by a numerical statistical test namely Jarque-Bera statistical test which indicates the value is 9375.434 with a probability value is 0.0000. The probability value indicates the data distribution for the Bitcoin return rate is non-normal distribution.

Next, this study performed unit root to check for stationarity of Bitcoin return data. Table 2 shows three types of unit root tests namely ADF, PP, and KPSS. The data for Bitcoin return follows stationary characteristics. The parameters such as mean and variance do not change over time.

Table.1: Descriptive statistics for Bitcoin return rate

| Parameter | Value     |
|-----------|-----------|
| Mean      | 0.123442  |
| Median    | 0.177448  |
| Maximum   | 22.51190  |
| Minimum   | -46.47302 |

|                       |                         |
|-----------------------|-------------------------|
| Std. Dev.             | 4.187009                |
| Skewness              | -0.705640               |
| Kurtosis              | 14.01064                |
| Jarque-Bera statistic | 9375.434                |
| Probability           | 0.000000                |
| Distribution          | Non-normal distribution |

Table.2: Unit root tests for Bitcoin return

| Variable: Level                   | ADF        | PP         | KPSS           |
|-----------------------------------|------------|------------|----------------|
| <b>No intercept, No trend</b>     | -44.30181  | -44.29933  | Not applicable |
| Probability                       | 0.0001     | 0.0001     | -              |
| Comment                           | Stationary | Stationary | -              |
| <b>With intercept, No trend</b>   | -44.32883  | -44.32036  | 0.194          |
| Probability                       | 0.0001     | 0.0001     | 0.46300        |
| Comment                           | Stationary | Stationary | Stationary     |
| <b>With intercept, With trend</b> | -44.35202  | -44.33940  | 0.134175       |
| Probability                       | 0.0000     | 0.0000     | 0.14600        |
| Comment                           | Stationary | Stationary | Stationary     |

Table 3 shows estimation of the model for Bitcoin return rate and volatility. The four models involved are OLS, GARCH (1,1), GARCH (1,1)-M and EGARCH (1,1). In this study, EGARCH (1,1) selected the most suitable model for analyzing volatility for Bitcoin return. The value for AIC is the lowest with a value of 5.5984 for EGARCH (1,1).

Table.3: Estimation of the models

| Model                       | OLS     | GARCH (1,1) | GARCH (1,1)-M | EGARCH (1,1) |
|-----------------------------|---------|-------------|---------------|--------------|
| 1. Mean Equation ARMA (1,1) |         |             |               |              |
| $\mu$                       | 0.1232  | 0.1546      | -0.2307       | 0.1227       |
| Probability                 | 0.2066  | 0.4411      | 0.6322        | 0.2001       |
| $\phi_1$                    | -0.6774 | -0.8079     | -0.8203       | -0.7916      |
| Probability                 | 0.0009  | 0.0001      | 0.0000        | 0.0000       |
| $\theta_1$                  | 0.6383  | 0.8006      | 0.8106        | 0.7765       |
| Probability                 | 0.0025  | 0.0002      | 0.0000        | 0.0000       |

|                             |        |             |               |                |
|-----------------------------|--------|-------------|---------------|----------------|
| $\lambda$                   |        |             | 0.1053        |                |
| Probability                 |        |             | 0.4054        |                |
| 2. Model selection          |        |             |               |                |
| Akaike info criterion (AIC) | 5.7029 | 5.8351      | 5.6068        | 5.5984         |
| Schwarz criterion (SC)      | 5.7149 | 5.8532      | 5.6279        | 5.6196         |
| Hanna-Quinn criteria (HQC)  | 5.7073 | 5.8417      | 5.6146        | 5.6062         |
| Model                       | OLS    | GARCH (1,1) | GARCH (1,1)-M | EGARCH (1,1)   |
| 3. Variance Equation        |        |             |               |                |
| $\omega$                    |        | 11.3769     | 1.0290        | 0.0892         |
| Probability                 |        | 0.0003      | 0.0000        | 0.0000         |
| $\alpha_1$                  |        | 0.1371      | 0.0843        |                |
| Probability                 |        | 0.0016      | 0.0000        |                |
| $\beta_1$                   |        | 0.5871      | 0.8600        |                |
| Probability                 |        | 0.0000      | 0.0000        |                |
| $\alpha$                    |        |             |               | 0.1766         |
| Probability                 |        |             |               | 0.0000         |
| $\gamma$                    |        |             |               | <b>-0.0497</b> |
| Probability                 |        |             |               | <b>0.0000</b>  |
| $\beta$                     |        |             |               | 0.9237         |
| Probability                 |        |             |               | 0.0000         |
| 4. Model diagnostics        |        |             |               |                |
| Q-statistics (36)           | 39.979 | 38.639      | 35.871        | 36.606         |
| Probability                 | 0.222  | 0.268       | 0.381         | 0.349          |
| Autocorrelation Problem     | No     | No          | No            | No             |
| ARCH-LM (36)                | 58.219 | 20.863      | 5.7190        | 5.3717         |
| Probability                 | 0.011  | 0.979       | 1.000         | 1.000          |

|                               |     |    |    |     |
|-------------------------------|-----|----|----|-----|
| Heteroscedasticity problem    | Yes | No | No | No  |
| 5. Summary of model selection |     |    |    |     |
| Decision                      | No  | No | No | Yes |

The mean equation for this study uses ARMA (1,1) model. The ARMA model for EGARCH (1,1) reveals that the coefficient for the past value of lag one is statistically significant with a coefficient value of -0.7916. In addition, the coefficient for past shock is also statistically significant with a coefficient value of 0.7765.

Referring to EGARCH (1,1) variance model, the value  $\gamma$  is -0.0497. The term  $\gamma$  is functioned to measure the asymmetry effect regarding news on the volatility. The asymmetry effect is to measure whether positive and negative shocks have a different effect. A GARCH model allows for asymmetry if positive and negative shocks of the same (absolute) size have a different impact on the variance (or volatility). Table 3 shows the value  $\gamma$  is negative that indicates there is a leverage effect. The leverage effect is caused by the fact that negative returns have a greater influence on future volatility than positive returns.

In validating the robustness of the EGARCH (1,1) model, this study performed two numerical statistical tests namely Ljung-Box Q-statistics and ARCH-LM test. The Ljung-Box Q statistics test for serial correlation. This test is to evaluate whether the model exhibits independence of error term. The value of Q-statistics for this analysis is larger than 0.05 which indicates no autocorrelation problem for EGARCH (1,1).

Next, LM-test evaluated the heteroscedasticity problem for non-constant variance. Table 3 shows LM test is larger than 0.05 which defined the EGARCH (1,1) exhibits no heteroscedasticity problem.

**V. CONCLUSION**

The aim of this research project is to evaluate volatility modeling for cryptocurrency prices namely Bitcoin. The importance of analyzing the volatility is to assist investors in understanding the dynamic behavior of return rate for cryptocurrency prices. The main points for the conclusion of this study concluded as follows:

- (a) The selection of data is involving from July 2017 until July 2022. This data period is selected because during this time the COVID-19 pandemic spread worldwide which created an unstable economic

situation. There are 1827 daily observations involved in this analysis.

- (b) This study calculated the return rate for Bitcoin price. Then, this study analyzed the volatility of the return rate. The dynamic behavior of the Bitcoin return rate shows the volatility characteristics with clustering. Therefore, the ARCH effect exists in the data.
- (c) For descriptive statistics, the mean value for Bitcoin return is 0.123442 %. The maximum value for the Bitcoin return rate is 22.51190 % at the 144th daily observation. Meanwhile, the minimum value for Bitcoin return is -46.47302 % at the 970th daily observation.
- (d) Next, this study performed unit root to check for stationarity of Bitcoin return data. Three types of unit root tests namely ADF, PP, and KPSS. The data for Bitcoin return exhibit stationary at level. A stationary process has the property that the mean, variance, and autocorrelation structure do not change over time.
- (e) In this study, EGARCH (1,1) selected the most suitable model for analyzing volatility for Bitcoin return. The value for AIC is the lowest with a value of 5.5984 for EGARCH (1,1).
- (f) Referring to EGARCH (1,1) variance model, the value of  $\gamma$  is -0.0497. The term  $\gamma$  is functioned to measure the asymmetry effect regarding news on the volatility. The value of  $\gamma$  is negative that indicates there is a leverage effect. The leverage effect is caused by the fact that negative returns have a greater influence on future volatility than do positive returns.

**ACKNOWLEDGEMENTS**

This study was supported by a research grant from Universiti Utara Malaysia (UUM), S/O Code: 14249, Development and Ecosystem Research Grant Scheme (DeCOR). We thank you for the facilities provided by Universiti Malaysia Perlis (UniMAP) and Universiti Utara Malaysia (UUM).

**REFERENCES**

- [1] Abu Bakar, N. and Rosbi, S. (2022). Effect of Coronavirus Disease (COVID-19) to Airlines Industry. *IOSR Journal of Economics and Finance*, 13(2), 35-44.
- [2] Abu Bakar, N., Rosbi, S. and Uzaki, K. (2022). Impact of Coronavirus Disease (COVID-19) towards Hotel Tourism Industry. *International Journal of Advanced Engineering Research and Science*, 9(3), 43-50.
- [3] Abu Bakar, N. and Rosbi, S. (2021a). Effect of COVID-19 outbreak towards banking and finance industry.

- International Journal of Advanced Engineering, Management and Science*, 7(3), 1-5.
- [4] Abu Bakar, N. and Rosbi, S. (2021b). Impact of Coronavirus Disease (COVID-19) towards Economy and Vaccine Industry. *International Journal of Advanced Engineering Research and Science*, 8(2), 68-72.
- [5] Abu Bakar, N., Rosbi, S. and Uzaki, K. (2020). Weighted Moving Average Method for Forecasting of Cryptocurrency Price: A Data Analytical Study on XRP Ripple Cryptocurrency. *International Journal of Advances in Scientific Research and Engineering*, 6 (1), 127-133.
- [6] Abu Bakar, N. and Rosbi, S. (2020a). Effectiveness of lockdown policy to control spreading of Coronavirus disease 2019 (COVID-19). *IOSR Journal of Business and Management*, 22(8), 34-41.
- [7] Abu Bakar, N. and Rosbi, S. (2020b). Impact of Coronavirus Disease 2019 (COVID-19) to Equity Market and Currency Exchange Rate. *IOSR Journal of Economics and Finance*, 11 (2), 17-26.
- [8] Abu Bakar, N., Rosbi, S. and Uzaki, K. (2019a). Forecasting cryptocurrency price movement using moving average method: a case study of bitcoin cash. *International Journal of Advanced Research*, 7 (12), 609-614.
- [9] Abu Bakar, N., Rosbi, S. and Uzaki, K. (2019b). Forecasting cryptocurrency price movement using moving average method: a case study of bitcoin cash. *International Journal of Advanced Research*, 7 (12), 609-614.
- [10] Abu Bakar, N., Rosbi, S. and Uzaki, K. (2017). Cryptocurrency Framework Diagnostics from Islamic Finance Perspective: A New Insight of Bitcoin System Transaction. *International Journal of Management Science and Business Administration*, 4 (1), 19-28.
- [11] Benlagha, N. and Hemrit, W. (2022). Asymmetric determinants of Bitcoin's wild price movements. *Managerial Finance*, 1-21.
- [12] Diniz, R., Prince, D.d. and Maciel, L. (2022). Bubble detection in Bitcoin and Ethereum and its relationship with volatility regimes. *Journal of Economic Studies*, 1-19.
- [13] Dubey, P. (2022). Short-run and long-run determinants of bitcoin returns: transnational evidence. *Review of Behavioral Finance*, 14(4), 533-544.
- [14] Grira, J., Guizani, S. and Kahloul, I. (2022). Bitcoin's hedging attributes against equity market volatility: empirical evidence during the COVID-19 pandemic. *Journal of Risk Finance*, 1-14.
- [15] Hung, N.T. (2022). Asymmetric connectedness among S&P 500, crude oil, gold and Bitcoin. *Managerial Finance*, 48(4), 587-610.
- [16] Kakinuma, Y. (2022). Nexus between Southeast Asian stock markets, bitcoin and gold: spillover effect before and during the COVID-19 pandemic. *Journal of Asia Business Studies*, 16(4), 693-711.
- [17] Kamran, M., Butt, P., Abdel-Razzaq, A. and Djajadikerta, H.G. (2022). Is Bitcoin a safe haven? Application of FinTech to safeguard Australian stock markets. *Studies in Economics and Finance*, 39(3), 386-402.
- [18] Kumar, S., Kumar, A. and Singh, G. (2022). Gold, crude oil, bitcoin and Indian stock market: recent confirmation from nonlinear ARDL analysis. *Journal of Economic Studies*, 1-18.
- [19] Lee, Y. and Rhee, J.H. (2022). A VECM analysis of Bitcoin price using time-varying cointegration approach. *Journal of Derivatives and Quantitative Studies*, 30(3), 197-218.

# Gamification as an Individual Skills Development Strategy: A Systematic Review

## Gamificação Como Estratégia de Desenvolvimento de Competências Individuais: Uma Revisão Sistemática

Leonardo Vinicius Cunha Segala<sup>2</sup>, Caroline de Lima Ericeira Façanha<sup>1</sup>

<sup>1</sup>Acadêmico - 8º período – Curso de Administração – UDC – União Dinâmica das Cataratas

<sup>2</sup>Orientadora: Professora Mestre. Curso de Administração – UDC – União Dinâmica das cataratas

Received: 29 Aug 2022,

Received in revised form: 20 Sep 2022,

Accepted: 26 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Gamification, strategy and individual skills.*

**Palavras-chave**— *Gamificação, estratégia e competências individuais.*

**Abstract** — *The development of individual skills in line with organizational strategies has been the subject of reflection and constant improvement. Considering the relevance of this theme, the present research sought to analyze and explore existing research on the application of gamification as a strategy for the development of individual competences. Therefore, it was decided to develop a systemic review of publications of a quantitative and qualitative nature, based on searches through the Portal of Periodicals of the Coordination for the Improvement of Higher Education Personnel (Capes) and the Web Of Science database. between the years 2002 (first appearance of the term) and 2020 (cutting year of this study). Taking information technologies into account as essential in corporate management models, the research results demonstrate that, from the application of gamified environments, it is possible to promote learning, engagement and the development of individual competences, capable of giving solidity to the organization.*

**Resumo** — *O desenvolvimento de competências individuais alinhado às estratégias organizacionais, tem sido objeto de reflexão e constante aprimoramento. Considerando à relevância desta temática, a presente pesquisa buscou analisar e explorar pesquisas existentes sobre a aplicação da gamificação como estratégia de desenvolvimento de competências individuais. Para tanto, optou-se pelo desenvolvimento de uma revisão sistêmica das publicações de cunho quantitativo e qualitativo a partir de buscas por meio do Portal de Periódicos da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Capes) e da base de dados da Web Of Science entre os anos de 2002 (primeira aparição do termo) e 2020 (ano de recorte deste estudo). Levando em conta as tecnologias da informação como essenciais em modelos de gestão corporativa, os resultados da pesquisa demonstram que, a partir da aplicação de ambientes gamificados, é possível promover a aprendizagem, o engajamento e o desenvolvimento de competências individuais, capazes de conferir solidez à organização.*

## I. INTRODUÇÃO

A primeira década deste novo século trouxe novos e grandes desafios para as organizações. Além das preocupações ambientais, aliada ao surgimento e estabelecimento de novas tecnologias, os mercados deixaram de ser locais para se tornarem globais e os consumidores estão cada vez mais exigentes em relação a atributos ligados à qualidade e ao bom atendimento. Vivencia-se, portanto, uma realidade transformadora no modo de operar das organizações.

A necessidade de inovação tem aumentado o uso das vias tecnológicas como recursos de gestão e de interação entre os agentes que compõem às organizações. Bassellier e Benbasat (2004) ao abordar às competências dos profissionais de Tecnologia da Informação afirmam que a utilização de tecnologias tem sido principalmente na gestão do conhecimento organizacional, no gerenciamento e desenvolvimento do capital humano e nos processos administrativos ou estratégicos que se alinham à missão, visão e valores da organização a fim de promover vantagem competitiva.

A gamificação é uma tecnologia derivada diretamente da popularização e popularidade dos games, e de suas capacidades intrínsecas de incentivar à ação, solucionar problemas e potencializar aprendizagens nas mais diferentes áreas do conhecimento. Esse fenômeno, diferentemente dos jogos criados para fins de diversão e lazer, pode ser utilizado para motivar o engajamento das pessoas em situações não relacionadas a jogos, para melhorar a experiência de envolvimento e para o desenvolvimento de competências individuais (RODRIGUES; OLIVEIRA; COSTA, 2016; SEIXAS; GOMES; FILHO, 2016).

Competência pode ser descrita como a capacidade de executar ações baseadas na integração de conhecimentos, habilidades e atitudes em situações que permitem o indivíduo a atingir seus objetivos pessoais e profissionais (LIU et al., 2019). Essa integração orienta os indivíduos a buscar desafios pessoais, possibilita a persistência pessoal e desempenha um papel importante na construção de um sistema de valores pessoais e profissionais. Para satisfazer a necessidade de competência e obter confiança, as pessoas buscam desafios que correspondam ou melhorem suas próprias habilidades (RYAN; DECI, 2002).

Diante dos argumentos apresentados, presume-se, que o desenvolvimento das competências individuais, em todos os níveis, torna-se essencial para às empresas. E utilizar os elementos dos games como estratégia contribuem para o engajamento dos colaboradores e para o alcance dos objetivos estratégicos.

A presente pesquisa buscou explorar a gamificação e o conceito de competências, estabelecendo uma análise embasada em estudos que tratam do emprego da gamificação no desenvolvimento de competências individuais. Diante disso, a obtenção de informações e variáveis sobre a temática central foi desenvolvida meio de análise sistemática, ou seja, uma revisão da literatura a partir da busca planejada com o intuito de responder ao objetivo proposto e que utiliza métodos explícitos e sistemáticos para identificar, selecionar, coletar e avaliar criticamente os estudos incluídos na revisão (CASTRO, 2001).

## II. REFERENCIAL TEÓRICO

### 2.1 Gamificação

Gamificação é uma expressão derivada, mas sem tradução equivalente do termo *gamification* que referencia o uso de jogos em atividades de entretenimento puro (VIANNA et al., 2013). Mais especificamente, a gamificação supõe a utilização de artefatos caracteristicamente encontrados nos games, como narrativa, competição, cooperação, conflito, sistema de *feedback*, sistema de recompensas, objetivos e regras claras, níveis, tentativa e erro, diversão, interação, interatividade, entre outros, em outras atividades que não são diretamente associadas aos jogos, com a intenção de tentar obter o mesmo nível de envolvimento e motivação que normalmente são encontrados nos jogadores quando estão em interação com bons games (DETERDING et al., 2011; ZICHERMANN; CUNNINGHAM, 2011).

Diferentemente dos jogos criados para fins de diversão e lazer, a gamificação pode ser utilizada para motivar o envolvimento das pessoas em situações não relacionadas a jogos e para melhorar toda a experiência de envolvimento, inclusive no ambiente profissional. Embora, o potencial desta ferramenta de interação tenha sido percebido há alguns anos, a técnica de gamificação começou a ser empregada recentemente com esquemas de *marketing*, onde ao comprar o cliente acumulava pontos para trocar por recompensas. O termo em si foi criado por Nick Pelling, programador e *game designer* britânico, em 2002, foi ao público em 2003. Mas, somente no ano de 2010 começou a ser popularizado e estudado por diversos autores internacionais (RODRIGUES; OLIVEIRA; COSTA, 2016; SEIXAS; GOMES; FILHO, 2016; VIANNA et al., 2013; ZICHERMANN; CUNNINGHAM, 2011).

O propósito da gamificação é promover a visualização um determinado problema ou cenário e ponderar sobre possíveis soluções a partir do ponto de vista de um *game designer* (profissional responsável pelo



desenvolvimento de *games* eletrônicos), já que esse profissional comumente tem uma capacidade ímpar em produzir experiências que concentram a energia e o foco de muitos indivíduos para resolver problemas em mundos virtuais (MCGONIGAL, 2000).

Sing (2012) descreve que o uso da gamificação como estratégia ajuda a converter a negatividade para a positividade. Isso porque esta tecnologia não envolve criar um jogo que aborde o problema, replicando a situação dentro de um mundo virtual, mas sim em utilizar os mesmos elementos e pensamentos empregados para resolver aqueles problemas nos mundos virtuais em situações do mundo real.

No que se refere aos elementos dos jogos, Costa e Marchiori (2015) ao citar Werbach e Hunter (2012) apresentam: dinâmicas, mecânicas e componentes como categorias válidas para desenvolvimento e estudos na temática. Segundo Kuutti (2013) esse trinômio se organiza em ordem decrescente de abstração, de modo que cada mecânica se liga a uma ou mais dinâmicas, e cada componente a uma ou mais mecânicas ou dinâmicas. Neste contexto, é necessário considerar o segmento ou área em que a gamificação será aplicada, isto é, posta em ação. Para o Instituto Brasileiro de Geografia e Estatística (IBGE), um segmento pode ser compreendido como uma categoria de unidade de produção separada das demais de acordo com a atividade que desenvolve.

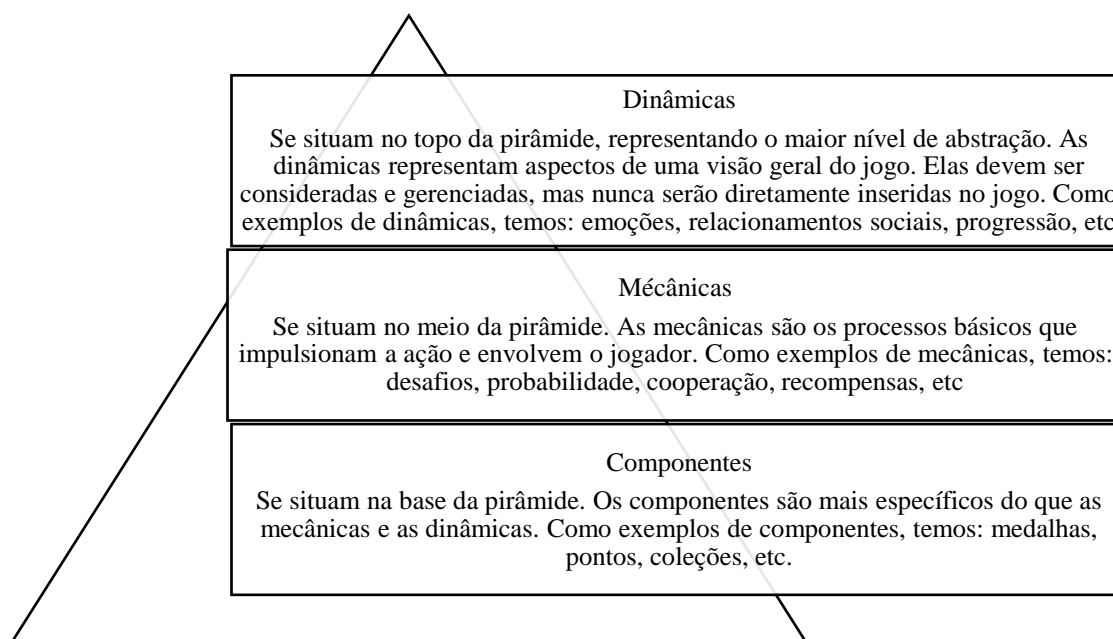


Fig.1- Elementos da gamificação

Fonte: Adaptado de Werbach e Hunter (2012).

As dinâmicas são os tipos de comportamentos que se desenrolam à medida que os participantes experimentam o jogo, que podem incluir tanto os desejados pela empresa (por exemplo, cooperação através da troca de informações) quanto respostas não intencionais (por exemplo, comportamentos subversivos destinados a "interromper" o jogo (ELVERDAM; AARSETH, 2007).

As mecânicas viabilizam o funcionamento dos jogos e orientam os jogadores. Incluí os sistemas de pontuação, manutenção de pontuação, níveis, tabelas de classificação para indicar o progresso de um participante individual em tarefas específicas e relatar seu status a outros participantes com a intenção de criar um "ciclo de gamificação" que intima um padrão de comportamento

iterativo (LIU; ALEXANDROVA; NAKAJIMA, 2011). Dependendo da mecânica utilizada, os jogos podem ter uma variedade ampla de formatos e estilos (ZICHERMANN; CUNNINGHAM, 2011).

Muitos são os mecanismos que podem estar incluídos em uma dinâmica como, por exemplo, *feedback* e recompensas – estes podem trazer uma sensação de o jogador está progredindo no jogo. Assim sendo, cada mecânica é uma maneira de alcançar uma ou mais das dinâmicas apresentadas. Um evento aleatório, tal como uma premiação que aparece sem aviso, pode tanto estimular o senso de diversão e curiosidade dos participantes como ser um meio de obter novos

participantes ou manter os jogadores mais experientes envolvidos (WERBACH; HUNTER, 2012).

Os componentes são aplicações específicas visualizadas e usadas na interface do game. Este é o nível mais concreto dos elementos de jogos e, assim como uma mecânica se liga com uma ou mais dinâmicas, vários componentes podem fazer parte de uma mecânica (COSTA; MARCHIORI, 2015). Werbach e Hunter (2012), afirmam que os componentes podem assumir várias combinações, e essa escolha deve ser feita com base no que atende mais adequadamente as demandas de um determinado contexto. Ao combinar as dinâmicas, mecânicas e componentes deve se considerar a efetividade das ações para o alcance de um determinado objetivo, essa é a tarefa central de um projeto de gamificação.

Com base nessas características é possível aferir que a gamificação possibilita a inovação e a quebra de paradigmas em uma organização, pois por meio desta estratégia tudo pode ser modificado, desde habilidades psicomotoras até o desenvolvimento de competências para solução dos problemas. Segundo Alves (2014) para cada habilidade a ser desenvolvida há uma técnica ou elemento da gamificação que pode ser aplicado para o alcance do objetivo pessoal ou profissional.

### **2.3 Conceito e importância das competências individuais para as empresas**

Nos últimos anos, o conceito de competências foi sendo aperfeiçoado na medida em que o contexto sócio/histórico e econômico foi se alterando e suscitando maior complexidade dos procedimentos no trabalho. Diante desta evolução, inúmeras definições de competência, as quais em comum consideram a utilização de um conjunto de conhecimentos, habilidades e atitudes, foram surgindo (CHOUHAN; SRIVASTAVA, 2014; FERNANDEZ; ODELIUS, 2013).

Pavlov e El Sawy (2006) descrevem competência como sendo os saberes que ajudam às empresas a realizar as atividades operacionais diárias. Nesta abordagem os autores apresentam o conceito de competências funcionais, dividindo-a em competência para o cliente, técnica e gerencial. A competência para o cliente envolve entender suas preferências, avaliar produtos concorrentes e formular incentivos ao consumidor. Requer proficiência no *design* de vendas, distribuição, preços e publicidade de produtos. A competência técnica envolve avaliar a viabilidade técnica de projetos de novos produtos, testar protótipos e avaliar especificações técnicas. A competência gerencial envolve monitorar o progresso, projetar incentivos aos trabalhadores e gerenciar conflitos. Todas estas dimensões apresentadas são importantes e requerem a integração de conhecimentos, habilidades e atitudes, na gestão dos

recursos organizacionais para obtenção da vantagem competitiva (PAVLOU; EL SAWY, 2006).

Tello-Gamarra e Verschore (2015) descrevem que às competências são indispensáveis para o crescimento e à permanência da organização no mercado. Nesta abordagem, os autores argumentam que comumente o conceito de competência é estudado considerando duas perspectivas: a macro e a micro. A visão macro explora como às competências contribuem para que a empresa atinja maior competitividade. A micro está relacionada com a gestão do capital humano, e está focada no gerenciamento da competência individual, que envolve a busca pelos perfis profissionais que possuem conhecimentos, habilidades e atitudes úteis para organização.

Li et al. (2011), ao estudarem como a estrutura do conhecimento pode melhorar o resultado da equipe, definiram competência como um sistema de habilidades cognitivas e comportamentais usadas para executar tarefas. Neste enfoque, apresentam o conceito em dois níveis diferentes: individual e grupal. A competência no nível individual remete o fator crítico necessário para eficácia do trabalho. Já, a competência grupal está relacionada com o conjunto de saberes individuais que auxiliam a equipe a atingir a meta, em outras palavras, a competência grupal é vista como o processo de solução de problemas em que todos os membros devem compartilhar informações e colaborar para que a organização alcance seus objetivos.

Para Freitas, Montezano e Odelius (2019) competências é a demonstração de um conjunto de conhecimentos, habilidades e atitudes convertido em comportamentos observáveis ou potenciais que geram valor e resultados ao indivíduo, à equipe e à organização.

Aguilar e Souza (2019) abordam o conceito de competências como a capacidade de articular conhecimentos e habilidades para o desenvolvimento de ações positivas no ambiente de trabalho. Para explicar o conceito, fazem um desdobramento em três dimensões. A primeira é denominada de competências técnicas, as quais se referem às capacidades do indivíduo em aplicar os recursos organizacionais de forma eficiente e eficaz, com vistas a garantir o domínio e a aplicação de métodos gerenciais. A segunda refere-se à competência comunicacional que visa à busca recorrente do aprimoramento da comunicação com clientes internos e externos por meio da aplicação dos princípios e técnicas da boa comunicação oral e escrita, garantindo a qualidade da informação e promovendo a boa imagem da organização. A terceira e última definição é a competência social, que tem relação com a capacidade de promover a convivência harmoniosa, cultivando um clima de integração e de

respeito às individualidades, no ambiente organizacional (AGUILAR; DE SOUZA, 2019).

Em uma perspectiva individual, Liu et al. (2019) definem competência como o sentimento da pessoa em apresentar sua capacidade de atingir objetivos pessoais ao integrar habilidades e conhecimentos em situações especiais. Acrescentam que o conceito de competência é saber fazer, e não requer apenas conhecimento, mas também à capacidade de saber ser. Covington (2000) argumenta que a competência orienta os indivíduos a buscar desafios pessoais, possibilita a persistência pessoal e desempenha um papel importante na construção de um sistema de valores pessoais e profissionais.

Contudo, para desenvolvê-las, a organização precisa ter uma capacidade potencialmente estratégica que forneça condições e uma plataforma para que o indivíduo se desenvolva.

#### 2.4 Gamificação no desenvolvimento de competências

Albir (2007) apresenta que a competência é desenvolvida através da integração de múltiplas habilidades e conhecimentos. Independentemente de iniciativa ou forma, Jönsson e Schölin (2016) argumentam que o desenvolvimento de competências sempre tem como objetivo principal criar algum tipo de mudança positiva para o indivíduo ou a organização. Com base nessa afirmação, definem o desenvolvimento como um fenômeno relacionado a valores, um termo que implica um propósito explícito ou implícito. Portanto, o desenvolvimento de competências sempre tem o objetivo explícito de criar efeitos em diferentes níveis; indivíduo, grupo / equipe ou organização.

Para Osagie et al. (2018) existem diferentes atividades para desenvolver competências, dentre elas, a execução de tarefas atribuídas no contexto do trabalho e nos processos de experimentação, socialização e observação de colegas experientes.

Aprendizados previamente combinados como cursos, treinamentos e a própria educação formal também promovem o desenvolvimento de competências. No entanto, essas atividades são focadas nas necessidades da maioria da força de trabalho e comumente são orientadas para o aprimoramento de competências simples. A interação social que ocorre sem que seja previamente combinado (aprendizado informal), também contribui para que as competências sejam desenvolvidas (OSAGIE et al., 2018).

Outra forma de elevar o desenvolvimento de competências individuais é por meio da reflexão crítica. Esta modalidade se concentra na obtenção de *insights*, refletindo sobre o conhecimento individual e dos outros e

sobre o próprio comportamento, contexto, valores e experiências passadas. Esta reflexão faz com que o indivíduo aprenda novas maneiras de agir no ambiente profissional e assim melhore suas competências (OSAGIE et al., 2018; TYNJÄLÄ, 2008)

Johnson e Sori (2003) desenvolveram um estudo que investigou os fatores, dentro de uma empresa, que incentivam às atividades de aprendizado organizacional. Nesta abordagem, foi identificado que quando os fatores apropriados estão presentes, é mais provável que a organização se envolva em atividades de aprendizagem essenciais ao desenvolvimento de competências. Segundo os autores, as condições para o desenvolvimento de competências são encontradas na cultura e no clima da empresa, na forma e na intenção do aprendizado, na disponibilidade para obtenção dos conhecimentos e transparência, elementos que podem ser facilmente adaptados e gerenciados em ambientes gamificados.

A gamificação difere de outras estratégias de desenvolvimento, porque além de possibilitar uma adaptação das formas de aprendizagem descritas por Osagie et al. (2018), ela introduz o componente da competição como um motivador de desafio para incentivar respostas comportamentais e emocionais. O engajamento iterativo começa com um desafio explícito. Sempre que o participante atinge uma pequena meta relacionada a esse desafio, ele ativa o mecanismo recompensa como pontos, moeda virtual ou similar (LIU; ALEXANDROVA; NAKAJIMA, 2011).

Além disso, a gamificação promove aos participantes a sensação de prazer resultante do reconhecimento dos objetivos alcançados. Verleye, Gemmel e Rangarajan (2014) argumentam que embora, isso seja destaque da natureza intrínseca da motivação, o engajamento pode ser incentivado por fatores extrínsecos ou puramente extrínsecos internalizados durante o jogo, com benefícios cognitivos, sociais, pessoais, pragmáticos e econômicos para os jogadores. No ambiente gamificado, fatores como interação social, auto expressão, reconhecimento de capacidade técnica, engajamento emocional, prestígio social no game motivam o engajamento no ambiente organizacional (COHEN, 2011; HARWOOD; GARRY, 2015).

Quando gamificação é aplicada como estratégia de aprendizagem, presume-se que a organização passa por um processo de inovação e quebra de paradigmas. Isto, por que, seus elementos promovem de forma integrativa e descontraída o desenvolvimento do pessoal. Contudo, Huotari e Hamari (2012) alertam para planejamento da aplicação, uma vez que a mera adição dos elementos dos

jogos não garante o alcance dos objetivos de maneira bem-sucedida. Para que a aplicação da gamificação assuma seu viés estratégico é necessário planejar e desenvolver seu design considerando dentre outras variáveis o contexto e os objetivos organizacionais (ZICHERMANN; CUNNINGHAM, 2011).

Papert (2008) descreve que este potencial que os jogos apresentam para o desenvolvimento individual já havia sido percebido há mais de três décadas. No entanto, na ocasião, a indústria dos games ainda estava se consolidando. Atualmente, pode-se afirmar que influência dessa forma de entretenimento é global e atinge praticamente todas as áreas.

Na gestão, a gamificação se mostrou útil para melhorar o desempenho das tarefas dos funcionários e o comprometimento das metas (LANDERS; BAUER; CALLAN, 2017). No *marketing*, promoveu efeitos positivos no comportamento dos clientes como engajamento dos clientes (como trocas sociais), emoções (como diversão e satisfação) e resultados do engajamento com o cliente (como lealdade e relacionamento) (HARWOOD; GARRY, 2015).

Um trabalho publicado por Vianna et al. (2013) apresentou o processo coordenado de implantação do sistema SAP (Sistemas, Aplicações e Produtos em Processamento de dados) em uma organização, empregando os elementos da gamificação como forma de engajar e desenvolver os empregados durante a implementação. Para tanto, foi desenvolvida, com base nos atributos da gamificação, a 'Maratona SAP', o objetivo era cada membro da empresa cumprir suas tarefas e compartilhar o que aprendeu, como num efeito multiplicador. As missões eram normalmente semanais e realizadas por trios. A cada atividade cumprida o grupo ganhava uma pontuação.

Neste game, havia dois objetivos, aprender e disseminar informações sobre o sistema SAP. Para aprendizagem do sistema foram indicadas atividades para as quais os empregados aprendiam a partir de atividades diárias e tinham que compartilhar seus conhecimentos. Quando concluído, recebiam uma pontuação. Para a disseminação do novo sistema, eram estabelecidas tarefas

que traziam colaboração e recreação e, ao final, somava-se a pontuação obtida pela conclusão dos dois temas. O objetivo do SAP era promover o conhecimento, a divulgação do projeto e transformar pessoas em agentes de mudança a partir do desenvolvimento pessoal e grupal (VIANNA et al., 2013).

### III. MÉTODOS

Foi realizada uma revisão sistêmica de artigos de cunho quantitativo e qualitativo a partir de buscas por meio do Portal de Periódicos da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Capes) e da base de dados da *Web Of Science* entre os anos de 2002 (primeira aparição do termo) e 2020 (ano de desenvolvimento deste estudo). Para iniciá-la, foram definidos antecipadamente os filtros de pesquisa, contemplando as categorias, *business, management*.

A primeira investigação envolveu o conceito de gamificação utilizando como palavra-chave (*gamification*) como título e na sequência como tópico. Após o emparelhamento, o resultado apresentou 94 trabalhos. O critério utilizado para seleção destes artigos foi o "mais citado", tendo Hamari et. al (2014), Seaborn e Fels (2015) como mais citados. Foram 197 e 193 citações respectivamente.

Na sequência inseriu-se no filtro de pesquisa o título desenvolvimento de competências (*development of competenc\**) considerando os mesmos parâmetros anteriores. Os resultados apresentaram 45 artigos, tendo como mais citados os estudos de Andersson, Forsgren e Holm (2002) com 573 citações e Pavlov e El Saway (2006) com 513 citações.

Por fim, foram inseridos nos filtros de pesquisa os dois conceitos centrais desta pesquisa (*gamification*) como título e (*development of competenc\**) como tópico, repetindo-se ação e invertendo as palavras chaves nos campos de busca - (*development of competenc\**) como título e (*gamification*) como tópico, nesta etapa apenas 1 artigo foi encontrado. O gráfico 1 apresenta a evolução das publicações dos temas elegidos e da relação entre eles.

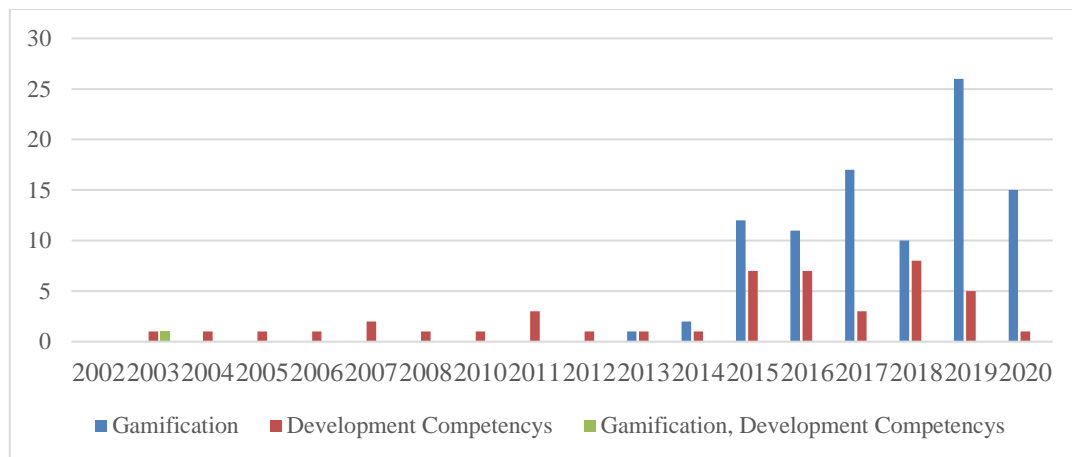


Gráfico 1- Evolução das publicações por ano.

Fonte: Adaptado de relatórios de citações da *Web of Science* (2020).

Conforme apresenta o gráfico 1, ao comparar o número de publicações relativos aos temas elegidos para esta revisão sistemática, constata-se que a produção científica sobre o desenvolvimento de competências superou às pesquisas sobre gamificação entre os anos de 2002 e 2013 e tem se mantido estável, com pelo menos uma publicação por ano, até 2014.

No entanto, às pesquisas sobre gamificação apresentou maior número de publicações no recorte apresentado, e embora ambos os temas tenham ganhado força entre os anos 2013 e 2020, a produção científica sobre gamificação foi cinco vezes maior no ano de 2019.

Quando analisada as duas temáticas em conjunto, apenas uma publicação no ano de 2003 foi encontrada, justificando a necessidade de estudos envolvendo os dois construtos. Além disso, a relevância desta pesquisa pode ser estabelecida pelo fato de que a utilização da gamificação como estratégia de aprendizagem, pode contribuir para criação de novas metodologias aplicadas ao desenvolvimento de competências.

A consulta foi realizada no mês de maio de 2020, a partir de uma leitura dos resumos capturados. Após um primeiro levantamento, os artigos pré-selecionados e aqueles sobre os quais pairassem dúvidas quanto à inclusão foram submetidos à leitura na íntegra, como nova rodada de decisões quanto à sua inclusão no estudo.

#### IV. CONCLUSÕES

Ao longo da presente pesquisa, buscou-se compreender as contribuições da gamificação, ao ser empregada como estratégia, no desenvolvimento de competências individuais, explorando abordagens relevantes que versam sobre essas temáticas.

Selecionaram-se estudos desenvolvidos entre os anos 2002 e 2020. Por meio desta revisão foi possível compreender que é possível sim o desenvolvimento de competências individuais utilizando os elementos da gamificação. No entanto, o alinhamento de sua aplicação à estratégia da organização requer um estudo mais aprofundado do que se tem explorado até o momento.

Como principais resultados, identificou-se que a gamificação atua de forma colaborativa no fortalecimento das relações interpessoais que por sua vez produz o engajamento. O engajamento cria um ambiente de colaboração e desenvolvimento de competências. Portanto, conclui-se que qualquer tipo de competência pode ser desenvolvida com o uso da gamificação, desde que sua formatação seja planejada e estabelecida em conformidade com os resultados esperados. Conclui-se também a gamificação, devido à sua característica dinâmica de interação, não contribui para o engajamento, ela o cria. Inclusive, pelos os resultados apresentados nesta revisão, é possível presumir que a gamificação é uma das melhores ferramentas para se criar o engajamento.

O objetivo da pesquisa foi alcançado, no entanto, se faz necessário uma pesquisa de campo para melhor visualizar como podem ser gerenciadas as variáveis relacionadas ao uso de tecnologia - nos níveis estratégico, tático e operacional -, a conectividade local, a legislação trabalhista e a responsabilidade de condução do projeto. Na literatura não foi possível encontrar estudos que abordassem de forma clara estas questões. A maior parte das pesquisas remetem abordagens e aplicações e relatos nas áreas de tecnologia da informação e educacional. Diante disso, recomenda-se estudos com direcionamentos voltados ao desenvolvimento do capital humano nas organizações e a utilização da gamificação como via tecnológica de gestão, alinhada a estratégia organizacional.

## REFERÊNCIAS

- [1] AGUILAR, L. DE; DE SOUZA, R. B. Uma breve análise do potencial da formação continuada como instrumento para o desenvolvimento das competências e habilidades requeridas pelo mercado de trabalho. **Revista de Gestão e Secretariado**, v. 10, n. 1, p. 1–25, 2019.
- [2] ALBIR, A. H. Competence-based Curriculum Design for Training Translators. **The Interpreter and Translator Trainer**, v. 1, n. 2, p. 163–195, set. 2007.
- [3] ALVES F. B. **Gamification - como criar experiências de aprendizagem engajadoras um guia completo: do conceito à prática**. São Paulo: DVS Editora, 2014.
- [4] ANDERSSON, U.; FORSGREN, M.; HOLM, U. The strategic impact of external networks: Subsidiary performance and competence development in the multinational corporation. **Strategic Management Journal**, v. 23, n. 11, p. 979–996, 2002.
- [5] BASSELLIER; BENBASAT. Business competence of information technology professionals: conceptual development and influence on IT-business partnerships. **MIS Quarterly**, v. 28, n. 4, p. 673, 2004.
- [6] CASTRO, A. A. Revisão sistemática e meta-análise. **Metodologia.org**, 2001.
- [7] CHOUHAN, V. S.; SRIVASTAVA, S. Understanding Competencies and Competency Modeling — A Literature Survey. **IOSR Journal of Business and Management**, v. 16, n. 1, p. 14–22, 2014.
- [8] COHEN, A. M. The gamification of Education. **Futurist**, v. 45, n. 5, p. 16–17, 2011.
- [9] COSTA, A. C. S.; MARCHIORI, P. Z. Gamificação, elementos de jogos e estratégia: uma matriz de referência. **InCID: Revista de Ciência da Informação e Documentação**, v. 6, n. 2, p. 44, 2015.
- [10] COVINGTON, M. V. Goal theory, motivation, and school achievement: An integrative review. **Annual Review of Psychology**, v. 51, n. 1, p. 171–200, fev. 2000.
- [11] DETERDING, S. et al. **From game design elements to gamefulness: defining gamification**. Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments. **Anais...2011**
- [12] ELVERDAM, C.; AARSETH, E. Game classification and game design: Construction through critical analysis. **Games and Culture**, 2007.
- [13] FERNANDEZ, F. F.; ODELIUS, C. C. Validação de uma escala de domínio de competências em grupos de pesquisa. **Revista de Administração FACES Journal**, v. 12, n. 2, p. 81–97, 2013.
- [14] FREITAS, P. F. P. DE; MONTEZANO, L.; ODELIUS, C. C. A influência de Atividades Extracurriculares no Desenvolvimento de Competências Gerenciais em Grupos de Pesquisa. **Administração: Ensino e Pesquisa**, v. 20, n. 1, p. 12–49, 2019.
- [15] HARWOOD, T.; GARRY, T. An investigation into gamification as a customer engagement experience environment. **Journal of Services Marketing**, v. 29, n. 6/7, p. 533–546, 14 set. 2015.
- [16] HUOTARI, K.; HAMARI, J. **Defining gamification - A service marketing perspective**. Proceedings of the 16th International Academic MindTrek Conference 2012: “Envisioning Future Media Environments”, MindTrek 2012. **Anais...2012**
- [17] JOHNSON, J. L.; SOHI, R. S. The development of interfirm partnering competence. **Journal of Business Research**, v. 56, n. 9, p. 757–766, set. 2003.
- [18] JÖNSSON, S.; SCHÖLIN, T. Process of change – competence development as a restructuring strategy. **Journal of Management Development**, v. 35, n. 1, p. 2–16, 2016.
- [19] KUUTTI, J. **Designing gamification**. [s.l.] (Master in Business Administration) – University of Oulo, 2013.
- [20] LANDERS, R. N.; BAUER, K. N.; CALLAN, R. C. Gamification of task performance with leaderboards: A goal setting experiment. **Computers in Human Behavior**, 2017.
- [21] LI, Y. et al. The role of team problem solving competency in information system development projects. **International Journal of Project Management**, v. 29, n. 7, p. 911–922, out. 2011.
- [22] LIU, C. R. et al. Festival gamification: Conceptualization and scale development. **Tourism Management**, v. 74, p. 370–381, 2019.
- [23] LIU, Y.; ALEXANDROVA, T.; NAKAJIMA, T. Gamifying smart environment. **MM’11 - Proceedings of the 2011 ACM Multimedia Conference and Co-Located Workshops - Ubi-MUI 2011 Workshop, Ubi-MUI’11**, p. 7–12, 2011.
- [24] MCGONIGAL, J. Autobiographical Time. **Narrative Inquiry**, v. 10, n. 1, p. 51–73, 17 out. 2000.
- [25] No Title. [s.d.].
- [26] OSAGIE, E. R. et al. Unraveling the competence development of corporate social responsibility leaders: The importance of peer learning, learning goal orientation, and learning climate. **Journal of Business Ethics**, v. 151, n. 4, p. 891–906, 14 set. 2018.
- [27] PAPERT, S. **A Máquina das crianças: pepensando a escola na era da informática - trad. sandra costa**. Porto Alegre: Artmed, 2008.
- [28] PAVLOU, P. A.; EL SAWY, O. A. From IT Leveraging Competence to Competitive Advantage in Turbulent Environments: The Case of New Product Development. **Information Systems Research**, v. 17, n. 3, p. 198–227, set. 2006.
- [29] RODRIGUES, L. F.; OLIVEIRA, A.; COSTA, C. J. Does ease-of-use contributes to the perception of enjoyment? A case of gamification in e-banking. **Computers in Human Behavior**, v. 63, p. 392–407, 2016.
- [30] RYAN, R. M.; DECI, E. L. Overview of self-determination theory: An organismic-dialectical perspective. In: **Handbook of self-determination research**. [s.l.: s.n.].
- [31] SEIXAS, L. D. R.; GOMES, A. S.; FILHO, I. J. D. M. **Effectiveness of gamification in the engagement of students** **Computers in Human Behavior**, 2016.
- [32] SINGH, S. P. Gamification: a strategic tool for organizational effectiveness. **International Journal of Management Education**, v. 1, p. 108–114, 2012.

- [33] TELLO-GAMARRA, L.; VERSCHOORE, J. R. O desenvolvimento das competências coletivas no terceiro setor. **Suma de Negocios**, v. 6, n. 14, p. 194–203, jul. 2015.
- [34] TYNJÄLÄ, P. Perspectives into learning at the workplace. **Educational Research Review**, v. 3, n. 2, p. 130–154, jan. 2008.
- [35] VERLEYE, K.; GEMMEL, P.; RANGARAJAN, D. Managing Engagement Behaviors in a Network of Customers and Stakeholders. **Journal of Service Research**, v. 17, n. 1, p. 68–84, 2 fev. 2014.
- [36] VIANNA, Y. et al. **Gamification, INC: Como reinventar empresas a partir de games: MJV Press**, 2013.
- [37] WERBACH, K. .; HUNTER, D. **For the win: how game thinking can revolutionize your business** Philadelphia Wharton Digital Press, , 2012.
- [38] ZICHERMANN, G.; CUNNINGHAM, C. **Gamification by design Implementing game mechanics in web and mobile apps**. Canada O'Reilly, , 2011.

# ESG indicator metrics used by organisations to assess the degree of sustainability in companies

João Alvarez Peixoto<sup>1</sup>, Andréia Bem Machado<sup>2</sup>, Marc François Richter<sup>3</sup>

<sup>1</sup>Postgraduate Program in Science, Technology, Engineering and Mathematics (PPGSTEM), State University of Rio Grande do Sul, Brazil

<sup>2</sup>Department of Engineering and Knowledge Management, Federal University of Santa Catarina, Brazil

<sup>3</sup>Postgraduate Program in Environment and Sustainability (PPGAS), State University of Rio Grande do Sul, Brazil

Received: 27 Aug 2022,

Received in revised form: 19 Sep 2022,

Accepted: 25 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**—*Environmental, governance, market, social, sustainability.*

**Abstract**— *Sustainability is increasingly becoming a necessity for corporations due to changing perspectives around the world. In this scenario the following problematic issue has arisen: Which ESG indicators are used to evaluate companies? To answer this problem the following objective was set: map the ESG indicator metrics used by organisations to analyse sustainability in companies. To this end, an integrative literature review was conducted using the Web of Science database. The results of the research indicate the instruments for this analysis as: Bloomberg Sustainability Report, Compustat database, Thomson Reuters Eikon™ Report (ASSET4), MERCO Index, Kinder Lydenberg Domini (KLD) Report, Global Reporting Index (GRI) Report, Global Engagement Services (GES), Sustainalytics database and in some cases interviews with the organizations' managers. These instruments measure ethical behavior, responsibility with employees, transparency and good governance, contribution to the Community, and commitment to the environment and climate change, and help assess companies on their ESG performance.*

## I. INTRODUCTION

Sustainability can be defined as satisfying present needs without compromising the needs of future generations to meet theirs. It is structured on three pillars: economic, environmental and social. In the corporate context, a sustainable business strategy seeks to have a beneficial effect on one or both, contributing to the resolution of some of the most serious issues facing the globe. Some of the global issues that sustainable business strategies help address include: climate change; natural resource depletion; gender inequality; fair working conditions; racial injustice; income inequality; pollution; circular economy; human rights issues [1].

Against this backdrop are the Sustainable Development Goals (SDGs) which represent an unprecedented global consensus. They are the result of 193 countries joining together in an agreement on a comprehensive and

ambitious development agenda for people and planet by 2030 [2]. The SDGs describe the biggest challenges and needs for human mankind of our time and the goals to address them. Achieving these goals requires collective action between governments, private sector, civil society, communities and dedicated individuals, needs to be linked with the appropriate resources, innovative capacity, and relationships to promote implementation [3].

There are several compelling reasons for corporations to achieve social impact and participate with the SDGs in the context of organizations. Beyond the requirement to satisfy society's demands for increased responsibility and transparency, fusing purpose with profit can produce a special competitive edge to satisfy the demands of discriminating customers, investors, and staff [4].

Companies are compelled to integrate social impact and SDG alignment into their core business by five main



financial value drivers: 1) Generate new revenues by creating opportunities for market differentiation, expansion and growth, including innovating to access extremely promising markets that do not yet exist or are in their early days; 2) employer attractiveness for better recruitment and retention; 3) increasing supply chain resilience by increasing supply chain sustainability and operational efficiency; 4) pique investor interest, increasing attractiveness to a wider range of investors; 5) be "ahead of the curve" in securing a license to operate, addressing regulatory compliance and managing risk [5] [6].

Linked to the SDGs stands ESG (Environmental, Social and Governance), which refers to these three dimensions and criteria to measure the sustainability impact of an investment in companies [7]. ESG criteria are a set of standards for a company's behaviour used by environmentally and socially conscious investors to select potential investments in particular companies. Environmental standards take into account how a business safeguards the environment, including corporate policies that address climate change, for instance. Social factors look at the company's interactions with its customers, suppliers, employees, and the communities in which it operates. Governance deals with company leadership, executive remuneration, audits, transparency, internal controls and shareholder rights [8].

ESG criteria are increasingly clear in defining the investment choices of large institutional investors, such as public pension funds and various types of mutual funds. The most recent US SIF Foundation report claims that at the end of 2019, investors held assets chosen based on ESG criteria for \$17.1 trillion, up from \$12 trillion just two years earlier [9]. O investimento da ESG é às vezes referido como investimento sustentável, investimento responsável, investimento de impacto, ou investimento socialmente responsável. To evaluate a company based on ESG criteria, investors look at a wide range of institutional behaviours and policies [10].

Environmental criteria should include corporate climate policies, waste, energy use, natural resource conservation pollution, and animal welfare. These criteria can also help to assess any environmental risks that a company may face and how the company is managing these risks. Likewise, the social criteria analyse the company's relations with stakeholders, including employees, customers and suppliers. ESG governance standards, meanwhile, ensure that a company employs transparent and accurate accounting practices, looks for integrity and diversity when choosing its leaders, and is accountable to shareholders [11].

Thus, the main aim of this study is to map ESG indicator metrics used by organisations to analyse sustainability in companies, in light of the bibliometric review. To this end, a bibliometric search was carried out in the Web of Science database. The research is divided, in addition to this introduction, into five parts. The first part is entitled introduction, the second presents the concepts on ESG indicators, the third the methodological path, the fourth results and discussions, and finally the authors' final considerations.

## II. ESG INDICATORS

The concern and responsibility of companies with environmental, social and management/governance aspects are constantly being questioned. It is a fact that there are selfless companies that take care of these issues and include them in their business plan. But it is also a fact that other companies only address this issue if they see a value to their product and their corporate image and reputation. If the company uses resources, extracted from the same environment where it is located, for its manufacture, and at the end returns waste to this same environment, it needs a motivation to have a greater responsibility in this type of behaviour. If their actions, involving increased ESG responsibility, can be presented to the market as an added value to the product, then the market and consumers can value this as "good business" with a focus on sustainability. But the value of this responsibility in ESG is not always easily recognized [12] [13].

The Fig. 1 presents a particular scenario depicting the company's attempt to offer ESG responsibility value. And therein emerges the figure of "research firms" and "financial analysis firms", which assist investors, through specialized ESG reports. There are also "consulting companies", which help companies in their internal processes to meet the expectations of investors and the goods and consumer market.

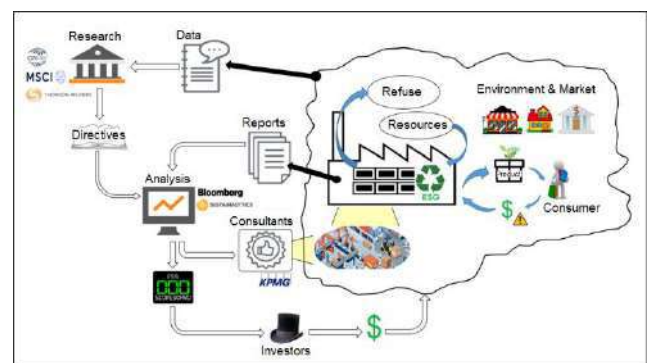


Fig. 1: ESG management in a company

There are other reasons why ESG liability happens. One very important reason is the company's image with investors. These investors increasingly consider and prioritize companies' ESG responsibility in their assessments and decisions to invest in a given company. If this occurs, it makes a lot of sense for companies to have a governance policy, which considers ESG criteria as a central pillar of their management model, which can attract the investor and simultaneously be a company of preference of conscious consumers [14].

But it is not enough to be responsible in ESG, as it is necessary for the company to measure its degree of responsibility. It is a way to demonstrate the effects of actions and to manage its management. It is necessary for the company to monitor and evaluate the different ESG indicators on an ongoing basis in order to measure and qualify each one of them [15]. When a company adopts ESG concern in its management, it commits to meet environmental, social and governance topics, generating product value, since its commitment to ESG needs to be disclosed to the market [16]. The Fig. 2 shows the three ESG pillars and the most important criteria for each one.



Fig. 2: ESG Pillars and some criteria

Announcing to the market that a company manages its waste, for example, does not automatically result in being recognised by the market. It is necessary to quantify or qualify this waste management in order to compare it with other companies that are in the same business context. It is therefore necessary to know how effective certain actions are in each ESG criteria, which it proposes to attend to, in order to manage its actions, investments and the dissemination of results. Thus the need arises to establish indicators to qualify or quantify the result of actions, in each ESG criteria [17].

Performance indicators are metrics used to measure and evaluate the performance of decisions and actions, which a particular company is taking to achieve its ESG goals. The objective is to understand how people or equipment/machinery are performing in relation to the different criteria, in order to know if they meet the expected standard and if in fact they will be able to achieve the determined goals. A meaningful indicator should be measurable and comparable, considering similar scenarios.

In this way one cannot only quantify, but also qualify the performance of certain ESG criteria [18].

As it is very difficult for a company to meet all ESG criteria, it is suggested that some specific indicators are prioritized, those that have the greatest impact on its operations and that can add value to the company's image in society. This is why it is important for a company to know the ESG criteria and indicators that the most reputable companies use. Investment funds or banks look at companies' ESG responsibility to measure their ESG risk [19].

### III. METHODOLOGICAL APPROACH

To address the problem of this research, the present study is classified as exploratory-descriptive in order to describe the theme and increase the familiarity of researchers with the issue. The specific literature search method used was a systematic search in an online database (Web of Science), for the period from 2004 to 2022, followed by a bibliometric analysis of the obtained data. Bibliometrics is a methodology from the information sciences that uses mathematical and statistical methods to map documents from bibliographic records stored in databases [20].

It allows relevant calculations such as: number of production per region; temporality of publications; organization of research by area of knowledge; count of literature related to the citation of the study; identification of the impact factor of a scientific publication, among others that contribute to the systematization of the research result and the minimization of the occurrence of biases when analysing a certain topic.

For this type of analysis the present study was organized into three distinct stages: 1) planning, 2) collection and 3) result. These stages converge to answer the study's guiding question, namely: "What are the ESG indicator metrics used by organisations to assess the degree of sustainability in companies?"

### IV. RESULTS AND DISCUSSION

The planning and research in the database took place in May 2022. In this phase, some criteria were defined, such as the limitation of the search to electronic databases, not contemplating physical catalogues in libraries, due to the number of documents considered sufficient in the databases chosen for the present research. In the planning scope, the Web of Science database was chosen as relevant to the research domain due to its relevance in the academic field and its interdisciplinary nature, and also because it is one of the major databases of abstracts and bibliographic

references of peer reviewed scientific literature, being constantly updated.

Considering the research problem, the search terms were defined during the planning phase, namely "Companies" and "ESG" or "Environmental Social Governance" and "indicator\*". It is considered that the variations of the expressions used in the search are presented, in a larger context, within the same proposal, since a concept depends on the context to which it is related. Finally, the terms defined in the "title, abstract and keyword" fields were used without temporal, language or any other restriction that might limit the results.

Firstly, planning was conducted by elaborating the guiding question: "What are the ESG indicator metrics used by organizations to assess the degree of sustainability in companies?". To refine the search aligning it to the research problem the search was conducted using the following terms: "Companies" and "ESG" or "Environmental Social Governance" and "indicator\*" which originated a set of 620 documents found. From these, some types of documents were excluded such as: reference articles, conferences, ebooks and book chapters, which resulted in a set of 475 indexed scientific articles published in scientific journals in the temporal period from 2004 to 2022.

As a result of this survey, 475 papers were identified, involving 1,372 authors, linked to 785 institutions in 65 different countries. The 5 main countries that have the most publications on the subject are the USA (102 publications), Italy (93), England (67), China (59) and Spain (59). In this set of articles, 1509 keywords were used. Table 1 shows the results of this data collection in a general bibliometric analysis.

Table 1: Bibliometric data of the search

| Topic                   | Description                        | Results     |
|-------------------------|------------------------------------|-------------|
| Time period.            | Time period analysed.              | 2004 a 2022 |
| Document type.          | Retrieved documents/publications   | 620         |
|                         | Scientific articles.               | 475         |
| Additional information. | Keywords.                          | 1,509       |
|                         | Authors.                           | 1,372       |
|                         | Number of authors per publication. | 2.46        |

The eligible articles in the Web of Science database were published between 2004 and 2022. In 2020 there was a significant increase in publications, with 110 publications and in 2021 there was another increase in the

number of publications, with a total of 140 publications, as shown in Fig. 3.

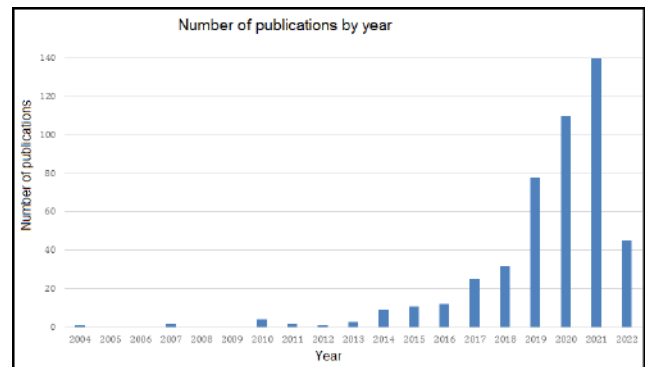


Fig. 3: Time distribution of obtained publications

When analysing the 20 countries with the highest number of citations in the area, the United States stands out with an average of 14% of total citations, a total of 786 citations, followed by Italy and the United Kingdom with 13% (717) and 12% (698), respectively, according to Fig. 4.

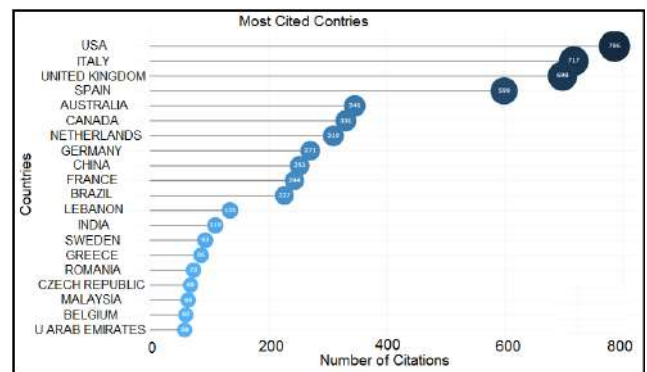


Fig. 4: Distribution of the number of citations of the articles found in the bibliometric search by country

Retrieved documents were published in 206 different scientific journals, 87 (25%) of which were published in the journal "Sustainability", as shown in Fig. 5, which presents the 20 scientific sources (journals) with the highest number of publications on the topic of "ESG" and "indicators".

The second most relevant journal among the 20 indicated in Fig. 5, is "Corporate Social Responsibility And Environmental Management", with 20 documents. In sequence is, with 17 publications, "Business Strategy And The Environment" on the subject matter of this study.

From the bibliometric analysis, based on the group of papers retrieved and the 1,509 keywords indicated by the authors, "performance" (performance) stood out with 119, "impact" with 99, "financial performance" with 95

occurrences, "management" with 87 and "governance" with 86, according to Fig. 6, concluding that the ESG pillar "governance" is an area widely explored by the scientific literature.

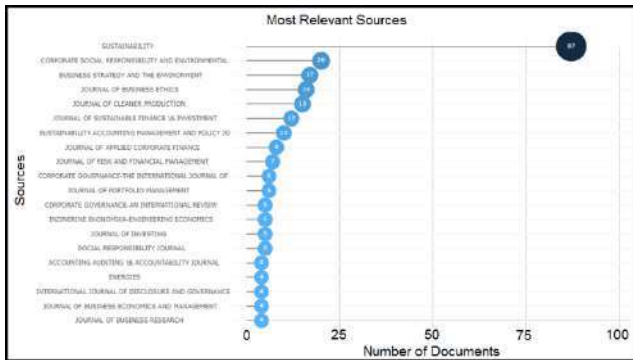


Fig. 5: Scientific journals with the highest number of publications



Fig. 6: TAG cloud

The 20 (twenty) most cited documents worldwide from the papers obtained through the database search are listed in Fig. 7.

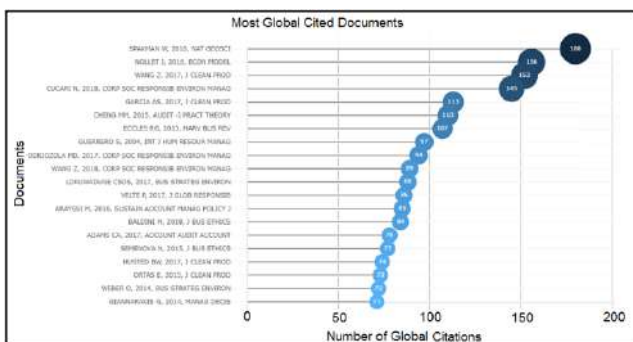


Fig. 7: Most cited documents globally

After systematic analysis of these 20 (twenty) most cited publications globally, the full reading of all articles was conducted in order to answer the research question: "What are the metrics of ESG indicators used by organizations to assess the degree of sustainability in companies?" Based on these 20 papers, 14 (fourteen) publications were chosen, for being of open access and for

answering the problematic of this study. Table 2 presents a summary for each of the 14 articles.

Table 2: Summary of the selected articles

| Authors                            | Results                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nollet; Filis and Mitrokostas [21] | The authors seek to define the existing relationship between social performance (CSP - Corporate Social Performance) and financial performance (CFP - Corporate Financial Performance), as from the ESG Disclosure report issued by Bloomberg Sustainability institution, with the premise that potentiating the consumers' socially conscious demands and contributing with the company's financial performance, admitting of ESG actions do not cause linear effects on financial performance. The study disaggregated ESG into its subcomponents and added financial indicators, resulting in a set to be correlated, as follows: environmental significance (ENV), social significance (SOC), governance significance (GOV), return on assets (RoA), return on capital (RoC), return over market shares (Stock Returns), market risk assessment (Risk), sales revenue (Sales) and expenses in research and development (R&D). The results of this linear model suggest that no significant relationship can be reported between social performance (CSP) and financial performance (CFP), vis-à-vis financial indicators RoA, RoC and Stock Returns. In a non-linear relationship, this relationship implies that social performance pays off only after a certain threshold of investments and achievements in relation to financial performance. In general, companies use social performance as part of their strategic planning in order to create additional value for their product. |
| Wang and Sarkis [22]               | The authors make a study of the relationship between Corporate Social Responsibility (CSR) management and corporate financial performance, based on environmental, social and governance (ESG) data from Bloomberg Sustainability and the COMPUSTAT database, in a sample of the 500 largest                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

green companies in the United States for the years 2009 to 2013. Based on the financial indicators of return on assets (RoA) and Tobin's Q factor, which represents the ratio between the sum of the market value of a company and its debts, by the replacement value of its current assets, focusing on its stock, confronted with the ESG indicators in their sub-components, namely: environmental significance (ENV), social significance (SOC), governance significance (GOV). As results, the paper presents that good CSR results help companies to achieve and maintain social legitimacy, thus contributing to the business environment and higher financial returns. And that a symbolic governance in CSR creates a legitimacy gap, resulting in lower financial returns. Good financial outcomes are related to good CSR outcomes. True legitimacy goals with real results will pay off more as financial performance, than token legitimacy efforts.

Cucari;  
Falco and  
Orlando  
[23]

This study investigates the association between environmental, social and governance (ESG) indicators and board diversity (BoD) in 54 Italian companies for the period 2011 to 2014, based on Bloomberg Sustainability reports, in the Italian context. The work disaggregated ESG into its subcomponents, being: environmental significance (ENV), social significance (SOC), governance significance (GOV). The results indicate that corporate social responsibility (CSR) of the company is associated with the board, independent and committee. Moreover, women on management boards are negatively correlated to CSR, while board age is not significant. Based on this study, shareholders and policy makers will have a deeper insight into the significant roles that board diversity is defined as a determinant of ESG disclosure.

Garcia;  
Mendes da

The study investigates whether the financial profile of sensitive industries

Silva and  
Orsato [24]

(subject to systematic social taboos, moral debates and political pressures, more likely to cause social and environmental damage), is associated with social and governance performance in ESG, using indicators from the database, Thomson Reuters EikonTM, considering 365 companies from Brazil, India, Russia, South Africa, and China (BRICS), said emerging countries. ESG performance indicators were used and their subsets in environmental performance (ENV), social performance (SOC), performance in corporate governance (GOV), systematic risk index, company financial leverage index, cash flow, company size and profit over assets. Results do point out that the best environmental performance is predominant in companies perceived as sensitive or more likely to cause harm to society, confirming the premise that companies in sensitive sectors tend to disclose their ESG indicators to protect their reputation. The systematic risk of the company and its ESG performance is described as an inverted U curve, indicating a maximum value for ESG performance, leading the investor to have to observe the opportunity for the investment. Overall, companies with better ESG performance tend to be less profitable.

Cheng;  
Green and  
Ko  
[25]

The authors bring two studies that investigate the effect of environmental, social and governance indicators (ESG) in investors' decisions, varying the company's strategy according to these indicators, in its subcomponents, being them: environmental significance (ENV), social significance (SOC), significance in governance (GOV). A survey was applied to graduate students in Financial Analysis, in the role of non-professional investors. Points out that investors perceive the most important ESG indicators, and are more willing to invest in the company where ESG indicators have greater strategic relevance. The experimentation was a laboratory-based experiment, in a controlled environment. Results indicate that non-professional

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                             | <p>investors attach greater importance to ESG indicators when making investment decision and perceived importance increases willingness to invest, in direct relationship. The paper suggests that companies are likely to benefit both from ESG indicators perceived as strategically relevant and their assurance of sustainability reports containing this information.</p>                                                                                                                                                                                                                                                                                                                                                                                                                          | <p>Wang;<br/>Hsieh and Sarkis<br/>[28]</p> | <p>The authors used data from 331 Corporate Social Responsibility (CSR) reports issued by US public companies in the period from 2009 to 2012, adopting the Fog, Kincaid and Flesch indices to measure CSR report readability and Bloomberg sustainability and Kinder Lydenberg Domini (KLD) databases to measure ESG indicators and their components, with the purpose of examining the relationship between CSR performance and CSR report readability. Their results show a significant positive relationship between CSR performance and CSR report readability, indicating that companies with stronger CSR performance are more likely to have CSR reports with higher readability. Furthermore, the association of CSR reports readability with social performance is stronger than with environmental performance. Companies with good CSR performance are more likely to use plain language to disclose their CSR achievements, as a means of emphasizing positive information.</p>                      |
| <p>Guerrero and Barraud-Didier<br/>[26]</p> | <p>The authors do not directly point to a study on ESG indicators, but address the significance of human resource practices (HRPs), which make up the social (SOC) and governance (GOV) indicators, components of ESG. In order to test the effect of HRP on social and organizational performance and financial performance, 1,530 HR directors working in large companies in France were questioned. The results show that there is no significant correlation between high involvement actions and financial performance. As well as there is no effect on performance with regard to remuneration. Communication and training are strong points for improving organizational results. This highlights the importance of creating challenging and enriched activities to manage high engagement.</p> | <p>Lokuwaduge and Heenetigala<br/>[29]</p> | <p>The paper explores the extent of ESG reporting of 30 companies in the metals and mining sector listed on the Australian Securities Exchange in the year 2013 to determine the ESG indicators in use in the Australian metals sector. It used the indicators of the Global Reporting Index (GRI). They verified environmental (ENV), social (SOC) and governance (GOV) indicators. According to their results, the motives of ESG reporting are highly influenced by regulations. Some ESG reports that may negatively influence the legitimacy of the company are not reported or are less reported, which implies that legitimacy. Mining companies, as companies operating in a highly environmentally sensitive sector, are reasonably trying to disclose the information required by environmental regulators. Companies have used different measures to report ESG incidents and there is no uniformity in the measures used. In general, ESG reporting is not meaningful unless it is comparable, as</p> |
| <p>Odriozola and Baraibar-Diez<br/>[27]</p> | <p>The aim of this paper is to test whether the quality of sustainability reporting in ESG influences subsequent corporate reputation. Conducted on 22 Spanish companies listed on the Ibex35, representing the largest capitalization companies in the country, in the period 2006 to 2011. In this report, information was extracted on corporate reputation (MERC index), quality of information, company size, financial performance and visibility, against disclosure of general ESG indicators. The result highlights the importance of the quality of ESG information disclosed to obtain corporate reputation.</p>                                                                                                                                                                             |                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                       | <p>there is no uniformity due to lack of reporting standards.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                        | <p>Johannesburg Stock Exchange and the Australian Stock Exchange. The findings point out that there is a link between ESG risk, reputational damage and strategy compliance, as there is evidence of increasing investor demand for information on ESG risk. The importance of board involvement in integrating environmental and social sustainability into corporate practices is highlighted, as well as need for increased regulatory and stock exchange requirements to disclose both ESG risks and strategy. Further global discussion on the role of corporate reporting in setting sustainable development goals is necessary.</p>                     |
| <p>Velte<br/>[30]</p>                 | <p>The author presents a study of the impact of ESG performance, in each of its subsets, on financial performance (FINP), conducted on a sample of 412 companies listed on the German Prime Standard, in the period from 2010 to 2014. The ESG indicators were obtained by Asset4 data from Thomson Reuters, being the financial indicators used the Return on Assets (RoA) and Tobin's Q. As results, the paper points out that there is a positive impact of ESG performance on RoA, but no impact on Tobin's Q. Moreover, analyzing the three different components of ESG, governance performance has the strongest impact on financial performance (FINP) compared to environmental and social performance.</p>                                            | <p>Semenova and Hassel<br/>[33]</p>    | <p>This study explores the validity of MSCI ESG STATS (aka Kinder, Lydenberg and Domini Research &amp; Analytics - KLD), Thomson Reuters ASSET4 (ASSET4) and Global Engagement Services (GES) environmental ratings. The results suggest that KLD environmental strengths tend to be a company-specific metric, while KLD environmental concerns appear to capture more industry attributes. ASSET4 and GES environmental metrics reflect more of an environmental opportunity perspective and provide information about a company's future performance. The study shows that the rankings have common dimensions, but on the whole, they do not converge.</p> |
| <p>Arayssi; Dah and Jizi<br/>[31]</p> | <p>The authors investigate the impact of female participation on corporate boards on their ESG performance. ESG data were extracted from Bloomberg Sustainability reports, in the period from 2007 to 2012, with 100 companies. As results, it points out that gender diversity on company boards and management positively impacts ESG performance. ESG disclosure sends a positive signal to stakeholders regarding expectations of future company growth and financial position. Female participation materially elevates shareholder well-being. Better decision making increases investors' perception of the legitimacy and competence of reported social activities, raising the signal of legitimacy and significance of sustainability reporting.</p> | <p>Husted and Sousa-Filho<br/>[34]</p> | <p>The authors examine how sustainability project governance affects environmental, social and corporate governance (ESG) performance. They use information from Sustainalytics and Bloomberg Sustainability databases, with 459 companies, in nine countries, over a range from 2013 to 2016. Results suggest that there are comparative impacts of sustainability governance on ESG performance. Collaborative governance resulted in the highest ESG performance benefits, followed by in-house and third-party. Internal company sustainability projects are positively related to company ESG performance.</p>                                            |
| <p>Adams<br/>[32]</p>                 | <p>The author investigates the relationship that exists in ESG risk management and governance and value strategy development. The paper also investigates how corporate reporting mitigates these relationships. The data is drawn from interviews with CEOs and directors of large companies listed on the</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

The aim of the review of the selected articles in the present study is to identify the ESG indicator metrics used by organizations to assess the degree of sustainability in companies. Table 3 presents the list of articles indicating the ESG indicator metrics used.

Table 3: ESG Indicator Metrics used by organizations in the selected articles

| Authors                                  | ESG indicator metrics used                                             |
|------------------------------------------|------------------------------------------------------------------------|
| Nollet; Filis and Mitrokostas [21].      | Bloomberg Sustainability Report.                                       |
| Wang and Sarkis [22].                    | Bloomberg Sustainability Report; Compustat Database.                   |
| Cucari; Falco & Orlando [23].            | Bloomberg Sustainability Report.                                       |
| Garcia; Mendes da Silva and Orsato [24]. | Thomson Reuters EikonTM (ASSET4) Report.                               |
| Cheng; Green and Ko [25].                | Interviews with graduate students.                                     |
| Guerrero and Barraud-Didier [26].        | Interviews with HR directors of companies.                             |
| Odriozola and Baraibar-Diez [27].        | MERCO Index.                                                           |
| Wang; Hsieh and Sarkis [28].             | Bloomberg Sustainability Report; Kinder Lyndenber Domini (KLD) Report. |
| Lokuwaduge and Heenetigala [29].         | Global Reporting Index (GRI) Report.                                   |
| Velte [30].                              | Thomson Reuters EikonTM (ASSET4) Report.                               |
| Arayssi; Dah and Jizi [31].              | Bloomberg Sustainability Report.                                       |

|                              |                                                                                                                        |
|------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Adams [32].                  | Interviews with company chairmen and directors.                                                                        |
| Semenova and Hassel [33].    | Thomson Reuters EikonTM (ASSET4) Report;<br>Kinder Lyndenber Domini (KLD) Report;<br>Global Engagement Services (GES). |
| Husted and Sousa-Filho [34]. | Sustainalytics Database;<br>Bloomberg Sustainability Report.                                                           |

Table 3 details that the ESG indicator metric provided by the "Bloomberg Sustainability Report" has the highest recurrence among related articles, accounting for a total of 6 (six) papers. In second place comes the "Thomson Reuters EikonTM Report (ASSET4)" and the format of "Interviews" with different sectors of companies, each cited by 3 (three) articles as assessed in the present study. The "Kinder Lyndenber Domini (KLD) Report" was used in 2 (two) cited papers.

Global Reporting Initiative (GRI) and Thomson Reuters (Asset4) are analysis companies with guidelines that use ESG indicators and have a greater focus on the environment and context in which they operate, valued by the investment market and used by them for decision making. They issue ESG reports and ratings of companies, considering the environment and context in which they operate. In addition, there are also economic/financial analysis companies, such as Sustainalytics and Bloomberg, that use ESG indicators and focus on an analysis based on corporate governance. KLD, on the other hand, uses a methodology more focused on the "Social" part of ESG.

The Global Reporting Initiative (GRI) Report helps companies and other organisations, through standards for sustainability reporting, by providing them with the common global language to communicate these impacts [35]. The GRI Report issues sustainability reports that present a company's economic, environmental, social and governance performance to society. It is the company's way of showing its impacts and measuring its actions, bringing increment of positive values to its image and increasing brand loyalty, comparing the organizational performance, with other organizations [36]. The Thomson Reuters EikonTM Report (ASSET4), on the other hand, provides market analysis, which aims to help professionals make decisions to better manage their businesses. It



investigates world economies regarding their laws, taxes, compliance, government, media, regulations and technology [37]. It uses the records of ASSET4-ESG, which has a database of information in this regard.

Sustainalytics is an international market analysis organization that measures ESG risk ratings, using Sustainalytics database, measuring a company's exposure to sector-specific risks, and how well a company is managing them. It combines the concepts of management and exposure, to arrive at an absolute ESG risk assessment, using GRI guidelines [38].

The Bloomberg Sustainability Report basically performs an economic/financial analysis that considers the ownership and control structures of the company, the composition and effectiveness of its board, the effectiveness of its incentive practices and the integrity of its accounting, including any controversies that may have a significant, negative impact on the value of the company. The method applied by KLD (Kinder Lydenberg Domini Report) aims to remove barriers to socially responsible investment by providing research and support to the socially responsible investment market, with a view to influencing corporate behaviour towards a fairer and more sustainable world.

The MERCO index (Corporate Reputation Business Monitor) is a corporate instrument of reference in Latin America for the evaluation of ESG criteria, which assesses the reputation of companies, based on a methodology consisting of six indices, plus twenty additional sources of information, and independently audited by KPMG, that validates the method and the results, obtained [39].

The methodology signals two strengths and one weakness among the following values: ethical behaviour, transparency and good governance, responsibility towards employees, commitment to the environment and climate change, and contribution to the community. Based on this information, interviews are conducted with various groups of people, including the general population, corporate social responsibility experts, financial analysts, NGOs, trade unions, consumer associations, economic information journalists, government representatives and social media managers. In addition, objective indicators answered by the companies themselves are considered [39].

All instruments for analysing companies and markets mentioned above point out that ethical behaviour, transparency and good governance, responsibility towards employees, commitment to the environment and climate change and contribution to the community contribute to measuring the indicators used in companies.

## V. FINAL CONCLUSIONS

The search using the Web of Science database identified 475 papers, which deal with ESG indicator metrics in companies. The number of citations of these articles, by country, has the United States of America in first place with 786 citations, followed by Italy with 717 citations in the evaluation period, from 2004 to 2022. The 475 articles obtained in the bibliometric search are published in 206 different scientific journals, being in first place the journal "Sustainability" with 87 articles (25%). The main aim of this systematic review was to map ESG indicator metrics used by organisations to analyse sustainability in companies, in the light of a bibliometric review.

Regarding ESG indicator metrics used by organisations, the following stand out: Bloomberg Sustainability Report, Compustat database, Thomson Reuters Eikon™ Report (ASSET4), MERCO Index, Kinder Lydenberg Domini (KLD) Report, Global Reporting Index (GRI) Report, Global Engagement Services (GES), Sustainalytics database and in some cases interviews with the organizations' managers.

For future research, it is intended to map which specific indicators are used by organisations to assess the implementation and degree of sustainability of ESG in companies, and to compare between them, focusing on the metrics presented in the project study.

## REFERENCES

- [1] Jonsdottir, G. E., Sigurjonsson, T. O., Alavi, A. R., & Mitchell, J. (2021). Applying responsible ownership to advance SDGs and the ESG framework, resulting in the issuance of green bonds. *Sustainability*, 13(13), 7331. <https://doi.org/10.3390/su13137331>
- [2] Caiado, R. G. G., Leal Filho, W., Quelhas, O. L. G., de Mattos Nascimento, D. L., & Ávila, L. V. (2018). A literature-based review on potentials and constraints in the implementation of the sustainable development goals. *Journal of cleaner production*, 198, 1276-1288. <https://doi.org/10.1016/j.jclepro.2018.07.102>
- [3] Florini, A., & Pauli, M. (2018). Collaborative governance for the sustainable development goals. *Asia & the Pacific Policy Studies*, 5(3), 583-598. <https://doi.org/10.1002/app5.252>
- [4] Bull, B., & Miklian, J. (2019). Towards global business engagement with development goals? Multilateral institutions and the SDGs in a changing global capitalism. *Business and Politics*, 21(4), 445-463. <https://doi.org/10.1017/bap.2019.27>
- [5] Sachs, J. D., & Sachs, L. E. (2021). Business alignment for the "Decade of Action". *Journal of International Business Policy*, 4(1), 22-27. <https://doi.org/10.1057/s42214-020-00090-6>

- [6] Van Zanten, J. A., & Van Tulder, R. (2021). Analyzing companies' interactions with the Sustainable Development Goals through network analysis: Four corporate sustainability imperatives. *Business Strategy and the Environment*, 30(5), 2396-2420. <https://doi.org/10.1002/bse.2753>
- [7] De Franco, C., Nicolle, J., & Tran, L. A. (2021). Sustainable investing: ESG versus SDG. *The Journal of Impact and ESG Investing*, 1(4), 45-62. <https://doi.org/10.3905/jesg.2021.1.019>
- [8] Kotsantonis, S., & Serafeim, G. (2019). Four things no one will tell you about ESG data. *Journal of Applied Corporate Finance*, 31(2), 50-58. <https://doi.org/10.1111/jacf.12346>
- [9] The US SIF Foundation's Biennial "Trends Report" Finds That Sustainable Investing Assets Reach \$17.1 Trillion. (2020). [www.ussif.org](http://www.ussif.org). Retrieved September 21, 2022, from [https://www.ussif.org/blog\\_home.asp?Display=155#:~:text=WASHINGTON%2C%20D.C.%2C%20November%2016%2C](https://www.ussif.org/blog_home.asp?Display=155#:~:text=WASHINGTON%2C%20D.C.%2C%20November%2016%2C)
- [10] Townsend, B. (2020). From SRI to ESG: The Origins of Socially Responsible and Sustainable Investing. *The Journal of Impact and ESG Investing*, 1(1), 10-25. <https://doi.org/10.3905/jesg.2020.1.1.010>
- [11] Park, S. R., & Jang, J. Y. (2021). The Impact of ESG Management on Investment Decision: Institutional Investors' Perceptions of Country-Specific ESG Criteria. *International Journal of Financial Studies*, 9(3), 48. <https://doi.org/10.3390/ijfs9030048>
- [12] Meira, E., Cunha, F. A. F. D. S., Orsato, R. J., Miralles-Quirós, M. M., & Miralles-Quirós, J. L. (2022). The added value and differentiation among ESG investment strategies in stock markets. *Business Strategy and the Environment*. DOI: <https://doi.org/10.1002/bse.3221>
- [13] Zumente, I., & Bistrova, J. (2021). ESG importance for long-term shareholder value creation: Literature vs. practice. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(2), 127. DOI: <https://doi.org/10.3390/joitmc7020127>
- [14] Martins, M. (2022). A relação da divulgação das práticas ESG com o valor de mercado das empresas brasileiras de capital aberto (p. 110) [Review of *A relação da divulgação das práticas ESG com o valor de mercado das empresas brasileiras de capital aberto*]. <http://doi.org/10.14393/ufu.di.2022.175>
- [15] Buchetti, B., & Santoni, A. (2022). CG Stock Markets and the Environmental, Social, and Corporate Governance (ESG) Indicators. In *Corporate Governance in the Banking Sector* (pp. 93-111). Springer, Cham. [https://doi.org/10.1007/978-3-030-97575-3\\_4](https://doi.org/10.1007/978-3-030-97575-3_4)
- [16] Ye, C., Song, X., & Liang, Y. (2022). Corporate sustainability performance, stock returns, and ESG indicators: fresh insights from EU member states. *Environmental Science and Pollution Research*, 1-12. <https://doi.org/10.1007/s11356-022-20789-8>
- [17] Li, S. (2022). Enterprise Value Assessment Based on ESG Evaluation. *Frontiers in Business, Economics and Management*, 4(3), 48-51. <https://doi.org/10.54097/fbem.v4i3.1073>
- [18] Francischini, A. S. N., & Francischini, P. G. (2017). *Indicadores de desempenho* (Alta Books, Ed.; p. 448)
- [19] Börsche, J. (2021). A Concept for Measuring Real Estate Sustainability from the Investors' Perspective. *Vierteljahrshefte zur Wirtschaftsforschung/Quarterly Journal of Economic Research*, 90(4), 19-42. <https://doi.org/10.3790/vjh.90.4.19>
- [20] Linnenluecke, M. K. (2017). Resilience in Business and Management Research: A Review of Influential Publications and a Research Agenda. *International Journal of Management Reviews*, 19(1), 4-30. <https://doi.org/10.1111/ijmr.12076>
- [21] Nollet, J., Filis, G., & Mitrokostas, E. (2016). Corporate social responsibility and financial performance: A non-linear and disaggregated approach. *Economic Modelling*, 52, 400-407. <https://doi.org/10.1016/j.econmod.2015.09.019>
- [22] Wang, Z., & Sarkis, J. (2017). Corporate social responsibility governance, outcomes, and financial performance. *Journal of Cleaner Production*, 162, 1607-1616. <https://doi.org/10.1016/j.jclepro.2017.06.142>
- [23] Cucari, N., Esposito De Falco, S., & Orlando, B. (2017). Diversity of Board of Directors and Environmental Social Governance: Evidence from Italian Listed Companies. *Corporate Social Responsibility and Environmental Management*, 25(3), 250-266. <https://doi.org/10.1002/csr.1452>
- [24] Garcia, A. S., Mendes-Da-Silva, W., & Orsato, R. J. (2017). Sensitive industries produce better ESG performance: Evidence from emerging markets. *Journal of Cleaner Production*, 150, 135-147. <https://doi.org/10.1016/j.jclepro.2017.02.180>
- [25] Cheng, M. M., Green, W. J., & Ko, J. C. W. (2014). The Impact of Strategic Relevance and Assurance of Sustainability Indicators on Investors' Decisions. *AUDITING: A Journal of Practice & Theory*, 34(1), 131-162. <https://doi.org/10.2308/ajpt-50738>
- [26] Guerrero, S., & Barraud-Didier, V. (2004). High-involvement practices and performance of French firms. *The International Journal of Human Resource Management*, 15(8), 1408-1423. <https://doi.org/10.1080/0958519042000258002>
- [27] Odriozola, M. D., & Baraibar-Diez, E. (2017). Is Corporate Reputation Associated with Quality of CSR Reporting? Evidence from Spain. *Corporate Social Responsibility and Environmental Management*, 24(2), 121-132. <https://doi.org/10.1002/csr.1399>
- [28] Wang, Z., Hsieh, T. S., & Sarkis, J. (2017). CSR Performance and the Readability of CSR Reports: Too Good to be True? *Corporate Social Responsibility and Environmental Management*, 25(1), 66-79. <https://doi.org/10.1002/csr.1440>
- [29] Lokuwaduge, C. S. D. S., & Heenetigala, K. (2016). Integrating Environmental, Social and Governance (ESG) Disclosure for a Sustainable Development: An Australian

- Study. *Business Strategy and the Environment*, 26(4), 438–450. <https://doi.org/10.1002/bse.1927>
- [30] Velte, P. (2017). Does ESG performance have an impact on financial performance? Evidence from Germany. *Journal of Global Responsibility*, 8(2), 169–178. <https://doi.org/10.1108/jgr-11-2016-0029>
- [31] Arayssi, M., Dah, M., & Jizi, M. (2016). Women on boards, sustainability reporting and firm performance. *Sustainability Accounting, Management and Policy Journal*, 7(3), 376–401. <https://doi.org/10.1108/sampj-07-2015-0055>
- [32] Adams, C. A. (2017). Conceptualising the contemporary corporate value creation process. *Accounting, Auditing & Accountability Journal*, 30(4), 906–931. <https://doi.org/10.1108/aaaj-04-2016-2529>
- [33] Semenova, N., & Hassel, L. G. (2014). On the Validity of Environmental Performance Metrics. *Journal of Business Ethics*, 132(2), 249–258. <https://doi.org/10.1007/s10551-014-2323-4>
- [34] Husted, B. W., & Sousa-Filho, J. M. de. (2017). The impact of sustainability governance, country stakeholder orientation, and country risk on environmental, social, and governance performance. *Journal of Cleaner Production*, 155, 93–102. <https://doi.org/10.1016/j.jclepro.2016.10.025>
- [35] GRI. (2022). Global Reporting Initiative. [Globalreporting.org](https://www.globalreporting.org). <https://www.globalreporting.org>
- [36] Terreo, G. (2022). Evolução dos relatórios de sustentabilidade (K. P. Silveira, Interviewer) [Review of *Evolução dos relatórios de sustentabilidade*]. In *Federação das Indústrias do Estado de São Paulo*. <https://www.fiesp.com.br/indices-pesquisas-e-publicacoes/entrevista-glaucia-terreo-representante-da-global-reporting-initiative-gri-no-brasil-fala-sobre-a-evolucao-dos-relatorios-de-sustentabilidade/>.
- [37] Thomson Reuters ESG Scores. (2017). [https://www.esade.edu/itemsweb/biblioteca/bbdd/inbdd/archivos/Thomson\\_Reuters\\_ESG\\_Scores.pdf](https://www.esade.edu/itemsweb/biblioteca/bbdd/inbdd/archivos/Thomson_Reuters_ESG_Scores.pdf)
- [38] ESG Risk Ratings. (2022). [Www.sustainalytics.com](https://www.sustainalytics.com/esg-data). <https://www.sustainalytics.com/esg-data>
- [39] Ranking Merco Corporate Responsibility ESG Brasil. (2022). [Www.merco.info](https://www.merco.info). Retrieved September 21, 2022, from <https://www.merco.info/br/ranking-merco-responsabilidad-gobierno-corporativo>

# Marketing Greenwashing E os Danos Aos Consumidores

Munirah Muhieddine Rizatti

Professora de Direito, Acadêmica em Administração de Empresas, Doutoranda em Direito Político Econômico, Brasil,

Received: 30 Aug 2022,

Received in revised form: 22 Sep 2022,

Accepted: 27 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license  
(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *greenwashing; lavagem  
verde, marketing, consumidor.*

**Abstract**— *This article aims to conceptualize the marketing practice of large companies in the dissemination of the manufacture of ecologically sustainable products in a false way that can lead consumers, inducing error, to consume their products and involuntarily propagate more violation of the correct environment. The methodology to be used is the bibliography.*

**Resumo**— *O presente artigo tem como objetivo conceituar a prática do marketing de grandes empresas na disseminação de fabricação de produtos ecologicamente sustentáveis de forma falsa que podem levar consumidores, induzindo ao erro, a consumir seus produtos e involuntariamente propagarem mais violação ao meio ambiente correto. A metodologia a ser utilizada é a bibliográfica.*

## I. INTRODUÇÃO

O presente artigo tem como finalidade demonstrar o conceito de práticas de marketing ilegal como o greenwashing conhecido como propaganda maquiada que seria benéfica ao meio ambiente o qual em verdade acaba levando o consumidor ao erro na aquisição dos produtos ou serviços. A metodologia utilizada foi a bibliográfica com autores que trazem explicações pertinentes sobre o tema.

## II. GREENWASHING E CONSUMIDORES

A informação nos últimos anos vem sendo disseminada de forma extremamente rápida na sociedade moderna, em especial, quando falamos de produtos comercializáveis e consumíveis.

Com o grande estouro das redes sociais, é fácil encontrar produtos que mesmo sem necessidade, pessoas adquirem com o fim de saciar suas vontades iminentes e passageiras de consumo.

Muitos produtos que fazem sucesso advém de grandes indústrias que usam como método de marketing Greenwashing, ou seja um demonstração de sustentabilidade na elaboração de seus feitos, de forma enganadora.

O discurso da sustentabilidade está em voga, em razão da necessidade de preservação do meio ambiente em prol da manutenção da vida humana.

Com essa sociedade cada vez mais consciente das necessidades de preservação ambiental, cresce as falsas propagandas das grandes empresas que levam o consumidor ao erro.

Com certeza já foi visto em alguma propaganda a seguinte frase: “Adquirindo nosso produto você estará ajudando o meio ambiente.” ou ainda a frase: *Nossa empresa é amiga do meio ambiente.* Pois bem, nos dizeres de Ricardo Ribeiro Alves:

*Frases semelhantes a essa são repetidas à exaustão por diversas empresas que utilizam a variável “meio ambiente” como fator de promoção de vendas. Para o consumidor, no entanto, fica uma dúvida: será que os produtos dessas empresas realmente são “verdes” como anunciados em suas campanhas publicitárias? Como ter garantia que a mensagem “verde” propagada pelas empresas é verdadeira? O fato é que a inserção da variável “meio ambiente” no mundo empresarial não é mais uma atitude passageira, e sim uma condição para manutenção de mercados e obtenção de novos negócios, mesmo que em alguns casos essa inserção seja apenas aparente. O desafio é criar mecanismos para separar as*

*empresas que realmente adotam práticas ambientalmente responsáveis daquelas que apenas querem parecer “verdes” perante seus clientes. (Alves, 2016. p. 23)*

Poucos consumidores se interessam em buscar a verdadeira essência do produto que adquirem, deixando que o poder público fiscalize, porém sem estrutura suficientes para tal função acaba sendo o destinatário final do produto ou serviço enganado.

Autores nesse sentido já destacaram:

*Com o decorrer do tempo, devido a essa mudança de paradigma em todo o globo, produtos e serviços que fazem uso de sistemas de produção ecologicamente corretos, seja por meio da utilização de matérias primas menos danosas, alterações do modo de extração e práticas pouco nocivas que causam menos impactos ambientais, passaram a ganhar valor de mercado, sendo um destaque positivo, tanto para fidelização de clientes, como o de investidores. Diante dessa realidade, a ciência do marketing passou a fazer uso desse novo ideal, enfatizando as práticas ecológicas das organizações, empresas e até mesmo entes estatais na busca da captação do mercado consumidor e investidor, tal atuação é comumente distinguida como marketing verde, aqui encarado como espécie do gênero marketing social. A problemática ocorre quando as eco propagandas não passam de divulgações falsas, ao que tange efetiva ação de proteção ambiental pelas organizações, de modo a traduzir-se em um verdadeiro abuso de confiança do consumidor, além de uma prática antiética no mercado. (Paviani, G. A, 2019) - Grifo nosso*

Com essa situação elencada, vislumbra-se que ser sustentável perante o meio ambiente é algo que está em voga, muitas empresas de grande renome vendem esse lema na produção de seus produtos atraindo mais consumidores conscientes dos danos que a produção em massa pode trazer ao sistema ecológico.

Quando alguma empresa tenta usar desse lema de sustentabilidade sem ser verdade produzir seus produtos de forma sustentável, se visualiza uma prática infratora que a doutrina denominou de greenwashing:

O Greenwashing é um termo em inglês que pode ser livremente traduzido como “lavagem verde”. O IDEC (Instituto Brasileiro de Defesa do Consumidor) assim definiu o tema:

*“Com o aumento da população preocupada com o meio ambiente e questões ligadas ao bem-estar animal e saúde, diversas empresas passaram a utilizar uma comunicação com apelo ecológico em seus rótulos, muitas vezes abusando de selos, certificados e termos como “ecológico”, “sustentável” ou “amigo do meio ambiente” para atrair o consumidor. Mas você já parou para pensar*

*se todos esses produtos realmente cumprem o que os rótulos prometem? Essa situação é chamada de Greenwashing, expressão que significa “maquiagem verde” ou “lavagem verde”. Nesses casos, as marcas criam uma falsa aparência de sustentabilidade, sem necessariamente aplicá-la na prática. Em geral, a estratégia é utilizar termos vagos e sem embasamento, que levam o consumidor a acreditar que ao comprar um produto “ecológico” está contribuindo para a sustentabilidade ambiental e animal.”<sup>1</sup>*

Essa prática comercial e de marketing tem tomado grandes proporções na esfera social, pois a produção de produtos e seu consumo por pessoas que prezam pela proteção à saúde e ao meio ambiente não pode ser maquiada por grandes empresas que usufruem da ignorância do consumidor, podendo causar danos inimagináveis.

A prática da maquiagem verde é repudiada pelo ordenamento jurídico:

*É verdade, porém, que o consumidor vem criando consciência ecológica, e passou a se preocupar com o tipo de produto, ou serviço, que adquire ou contrata. Preocupação essa voltada para os impactos ambientais por eles causados, dando asas ao dito consumo verde. No entanto, empresas públicas e privadas, tentando acompanhar evolução do mercado, e tentando garantir a preocupação ambiental, tem se utilizado de práticas de marketing verde. Técnicas de marketing essas que são responsáveis por fornecer informações relativas a qualidade e impactos ambientais positivos, para que possam atrair o consumidor e convencê-lo a adquirir ou contratar seu produto e serviço. Todavia, com o intento de se obter lucro a todo custo, muitos fornecedores se utilizam desse marketing verde de forma excessiva, transmitindo as informações de forma distorcida, falsas, omissas, incompletas, e persuadindo o consumidor, fazendo-o acreditar que se trata de um produto verde, mas que, ao contrário disso, gera e causa impactos ambientais. A retro mencionada prática é denominada Greenwashing, ou maquiagem verde, e é vedada pelo ordenamento jurídico brasileiro. (Carchedi, K., & Ferrer, W., 2020, p.g. 1089-1090)*

A prática de greenwashing é atitude ilegal pois pode ser conceituada como uma prática de ocultar informações ou utilizá-las de forma inverídica relacionada ao marketing ambiental da empresa.

Algumas das práticas de greenwashing utilizadas por empresas em marketing ambiental consistem em fornecer informações equivocadas a respeito do custo ambiental,

<sup>1</sup> <https://idec.org.br/greenwashing>

que muitas vezes é superior àquele relatado, a mera aposição da informação sem trazer lastro comprobatório, rotulação dos produtos com falsa certificação, informação de que o produto não acarreta danos ambientais, quando, na verdade, pode causar impacto relevante, utilização de expressões que podem gerar interpretações (Carchedi, K., & Ferrer, W., 2020, p.g. 1092)

A Constituição Federal Brasileira no artigo 5º, inciso XXXII traz como direito fundamental a proteção ao consumidor, incumbindo assim ao Estado a proteção.

Nesse aspecto, vale a seguinte colocação de Gabriela Pavani:

*Entretanto, o greenwashing não se trata apenas de informações enganosas em desfavor da população, eco propagandas falsas, promessas publicitárias de ecoeficiência, estratégias de marketing verde, que visam disseminar desinformação ou manipulação de alguma informação para favorecer a empresa, é muito maior do que isso, trata-se de por em cheque os compromissos assumidos por essas empresas e organizações em ações direcionadas a proteção do meio ambiente. As eco propagandas, como o já demonstrado, possuem um papel de extrema relevância no que diz respeito ao compromisso com questões ambientais, posto ser o meio direto de contato com o consumidor, o induzindo não raras vezes ao erro. (Paviani, G. A. 2019, pág 99)*

Muito embora existam empresas que seguem a veracidade das práticas de sustentabilidade, algumas merecem atenção da legislação com o fim de coibir o engano ao consumidor e ao próprio meio ambiente equilibrado, pelo que no ano de 2011 o Brasil buscou regulamentar a publicidade nesse aspecto:

*O crescimento de campanhas publicitárias fazendo o uso do greenwashing no Brasil levou o Conselho Nacional de Autorregulamentação Publicitária (Conar) a incluir, no ano de 2011 em seu Código Brasileiro de Autorregulamentação Publicitária novas regras sobre a publicidade que contenha apelos de sustentabilidade. Tal normatização traz princípios como os da veracidade, exatidão, pertinência e relevância – características ausentes na prática do greenwashing – às campanhas publicitárias que apresentem determinado produto ou serviço como ecologicamente correto. Muito embora as inovações trazidas pela referida norma sejam de suma importância, o Conar é um órgão de autorregulação, como seu próprio nome diz, e possui suas limitações quanto à sua ação fiscalizadora. Se é bem verdade que os centros geradores do Direito não podem se resumir ao tradicional monopólio da norma estatal (WOLKMER, 2001, p.153.), bem como a autorregulação é uma realidade da pós-modernidade,*

*o fato é que a atuação destes institutos deve se dar de forma conjunta com a sociedade. E no que diz respeito ao greenwashing, especificamente, o controle sobre esta prática no país pode e deve ser direcionado pelos princípios jurídicos que, direta ou indiretamente, estabelecem um diálogo entre as tradicionais fontes do direito e a sociedade civil. (Lovato, M. L. 2013)*

Em que pese a existência de regulamentações, ainda a sociedade se depara com a prática por algumas empresas de atos de lavagem verde ou maquiagem verde, que buscam ludibriar os consumidores que querem uma vida mais saudável para o mundo. Essa prática deve ser repudiada e fiscalizada, não somente pelo Estado, mas também por toda a sociedade, a qual busca um bem maior, o bem do meio ambiente e a manutenção da vida humana.

### III. CONCLUSION

Há de se observar que a prática de *greenwashing* pelas indústrias traz desequilíbrio social, em especial danos aos consumidores e também ao meio ambiente ecologicamente protegido. Assim, deve ser coibido tais atos com criações de políticas públicas e privadas preventivas e sanções mais severas na atuação repressiva destas práticas. A conscientização de toda a sociedade a buscar os órgãos de proteção aos consumidores para a efetivação dessas repressões.

### REFERENCIAS

- [1] ALVES, Ricardo R. Marketing Ambiental: Sustentabilidade Empresarial e Mercado Verde. Disponível em: Minha Biblioteca, Editora Manole, 2016.
- [2] PAVIANI, Gabriela Amorim. Greenwashing: o falso marketing e a responsabilidade civil em relação ao consumidor. **Revista de Direito e Sustentabilidade**, v. 5, n. 1, p. 76-91, 2019.
- [3] CARCHEDI, K.; FERRER, W. A tutela jurídica do consumidor nas práticas empresariais de greenwashing. 2020.
- [4] LOVATO, Marcos Luiz. Greenwashing no Brasil: quando a sustentabilidade ambiental se resume a um rótulo. **Revista Eletrônica do Curso de Direito da UFSM**, v. 8, p. 162-171, 2013.

# Seroprevalence of Cattle Respiratory Viral Pathogens in Paranatinga, Mato Grosso State, Brazil

Maycon J. Heidmann<sup>1</sup>, Cristiano G. do Nascimento<sup>2</sup>, Liria H. Okuda<sup>3</sup>, Edviges M. Pituco<sup>3</sup>, Eliana de Stefano<sup>3</sup>, Adriana H. de C. N. Romaldini<sup>3</sup>, Bruno G. de Castro<sup>4</sup>

<sup>1</sup>Discentes de Mestrado do Programa de Pós-Graduação em Ciências em Saúde, Campus Universitário de Sinop, Universidade Federal de Mato Grosso, Brasil

<sup>2</sup>Convolution Animal Health, Brasil.

<sup>3</sup>Instituto Biológico, São Paulo, Brasil

<sup>4</sup>Programa de Pós-Graduação em Ciências em Saúde, Campus Universitário de Sinop, Universidade Federal de Mato Grosso, Brasil

Received: 29 Aug 2022,

Received in revised form: 18 Sep 2022,

Accepted: 23 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Bovine Hesperivirus Type 1, Bovine Respiratory Diseases Complex, Bovine Viral Diarrhea Virus, Feedlot, Parainfluenza Type 3 Virus*

**Abstract**— *The Bovine Respiratory Diseases Complex (BRD) is characterized by respiratory tract infection and may be origin by viral, bacterial or through the association of both. BRD has been identified as one of the most important causes of morbidity and mortality of intensive breeding, especially in young animals, causing serious economic losses with the use of drugs for treatment of animals and significant losses of weight, directly affecting the meat production. The objective of this study was to verify the presence, through the serological and / or antigenic detection, of etiological agents that cause BRD in blood and nasal swab samples, such as Bovine Hesperivirus Type 1 (BoHV-1), Bovine Viral Diarrhea Virus, Parainfluenza Type 3 virus (BPI-3). There were evaluated 100 bulls from four properties in the municipality of Paranatinga sent for termination in a feedlot located in the municipality of Ipiranga do Norte, MT. According to the results obtained, a high prevalence of the viral agents studied was observed, mainly the BPI-3 and BoHV-1 viruses. The results indicate the circulation of agents that cause diseases of importance in beef cattle, thus requiring greater vigilance over them in feedlots.*

## I. INTRODUCTION

Bovine livestock has been playing a role of great economic importance within the national agribusiness. Brazil has the largest commercial herd in the world and the second largest effective herd in the world, over 220 million heads (Brasil 2022). Within the meat production chain, intensive farming through confinement is an excellent alternative for the producer in off-season periods, as it provides greater use of the rural property area and has a fast cycle.

According to the Instituto Matogrossense de Economia Agropecuária (IMEA 2022) in 2020, about 860,000 head of cattle were confined in the state, where the mid-north region of Mato Grosso stands out, participating in 13,6%

of the total of confined animals, highlighting, thus, the importance of the activity for the region.

Despite the productive increase in beef cattle, the intensive confinement system presents some health problems. In the United States, studies reveal that the Bovine Respiratory Disease Complex (BRD) is a major problem for the meat production chain. Characterized as the main cause of morbidity and mortality in feedlots, it contributes to significant losses in weight and carcass quality in cattle, in addition to generating costs with medicines for its treatment (Griffin 2014).

BRD is an important disease mainly for intensive breeding and young animals. Its etiopathogenesis is complex and composed of several environmental factors that combined with viral and bacterial infectious agents

end up suppressing and overloading the animal's immune system. The multiple factors end up conditioning the animal to a stressful situation, among them we can highlight the inadequate management of the herd, food imbalance, nutritional failures, transport and veterinary interventions (Guzman and Taylor 2015, Earley et al. 2017).

The infectious agents of the disease can act alone or in association, or also in a primary or secondary way. Of the viral agents, the most important are Parainfluenza virus type 3 (BPI-3), Bovine Herpesvirus type 1 (BHV-1) and Bovine Viral Diarrhea Virus (BVD) (JARED et al. 2010, Earley et al. . 2017). The immunosuppression caused by the viral infection allows the bacterial agent to migrate and colonize the lower respiratory tract, leading to pulmonary involvement and a serious infection. Among the most important bacterial agents we can mention *Mannheimia haemolytica*, *Pasteurella multocida*, *Histophilus somni* (Jared et al. 2010).

The development of symptoms can occur in an acute or chronic clinical form. In the chronic form, the animals present the subclinical form. In this, the animals are apparently healthy, and may present mild mucoid or mucopurulent oronasal discharge (Assis-Brasil et al. 2013). The clinical signs of the acute form include dyspnea, apathy, weight loss, tremors, bruxism, noisy breathing, tachypnea, serous or mucopurulent nasal discharge, fever, productive cough, recumbency and death (Assis-Brasil et al., 2013).

Therefore, the objective of the present study was to verify the presence through serological and/or antigenic detection of etiological agents causing BRD, such as Bovine Hesperivirus Type 1 (BoHV-1), Bovine Viral Diarrhea Virus, Parainfluenza Virus Type 3 (BPI-3) in blood and nasal swab samples from 100 unvaccinated bulls from four properties in the municipality of Paranatinga sent for a feedlot located in the municipality of Ipiranga do Norte, MT.

## II. MATERIAL AND METHODS

The present study was carried out in a rural property located in the municipality of Ipiranga do Norte MT that receives beef cattle for finishing, with a confined population of approximately five thousand animals per month. Twenty-five bulls were randomly selected from each of the four selected properties in the municipality of Paranatinga, MT. The animals that participated in the study were clinically evaluated upon arrival at the confinement, and then identified with earrings. All animals were intact males with a mean age of 15 months and mean entry weight of 353.61 kg. None of the properties

evaluated performed immunization of the animals against the mentioned agents evaluated in this study.

For diagnostic procedures on the day of arrival of the animals, blood samples were collected by coccygeal venipuncture, in addition to a double nasal swab from each of the animals involved in the study. The samples were identified and sent under refrigeration in isothermal boxes to the Laboratory of Infectious Diseases at UFMT Sinop where the samples were processed.

The blood was desorbed under centrifugation and the serum was stored in double aliquots in 1.5 mL microtubes and kept under refrigeration between +2 and +8°C. The swabs were identified and kept under refrigeration between +2 and +8°C.

The day after collection, the blood samples and swabs were taken to the Biological Institute of São Paulo, where they were re-identified and sent to the Bovine Viral Diseases Laboratories for analysis. Serum samples were evaluated by the virus neutralization technique for the presence of antibodies against Bovine Herpesvirus Type 1, Viral Diarrhea Virus and Parainfluenza Virus Type 3. From the nasal swab, Viral Isolation techniques were performed to search for BoHV-1 and BPI3 and subsequent confirmation by the Real Time Polymerase Chain Reaction (qPCR) for BoHV-1 as well as the ELISA for antigenic detection of BVDV from serum and swab samples.

For the virus neutralization (VN) test, 96-well, flat-bottomed microtiter plates were used. Column one of the test plate was used to control cells, column two to control the toxicity of each serum and in columns three to 12 the samples were serially diluted, on a logarithmic basis 2 from a 1:2 dilution to 1:1024 for BPI3 and BoHV-1; for BVDV 1:10 to 1:5.120, using MEM medium as diluent. For validation of the test, standard negative, weak positive and positive serum with known antibody titers were included. The plates were incubated for one hour in an oven at 37°C with 5% CO<sub>2</sub>, after which they received 50µL of MDBK (Madin-Darby Bovine Kidney) cell suspension, at a concentration of 3 x 10<sup>5</sup> cells/mL for BPI3 VNs and BVDV. In the case of BoHV-1, the incubation took place for 18 to 24 hours, after which 100µL of MDBK cell suspension was added, at a concentration of 3 x 10<sup>5</sup> cells/mL.

Infectivity was indicated by the visible cytopathic effect on the cell monolayer on plates, under an inverted microscope, after four days of incubation at 37°C and 5% CO<sub>2</sub>. The antibody titer was expressed as the highest serum dilution that completely inhibited infectivity in both wells of each dilution, with the lowest dilution detected by the BPI3 and BoHV-1 test being 1:2 and BVDV 1:10, whose titer was calculated and expressed in log<sub>10</sub>.



Samples with titers equal to or greater than 0.3 log<sub>10</sub> were considered reagents. The test was validated when the cells from the wells destined to control cells remained intact, the cells from the wells to control the toxicity of the sera also remained unaltered, that is, they did not present a toxic effect, and the negative, weak positive and positive control sera showed the expected results. Regarding dose control, the test was validated when the infecting dose was between 300 and 3000/mL, and if in the viral re-titration the titer obtained presented a variation of only  $\pm 0.3 \log_{10}$  when compared to the titer of the stock solution, calculated according to the method by Reed and Muench (1938).

In the viral isolation, the samples were first processed, where each swab sample was subjected to vortex agitation and the swab was pressed against the wall of the tube for total removal of the secretion. Each sample was kept in a -20°C freezer until laboratory analysis. The previously processed swab was thawed and subjected to viral isolation in 24-well cell culture plates, previously prepared and containing a monolayer of MDBK (Madin-Darby Bovine Kidney) cells at a concentration of  $2 \times 10^5$  cells/mL. After 24 hours of cell growth, the MEM medium was removed, the monolayer washed and 200  $\mu$ L of the sample suspension was inoculated into each well of the plate.

After one hour of incubation in a controlled oven at 37°C containing 5% CO<sub>2</sub>, the inoculum was discarded, the monolayer washed with MEM medium and then 1 mL of maintenance medium (MEM medium containing 2% fetal bovine serum and 1% antibiotic solution). The monolayer was observed under an inverted optical microscope and monitored daily for seven days to visualize the cytopathic effect (CPE). This procedure was repeated two more times, with an interval of seven days each. Samples that showed CPE were subjected to quantitative real-time PCR for BoHV-1 (qPCR) to confirm the diagnosis, according to OIE (2019). Samples were considered negative after three passages without the presence of CPE (OIE 2019). To detect BVDV in the swab, the IDEXX® BVDV Ag kit was used, according to the manufacturer's instructions.

This study was approved by the Ethics Committee on the Use of Animals (CEUA) of the Federal University of Mato Grosso under number 28108.713904/2015-91.

### III. RESULTS AND DISCUSSION

Immediately after unloading the animals on the property, a clinical evaluation of the animals was carried out, and no animal with clinical symptoms related to the Bovine Respiratory Disease Complex was found. After laboratory analysis of the collected samples, the presence of the three viral agents or antibodies against them was verified in animals from the four properties evaluated.

Regarding the presence of anti-Parainfluenza-3 (PI-3) virus antibodies, only four animals were not reactive by the virus neutralization technique, where all properties showed seroreactive animals. The frequency of 96% of reagent animals corroborates the findings in several studies in Brazil. Candeias and Ribeiro (1970) detected 84.1% of seropositive animals in the state of São Paulo. Wizigmann et al. (1972) found a frequency of approximately 97% in bovine serum samples positive for the presence of anti-PI-3 antibodies. Viral circulation in sheep was also verified, as reported in the studies by Gonçalves et al. (2003) and Gonçalves et al. (2009), respectively in the states of Rio Grande do Sul and São Paulo.

Abroad, several studies also report high rates of occurrence of seroreactive animals. Durham and Hassard (1990) found prevalence rates of 93.9% and 99.7% for focus animals and farms in Canada. In France, Vallacher and Hagglung (2006) detected anti-PI-3 antibodies in 100% of the cows tested. More recently, Murray et al. (2017) reported that PI-3 was the most isolated viral agent from cases of animals with respiratory disease in Ireland. Similarly Callaby et al. (2016) verified the presence of the aforementioned agent as one of the main causative agents of BRC in wild cattle in Kenya.

In general, most studies report a high occurrence of seroreactive animals, however with almost all animals without any clinical symptoms. This fact was also verified in the current study. According to Gonçalves et al. (2003), PI-3 causes a mild disease with mild respiratory conditions with many animals presenting in the subclinical form.

Regarding the serological diagnosis of the causative agent of Infectious Bovine Rhinotracheitis (IBR), of the 100 animals evaluated in the present study, all had anti-BoHV-1 antibodies by the virus neutralization test. When the viral isolation technique was used, the agent was detected in nine animals, which were confirmed by the qPCR technique.

These results confirm what has already been mentioned by other authors, that the best technique for diagnosing the agent is serological as opposed to antigenic, given the possibility of Herpesviruses being in a latency phase, making it difficult to detect the agent outside the viremia phase (Takiuchi et al. 2001; Flores et al. 2012).

In relation to the frequency verified in the animals of Paranatinga (MT), the result obtained presented the highest rate of occurrence among the studies verified in the country. Richtzenhain et al. (1999) carried out the largest study in Brazil on the prevalence of BoHV-1. In this study, 1992 herds were evaluated in all Brazilian states and a total of 21062 animals. According to the authors, 94.7% of the herds and 64.3% of the samples were positive for the

virus neutralization technique, demonstrating a wide viral circulation throughout the country. Similarly, Dias et al. (2013) more recently performed a retrospective study of 14803 samples of unvaccinated females from 2018 herds in the state of Paraná. In this study, a prevalence of 59.0% and 71.3% of positive animals and herds was verified, respectively.

In the Midwest region, in different studies carried out in the state of Goiás, different authors evaluated the occurrence of BoHV-1. According to Barbosa et al. (2005), the observed prevalence was 98.5% of the properties, while 51.9% of the 6932 animals were seroreactive. Corroborating the findings of this study, Vieira et al. (2006) found a prevalence closer to that found in the present study. According to these authors, 83% of the samples were seropositive, while almost all the properties (96.7%) were foci of the agent.

The isolation of the agent, associated with confirmation by qPCR, reports the high occurrence of the agent in unvaccinated herds. However, possibly these are strains of low pathogenicity since no animals with clinical aspects of diseases caused by BoHV-1 were observed, or the subclinical picture was due to the humoral memory response of the animals.

Regarding the last viral agent evaluated, 62% of the animals had anti-BVDV antibodies at the time of arrival at the Feedlot, and it was observed that all properties had reactive animals. Among the non-reactive animals, none of them showed the presence of a persistently infected animal by the ELISA technique.

In population studies carried out in Brazil on Bovine Viral Diarrhea, Chaves et al. (2010) found that 61.5% of animals were seropositive to the virus neutralization technique, while 95% of properties in the Amazon region of Maranhão had seroreactive animals. Brito et al. (2010), in the state of Goiás, found a prevalence of 64% of seropositive animals and 88.3% of focus properties. More recently, Fernandes et al. (2016) carried out a study in herds in the state of Paraíba. In this study, prevalences of 65.5% and 39.1% of seropositive herds and animals were observed, respectively.

The results obtained in the present study are similar to most of the works found in the literature. The circulation of BVDV is common in the national herd, and these agents are possibly of low pathogenicity, thus not causing animals with clinical signs of the disease.

According to the results obtained, it was possible to verify the wide circulation of several agents with great potential for pathogenicity in animals from properties in the municipality of Paranatinga, Mato Grosso. Despite the high occurrence of seropositive animals for BoHV-1,

BVDV and PI-3, none of them showed any change in the clinical examination upon arrival at the property.

According to Callaby et al. (2016), there is a high correlation between the joint occurrence of the three pathogens evaluated in the present study in animals, with their co-circulation in cattle herds being common.

Therefore, due to the productive pressure in confinement conditions, sanitary management is of great importance in these animals raised intensively with a focus on nutrition and health. Associated with this, it is recommended to cattle producers with the objective of confinement to prevent with polyvalent vaccines aimed at immunizing animals from an early age to avoid damage in cases of outbreaks of these diseases.

#### IV. CONCLUSION

The results of this study pointed to the circulation of viruses of relevance to bovine health, especially in intensive production environments such as feedlots. The detection of antibodies against the agents, as well as the specific verification of the pathogens increases the need for epidemiological surveillance and prevention of the agents related to the Complete Respiratory Diseases of Cattle from the properties related to the reproduction and production of calves. In this way, the use of vaccines would be an efficient way to avoid possible contamination and the development of clinical conditions in the adult phase of the animal.

#### REFERENCES

- [1] Brasil, N. D. A., Hinnah, F. L., Fiss, L., Sallis, E. S., Grecco, F. B., Ladeira, S. R., ... & Schild, A. L. (2013). Doenças respiratórias em bezerros na região sul do Rio Grande do Sul: estudo retrospectivo de 33 surtos. *Pesquisa Veterinária Brasileira*, 33, 745-751.
- [2] Silva, B. P. e, Soares, L. B. F., Macêdo, A. A. de, Oliveira, J. M. B. de, Aragão, B. B., Nascimento, S. A. do, & Pinheiro Júnior, J. W. (2020). Soroprevalência e fatores de risco associados ao herpesvírus bovino tipo 1 e ocorrência da infecção pelo vírus da diarreia viral bovina em vacas leiteiras no estado de Pernambuco. *Medicina Veterinária (UFRPE)*, 13(3), 399–405. <https://doi.org/10.26605/medvet-v13n3-3302>
- [3] BRASIL. Ministério da Agricultura Pecuária e Abastecimento. 2020. Disponível em <<https://agenciadenoticias.ibge.gov.br/agencia-noticias/2012-agencia-de-noticias/noticias/16994-rebanho-de-bovinos-tem-maior-expansao-da-serie-historica.html>> Acesso em 05 de dezembro de 2021.
- [4] Brito, W. M. E. D. de, Alfaia, B. T., Caixeta, S. P. de M. B., Ribeiro, A. C. C., Miranda, T. de M. T., Barbosa, A. C. V. C., Barthasson, D. L., Linhares, D. C., & Faria, B. O. (2010). Prevalência da infecção pelo Vírus da Diarreia Viral Bovina (BVDV) no Estado de Goiás, Brasil. *Revista De*

- Patologia Tropical*, 39(1), 07–20. <https://doi.org/10.5216/rpt.v39i1.9494>
- [5] Callaby, R., Toye, P., Jennings, A., Thumbi, S. M., Coetzer, J. A., Conradie Van Wyk, I. C., Hanotte, O., Mbole-Kariuki, M. N., Bronsvort, B. M., Kruuk, L. E., Woolhouse, M. E., & Kiara, H. (2016). Seroprevalence of respiratory viral pathogens of indigenous calves in Western Kenya. *Research in veterinary science*, 108, 120–124. <https://doi.org/10.1016/j.rvsc.2016.08.010>
- [6] Candeias, J.A.N. & Ribeiro, L.C. (1968). Anticorpos inibidores da hemaglutinação para o vírus parainfluenza 3 (Ha-1), em gado bovino. *Revista de Saúde Pública*. 2(2):180-185. DOI: 10.1590/S0034-89101968000200004
- [7] Chaves, N.P., Pereira, H.M., Sousa, V.E., Santos, H.P. & Bezerra, D.C. (2010). Frequência de anticorpos e fatores de risco para a infecção pelo vírus da diarreia viral bovina em fêmeas bovinas leiteiras não vacinadas na região Amazônica Maranhense, Brasil. *Ciência Rural*, 40(6),1448-1451. [fecha de Consulta 19 de Septiembre de 2022]. ISSN: 0103-8478. Disponible en: <https://www.redalyc.org/articulo.oa?id=33117724028>
- [8] Dias, J. A., Alfieri, A. A., Ferreira-Neto, J. S., Gonçalves, V. S., & Muller, E. E. (2013). Seroprevalence and risk factors of bovine herpesvirus 1 infection in cattle herds in the state of Paraná, Brazil. *Transboundary and emerging diseases*, 60(1), 39–47. <https://doi.org/10.1111/j.1865-1682.2012.01316.x>
- [9] Durham, P. J., & Hassard, L. E. (1990). Prevalence of antibodies to infectious bovine rhinotracheitis, parainfluenza 3, bovine respiratory syncytial, and bovine viral diarrhoea viruses in cattle in Saskatchewan and Alberta. *The Canadian veterinary journal*, 31(12), 815–820.
- [10] Earley, B., Buckham Sporer, K., & Gupta, S. (2017). Invited review: Relationship between cattle transport, immunity and respiratory disease. *Animal*, 11(3), 486–492. <https://doi.org/10.1017/S1751731116001622>
- [11] Edwards T. A. (2010). Control methods for bovine respiratory disease for feedlot cattle. *The Veterinary clinics of North America. Food animal practice*, 26(2), 273–284. <https://doi.org/10.1016/j.cvfa.2010.03.005>
- [12] Fernandes, L. G., Nogueira, A. H., De Stefano, E., Pituco, E. M., Ribeiro, C. P., Alves, C. J., Oliveira, T. S., Clementino, I. J., & de Azevedo, S. S. (2016). Herd-level prevalence and risk factors for bovine viral diarrhoea virus infection in cattle in the State of Paraíba, Northeastern Brazil. *Tropical animal health and production*, 48(1), 157–165. <https://doi.org/10.1007/s11250-015-0937-x>
- [13] FLORES E. (2012) *Virologia veterinária: virologia geral e doenças víricas*. 2nd ed. Editora da UFSM, Santa Maria.
- [14] Franco, A.C., Oliveira, M., Spilki, F., Roehe, P.M., Chiminazzo, C., Gonçalves, D. (2003). Isolamento do vírus Parainfluenza bovino tipo 3 no Rio Grande do Sul, Brasil. *Ciência Rural*, 33(5),953-956. <https://www.redalyc.org/articulo.oa?id=33133525>
- [15] Gonçalves, R. C., Silva, A. A. da, Ferreira, D. O. L., Marcondes, J., Pituco, E. M., & Dias, A. (2009). Ocorrência do vírus parainfluenza-3, vírus respiratório sincicial, vírus da diarreia viral bovina e herpesvírus tipo 1 em rebanhos ovinos da região de Botucatu-SP. *Ciência Animal Brasileira*, 1, 563–568. <https://revistas.ufg.br/vet/article/view/7859>
- [16] Griffin D. (2014). The monster we don't see: subclinical BRD in beef cattle. *Animal health research reviews*, 15(2), 138–141. <https://doi.org/10.1017/S1466252314000255>
- [17] Guzman, E., & Taylor, G. (2015). Immunology of bovine respiratory syncytial virus in calves. *Molecular immunology*, 66(1), 48–56. <https://doi.org/10.1016/j.molimm.2014.12.004>
- [18] Taylor, J. D., Fulton, R. W., Lehenbauer, T. W., Step, D. L., & Confer, A. W. (2010). The epidemiology of bovine respiratory disease: What is the evidence for predisposing factors?. *The Canadian veterinary journal*, 51(10), 1095–1102.
- [19] MATO GROSSO, Instituto Matogrossense de Economia Agropecuária. 2022. Relatório Técnico 05 de Maio de 2022. Disponível em <<http://www.imea.com.br/upload/publicacoes/arquivos/08052017201905.pdf>>. Acesso em 12 de maio de 2022.
- [20] Murray, G. M., More, S. J., Sammin, D., Casey, M. J., McElroy, M. C., O'Neill, R. G., Byrne, W. J., Earley, B., Clegg, T. A., Ball, H., Bell, C. J., & Cassidy, J. P. (2017). Pathogens, patterns of pneumonia, and epidemiologic risk factors associated with respiratory disease in recently weaned cattle in Ireland. *Journal of veterinary diagnostic investigation*, 29(1), 20–34. <https://doi.org/10.1177/1040638716674757>
- [21] OIE Terrestrial manual 2019. International Animal Health Code. Manual of standards. Disponível em: <[http://www.oie.int/fileadmin/Home/esp/Health\\_standards/tahm/2.04.13.%20Rinotraqueitis%20infectiosa%20bovina.pdf](http://www.oie.int/fileadmin/Home/esp/Health_standards/tahm/2.04.13.%20Rinotraqueitis%20infectiosa%20bovina.pdf)> Acesso em: 15 mar. 2019.
- [22] L.J. REED, H. MUENCH (1938) A simple method of estimating fifty per cent endpoints. *American Journal of Epidemiology*, 27(3), 493–497, <https://doi.org/10.1093/oxfordjournals.aje.a118408>
- [23] Richtzenhain, L. J., Barbarini, O., Umehara, O., De Gracia, A. S., Cortez, A., Heinemann, M. B., & Ferreira, F. (1999). Rinotraqueíte infecciosa bovina: levantamento sorológico nos estados de Minas Gerais, Mato Grosso do Sul, São Paulo, Rio de Janeiro, Paraná e Rio Grande do Sul. *Arquivos do Instituto Biológico*, 66, 83-88.
- [24] Takiuchi E., Médici K.C., Alfieri A.F. & Alfieri A. A. (2003). Otimização da reação em cadeia pela polimerase (Semi Nested-PCR) para a detecção do herpesvírus bovino tipo 1 em fragmentos de órgãos fetais e em semen de bovinos naturalmente infectados. *Semina, Ciências Agrárias* 24(1):43-56.
- [25] Valarcher J.F. & Hägglund S. (2006). Viral respiratory infections in cattle. In: Proceedings of XXIV World Buiatrics Congress. Nice, France. <https://pdfs.semanticscholar.org/ab14/cd3e578fdd97c7e314a6470ad67ed60c892f.pdf>
- [26] Vieira S., Brito W.M.E.D., Souza W.J., Alfaia B.T. & Linhares D.C.L. (2003). Anticorpos para o herpesvírus bovino 1 (BHV-1) em bovinos do estado de Goiás. *Ciência Animal Brasileira*. 4(2):131-137.
- [27] Wizigmann G., Vidor T. & Ricci Z.M.T. (1972). Investigações sorológicas sobre a ocorrência e incidência dos vírus da diarreia a vírus-enfermidade das mucosas dos bovinos, no estado do Rio Grande do Sul. *Boletim do Instituto de Pesquisas Veterinárias Desidério Finamor* 1:2-58.

# Analysis of accidents caused by problems in the drainage infrastructure of highways in Brazil

## Análise de acidentes causados por problemas na infraestrutura drenante das rodovias do Brasil

William Wilson dos Santos, Paulo Afonso Lopes da Silva, Antônio Carlos Rodrigues Guimarães

Instituto Militar de Engenharia, Pós-Graduação Engenharia de Transportes, Rio de Janeiro, Brasil.

Received: 29 Aug 2022,

Received in revised form: 18 Sep 2022,

Accepted: 25 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *Infrastructure, Accidents, Drainage, Highways.*

**Palavras-Chave**— *Infraestrutura, Acidentes, Drenagem, Rodovias.*

**Abstract**— *Every year accidents in Brazil, thousands of people suffer and good parts even lose their lives. There are many causes of accidents on highways and each year we seek to mitigate or the number of accidents. It should be noted that most of these events are also due to lack of attention on the part of drivers, however, the road infrastructure has a good share of responsibility in preventing accidents. Article, through drainage data, the importance of the accident prevention analysis system, since according to the Federal Police, many accidents are caused by the malfunction of the infrastructure. From this, the infrastructure stands out, that road safety also depends on a good drainage, as it depends on an analysis of the data, not that the infrastructure drainage is responsible for a number of accidents and deaths.*

**Resumo**— *Todos os anos no Brasil, milhares de pessoas sofrem acidentes e boa parte desses chegam até a perder suas vidas. Muitas são as causas de acidentes nas rodovias e a cada ano busca-se mitigar o número de acidentes. É de se notar que boa parte desses acontecimentos se dão por falta de responsabilidade ou desatenção dos condutores, porém, a infraestrutura viária também tem uma boa parcela de importância na prevenção de acidentes. Esse artigo, busca através de análise de dados, esclarecer a importância do sistema drenante na prevenção de acidentes, visto que segundo a Polícia Rodoviária Federal, muitos acidentes são causados pelo mal funcionamento da infraestrutura viária. A partir disso, salienta-se, que a segurança viária também depende de uma boa infraestrutura drenante, pois ao analisar os dados, notou-se que a infraestrutura de drenagem é responsável por um número significativo de acidentes e mortes.*

### I. INTRODUÇÃO

Todos os anos no Brasil milhares de pessoas perdem suas vidas, vítimas de acidentes em rodovias. Ao longo dos anos, esse problema não apenas é referente ao

transporte, mas tornou-se também uma questão de saúde pública, visto que, além de mortes, tem-se um alto custo com medicamentos, internações e tratamentos quando as lesões e ferimentos são graves, decorrentes de acidentes

cotidianos. Somente em rodovias no Brasil, em 2021, mais de 71.000 morreram ou ficaram gravemente feridas em acidentes. (PRF 2022).

O número de mortes e lesões no trânsito é previsível e pode ser minimizado e evitado. Países de alta renda reduziram o nível de mortes no trânsito ao longo dos anos, mesmo com o aumento do uso de veículos. Isto é principalmente o resultado da aplicação sistemática de medidas baseadas em evidências, com eficácia comprovada, promovendo usuários e estradas mais seguras. As condições da estrada podem ser o fator mais letal em acidentes graves, à frente de excesso de velocidade, álcool ou não uso de cinto de segurança. No entanto, o papel dos fatores relacionados com a estrada tanto na causa como no resultado dos acidentes tem sido subestimado, muitas vezes porque as investigações de acidentes se concentram na causa do motorista. (ITF, 2016).

Ao fazer considerações sobre a infraestrutura da via, deve-se atentar principalmente para a drenagem, que apesar de contar por pouca tradição acerca da sua avaliação ou medida em rodovias no Brasil, é um ponto muito importante. Mattos (2009), salienta que a aderência fornecida pelo revestimento ao pneu do veículo enquanto o

mesmo está em movimento, é uma característica de suma importância. Deve-se ter um bom funcionamento da camada de rolamento garantindo a segurança viária mesmo em condições adversas de dirigibilidade. Pimenta e Oliveira (2004) ressaltam a grande relevância de uma drenagem adequada e Pimenta *et al.* (2017) afirma a necessidade de cuidados especiais com o escoamento das águas superficiais em trechos em nível ou em rampas muito suaves. A segurança em pistas molhadas, segundo Bernucci *et al.* (2008) é um aspecto funcional do pavimento.

## II. REVISÃO BIBLIOGRÁFICA

A Polícia Rodoviária Federal (2022) apresenta dados relativos à série histórica de acidentes no país desde o ano de 2007. Essa série evidencia que tanto o número de acidentes quanto o número de feridos e de óbitos tem caído nos últimos anos, os gráficos mostram que o número vinha crescendo entre os anos de 2007 a 2013, mas que a partir do ano de 2014 vem diminuindo até o ano de 2021. Porém, nos últimos 3 anos não se teve uma queda significativa, os números são parecidos, como demonstram os gráficos a seguir.



Fig. 1. Gráfico de acidentes

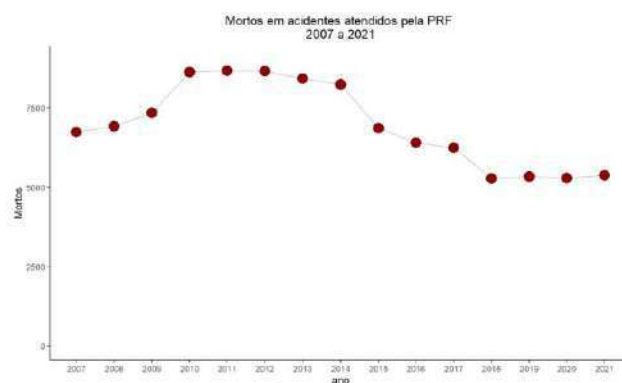


Fig. 2. Gráfico de mortes

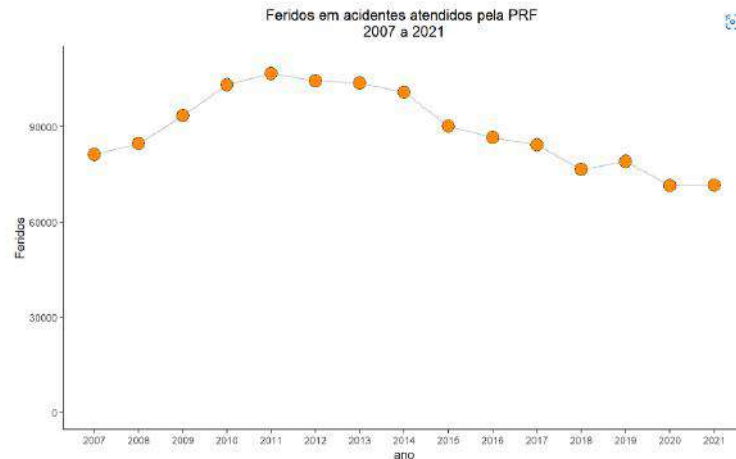


Fig. 3. Gráfico de feridos

Ao analisar os dados da série histórica da Polícia Rodoviária federal (2022), nota-se que até poucos anos atrás não se salientava a importância dos elementos drenantes na causa dos acidentes. A classificação de causas de acidentes só continha os seguintes termos: Velocidade incompatível; Ultrapassagem indevida; outras; não guardar distância de segurança; Ingestão de Álcool; Falta de atenção; Dormindo; Desobediência a sinalização; Defeito na via; Defeito mecânico em veículo; Animais na pista. Nota-se que a maioria das causas elencadas estão ligadas ao condutor, há pouca diversificação no que diz respeito a rodovia. Os anuários disponíveis, desde o ano de 2007 até o ano de 2016 não são específicos nas causas quando se tem ligação com a drenagem das vias, o que dificulta mais a análise, essa especificação só começa no ano de 2017 onde o termo “pista escorregadia” é apresentado como causa. A partir do ano de 2020 tem-se uma especificação ainda mais ramificada, o que é de grande valia. Agora foram introduzidos novos termos para as causas de acidentes, dentre eles encontram-se alguns relativos a drenagem, tais como: “acumulo de água sobre o pavimento”, “chuva”, “pista escorregadia” e “sistema de

drenagem ineficiente” o que torna melhor e valoriza esse elemento que é de grande importância para segurança e deve receber mais atenção para prevenção de acidentes.

Além das inundações e enchentes uma das maiores causas de acidentes nas rodovias decorrentes do mal funcionamento da infraestrutura drenante são os fenômenos de hidroplanagem ou aquaplanagem. Bernucci *et al.* (2008) ressalta que esse fenômeno ocorre quando há a perda de contato dos pneus do veículo com o pavimento, devido a presença de uma camada de água não rompida pelos pneus ou pela textura da pista. Quando isso ocorre, os pneus deixam de rolar sobre a superfície e há um efeito de escorregamento sobre a camada d’água. A manutenção do contato entre as superfícies é essencial, portanto, para evitar a aquaplanagem. Através desse contato pode-se garantir o atrito, que é mobilizado quando uma das superfícies está em movimento em relação a outra. Ao reduzir o atrito do pneu com o pavimento, é possível perder o controle da direção e a frenagem também fica prejudicada. A Figura 4 mostra como acontece o efeito de aquaplanagem.

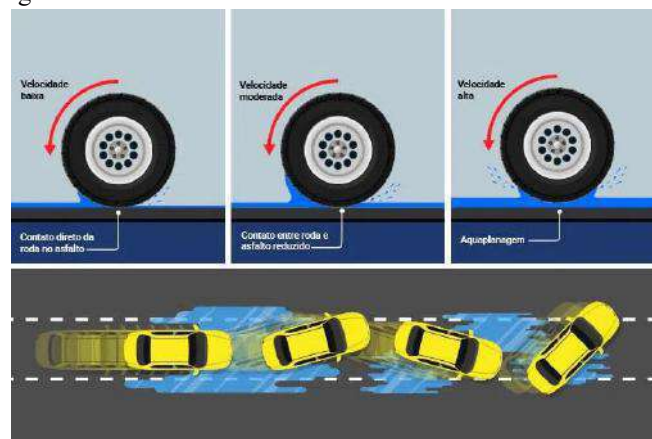


Fig. 4. Aquaplanagem (Fonte: Tecfil)

### III. RESULTADOS E DISCUSSÕES

A partir dos dados da PRF (2022), foi calculada a média do número total de acidentes nos últimos 5 anos chegando-se a um número 70.859 acidentes por ano nas rodovias do país. Mesmo com o advento da pandemia do Covid-19, os números de 2020 e 2021 são pouco menores

que o de 2019. As Tabelas 1 e 2 mostram como se desenvolveram os números ao longo dos anos e a significância dos números decorrentes a infraestrutura drenante da via que representam em média quase 4% dos acidentes nas rodovias do país.

Tabela 1. Número total de acidentes (Fonte: PRF 2022)

| Ano          | Acidentes     | Feridos       | Mortos       |
|--------------|---------------|---------------|--------------|
| 2017         | 89.563        | 84.317        | 6.247        |
| 2018         | 69.295        | 76.647        | 5.271        |
| 2019         | 67.446        | 79.073        | 5.333        |
| 2020         | 63.548        | 71.480        | 5.291        |
| 2021         | 64.441        | 71.690        | 5.381        |
| <b>Média</b> | <b>70.859</b> | <b>76.641</b> | <b>5.505</b> |

Tabela 2. Número de acidentes Decorrentes de mal funcionamento da Infraestrutura drenante (Fonte: PRF 2022)

| Ano          | Acidentes decorrentes de Infraestrutura drenante | Porcentagem | Feridos      | Mortos     |
|--------------|--------------------------------------------------|-------------|--------------|------------|
| 2017         | 4.253                                            | 4,7%        | 3.697        | 153        |
| 2018         | 2.549                                            | 3,7%        | 2.954        | 106        |
| 2019         | 2.186                                            | 3,2%        | 2.759        | 105        |
| 2020         | 2.017                                            | 3,2%        | 2.619        | 106        |
| 2021         | 2.532                                            | 3,9%        | 3.232        | 164        |
| <b>Média</b> | <b>2.707</b>                                     | <b>3,8%</b> | <b>3.052</b> | <b>127</b> |

Ao verificar os dados, a porcentagem de acidentes causados pelo mal funcionamento da estrutura de drenagem da via parece pequena, mas ao apresentar em ordem as 71 causas de acidentes nas rodovias no ano de 2021, percebemos que os acidentes devido à má drenagem ocupam a parte de cima da tabela, com acidentes decorrentes a chuva em 13º lugar, por exemplo. A tabela 3 está resumida, pois o número total de causas é 71, porém, aqui foram elencados apenas os 30 primeiros. Além disso,

se somarmos as 3 causas ligadas a drenagem teríamos um número representativo que ocuparia a 9ª posição. Isso mostra como a drenagem exerce um impacto considerável na segurança e que é responsável por muitos acidentes, com números que ultrapassam muitos acidentes devido ao condutor. Logo, a infraestrutura drenante é algo que necessariamente precisa ser estudado com cada vez mais cautela.

Tabela de Frequência 3 - Causas de acidentes em ordem decrescente 2021. (Fonte: PRF 2022)

|    | Causa do acidente                                         | Acidentes | Feridos | Mortos |
|----|-----------------------------------------------------------|-----------|---------|--------|
| 1º | Reação tardia ou ineficiente do condutor                  | 6.888     | 7.755   | 430    |
| 2º | Velocidade Incompatível                                   | 6.741     | 7.857   | 675    |
| 3º | Ausência de reação do condutor                            | 5.593     | 5.829   | 451    |
| 4º | Acessar a via sem observar a presença dos outros veículos | 5.193     | 6.181   | 303    |
| 5º | Condutor deixou de manter distância do veículo da frente  | 5.108     | 5.313   | 110    |
| 6º | Ingestão de álcool pelo condutor                          | 4.532     | 3.830   | 216    |
| 7º | Manobra de mudança de faixa                               | 3.710     | 4.465   | 261    |

|     |                                                               |              |              |           |
|-----|---------------------------------------------------------------|--------------|--------------|-----------|
| 8°  | Demais falhas mecânicas ou elétricas                          | 2.723        | 2.093        | 50        |
| 9°  | Condutor Dormindo                                             | 2.310        | 2.888        | 227       |
| 10° | Transitar na contramão                                        | 1.776        | 2.348        | 636       |
| 11° | Desrespeitar a preferência no cruzamento                      | 1.747        | 2.215        | 58        |
| 12° | Ultrapassagem Indevida                                        | 1.644        | 2.429        | 357       |
| 13° | <b>Chuva</b>                                                  | <b>1.285</b> | <b>1.663</b> | <b>91</b> |
| 14° | Avarias e/ou desgaste excessivo no pneu                       | 1.255        | 1.687        | 42        |
| 15° | Animais na Pista                                              | 1.212        | 1.346        | 57        |
| 16° | Conversão proibida                                            | 873          | 1.128        | 50        |
| 17° | Trafegar com motocicleta (ou similar) entre as faixas         | 818          | 892          | 45        |
| 18° | Pedestre andava na pista                                      | 701          | 512          | 311       |
| 19° | <b>Pista Escorregadia</b>                                     | <b>672</b>   | <b>818</b>   | <b>43</b> |
| 20° | Mal súbito do condutor                                        | 631          | 734          | 75        |
| 21° | Pedestre cruzava a pista fora da faixa                        | 594          | 573          | 159       |
| 22° | Entrada inopinada do pedestre                                 | 577          | 488          | 188       |
| 23° | <b>Acumulo de água sobre o pavimento</b>                      | <b>574</b>   | <b>746</b>   | <b>30</b> |
| 24° | Acesso irregular                                              | 546          | 639          | 37        |
| 25° | Frear bruscamente                                             | 451          | 485          | 7         |
| 26° | Transitar no acostamento                                      | 445          | 484          | 53        |
| 27° | Objeto estático sobre o leito carroçável                      | 376          | 402          | 20        |
| 28° | Problema com o freio                                          | 359          | 374          | 40        |
| 29° | Ingestão de álcool e/ou substâncias psicoativas pelo pedestre | 350          | 280          | 34        |
| 30° | Pista esburacada                                              | 346          | 421          | 16        |

#### IV. CONCLUSÃO

Fica evidente que a infraestrutura drenante é de suma importância para a segurança da via. Mesmo com um número menor de dados, comparado a outras causas relativas ao condutor, é notório que se tem um elevado número de acidentes, feridos e mortos por conta de um mal funcionamento na drenagem das rodovias do país. Além das enchentes e inundações, que acometem o brasileiro todos os anos, deve-se observar também os danos causados aos motoristas e as vítimas de acidentes, pois os números são significativos. Uma boa drenagem tem um grande impacto para a vida útil do pavimento entre outras vantagens, além disso, tratando-se de um país tropical é evidente que a segurança da estrada é totalmente afetada, logo, deve-se tratar com cada vez mais atenção os elementos de drenagem. Não apenas na sua execução, mas também nas manutenções. Uma análise mais profunda pode ser feita também em rodovias específicas, pesquisando trechos com maior incidência de acidentes

relativos à segurança da via em períodos chuvosos, fazendo um levantamento de dados e de possíveis ações que previnam acidentes no trecho.

#### REFERÊNCIAS

- [1] Polícia Rodoviária Federal. Anuário 2021. Brasília – DF, 2022. Disponível em: [https://www.gov.br/prf/pt-br/acao-a-informacao/dados-abertos/anuario-2021\\_final.html#Acidentes\\_registrados\\_em\\_2021](https://www.gov.br/prf/pt-br/acao-a-informacao/dados-abertos/anuario-2021_final.html#Acidentes_registrados_em_2021)
- [2] ITF, Zero Road Deaths and Serious Injuries: Leading a Paradigm Shift to a Safe System, OECD Publishing, Paris, 2016.
- [3] Pimenta, C. R. T.; M. P. Oliveira, *Projeto Geométrico de Rodovias*. 2ª edição. RiMa Editora, 198p, São Carlos, 2004.
- [4] Pimenta, C. R. T.; I. Silva; M. P. Oliveira; P. C. L. Segantine, *Projeto Geométrico de Rodovias*. 1ª edição. Elsevier, 327p, Rio de Janeiro, 2017.
- [5] Bernucci, L. B.; L. M. G. Motta; J. A. P. Ceratti; J. B. Soares, *Pavimentação asfáltica: formação básica para*



engenheiros. PETROBRÁS; ABEDA, 504 f. Rio de Janeiro, 2008.

- [6] Tecfil. Aquaplanagem: entenda os seus riscos para o motorista. 2022. Disponível em: <https://www.tecfil.com.br/aquaplanagem-entenda-os-seus-riscos-para-o-motorista/>

# The Agroecological Approach and Interdisciplinarity in the Scope of University Teaching, Research and Extension

## O Enfoque Agroecológico e a Interdisciplinaridade no Âmbito do Ensino, Pesquisa e Extensão Universitários

Jorge Luiz Schirmer de Mattos<sup>1</sup>, Luis Claudio Monteiro de Mattos<sup>1</sup>, Laécia Medeiros Jalil<sup>1</sup>, Tarcísio Augusto Alves da Silva<sup>1</sup>, Ana Maria Dubeux Gervais<sup>1</sup>, José Nunes da Silva<sup>1</sup>, Julia Figueredo Benzaquen<sup>1</sup>, Anderson Fernandes de Alencar<sup>2</sup>, Walter Santos Evangelista Júnior<sup>1</sup>, Maria Rita Ivo de Melo Machado<sup>1</sup>, Francinete Francis Lacerda<sup>3</sup>, Marcos Antonio Bezerra Figueiredo<sup>1</sup>, Óscar Emerson Zuñiga Mosquera<sup>1</sup>

<sup>1</sup>Professor of Universidade Federal Rural de Pernambuco, Brazil.

<sup>2</sup>Professor of Universidade Federal do Agreste de Pernambuco, Brazil.

<sup>3</sup>Researcher of Instituto Agrônomo de Pernambuco, Brazil.

Received: 30 Aug 2022,

Received in revised form: 19 Sep 2022,

Accepted: 24 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI Publication. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— *agricultural sciences, agroecology, agronomy, education, inseparability of teaching - research - extension*

**Palavras-chave**— *agroecologia, agronomia, ciências agrárias, educação, indissociabilidade do ensino -pesquisa - extensão*

**Abstract** — *The Courses of Agrarian Sciences have been losing their original characteristics through the pasting years, especially after the WWII, under the influence of the 'green revolution' over agriculture practices worldwide, increasing productivity to address the hunger extinction. The productivity has been significantly increased since that. However, the hunger remains a huge concern across the world. This model also generated several social and environmental negative externalities. Some of reasons for these results are well-known. The agri-food systems were captured by few international corporations, who control the entire the food chains from the farms to the supermarkets shelves. Therefore, the courses of agrarian sciences are being realigned to prepare professionals to work only for these sectors of agriculture. Furthermore, these conglomerates are guided by the international commodity markets, undermining the local markets of food production and distribution. Notwithstanding, with the arise of agroecology movements, this model has been strongly questioned both inside the educational institutions and across the society. In this context, some universities launched courses with agroecological approaches, whose UNEMAT, in the Brazilian State of Mato Grosso, is one case, where the bachelor's degree in agronomy incorporated not only the agroecological approach, but also an interdisciplinary teaching. That is the experience that this article is about. It includes an analysis of the historical, pedagogical and political aspects that influenced the course design, from its conception until its collapse. The lessons learned offer insights to how being more successful in designing new courses of agrarian sciences based on interdisciplinary and*

*agroecological approaches.*

**Resumo** — Os Cursos de Ciências Agrárias vêm perdendo suas características originais ao longo dos últimos anos, principalmente após a Segunda Guerra Mundial, sob a influência da “revolução verde” sobre as práticas agrícolas, aumentando a produtividade para enfrentar a extinção da fome. A produtividade aumentou significativamente desde então, mas a fome continua a ser uma grande preocupação em todo o mundo. Esse modelo também gerou diversas externalidades negativas sociais e ambientais. Algumas razões para estes resultados são bem conhecidas. Os sistemas agroalimentares foram capturados por poucas corporações internacionais, que controlam toda a cadeia alimentar desde as propriedades até os supermercados. Por isso, os cursos de ciências agrárias estão sendo realinhados para preparar profissionais para atuar apenas nesses setores da agricultura. Além disso, esses conglomerados são orientados pelos mercados internacionais de commodities, prejudicando os mercados locais de produção e distribuição de alimentos. Contudo, com o surgimento dos movimentos agroecológicos, esse modelo tem sido questionado tanto dentro das instituições de ensino quanto na sociedade. Nesse contexto, algumas universidades lançaram cursos com enfoques agroecológicos, sendo a UNEMAT, em Mato Grosso/MT, um caso, onde o bacharelado em agronomia incorporou não apenas a agroecologia, mas também um ensino interdisciplinar. Essa é a experiência de que trata este artigo. Inclui uma análise dos aspectos históricos, pedagógicos e políticos que influenciaram o desenho do curso, desde a sua concepção até o seu colapso. As lições aprendidas oferecem insights sobre como ter mais sucesso na concepção de novos cursos de ciências agrárias com base em abordagens interdisciplinares e agroecológicas.

## I INTRODUÇÃO

Ninguém mais tem dúvida de que estamos vivendo em um mundo incerto, complexo, plural e de múltiplas possibilidades. Mas cheio de contradições, paradoxos e injustiças com problemas e necessidades de toda ordem (Moraes & Navas, 2010). São problemas sociais e ambientais, em especial, sem precedentes na história que anunciam uma crise civilizatória ou planetária (Morin, 2000). Não obstante, por trás dessa crise ainda persiste a crença de que, com a contínua inovação tecnológica, a civilização caminha inexoravelmente para superar os *limites naturais* que impedem a expansão do progresso humano no decorrer da história (Petersen et al., 2009). Mas a gravidade disso reside, contudo, no fato de que o modo de vida e o paradigma civilizatório que o sustenta continuam pondo em risco a própria sobrevivência não do planeta, mas talvez da espécie humana.

Do ponto de vista filosófico esse aparente *frisson* ou encantamento (fetiche) para com a inovação e invenção tecnológica é herança da concepção moderna de ciência que, em nome da ‘verdade científica’ e da ‘neutralidade’, vem dando sustentação teórica ao paradigma dominante.

Sempre que pôde, ele esteve a serviço do capital, a exemplo do que ocorreu com a modernização da agricultura. Pela via da revolução verde, as tecnologias tornaram-se meras mercadorias, e, portanto, acessíveis somente aos poucos que podem pagar por elas. Ademais, essa concepção de ciência é excludente, pois reconhece como válido somente o conhecimento científico, transformado em ideologia e mecanismo de dominação (Gomes, 1999). Segundo Morin (2008), existe uma ignorância ligada ao desenvolvimento da própria ciência. E, portanto, a superação dessa crise pressupõe uma radical mudança na maneira de pensar, gerar e aplicar ciência e tecnologia (Toledo, 2012). E, se por um lado a ciência moderna é dominante, por outro lado, não é única. Não há uma só ciência, mas muitas formas de conceber e fazer ciência e produzir conhecimento e tecnologia. É precisamente nessa fenda paradigmática que se insere a cunha da ciência denominada Agroecologia.

Ainda que o uso contemporâneo do termo Agroecologia date dos anos 1970, acredita-se que, tal qual ciência e prática, a Agroecologia seja tão antiga quanto a própria agricultura (Hecht, 2002). De um ponto de vista teórico, trata-se de um campo do conhecimento que

emerge da relação, nem sempre pacífica, entre o conhecimento científico e os saberes populares ou endógenos. Mas, ao traçar caminho próprio, a Agroecologia distanciou-se do engessamento disciplinar e linear, buscando fundamentação na interface, ora de negação ora de assimilação de conteúdos de outras áreas do conhecimento (agronomia, antropologia, biologia, comunicação, ecologia, educação, economia ecológica, física, história, sociologia etc.) para fundar aquilo que Caporal et al. (2006, p. 8) chamaram de “matriz teórica da Agroecologia”. Contudo, segundo Gomes (2006), a Agroecologia ainda não pode ser algo puro e acabado, que represente uma ruptura e que oriente a produção e circulação do conhecimento na agricultura. Isso poderá vir a ocorrer, mas dependerá de esforço intelectual, prática política, ajustes institucionais, entre outras coisas.

Até mesmo o conceito de Agroecologia ainda está em construção e vem recebendo várias contribuições nesse sentido. Para uns, “a Agroecologia é entendida como um enfoque científico destinado a apoiar a transição dos atuais modelos de desenvolvimento rural e de agricultura convencionais para estilos de desenvolvimento rural e de agriculturas sustentáveis” (Caporal & Costabeber, 2000). Para outros, o enfoque agroecológico pode ser definido como “a aplicação dos princípios e conceitos da ecologia no manejo e desenho de agroecossistemas (ou sistemas agroalimentares) sustentáveis” (Gliessman, 2001; 2014). A Agroecologia também tem sido entendida como um campo de conhecimento transdisciplinar que oferece os princípios teóricos e metodológicos básicos para possibilitar o desenho, redesenho e manejo de agroecossistemas sustentáveis e, além disso, contribuir para a conservação da agrobiodiversidade, da biodiversidade e da diversidade sociocultural (Empresa Brasileira de Pesquisa Agropecuária, 2006). Nesse sentido, o processo de transição agroecológica adquire grande relevância, e:

[...] está longe de ser considerado como algo pacífico, pré-determinado e tampouco pronto e acabado, pois encontra-se sob a disputa de dois projetos de sociedade que geram tensões e conflitos interna e externamente aos agroecossistemas. E a depender das opções dos atores sociais envolvidos poderá se trilhar o caminho em direção a modelos mais sustentáveis ou que referendem o modelo hegemônico/convencional. (Mattos et al., 2013, p. 4)

Isso pode ser visualizado na representação esquemática ilustrada na **Fig. 1**.

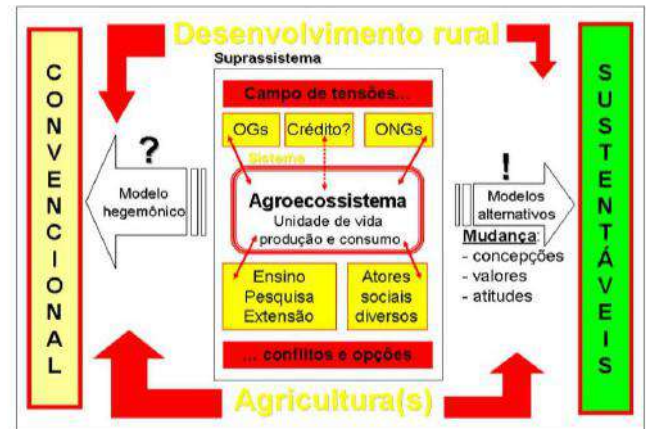


Fig.1: Representação esquemática da transição agroecológica. (Caporal et al, 2006).

Segundo Toledo (2012) encontra-se em curso na América Latina e Caribe um tríplice processo de transformação desencadeado pelo campo agroecológico: (i) cognitivo, epistêmico ou científico; (ii) prático ou tecnológico; e, (iii) social e/ou político. Não se sabe ao certo se é o conhecimento que provoca as mudanças tecnológicas e sociais, ou se são os movimentos sociais e políticos que induzem a um salto epistêmico e tecnológico, ou, ainda, se é um complexo de sinergias e reciprocidades resultantes de uma atuação conjunta. O que se sabe é que implica um único processo que articula essas três dimensões, e que opera de forma articulada promovendo mudanças substanciais nas sociedades, notadamente as latino-americanas em que estamos inseridas.

Gomes (2006) anunciou uma epistemologia para a Agroecologia, consubstanciada no pluralismo metodológico: (a) pluralidade de contextos e soluções para a produção e circulação do conhecimento; (b) abertura aos conhecimentos tradicionais como válidos; (c) implicação do contexto social e suas demandas na produção; e, (d) circulação do conhecimento e combinação de técnicas de pesquisa variadas, quantitativas e qualitativas; todas articuladas em uma perspectiva interdisciplinar. A esse pluralismo poderia ser atribuído a ideia-força da convivência, ao que Braudel (1987) chamou de “*vida material cotidiana*” e a relação entre o ser humano e a natureza, trazendo a ciência para este mundo em que as coisas acontecem: o mundo da vida, das mulheres, dos homens e da juventude. Nessa perspectiva, o pluralismo resulta numa ciência mais humanista, democrática, dialógica e inclusiva. Mas é necessário adotar não só ações de tipo interdisciplinares ou transdisciplinares, como também promover o diálogo de saberes, articulando os conhecimentos acadêmico-científico e popular-empírico.

Ou seja, é preciso superar a concepção de ciência como fonte única do conhecimento válido.

Mas qual tem sido o papel ou a conexão da educação do campo agroecológico com essa perspectiva pluralista? Na tentativa de fazer circular o conhecimento de base agroecológico na sociedade, várias iniciativas incorporaram a temática da Agroecologia em processos formativos sejam na concepção de novos cursos, novas disciplinas, sejam na inclusão como conteúdo do programa de disciplinas afins. Segundo Caporal (2010), em 2008 já existiam mais de 70 cursos de Agroecologia ou com enfoque em Agroecologia no país: “...vale a pena recordar que o Brasil é, provavelmente, o país com maior número de cursos de Agroecologia ou com enfoque agroecológico em funcionamento na atualidade, tanto de nível médio, quanto de nível superior”. (Caporal, 2010, p.2)

De fato, muitas disciplinas e cursos de Agroecologia têm sido criadas nas universidades, institutos federais e no ensino técnico, desde o nível médio, passando pelos cursos tecnológicos e bacharelados, até às pós-graduação *lato e strictu sensu*, sejam especializações, mestrados e doutorados. Isso por si só já poderia ser considerado um grande avanço pois, ao menos, sinaliza mudanças nas instituições de ensino, que reconhecem insuficiências nos cursos convencionais na área das ciências agrárias para dar conta da complexidade das questões socioambientais contemporâneas. E nesse sentido todas essas iniciativas, por serem legítimas e atuais, precisam ser reconhecidas e valorizadas.

Contudo, ao lançarmos um olhar pormenorizado sobre a práxis pedagógica dessas experiências, de valor, vamos perceber que algumas delas ainda guardam semelhança com concepções tradicionais do ponto de vista epistemológico e metodológico. Por decorrência, podem levar a resultados pouco expressivos para a transição agroecológica. Algumas delas, a despeito de esforços dos seus corpos docentes, não conseguiram ir além de um movimento para “ecologizar” e/ou “sociologizar” os cursos das ciências agrárias, em especial a agronomia. E isso, não deixa de ser algo bastante positivo.

Mas, a manutenção da estrutura curricular baseada na fragmentação do conhecimento, imposta pela segmentação disciplinar, pode por fim reduzir o alcance que se quer com o conceito de agroecologia.

A construção da Agroecologia não é uma questão de nomenclatura, e vai além da introdução de disciplinas de cunho mais sociológico e/ou ambiental. Requer uma prática pedagógica que supere a transmissão de conhecimento, centrada no professor e na sala de aula, cujo desdobramento tem implicado, não raro numa formação profissional reducionista.

Os motivos desta inércia já são bem conhecidos e, ainda que paulatinamente, precisam ser enfrentados, pois implicam numa reforma do pensamento e introdução de novos paradigmas. Ocorre que muitas vezes existe a vontade de mudar, mas não se sabe muito bem como e por onde começar. E se é verdade que a mudança deve ser profunda, também é verdade que algumas experiências parecem estar no caminho certo, ao menos, com referência aos fundamentos epistemológicos e metodológicos. Nesse sentido, valeria a pena serem conhecidas e acompanhadas, criticadas e, reajustadas para servirem de fonte de inspiração para a construção de algo no contexto educacional brasileiro. Não necessariamente para serem copiadas pois, nesse caso, quaisquer experiências só lograrão êxito se concebidas, construídas e assimiladas pelo conjunto dos próprios sujeitos envolvidos localmente.

Por razões objetivas, esse artigo procura abordar uma experiência em particular do Programa de Ciências Agroambientais da Universidade do Estado de Mato Grosso (UNEMAT), mais precisamente do curso de Bacharelado de Agronomia do *Campus* Universitário de Tangará da Serra/MT, Brasil. Ela traz para o debate alguns elementos importantes no que se refere às suas concepções metodológicas. Eles poderão subsidiar futuras análises, tanto do ponto de vista dos avanços, quanto dos possíveis retrocessos aos quais tais iniciativas, pela sua natureza, poderão enfrentar. Trata-se de um curso de Agronomia com enfoque em Agroecologia. Esse bacharelado primou durante alguns anos por uma formação universitária baseada numa abordagem (inter)transdisciplinar, nos princípios e fundamentos da Agroecologia, de modo a compor novos arranjos entre ensino, pesquisa e extensão.

Das várias experiências que têm sido postas em prática no Brasil abordaremos aqui a experiência do

A partir desse caso, passa-se a uma abordagem crítica do tripé ensino – pesquisa – extensão, que em tese deveria estar presente no dia a dia de todas as universidades. A terceira parte diz respeito as experiências propriamente ditas do curso de agronomia da UNEMAT. Por fim, são apresentadas algumas contribuições para seguimento desse debate, que não iniciou e nem terminará aqui, merecendo uma reflexão mais ampla por todos aqueles que estão engajados em pensar as bases para uma **educação de base agroecológica**.

### **1.1 A necessária crítica à relação entre ensino, pesquisa e extensão**

À universidade é atribuída ainda desconhecida trilogia do ensino, pesquisa e extensão como marca de indissociabilidade. Mas, em geral, se prioriza a pesquisa em prejuízo do ensino e da extensão, como se ambos não

fossem também flechas de um mesmo arco: a construção integrada do conhecimento.

Na maioria das vezes, o processo de ensino-aprendizagem está centrado na figura docente na sala de aula. O professor fala, o aluno escuta, toma nota e devolve na prova, e o aluno vinga-se na “cola”, que é a perfeição da cópia (Demo, 2001, p. 137). Isso vai de encontro aos ensinamentos de Paulo Freire, que diz: “[...] nas condições da verdadeira aprendizagem os educandos vão se transformando em reais sujeitos da construção do saber ensinado, ao lado do educador igualmente sujeito do processo” (Freire, 2002, p. 14).

O paradigma educacional dominante está baseado, portanto, na ideia de que o professor apenas transmite o conhecimento que deverá ser assimilado pelo aluno. Nesse processo, não são desenvolvidos o senso crítico e a capacidade de reflexão para a problematização da realidade, muitas vezes distante da sala de aula. Ao modelo educacional baseado nessa dinâmica, Freire denominou de *bancário*, em que o educador seria um depositante e o educando, um depósito de conhecimentos, com a função, prioritariamente, de memorização de algo já acabado. Em lugar de comunicar-se, o educador faz comunicados - os depósitos - que os educandos - meros depositários - recebem pacificamente, memorizam e, repetem. Eis aí a concepção bancária da educação, em que a única margem de ação que se oferece aos educandos é a de receberem os depósitos, guardá-los e arquivá-los (Freire, 1987).

Associado a isso, não raro, encontra-se aquilo que Libâneo (2009) caracterizou como marcas tradicionais das práticas de ensino:

[...] conteúdos descontextualizados, fragmentação dos saberes, individualismo dos professores, disputa hegemônica entre os campos científicos. A essas características juntam-se algumas consequências: aulas monótonas e predominantemente expositivas que não despertam o interesse dos alunos, formas de avaliação restritas a cobrar a memorização, pouca ligação entre o ensino e a prática, professores inflexíveis no modo de pensar, distanciados das vivências dos alunos e sem capacidade de diálogo ou de sensibilidade para motivá-los. A solução sugerida para melhorar a qualidade do ensino tem sido ministrar formação pedagógico-didática a esses professores. Contudo, alguns estudos no âmbito da pedagogia apontam que as limitações das formas atuais de ensino seriam decorrentes menos da falta de formação pedagógico-didática e mais de um posicionamento epistemológico tácito dos professores, isto é, de um modo de pensar decorrente da visão cartesiana de ciência, que se reflete

em aprendizagens parciais, fragmentadas, pouco imaginativas (Libâneo, 2009, p. 9).

A extensão, por sua vez, em especial a Extensão Rural (vista como extensão para o rural), é com frequência praticada como via de mão única nas comunidades, a exemplo de obras assistenciais, pois quase sempre se desconsidera o que pensam, o que sabem, o que fazem e o que desejam as pessoas que vivem nesse mesmo rural. Como resultado, quase invariavelmente, os projetos rurais são formulados nos gabinetes, sem a participação do público beneficiário.

Já a pesquisa não é concebida como um instrumento de ensino (Demo, 2003), mas como um fim em si mesmo, ou para a obtenção de qualificações circunscritas ao mundo acadêmico. Nessas circunstâncias, a participação discente se converte em “mão de obra barata”, e os grupos pesquisados se tornam “objeto da pesquisa”, e nunca sujeitos/agentes de reflexão, emancipação e intervenção.

Freire (1990) nos ensina que:

No uso de instrumentos de pesquisa, a minha opção deve ser libertadora, se a realidade se dá a mim não como algo parado, imobilizado, posto aí, mas na relação dinâmica entre objetividade e subjetividade. Não posso reduzir os grupos populares a meros objetos de minha pesquisa. Simplesmente não posso conhecer a realidade de que participam a não ser com eles, como sujeitos também deste conhecimento que, sendo, para eles, um conhecimento do conhecimento anterior (o que se dá ao nível da sua experiência cotidiana), se torna um novo conhecimento. Na perspectiva libertadora em que me situo, a pesquisa, como ato de conhecimento, tem como sujeitos cognoscentes, de um lado, os pesquisadores profissionais; de outro, os grupos populares e, como objeto a ser desvelado, a realidade concreta. (p. 36).

Ensino sem pesquisa é um mero repasse ultrapassado de conhecimento (Demo, 2003). E, uma universidade que apenas ensina está obsoleta, pois tornou-se herdeira de uma relação perversa, autoritária e vertical em que o professor finge que ensina e o estudante finge que aprende (Werneck, 1992). Da mesma forma, ensino e pesquisa sem extensão é conceber a universidade como ilha do saber, que cultiva seu próprio “umbigo” como objeto de estimação, desvinculado da realidade e da sociedade que, em última análise, a mantém financeiramente.

Segundo Brandão (1999, p. 8), “[...] só se conhece em profundidade alguma coisa da vida da sociedade ou da cultura quando através de um envolvimento — em alguns casos, de comprometimento — pessoal entre o pesquisador e aquilo ou aquele que ele investiga”.

Portanto, para lograr êxito, os processos educativos não podem se dar desvinculados da realidade, nem tampouco prescindir da figura dos grupos pesquisados e dos próprios estudantes como coparticipes da construção do conhecimento, senão serão meros objetos de ensino, de extensão ou de pesquisa. Isso porque “[...] não se faz antes pesquisa e depois educação, ou vice-versa, mas, no mesmo processo, educação através da pesquisa” (Demo, 2003).

Um modo de se fazer pesquisa a partir de realidades concretas, com vista a se desenvolver processos educativos transformadores e emancipadores, é a pesquisa-ação. Nesse aspecto, nos alinhamos com a concepção crítica de Franco (2005), que diz:

[...] se essa transformação é percebida como necessária a partir dos trabalhos iniciais do pesquisador com o grupo, decorrente de um processo que valoriza a construção cognitiva da experiência, sustentada por reflexão crítica coletiva, com vistas à emancipação dos sujeitos e das condições que o coletivo considera opressivas, essa pesquisa vai assumindo o caráter de criticidade e, então, tem se utilizado a conceitualização de pesquisa-ação crítica.

A pesquisa-ação pode ser definida, de acordo com Thiollent (2005, p.14) como:

[...] um tipo de pesquisa com base empírica que é concebida e realizada em estreita associação com uma ação ou realização de um problema coletivo e no qual pesquisadores e participantes representativos da situação ou do problema estão envolvidos de modo cooperativo ou participativo.

Portanto, rearticular ensino-pesquisa-extensão não só é possível como necessário. Principalmente em se tratando do contexto brasileiro, em que a regra é a falta de acesso aos conhecimentos, à educação, às políticas públicas, enfim, aos direitos fundamentais.

## II MATERIAL E MÉTODOS

O presente trabalho constou de uma revisão bibliográfica, inserida no estudo de caso, já mencionado, do curso de agronomia no Campus de Tangará da Serra, Mato Grosso, Brasil. Segundo Berbel (2011, p.31) o estudo de caso é recomendado para investigar situações que requerem análises sob diferentes ângulos. Contudo, “o importante é que haja critérios explícitos para a seleção do caso e que este seja realmente um ‘caso’, isto é, uma situação complexa e/ou intrigante, cuja relevância justifique o esforço de compreensão” (Alves-Mazzotti, 2006, p. 650).

O curso foi implantado em 2001 e “perdeu sua identidade” em 2006, com a entrada de profissionais com

viés tecnicista, via concurso público. Na verdade, hoje o curso continua em funcionamento, porém sob uma roupagem mais convencional, pois está mais voltado para formar profissionais para atuarem na produção de *commodities* e atender a demanda do agronegócio da mesorregião do sudoeste do estado de Mato Grosso, Brasil, que tem nas culturas da cana-de-açúcar, soja e pecuária extensiva suas maiores expressões.

A experiência foi vivenciada por um dos autores, o que perfaz a condição de pesquisador participante. Além das observações, notas e sistematizações *in loco* e *póstumas* da experiência, as análises receberam contribuições e revisão de uma equipe de especialistas em educação agroecológica, composta por agrônomos, geógrafos, sociólogos e pedagogos, que retomaram a concepção original do curso, bem como abordaram de forma crítica os encontros e desencontros da de sua importante ainda que breve trajetória. Assim, aspectos históricos, pedagógicos e políticos são mencionados a luz de uma concepção agroecológica e interdisciplinar da educação superior.

## III RESULTADOS E DISCUSSÃO

### 3.1 A experiência do curso de agronomia com enfoque agroecológico no Programa de Ciências Agroambientais da UNEMAT

Com as possibilidades de aumentar a flexibilização curricular, decorrentes da Lei de Diretrizes e Bases da Educação Nacional (BRASIL, 1996), muitas ideias nesse sentido foram colocadas em prática. A partir delas, surgiram experiências com concepções mais integradoras nos processos formativos nas instituições de ensino superior do país. E isso foi mais fácil de implementar em instituições mais jovens ou “periféricas”, por não estarem tão atreladas a tradições e normas rígidas de estruturas conservadoras.

A partir daí, um grupo de professores da UNEMAT iniciou, em 1998, os primeiros movimentos para a elaboração de uma proposta que mais tarde veio a se configurar na criação de um Programa no campo das Ciências Agroambientais (PCAA) de natureza *multicampi*, mas focado nas especificidades regionais. O PCAA foi implementado a partir de 2001 em quatro *Campi* universitários da UNEMAT, a saber: (i) Alta Floresta - Agronomia, Ciências Biológicas e Engenharia Florestal; (ii) Cáceres - Agronomia; (iii) Pontes e Lacerda - Zootecnia; e, (iv) Tangará da Serra - Agronomia e Ciências Biológicas.

Tal Programa propunha a criação de cursos novos com enfoque agroecológico, cujo arcabouço curricular previa a existência de um **Núcleo Básico Comum**, correspondente

ao primeiro ano dos cursos, envolvendo conhecimentos básicos de biologia, física, matemática, filosofia, sociologia, etc, e um **Núcleo Específico**, correspondente aos três anos restantes do curso. Esse núcleo envolveria conhecimentos específicos da formação profissional dos cursos, consubstanciados por uma metodologia diferenciada, cujas unidades de ensino deveriam ser os **Grupos de Aprendizagens (GA)**. A metodologia foi adaptada do projeto político pedagógico de algumas Licenciaturas (Física, Química e Matemática) para atender as exigências da indissociabilidade do ensino, pesquisa e extensão da Lei 9394/96 (PCAA, 2004). Com isso, propunha-se então acabar com as metodologias de ensino puramente repetitivas, dependentes, limitantes e estáticas. Elas dariam lugar a metodologias participativas, estimulantes, criativas e autogeradoras dos mais elevados níveis de potencial humano.

Os GAs (composto por professores e estudantes) deveriam ser inseridos em estruturas pedagógicas mais amplas denominadas de **Grupo de Aprendizagem, Investigação e Extensão (GAIE)**, compostos por um coordenador, e todos os professores e estudantes dos GAs. Os GAIEs deveriam dar conta do estudo de temas-problemas, específicos de cada região onde estariam implantados os diferentes cursos. Estes temas-problemas deveriam ser definidos em assembleias quadrienais, com a participação da comunidade local. Assim, o PCAA de cada *Campus* deveria comportar em sua estrutura organizacional a assembleia, os temas-problemas, a coordenação do PCAA dos *Campi*, os coordenadores dos cursos, os GAIEs e os GAs (Fig. 2).

A metodologia previa liberdade na organização curricular, mas impunha como desafio a criatividade no planejamento pedagógico dos GAs e dos GAIEs que deveriam contemplar atividades de ensino, pesquisa e extensão numa perspectiva interdisciplinar e condições de ensino-aprendizagem propícias ao desenvolvimento dos alunos como sujeitos na construção de seu próprio conhecimento.

Assim, na concepção dos GAIEs e GAs seria adotada como estratégia pedagógica o método ou a pedagogia de projetos, cuja dinâmica deveria imprimir determinado grau de reflexão e aprofundamento suficiente para responder a uma questão/problema real a ser desvendada, tendo como base teórica o suporte da literatura e conhecimentos trabalhados em sala de aula e, como norte, a apreensão da realidade desvelada, mas sobretudo o próprio processo de aprendizagem derivado dessa mesma reflexão e vivência prática. Dessa maneira o número de GAIEs e GAs seria determinado em função do conjunto de conhecimentos e carga horária que deveriam ser integralizados à formação dos alunos ao longo dos quatro anos do curso. Além disso,

deveriam considerar as condições de infraestrutura e logística dadas e os níveis de entrosamento, envolvimento, integração, cumplicidade e capacidade operacional conjunta da equipe de professores e estudantes.

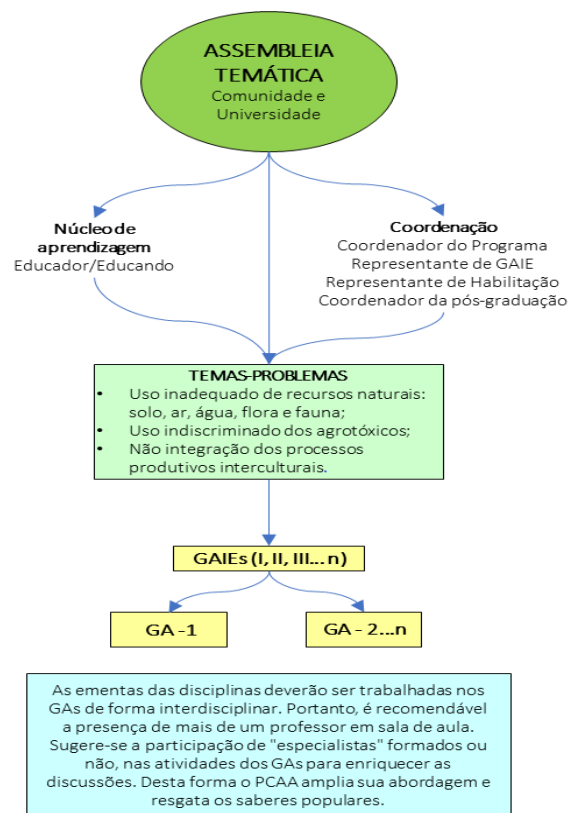


Fig.2 – Representação esquemática do PCAA do Campus de Tangará da Serra.

A ideia original do PCAA previa a disponibilização de uma infraestrutura mínima de funcionamento com salas de aulas, laboratórios, bibliotecas, rede de convênios e parcerias e a contratação de professores com dedicação exclusiva para atuarem no Programa.

O primeiro passo para pôr em prática o Programa seria a implantação do GA, com vistas ao autoconhecimento de professores e estudantes. O ponto de partida era o pressuposto de que o PCAA requereria uma mudança de mentalidade frente as questões colocadas para os indivíduos e que exigiria um (re)posicionamento destes no mundo. Nas palavras de Capra (1995, p. 85), seria necessário desenvolver uma sensibilidade ou uma “consciência do estado de inter-relação e interdependência essencial de todos os fenômenos físicos, biológicos, psicológicos, sociais e culturais”, de modo a assumir novas posturas, compromissos e atitudes diante de si e do mundo. Isso se deve ao fato que, por um lado, tanto professores quanto estudantes não teriam acompanhado o processo na fase de concepção e de elaboração do projeto do PCAA. Por outro lado, ambos viriam de experiências



cujos padrões pedagógicos estariam pautados numa concepção ainda limitada, cujo modelo de ensino e aprendizagem era centrada no professor que seria o detentor do conhecimento e os alunos meros receptores de informações. Daí a necessidade de uma imersão prévia na concepção do PCAA, no âmbito do indivíduo, das relações entre indivíduos e desses com o ambiente. O objetivo era de constituir os fundamentos para uma ação pedagógica coletiva.

Para tal deveria lançar-se mão de “laboratórios” envolvendo os temas da “anamnese” e neurolinguística, com a organização de oficinas no campo, junto às populações tradicionais, aos povos da floresta e das águas, onde se utilizam-se as dramatizações com vistas a recuperação do histórico pessoal, a mudança de linguagem e pensamento, a auto-organização, o desenvolvimento da percepção, a sinergia com o ambiente e com raízes étnicas e culturais, e a (re)socialização.

O segundo passo seria em termos práticos o planejamento dos GAIEs e GAs no âmbito do Núcleo Básico Comum e do Núcleo Específico nos diferentes cursos dos diversos *campi*. Isso desencadeou processos distintos com diferentes intensidades e amplitudes na organização dos GAIEs e GAs gerando concepções e formatos próprios de cada local. Desse modo, nos deteremos aqui, sem demérito para as experiências desenvolvidas nos demais *campi*, na análise do PCAA do *Campus* de Tangará da Serra, mais especificamente na experiência do curso de Agronomia com enfoque agroecológico.

Em Tangará da Serra não houve uma Assembléia para definir os temas-problemas e tampouco se realizou o GA – Conexão aos moldes propostos no projeto político pedagógico original do PCAA. Da mesma forma nem todos os professores foram contratados com dedicação exclusiva. Não obstante, optou-se pelos mesmos temas-problemas sugeridos no projeto original, a saber: i) uso inadequado dos recursos naturais (solo, água, ar, flora e fauna); ii) uso indiscriminado de agrotóxicos; e, iii) falta de integração dos processos produtivos interculturais. Partiu-se do entendimento de que os três temas estavam ainda bem atuais, mesmo que não tivessem sido resultado de um amplo debate com a comunidade local. Por sua vez, o GA de autoconhecimento também não aconteceu, e seu tempo foi dedicado ao estudo individual e coletivo da concepção do projeto político pedagógico do PCAA.

### 3.2 O processo de planejamento de GAIEs e de GAs

O planejamento dos GAIEs e dos GAs era feito na semana pedagógica. Ambos eram concebidos na forma de eixos temáticos e constituídos dos seus respectivos objetivos. Inicialmente, toda a equipe de professores se

reunia para tratar do planejamento dos GAIEs, que eram pensados de maneira sistêmica e contextualizada do ponto de vista espacial e temporal. Assim, para a estruturação do conjunto dos GAIEs, levava-se em consideração a totalidade expressa no perfil do profissional a ser formado, parte integrante do projeto político pedagógico do curso. Além disso, era fundamental a inserção sócio-política local, evidenciada pelas questões-problema, bem como a necessária interação, correlação e complementariedade entre os diferentes GAIEs. Tudo isso era integralizado em uma carga horária total de 4.050 horas.

Esse exercício exigia uma compreensão ampla do curso, não só na visualização de suas partes em correspondência com o todo, mas também da sincronia entre as partes. A ideia era viabilizar a sua exequibilidade e operacionalidade do ponto de vista metodológico e pedagógico. Os GAIEs eram planejados a cada semestre e/ou ano, buscando-se fazer uma permanente aproximação com o viés agroecológico do curso.

No **Quadro 1** encontra-se o exemplo/visão geral de uma das últimas aproximações pensadas nessa perspectiva agroecológica. O GAIE I consistiria na abordagem das diferentes concepções de ciência, tecnologia e sociedade no sentido de entender os processos históricos de ocupação socioeconômica e ambiental do território mato-grossense. No GAIE II seria focado mais o uso dos recursos naturais e suas implicações na sustentabilidade dos biomas Cerrado, Pantanal e Floresta amazônica. De posse destes conhecimentos os alunos estariam aptos a ingressar no GAIE III para tratar de maneira mais aprofundada o mundo do agroecossistema, ou seja, a unidade de análise da Agroecologia. Para, então, no GAIE IV e V aprender a redesenhar e manejar esses agroecossistemas, culminando com a preparação para a intervenção e reorganização sustentável do supra-sistema ou território, num sentido mais amplo, no GAIE VI.

Uma vez constituídos os GAIEs, o passo seguinte envolvia a concepção dos GAs, relacionados a cada um dos GAIEs. Para dar conta da temática do GAIE I foram pensados dois GAs. O GA 1 versava sobre as explorações extrativista, tradicional e industrial e seus desdobramentos na concentração dos meios de produção, na reforma agrária e na luta pela terra na região. Já o GA 2 estava voltado para o entendimento das dicotomias, conflitos e diálogos entre os conhecimentos indígena, tradicional e o científico. Os GA 3 e GA 4 trataram no GAIE II da biodiversidade dos biomas cerrado e da floresta amazônica despertando nos alunos uma visão mais *ecocêntrica* da relação sociedade – natureza e mais racional do ponto de vista do uso dos recursos naturais. Adentrando-se no GAIE III seria abordado o papel da Agronomia (GA 5) e a importância da multifuncionalidade da agricultura de base

familiar (GA 6) para a soberania e segurança alimentar e nutricional, cujos alimentos seriam oriundos de unidades produtivas nas quais o componente principal do sistema seria a família (GA 7). E a partir da compreensão dos conceitos de agroecossistemas equilibrados e resilientes (GA 8) e poupadores de energia (GA 9) do GAIE IV, seriam lançadas as bases para o entendimento do processo de transição agroecológica. Para, então, no GAIE V, abordar o manejo desses agroecossistemas (GA 10) em escalas mais amplas do supra-sistema (GA 11) e sob um enfoque territorial (GA 12), necessários a compreensão do processo de consolidação da transição agroecológica. De posse desses conhecimentos seria finalizado o processo formativo com o domínio das ferramentas de gestão de sistemas produtivos (GA13), desde os mais simples aos mais complexos (GA14), sem, contudo, deixar de abordar a necessária agregação de valor (GA14), bem como a estratégica criação de novos mercados (GA16), consubstanciada na solidariedade, ajuda mútua e na reciprocidade.

**Quadro 1 – Organograma do curso de Agronomia do Programa de Ciências Agroambientais do Campus Universitário de Tangará da Serra – UNEMAT/2006.**  
(Fonte: Os Autores).

| ORGANOGRAMA DO CURSO DE AGRONOMIA                                                                                 |                                                                 |                                                                                    |                                        |
|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------|
| Núcleo Básico Comum                                                                                               |                                                                 |                                                                                    |                                        |
| 1º Ano                                                                                                            |                                                                 |                                                                                    |                                        |
| <b>GAIE I</b><br>Ciência, tecnologia e sociedade: processos históricos de (re)ocupação socioeconômica e ambiental |                                                                 |                                                                                    |                                        |
| <b>GA 1</b>                                                                                                       |                                                                 | <b>GA 2</b>                                                                        |                                        |
| Modelos de extrativismo e de produção agrícola: embates e interações                                              |                                                                 | Relações entre os saberes e o desenvolvimento socioeconômico e ambiental da região |                                        |
| <b>GAIE II</b><br>Recursos naturais e suas relações com a sustentabilidade                                        |                                                                 |                                                                                    |                                        |
| <b>GA 3</b>                                                                                                       |                                                                 | <b>GA 4</b>                                                                        |                                        |
| Conhecimento das inter-relações dos recursos naturais                                                             |                                                                 | Identificação dos recursos naturais no processo de sustentabilidade                |                                        |
| Núcleo Específico                                                                                                 |                                                                 |                                                                                    |                                        |
| 2º Ano                                                                                                            |                                                                 |                                                                                    |                                        |
| <b>GAIE III</b><br>Conhecendo o Agroecossistema                                                                   |                                                                 |                                                                                    |                                        |
| <b>GA 5</b>                                                                                                       | <b>GA 6</b>                                                     | <b>GA 7</b>                                                                        |                                        |
| Histórico e perspectiva da agricultura e da agronomia                                                             | Estágio I: Limitações e potencialidades da agricultura familiar | Componentes dos agroecossistemas e suas relações                                   |                                        |
| <b>GAIE IV</b><br>Redesenhando o agroecossistema                                                                  |                                                                 |                                                                                    |                                        |
| <b>GA 8</b>                                                                                                       |                                                                 | <b>GA 9</b>                                                                        |                                        |
| Equilíbrio solo – planta – animal – atmosfera                                                                     |                                                                 | Viabilidade das fontes renováveis de energia                                       |                                        |
| 3º Ano                                                                                                            |                                                                 |                                                                                    |                                        |
| <b>GAIE V</b><br>Manejo sustentável do agroecossistema                                                            |                                                                 |                                                                                    |                                        |
| <b>GA 10</b>                                                                                                      | <b>GA 11</b>                                                    | <b>GA 12</b>                                                                       |                                        |
| Sistema de produção animal e vegetal                                                                              | Dinâmica das micróbacias no Vale do rio Sepotuba                | Estágio II: (Re)organização da agricultura familiar em bases agroecológicas        |                                        |
| 4º Ano                                                                                                            |                                                                 |                                                                                    |                                        |
| <b>GAIE VI</b><br>Organização e viabilidade das comunidades rurais                                                |                                                                 |                                                                                    |                                        |
| <b>GA 13</b>                                                                                                      | <b>GA 14</b>                                                    | <b>GA 15</b>                                                                       | <b>GA 16</b>                           |
| Gestão de agroecossistemas                                                                                        | Sistemas agroflorestais                                         | Agroindústria familiar                                                             | Comércio e consumo justos e solidários |

Uma vez definidos os GAIEs e seus respectivos GAs, os títulos de ambos eram dispostos numa matriz de modo a facilitar a sua visualização, bem como a inserção dos conhecimentos, conteúdos, carga horária e professores responsáveis relativos a cada GA, cuja unidade de ensino deveria comportar uma carga horária total de mais ou menos 250 h.a.

Os conhecimentos eram definidos e inseridos na matriz de modo a responder a temática do GA. Da mesma forma, os conteúdos eram selecionados, desde os ementários das disciplinas, para dar conta de atender à amplitude e conferir consistência a estes conhecimentos.

Ao final do planejamento do grande grupo de professores realizava-se uma espécie de exercício dinâmico de análise e de síntese envolvendo o coletivo dos professores que resultava, geralmente, em pequenos ajustes de modo a se chegar a uma distribuição completa dos conteúdos e da carga horária para cada GA. Ou seja, no exercício de análise partia-se do pressuposto de que para a operacionalização do GAIE seria necessário um conjunto de ações materializadas na figura do GA, que por sua vez deveria estar embasado por um conjunto de conhecimentos, conferidos pelo suporte de uma variedade de conteúdos integrados e correlatos.

No exercício de síntese, examinava-se se o elenco de conteúdos que compunha o conjunto de conhecimentos era suficiente para dar conta dos objetivos e das tarefas dos GAs, de modo a que estes atendessem aos desafios do GAIE. O último passo do planejamento consistia na preparação do GA propriamente dito. Essa etapa era trabalhada em sala de aula envolvendo os professores e os alunos do GA e resultava num conjunto de atividades materializadas na forma de projeto, cujo limite era a criatividade sem, contudo, perder o foco. Na elaboração do projeto a equipe do GA (re)definia os objetivos, a justificativa, o período de execução, as possíveis parcerias, os materiais e equipamentos, o orçamento, os resultados esperados e a avaliação. Além da preparação dessas atividades, os professores de cada GA se reuniam semanalmente para planejar as tarefas e atribuições da semana seguinte.

O conjunto das atividades envolvia desde aulas expositivas, dialogadas, com dois ou mais professores em sala de aula ou a campo, com convidados externos, geralmente técnicos ou agricultores de notável saber, pesquisa na biblioteca e internet, participação em congressos, júris simulados, visitas a campo (pelo menos uma por semestre), viagens de estudo, estudos de caso, ações com comunidades, etc. que culminavam em um grande seminário envolvendo a socialização das experiências de todos os GAs do PCAA local.

### 3.3 Resultado do planejamento - o caso do GA11

No **Quadro 2** é apresentado um esboço do planejamento do GA 11, parte integrante do GAIE V constando das disciplinas, cujos conhecimentos e conteúdos foram utilizados no desenvolvimento das atividades do grupo de aprendizagem, bem como carga horária do GA e professores participantes.

No início do semestre, como de praxe, os alunos receberam na sala de aula aporte teórico dos professores com vistas a “nivelar” seus conhecimentos sobre os conteúdos, e subsidiá-los na elaboração do projeto do GA. Antes disso, porém, foi realizado um Diagnóstico Rápido e Participativo (DRP) com uma comunidade, a fim de identificar possíveis problemas, soluções e prioridades. Ou seja, o ponto de partida foi a realidade dos sujeitos parceiros do projeto.

**Quadro 2** – Aspectos parciais do resultado do planejamento do GA 11 do GAIE V

| GAIE V                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                |                                                                                                                                                                                                                              |          |                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------------------------------|
| Manejo sustentável do agroecossistema                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                |                                                                                                                                                                                                                              |          |                                  |
| GA 11                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                |                                                                                                                                                                                                                              |          |                                  |
| Sistemas de produção animal e vegetal                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                |                                                                                                                                                                                                                              |          |                                  |
| Conhecimento                                                                                                                                                                                                                                                     | Conteúdo                                                                                                                                                                                                                                       | Disciplina                                                                                                                                                                                                                   | CH (h.a) | Prof.*                           |
| <ul style="list-style-type: none"> <li>Teoria dos sistemas</li> <li>Ecofisiologia</li> <li>Policultivos</li> <li>Diversidade</li> <li>Botânica</li> <li>Climatologia</li> <li>Solos</li> <li>Microbiologia</li> <li>Agricultura familiar</li> <li>Etc</li> </ul> | <ul style="list-style-type: none"> <li>Agroecossistema</li> <li>Interações dos componentes do sistema</li> <li>Manejo de pastagem</li> <li>Ciclagem de nutrientes</li> <li>Consórcio</li> <li>Simbiose</li> <li>Regime de chuvas...</li> </ul> | <ul style="list-style-type: none"> <li>Agroecologia</li> <li>Máquinas</li> <li>Fitotecnia</li> <li>Fertilidade do solo</li> <li>Manejo de plantas adventícias</li> <li>Planejamento</li> <li>Extensão rural, etc.</li> </ul> | 250      | P1<br>P2<br>P3<br>P4<br>P2<br>P1 |
| Atividades                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                |                                                                                                                                                                                                                              |          |                                  |
| 4 - Intercâmbio com a Comunidade Belo Horizonte                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                |                                                                                                                                                                                                                              |          |                                  |
| n...                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                |                                                                                                                                                                                                                              |          |                                  |
| 3 - Monitoramento da precipitação com pluviômetro                                                                                                                                                                                                                |                                                                                                                                                                                                                                                |                                                                                                                                                                                                                              |          |                                  |

\*A participação de alguns professores era pontual, ou seja, apenas para dar suporte a algum tema específico, cujos conhecimentos eram demandados no GA.

As atividades foram desenvolvidas numa comunidade de agricultores familiares mineiros no município de Tangará da Serra – MT. A disciplina de Extensão Rural forneceu os passos para a realização do DRP e identificação dos problemas com a comunidade Belo Horizonte, a partir da fala dos agricultores: “*não paga a pena soltar minhas vaquinhas nesse pasto seco porque não produz nada, o leite não dá nem pro bezerro*”, o que numa linguagem mais acadêmica seria traduzido como “*uma condição de pastagem sob superpastejo em solo degradado, com pouco potencial para a produção de leite*”.

A solução encontrada foi a implantação de um painel de plantas adubadoras e forrageiras em caráter

experimental, em uma área de um dos agricultores. Ou seja, como bem profetizou um dos agricultores “*se o estudo for feito aqui na comunidade vai dar pra gente ver se esse trem é bom mesmo*”. No início dos trabalhos, a disciplina de Planejamento orientou os cálculos de densidade de semeadura na área, levando em conta o material disponível e os custos de produção.

A identificação, preparo e sistematização do solo foi orientada pelas disciplinas de máquinas agrícolas e solos. A disciplina de microbiologia forneceu o aporte teórico para compreender a associação das leguminosas com as bactérias fixadoras de nitrogênio. As disciplinas de Fitotecnia e Forragicultura trataram de elencar as espécies de gramíneas e leguminosas adaptadas ao cultivo consorciado, ciclo de cultivo, bem como a aferição da quantificação de biomassa em comparação com as espécies de uso tradicional na comunidade. O plantio das espécies de adubos verdes e forrageiras bem como a sua colheita foram feitas na forma de mutirão envolvendo os agricultores experimentadores e alunos. Durante o ciclo das culturas foi feito o monitoramento das precipitações ocorridas no local com o uso de um pluviômetro e a identificação das plantas. Também foi feito o monitoramento de ocorrência de insetos-praga e microrganismos causadores de doenças das espécies cultivadas. No final das atividades realizou-se um dia de campo com a presença dos agricultores envolvidos na experimentação, alunos do GA e Escola Agrícola, professores, demais pessoas da comunidade e imprensa local.

Na ocasião os agricultores experimentadores e alunos relataram a experiência aos demais convidados e comentaram sobre o potencial das forrageiras e adubos verdes testados de modo a recuperar a fertilidade do solo. Foi também discutida as possibilidades para melhorar a produção de leite em regime de pasto. Na semana seguinte a atividade foi retomada em sala de aula com alunos e professores do GA para uma avaliação dos resultados tanto do ponto de vista técnico quanto pedagógico. A avaliação e autoavaliação percorreu depoimentos desde percepções que focaram o caráter multi e/ou interdisciplinar, coletivo, participativo e cooperativo do trabalho, passando pela constatação da efetiva relação da teoria com a prática propiciada pela pedagogia de projetos.

Contudo, o que mais chamou atenção foi o depoimento unânime dos alunos de que o aprendizado se deu de forma mais “leve, concreta, envolvente, efetiva, instigante e prazerosa”, pelo fato de ter se dado a partir da realidade dos agricultores e com os agricultores. E associado a isso a percepção do significativo envolvimento e compromisso dos agricultores com a execução do projeto. Ou seja, tornou-se evidente que aquilo que se planeja **com** os

agricultores tem mais chances de dar certo do que aquilo que se planeja **para** os agricultores. Por fim, a experiência vivenciada pelo GA foi apresentada pelos alunos no seminário geral no final do semestre diante de uma banca de professores, para o conjunto dos professores e alunos dos demais GAs.

### **3.4 Análise crítica da experiência do curso de agronomia da UNEMAT**

#### **3.4.1 Motivações iniciais**

A implantação do curso de agronomia com enfoque em Agroecologia, como parte do PCAA, na UNEMAT de Tangará da Serra, poderia ser vista como uma atitude aparentemente de pura ousadia ou perspicácia política dos gestores locais, que aproveitando a onda de criação de novos cursos na instituição, fizeram valer seu peso nas instâncias de tomada de decisões.

Afinal, um *campus* com poucos recursos, sob resistências internas dos demais cursos que ainda não haviam se consolidado, representava um cenário menos propício para tais mudanças, não fosse a demanda da sociedade, o apoio dos poderes públicos locais e a existência de um contexto rural significativamente rico e diverso. A região apresentava uma realidade rural essencialmente plural e repleto de contradições, construído por sujeitos diversos. De um lado povos indígenas, migrantes do sul, sudeste e nordeste, agricultores familiares tradicionais, ribeirinhos, assentados da reforma agrária são alguns exemplos. Essa população encontra-se até hoje comprimida no espaço agrário pela vasta extensão de terras que, por outro lado, pertencem a empresas rurais dedicadas a monocultura agroexportadora da soja, da cana-de-açúcar e de gado, cuja propriedade está em mãos de grupos externos, paulistas e estrangeiros, e, em geral, são os maiores responsáveis pelo desmatamento, assoreamento dos rios e contaminação do ambiente.

Esses contrastes criavam, portanto, um verdadeiro “laboratório” de estudo para o campo das ciências ambientais e da Agroecologia. Isso fortaleceu os argumentos para que os gestores e representantes locais se convencessem da viabilidade do curso, a ponto de colocar com muita habilidade na “mesa de negociação” da arena institucional aquilo que, por muito tempo teria sido apenas um sonho da comunidade tangaraense.

Outros argumentos se somaram a esses, perfazendo as bases para uma narrativa consistente que se sobrepôs às resistências internas e não mediram esforços para que o curso de agronomia se tornasse realidade. Juntamente com o curso de ciências biológicas, a Agronomia com enfoque agroecológico passou a compor o Programa de Ciências Agroambientais (PCAA) do *Campus* de Tangará da Serra.

A UNEMAT fez jus a sua fama de ser uma “universidade do interior para o interior”, ratificando seu compromisso com o desenvolvimento dos municípios interioranos do estado, seja diretamente criando oportunidade de acesso ao ensino superior aos jovens, seja indiretamente disponibilizando pessoal capacitado para atuar nos diferentes ramos das atividades produtivas, qualificando os serviços e dinamizando as economias locais.

#### **3.4.2 Estruturação da equipe docente e sua formação**

Uma vez aprovado nos âmbitos internos da instituição, tratou-se imediatamente da contratação de professores habilitados e capacitados para atender a demanda do Núcleo Básico Comum do curso, cuja seleção já estava em andamento. O quadro de professores foi composto por profissionais experientes de ensino médio, desejosos por complementar a renda familiar ainda que às custas de cargas horárias elevadíssimas, e por jovens mestres e doutores com pouca ou nenhuma experiência na docência, mas interessados em iniciar uma carreira acadêmica de sucesso. Isso teria se repetido nos anos seguintes de modo a atingir um número de docentes suficiente para atender também o Núcleo específico do curso.

Passado o processo seletivo docente, a próxima etapa deveria focar na apropriação pelos professores dos fundamentos filosóficos e políticos constantes do projeto político pedagógico do curso, para então adentrar no planejamento das atividades do primeiro semestre.

Um momento chave nesse processo de formação previsto no projeto político pedagógico do PCAA era o GA-Conexão, um momento de vivência e reflexão para despertar no grupo sensibilidade, sentimento de pertença e identidade com a proposta do curso. Contudo, a realização do GA-Conexão, lamentavelmente, não ocorreu. Pode-se atribuir a isso vários motivos, desde a falta de compreensão do sentido e importância dessa atividade, do ponto de vista pedagógico, metodológico e estratégico para a implantação do Programa, até resistências de cunho pessoal ou receio de estabelecer contato com grupos sociais como ribeirinhos, indígenas, quilombolas e assentados. Essa falta de compreensão, se associou à recorrente falta de recursos à época, para a operacionalização da atividade, tornando essa atividade a primeira a sofrer cortes orçamentários, terminando por não ocorrer.

Sua não realização cobrou um “preço alto” e, para muitos os envolvidos, provavelmente tenha sido o mais caro, pois não permitiu estabelecer as conexões com a realidade, pensadas pelos idealizadores do Programa para

ser premissa dos processos de ensino-aprendizagem, pesquisa-ação e extensão-dialógica.

Em lugar disso, optou-se por realizar a simples leitura, o estudo e o debate sobre os fundamentos filosóficos do projeto político pedagógico (PPP) na semana de planejamento. Ainda que tenha sido um evento importante, com o tempo ficou claro, porém, que isso não foi suficiente para despertar e tocar profundidade, e quantitativamente, os indivíduos e o coletivo com efetividade.

Esse envolvimento foi ocorrendo paulatinamente à medida que a experiência foi sendo colocada em prática. Cada qual foi assimilando a proposta do curso ao seu tempo e a sua maneira, porém de forma progressiva. A maioria dos professores foi se dando conta do caráter inovador e da exequibilidade da proposta interdisciplinar do curso na medida em que ela era implementada. Mas para alguns participantes isso literalmente nunca se sucedeu. Ou seja, na prática, a dinâmica adotada passou a expor as fragilidades dos detentores dos conhecimentos especializados, que “teimavam” em tratar de forma estanque e fragmentada o conhecimento.

Fato é que invariavelmente erguiam-se barreiras impenetráveis e formavam-se obstáculos intransponíveis em suas fronteiras, não raro amparados em “verdades absolutas” consubstanciadas em conteúdos pouco abertos ao diálogo com outras áreas do conhecimento e, sobretudo, com outros saberes e sem o necessário nexos com a realidade. E, muitas vezes, isso impediu, portanto, o exercício efetivo da religação destes conhecimentos ou minimamente a hibridação ou intersecção entre suas interfaces.

Isso é próprio da prática docente monodisciplinar e se explica em parte pela distância enorme entre a proposta de formação do curso, genuinamente inovadora do ponto de vista científico, metodológico e pedagógico e a formação do corpo docente, ainda baseada na noção positivista, dualista e cartesiana que sedimentou a fragmentação como uma herança histórica da ciência moderna, para os quais o conhecimento científico ainda é o único conhecimento válido. A ideia de neutralidade na ciência, de objetividade, de fragmentação, de especialização, sempre esteve rondando o cotidiano das discussões e a prática pedagógica de um pequeno grupo de professores do curso. Em certos momentos, algumas disciplinas precisaram ser trabalhadas no seu todo ou em parte de forma isolada, tamanha a dificuldade ou resistência de alguns professores em inserir os conteúdos nas temáticas das unidades de ensino ou aceitar a proposta interdisciplinar para além do mero discurso.

Curiosamente, em geral, tais professores enfrentavam uma “dupla” jornada de trabalho, pois tinham que participar do planejamento coletivo dos GAs e GAIEs e executá-lo e ainda planejar solitariamente as disciplinas isoladas.

Não obstante, a experiência do PCAA foi uma oportunidade de grande aprendizagem para a maioria dos professores que passaram pelo Programa. Muitos ainda jovens, recém mestres e doutores, bem formados e vindos de instituições renomadas do sul e sudeste do país encontraram na UNEMAT, também jovem, um porto aparentemente seguro para se afirmarem como docentes e pesquisadores.

### **3.4.3 Os desafios da proposta metodológica: interdisciplinaridade e agroecologia**

Todos no corpo docente chegaram muito bem-preparados técnica e cientificamente e ávidos para ensinar. Mas, se depararam com um desafio que os exigiu um repensar de suas práticas e concepções pedagógicas. Ocorre que a proposta do PCAA para o curso de agronomia estava assentada em dois pilares principais e condicionantes da prática pedagógica cotidiana do curso: a interdisciplinaridade e a Agroecologia.

A interdisciplinaridade exigia de cada um dos professores uma nova postura no trato do conhecimento, cujas unidades de ensino eram os GAs e não mais as disciplinas. Os GAs exigiam planejamento conjunto e de forma integrada ao planejamento e execução dos GAIEs e do curso como um todo, percorrendo uma verdadeira “engenharia pedagógica”. Ou seja, sua prática deveria proporcionar aos alunos, ao mesmo tempo, momentos e espaços de aprendizagem, investigação e extensão. Isso implicava a necessidade de cada um sair de seu campos temáticos, “as caixinhas” ou de suas “zonas de conforto”, para relacionar, integrar, religar os conhecimentos e interagir com o grupo de forma solidária, recíproca e articulada. E para religar essas partes havia a necessidade de um conhecimento mínimo do todo para além das partes, ou seja, dos fundamentos do projeto político pedagógico do curso, sem os quais era praticamente impossível acompanhar a dinâmica adotada e transitar nas diferentes atividades de planejamento e construção do conhecimento de forma coletiva, conforme o curso exigia.

Essa atitude deveria ser a precedida de uma postura mais humilde no sentido de reconhecer como válidos e importantes os demais conhecimentos acadêmicos que compunham o todo do curso, além da provisoriedade dos conhecimentos. E, por certo, isso não significou que todos devessem abandonar seus conhecimentos específicos e disciplinares, mas de relacioná-los aos demais e reconhecer a importância de outros conhecimentos sendo

eles de dentro ou de fora da academia para numa postura aberta e coletiva, estudar por diversos ângulos os fenômenos e as diferentes realidades concernentes ao processo formativo de um curso de Agronomia de base agroecológica.

Nesse sentido, o reconhecimento dos saberes tradicionais ou locais foi fundamental para imprimir ao processo formativo um enfoque agroecológico. As viagens de campo às aldeias indígenas, os estudos de caso nas comunidades tradicionais, os estágios nos assentamentos, são exemplos de atividades que ao longo de todo curso providenciaram essa nova postura diante dos conhecimentos autóctones, tanto para docentes quanto para discentes.

Isso não significou volta ao passado, mas sim uma valorização dos conhecimentos que vêm sendo testados e passados de geração a geração, e que demonstraram-se sustentáveis e harmoniosos com a natureza ao longo dos anos, fundamentais para a abordagem agroecológica. Da mesma forma as visitas as grandes fazendas foram importantes para confirmar os impactos sociais, econômicos e ambientais das monoculturas herdadas de sistemas de monocultivos agroexportadores (*plantation*).

### 3.5 A descaracterização e o fim

#### 3.5.1 Rotatividade docente, instabilidade e fragilização da proposta metodológica do PCAA

A proposta do Programa, pouco a pouco se chocou com a formação dos professores meramente especialistas. Questões como a elevada concentração fundiária, associada aos problemas sociais e/ou ambientais decorrentes do tecnicismo produtivista convencional, os custos ambientais dos monocultivos orgânicos artificializados, a especulação improdutiva da propriedade da terra, muitas em estágio avançado de degradação do solo, criaram um ambiente rico para um debate crítico sobre modelos e caminhos para o desenvolvimento agrícola e agrário. Afinal, quais as consequências das monoculturas? Quais os impactos dos tipos de tecnologias adotadas? Para quem servem, e quais os impactos do uso intensivo de maquinarias e insumos, como os agrotóxicos e os fertilizantes sintéticos?

Tais debates eram de forma geral conscienciosos, mas por vezes tornavam-se tensos e conflitantes. Alguns professores, nitidamente defensores do modelo do agronegócio, chegaram ao ponto de solicitar o desligamento do Programa. Além disso, as seleções docentes tinham sido de caráter temporário, o que por força de lei limitava o tempo que cada um podia permanecer na instituição era restrito. Esses dois

elementos junto geraram uma certa rotatividade no quadro de professores, e com isso instabilidade no programa.

E essa rotatividade de professores acabou gerando incompletude, pois precisamente quando os professores haviam atingido uma melhor compreensão da metodologia e da dinâmica do Programa e apresentavam um grau satisfatório de envolvimento, acabavam prestando concurso em outras instituições de ensino e de pesquisa e deixando o curso. Essa instabilidade e insegurança no trabalho era agravada também pela interferência política no Estado. Por ser uma autarquia estadual, a UNEMAT esteve sempre sob a mira do Governo do Estado e da Assembleia Legislativa, ambos reféns do poder do agronegócio no Estado. Por várias vezes o orçamento da instituição foi colocado sofreu cortes, colocando em risco o próprio pagamento dos salários de pessoal.

#### 3.5.2 Os desafios da seleção docente

Apenas em 2006, foi realizado o concurso público para professores na UNEMAT, uma antiga reivindicação tanto dos professores substitutos quanto dos visitantes, condição *sine qua non* para que o PCAA se consolidasse na instituição. Imaginava-se que, uma vez concursados, os professores do Programa teriam não só legitimidade, mas também legalidade para exigir e implementar as mudanças que ainda eram necessárias para cumprir com o que determinava o projeto original do curso. No entanto, o modelo de edital do concurso adotado não previu nenhuma diferenciação nos critérios de avaliação para os cargos destinados a atender a demanda do Programa, de modo que nem todos os professores que atuavam no curso de agronomia permaneceram na universidade.

Ainda que de forma transparente e lícita os candidatos mais bem preparados a luz do que rezava o edital tenham sido aprovados no concurso, os termos e critérios adotados na seleção estavam mais alinhados a um perfil mais convencional de profissional, signatário de uma formação disciplinar, fragmentada e especializada. Com isso, a mudança de perfis profissionais docentes acabou sendo abrupta, em detrimento da metodologia não-convencional que vinha sendo implementada pelo PCAA, contribuindo, desafortunadamente, em pouco tempo, para o seu colapso.

Longe de se tornar elemento de estabilidade, o formato no qual o concurso de 2006 se realizou acabou por radicalizar a rotatividade docente. O que seria a “solução definitiva” acabou por se tornar “um dos seus seus algozes”.

É preciso admitir também que os professores já engajados filosófica, política e pedagogicamente e experimentados na proposta do Programa foram pegos no “contrapé da história”. Tudo parecia ter sido resolvido epistemologicamente no campo da práxis pedagógica, a

propósito do promissor e exitoso exercício dialógico de religação dos conhecimentos e saberes vivenciados nos planejamentos dos GAs e GAIEs. No entanto, o edital exigiu um esforço imenso de selecionar docentes uma vez mais a partir de formações fragmentadas e demasiadamente especializadas. Era um retorno “às caixinhas”.

Vale salientar que nesse ínterim, não menos importante foi o fato de que a concepção e o teor do edital foi algo debatido e aprovado de forma legítima e legal nas instâncias da UNEMAT, representando, portanto, uma opção política da instituição.

### 3.5.3 Proposta inovadora em uma gestão conservadora

A gestão da UNEMAT à época do processo seletivo se comportou de forma ambígua, mostrando-se muitas vezes indiferente aos apelos relativos ao futuro do Programa, caso o concurso selecionasse preferencialmente profissionais com perfis assumidamente convencionais. Essa pouca sensibilidade ao programa também foi influenciada pela mudança da gestão universitária, já que PCAA havia sido concebido na gestão anterior. Havia pouca disposição na gestão para adoção de critérios específicos para atender as especificidades do PCAA.

Passado o tempo, tornou-se mais evidente perceber que as hipóteses aventadas à época tinham comprovação. Isso vale para a postura imparcial e indiferente da gestão durante o concurso, e as diferenças de tratamento dispensado ao PCAA em outros aspectos, quer seja na sua implantação, pela gestão que o criou, quer seja no decorrer do seu curto período de vida, pela gestão que se sucedeu. Além disso, ficou mais claro a fragilidade política das gestões frente a ingerência velada do governo estadual, que se perdiam nas confusões administrativas e não conseguiram entender, a tempo e a contento, o quanto inovador representava a proposta do PCAA.

Também é possível imaginar e concluir que os imbróglis se sucediam, e talvez principalmente, devido a motivos financeiros. Historicamente, os recursos destinados a educação são de poucos, o que tem obrigado as gestões a definirem prioridades. Esse contexto não é favorável a alocação de recursos suficientes para uma proposta de ruptura metodológica, nos marcos do PCAA. É possível afirmar que a alocação de recursos é um indicador de apoio político.

A própria condução de um processo seletivo com particularidades adequadas ao PCAA exigia recursos adicionais. Desse modo, a orientação de enxugar as despesas se impôs naquele momento, sob o argumento de que o próprio processo seletivo estaria em risco, o que iria frustrar as expectativas da instituição como um todo,

fragilizando ainda mais a gestão do ponto de vista da legitimidade acadêmica e política.

No PPP do PCAA também estavam previstos diálogos para maior interação com a comunidade local. Isso incluía discussões e tomadas de decisão via Assembleias Temáticas, que tinha participação ativa de setores populares. Como se verificou ao longo dos anos, infelizmente eles nunca aconteceram de forma efetiva e oficial.

Com a entrada de profissionais com perfis convencionais, e sem compromisso com a proposta metodológica desenhada para o Programa, o ambiente favorável ao programa se alterou. A esses novos profissionais, somaram-se os antigos adversários convictos da proposta metodológica, formando uma convicção antagônica que retroalimenta a visão conservadora da cultura universitária, da qual a UNEMAT é um exemplo.

Em pouco tempo, o enfoque agroecológico e interdisciplinar requerido pelo PPP do curso começou a se alterar, e o curso de agronomia e mesmo o PCAA não se consolidaram. A construção histórica, pedagogicamente ousada se deteriorou e teve seu sucesso circunscrito a um período determinado. Hoje é possível afirmar que ao menos como era anteriormente, não existe mais.

## IV CONCLUSÃO

São muitas as lições aprendidas dessa experiência. A primeira delas é a de que faltou então amarrar as práticas adotadas no exercício de implantação do curso com um movimento mais amplo de aproximação com a sociedade civil organizada (associações, sindicatos, movimentos sociais etc.). O mesmo se pode dizer das articulações com os poderes executivo e legislativo locais.

Isso não ocorreu talvez devido a inexperiência ou falta de visão política dos que estiveram à frente da gestão dos cursos. Ou ainda, por conta de uma tendência própria da academia à autossuficiência, ou mesmo “autonomismo”, que transparece como arrogância aos olhos da sociedade. Essa postura da universidade, não raro, despreza qualquer diálogo com quem a mantém e a quem ela deve servir.

Um reflexo dessa mesma postura pode ser visto na incapacidade que as universidades tem para construir efetivamente os seus pilares no âmbito do ensino, da pesquisa e da extensão de forma integrada à comunidade local. Tal distanciamento da universidade com a sociedade também guarda relação com o despreparo (e/ou receio) da instituição, para corresponder à altura as expectativas e demandas sociais historicamente reprimidas, que no caso da UNEMAT eram parte do contexto local.

O certo é que sem essa articulação externa a proposta metodológica perdeu sua sustentação social para fazer frente ao pouco apoio interno que dispunha. Com isso, o Programa se viu fragilizado como um todo no período pós-concurso, de modo que acabou cedendo em aspectos vitais da sua concepção original, cedendo a uma visão gradativamente reducionista do processo acadêmico de formação. Por fim, prevaleceu um viés ideologicamente conservador sobre o papel que a universidade e seus cursos deveriam cumprir diante da sociedade local.

Ademais há outros óbices que não apareceram de forma explícita, senão subliminarmente ao longo do processo. É o caso da velha e velada resistência ao novo. Ainda que esse caso em estudo trate de uma instituição muito nova como é o caso da UNEMAT, as mudanças propostas pelo PCAA não se implementavam tão somente com formulações programáticas e decisões de coordenação. Implicavam inexoravelmente na adesão, sobretudo do corpo docente as novas concepções pedagógicas e metodológicas, cujas formações conservadoras ofereciam grande resistência. Além disso, as atitudes e práticas pedagógicas deveriam ser assumidas também no âmbito da estrutura administrativa e burocrática, envolvendo novos procedimentos, normas, registros, certificados, etc.

Dessa forma pode-se inferir que o sucesso do processo de transição agroecológica dos cursos de agronomia, e das ciências agrárias em geral, depende de profundas modificações nas estruturas como um todo. Há que se superar aquilo que no caso da UNEMAT se demonstraram ser na prática as maiores dificuldades e impedimentos ao enfrentamento paradigmático dos modelos convencionais de produção: (i) o perfil ideologicamente conservador do quadro docente do ponto de vista político-pedagógico; e (ii) a frágil sustentação política interna e externa.

Isso implica, de forma imperativa, que o problema não estará nos alunos, na falta de recursos, na estrutura precária e tampouco nas resistências burocráticas internas ainda que sejam também aspectos relevantes nos obstáculos, ou que potencializem os dois acima mencionados.

A experiência relatada aqui mostra que, indubitavelmente o gargalo estará relacionado a: (i) a concepção de educação dos professores para o seu engajamento pedagógico; (ii) a valorização e estabilidade docente, para vincularem-se ao processo, ao menos, até que se se maturem as condições de continuidade; (iii) a costura de consensos internos nas instâncias de decisão sobre particularidades e especificidades metodológicas; e, (iv) na peremptória necessidade de se criar raízes, e com isso costurar apoios, junto a sociedade local.

Isso equivale a dizer que da experiência aqui relatada, ainda que se trate de uma experiência bastante particular e frustrada, poderá deixar aprendizados importantes para quem se interessa em promover mudanças significativas nos PPPs dos seus cursos de modo a torná-los mais agroecológicos, consistentes e duradouros. O exemplo ilustra uma vontade sempre renovada de fazer de fato a diferença em termos educativos, e forneceu elementos que podem se configurar em pistas significativas para se pensar como e por onde começar experiências de processos educativos de base agroecológica e (inter)transdisciplinares. A transição agroecológica dos cursos de ciências agrárias é condição *sine qua non* para formação de futuras equipes de docentes críticas, criativas e adeptas a uma práxis libertadora de educação. Uma postura que lhes permita dialogar horizontalmente entre si e com os sujeitos das comunidades locais e/ou territórios.

É preciso considerar também, que trata-se de uma referência a mais na reflexão sobre a concepção agroecológica das universidades. Tal e qual, não se trata de uma fórmula pronta e acabada do fazer educativo. Tampouco se desenrolou em cenário ideal, mas sobretudo real, cujas implicações são das mais variadas particulares possíveis.

O que vale destacar é que ao contrário das propostas concebidas em gabinetes, esta foi uma possibilidade construída cotidianamente por sujeitos aprendentes em que os erros e os acertos se fizeram presentes, mas que, dentro de certos limites, permitiram pedagogicamente um exercício de autoavaliação permanente com correção dos rumos e delineamento dos caminhos a percorrer.

Ao ressignificar a sua prática a partir de novos pressupostos, redefiniram-se objetivos, objetos, sujeitos e papéis nos processos educativos, tornando-os diferenciados e pedagogicamente significativos.

Esta experiência merece ser considerada e debatida, senão resgatada, em função de dois aspectos principais. Primeiro, por ser um bom exemplo do processo de “agroecologização” e “(inter)transdisciplinarização” dos cursos das Ciências Agrárias, a partir da iniciativa docente. Segundo, por demonstrar o quão frágeis se tornam as experiências se não forem alicerçadas internamente e pavimentadas externamente com o apoio da comunidade local.

Fato é que esse curso infelizmente já não existe mais ou, pelo menos, perdeu a sua concepção original, cujas razões foram abordadas neste texto. Assim, reproduzimos aqui quase que fielmente partes do que traz o projeto político pedagógico do curso, de modo a analisá-lo criticamente tanto no que se refere aos seus aspectos positivos quanto aos aspectos que julgamos negativos,



ainda que se trate de uma visão particular do grupo que a escreve.

Ademais, vale salientar que a experiência da UNEMAT é fruto de elaborações de várias mãos, muitas delas anônimas, mas nem por isso menos importantes e, de momentos privilegiados de criatividade e inovação, cujos envolvidos conseguiram enxergar a peremptória necessidade de mudar a base sobre a qual a muito vem se dando o processo formativo nos cursos de ciências agrárias.

## REFERÊNCIAS

- [1] Alves-Mazzotti, A. J. (2006) Usos e abusos dos estudos de caso. *Cadernos de Pesquisa*, 36(129), 637-651.
- [2] Berbel, N.A.N. (2011) As metodologias ativas e a promoção da autonomia de estudantes. *Semina: Ciências Sociais e Humanas*, 32(1), 25-40.
- [3] Brandão, C. R. (1999) Pesquisar-participar. In: Brandão C.R. *Repensando a pesquisa participante*. (pp. 7-14) São Paulo: Brasiliense.
- [4] Braudel, F. (1987). *A dinâmica do capitalismo* (Vol. 1). Rio de Janeiro: ROCCO.
- [5] BRASIL, LDB. (1996) Lei 9394/96 – Lei de Diretrizes e Bases da Educação Nacional. Disponível em: <www.planalto.gov.br>. Acesso em: 25 jun. 2003.
- [6] Caporal, F. R. (2007) As bases para a extensão rural do futuro: caminhos possíveis no Rio Grande do Sul. In: Caporal, F. R.; Costabeber, J. A. *Agroecologia e extensão rural: contribuições para a promoção do desenvolvimento rural sustentável*. (pp. 49-77) Brasília: MDA .
- [7] Caporal, F. R.; Costabeber, J. A. (2000) Agroecologia e desenvolvimento rural sustentável: perspectivas para uma nova Extensão Rural. *Agroecologia e Desenvolvimento Rural Sustentável*, 1(1), 16-37.
- [8] Caporal, F. R.; Costabeber, J. A.; Paulus, G. (2006) *Agroecologia: matriz disciplinar ou novo paradigma para o desenvolvimento rural sustentável*. Brasília: MDA.
- [9] Caporal, F.R. (2010) *Debate Nacional sobre Educação em Agroecologia*. Brasília: ABA.
- [10] Caporal, F.R.; Ramos, L.F. (2006) *Da extensão rural convencional à extensão rural para o desenvolvimento sustentável: enfrentar desafios para romper a inércia*. Brasília.
- [11] Capra, F. (1995) *O ponto de mutação: a ciência, a sociedade e a cultura emergente*. 14ªed. São Paulo: Cultrix.
- [12] Demo, P. (2003) *Educar pela pesquisa*. 6ªed. Campinas: Autores Associados.
- [13] Demo, P. (2011) *Complexidade e aprendizagem. A dinâmica não linear do conhecimento*. São Paulo: Atlas.
- [14] Demo, P. (2001) *Desafios modernos da educação*. Petrópolis: Vozes.
- [15] EMBRAPA (2006) *Marco referencial em Agroecologia*. Brasília: Embrapa Informação Tecnológica.
- [16] Franco, M. A. S. (2005) *Pedagogia da Pesquisa-Ação. Educação e Pesquisa*, São Paulo, 31(3), 483-502.
- [17] Freire, P. (1990) *Criando métodos de pesquisa alternativa: aprendendo a fazê-la melhor através da ação*. In: Brandão, C. R. (org.) *Pesquisa participante*. 8ªed (pp.35-41). São Paulo: Brasiliense.
- [18] Freire, P. (2002) *Pedagogia da autonomia: saberes necessários a prática educativa*. 25ªed. Rio de Janeiro: Paz e Terra.
- [19] Freire, P. (1987) *Pedagogia do oprimido*. 17ªed. Rio de Janeiro: Paz e Terra.
- [20] Gliessman, S.R. (2001) *Agroecologia: processos ecológicos em agricultura sustentável*. 2ªed. Porto Alegre: UFRGS.
- [21] Gliessman, S.R. (2014) *Conceito de Agroecología. Anotações de aula, disciplina Transição agroecológica*. Baeza, Espanha: UNIA.
- [22] Gomes, J. C. C. (1999) *Pluralismo metodológico en la producción y circulación del conocimiento agrário. Fundamentación epistemológica y aproximación empírica a casos del sur de Brasil* (Tese de Doutorado em Agroecologia) - Instituto de Sociología y Estudios Campesinos, Universidad de Córdoba. Córdoba-Espanha.
- [23] Gomes, J.C.C. (2006) *As bases epistemológicas da agroecologia*. Acesso em: 20 agosto de 2009. Disponível em: <http://www.macroprograma1.cnptia.embrapa.br/agroecologia/programa-de-formacao-textos-de-apoio/programa-de-formacao-textos-de-apoio/bases-epistemologicas-da-agroecologia/view>.
- [24] Hecht, S.B. (2002) A evolução do pensamento agroecológico. In: Altieri, M. *Agroecologia: as bases para uma agricultura sustentável*. (pp.21- 51) Porto Alegre: AS-PTA/Agropecuária.
- [25] Libâneo, J.C. (2009) Prefácio. In: Santos, A.; Sommerman, A. *Complexidade e transdisciplinaridade*. (pp.2-4) Porto Alegre: Sulina.
- [26] Mattos et al. (2013) Transição agroecológica no assentamento Chico Mendes III – PE. In: FEAGRI *Jornada De Estudos em Assentamentos Rurais*, (p15) Campinas. SP.
- [27] Moraes, M.C.; Naves, J.M.B. (Orgs.). (2010) *Complexidade e transdisciplinaridade em educação: teoria e prática docente*. Rio de Janeiro: Wak.
- [28] Morin, E. (2000) *A cabeça bem-feita: repensar a reforma, reformar o pensamento*. Rio de Janeiro: Bertrand.
- [29] Morin, E. (2008) *Introdução ao pensamento complexo*. 5ª ed. Lisboa: Instituto Piaget.
- [30] PCAA. (2004) *Programa de Ciências Agro-ambientais. Habilitação em Ciências Agrárias: Bacharelado em Agronomia*. Alta Floresta: UNEMAT.
- [31] Petersen, P.; Dal Soglio, F.K.; Caporal, F.R. (2009) A construção de uma ciência a serviço do campesinato. In: Petersen, P et al. *Agricultura familiar camponesa na construção do futuro* (pp.85-104). Rio de Janeiro, RJ: ASPTA
- [32] Thiollent, M. (2005) *Metodologia da pesquisa-ação*. 14ªed. São Paulo: Cortez.
- [33] Toledo, V.M. (2012) La agroecologia en latinoamerica: tres revoluciones, una misma transformación. *Agroecología*, 6(1),37-46.
- [34] Werneck, H. (1992) *Se você finge que ensina eu finjo que aprendo*. Petrópolis: Vozes.

# Sympathetic ablation combined to dorsal ganglion modulation was cost-effective for Complex Regional Pain Syndrome-1

Carlos A. F. Trindade, M.D., MSc<sup>1</sup>; Célia S Oliveira, M.D.<sup>1</sup>; Thiago S Serra, M.D.<sup>1</sup>, Helton A. Defino, M.D., MSc., Ph.D.<sup>2</sup>; Gabriela R. Lauretti, M.D., M.Sc., Ph.D., FIPP<sup>3,\*</sup>

<sup>1</sup>Postgraduate Student, Medical School of Ribeirão Preto, University of São Paulo (U.S.P.)

<sup>2</sup>Professor of Orthopedics, Medical School of Ribeirão Preto, U.S.P.

<sup>3</sup>Professor of Anesthesia and Interventional Pain Management, Medical School of Ribeirão Preto, U.S.P.

\*Corresponding author

Received: 26 Aug 2022,

Received in revised form: 20 Sep 2022,

Accepted: 26 Sep 2022,

Available online: 30 Sep 2022

©2022 The Author(s). Published by AI  
Publication. This is an open access article  
under the CC BY license

(<https://creativecommons.org/licenses/by/4.0/>).

**Keywords**— **Complex Regional Pain Syndrome-1, sympathetic block, dorsal ganglion, radiofrequency, central pain sensitization.**

**Abstract** — Sympathetic ablation combined to dorsal ganglion modulation was cost-effective for Complex Regional Pain Syndrome-1. **Background:** In Complex Regional Pain Syndrome-1 (CRPS), sympathetic ganglion block followed by radiofrequency (RF) is the treatment of choice. However, data suggest that dorsal ganglion (DG) is partly responsible for its central pain sensitization. The study aimed to evaluate the cost-effectiveness of central desensitization combined to either blocks or RF at the same levels. **Methods:** 36 patients with lower extremity CRPS-1 were randomly assigned to 1 of 2 Treatments (n=18). After effects of the first selected treatment receded, patients were crossed over to the second treatment. The treatments were : 1) test blocks followed by 4-weekly L3 sympathetic block + epidural sacral block or 2) test blocks followed by L3-L4-L5 sympathetic ablation + L3-L4-L5 DG modulation RF. Time of analgesia was defined as VAS>3cm. Patients acted as their own control related to analgesia, routine activities, sleep pattern and costs. **Results:** 24 patients completed the study. The analgesia time after the 4-weekly blocks were 5±1 months and the annual costs USA\$5000. Analgesia time after RF was 15±2 months (p<0.001) and costs reduced by 23% in the first year and 32%-36% in the following years extrapolation. Quality of life and sleep pattern improved during the analgesia period (p> 0.05). **Discussion:** Sympathetic ganglion combined to DR RF at the same levels (L3-L4-L5) resulted in 15-month compared to 5-month analgesia after the classical 4-weekly blocks, and improved physical capacity and sleep pattern. It was cost-effective, and reduced rates by 23% during the first-year evaluation, followed by 32%-36% cost reduction in following years, by extrapolation.

## I. INTRODUCTION

When conservative pain management and physical rehabilitation fails in Complex Regional Pain Syndrome (CRPS)-1, the sequence of sympathetic block is the interventional treatment is part of treatment. For a

lasting effect, sympathetic radiofrequency (RF) treatment is elected (2B+),<sup>1</sup> and the benefit of an early intervention is renowned in order to prevent long-term incapacity.<sup>2</sup> Inappropriately, RF is not included in all Health Systems,

mainly because the government authority's belief is that the higher costs would not justify its implementation.

Although CRPS-I classically implies in autonomic dysfunction,<sup>3,4</sup> central pain sensitization also develops with the disease,<sup>5,6</sup> and suggests evidence of pivotal inflammation.<sup>7</sup> Central sensitization has been included in the guidelines for back pain classification and may require specific treatment targeting the mechanisms underlying the hyper excitability of the central nervous system,<sup>8</sup> and epidural sacral block could be used for this purpose, as in turn it reaches dorsal ganglions (DG). The DG has been suggested participating in the central pain sensitization,<sup>9,10</sup> and its modulation maintained substantial pain relief over time.<sup>11</sup>

The aim of this study was to evaluate the cost-effectiveness of: a) the routinely applied sequence of sympathetic block combined with epidural sacral block, with b) RF ablation of sympathetic ganglion combined to RF modulation of DG at the same lumbar levels in CRPS-I patients, being either the epidural sacral block or the DG modulation involved in central pain desensitization.

## II. METHODS

This clinical protocol and patient consent forms were designed in accordance with the revised Declaration of Helsinki and the Good Clinical Practice of the International Conference on Harmonization and approved by the Ethics Committee of the School of Medicine of Ribeirão Preto, University of São Paulo (USP) (Reg 14302010). All blocks were performed under conscious sedation with 2-4 mg midazolam + alfentanil 500-750 mcg by one anesthesiologist. Monitoring of the patient included continuous pulse oximetry and electrocardiography and non-invasive blood arterial pressure at 5 min interval, combined to nasal  $O_2$  at 3 Lmin<sup>-1</sup>. All blocks were performed under fluoroscopy after adequate asepsis in operating room. The correct position of each needle was verified with 0.5 ml injection of Omnipaque 300 contrast (non-ionic, iohexol). The blocks and RF were performed by the same double anesthesiologists.

Diagnosis of CRPS-I was made on the basis of the proposed modified Budapest Criteria.<sup>12</sup> Subjects had to be willing and able (e.g. mental and physical condition) to participate in all aspects of the study, including use of medications, completion of evaluations, attending the scheduled clinic visit and compliance with protocol requirements. Patients were excluded from the study for the following reasons: clinically unstable disease, psychiatric disease other than depression, refusal or known allergy to the devices used, diabetes, previous cardiac infarction or angina, infection or coagulation disturbance.

Thirty six patients with lower extremity CRPS-I were computer randomly assigned to 1 of 2 interventional treatments (n=18) (Figure 1). After effects of the first selected treatment receded, patients were crossed over to the second treatment. The test blocks in all patients were: a) epidural sacral block with 40 mg lidocaine + 10 mg dexamethasone + 15 mcg clonidine, diluted to 10 ml volume with saline and b) sympathetic Lumbar L3 block at the affected side with 80 mg lidocaine + 5 mg dexamethasone + 15 mcg clonidine. The test blocks aimed at least 50% of pain relief in order the patient could carry on in the proposed protocol of the study.

The 2 Treatments are described as follows (Figure 1): 1) test blocks followed by 4-weekly Lumbar L3 sympathetic block + epidural sacral block or 2) test blocks followed by L3, L4 and L5 sympathetic ganglion ablation + L3, L4 and L5 DG modulation by RF. Time of analgesia was defined as VAS>3-cm. Patients acted as their own control related to analgesia, routine activities, sleep pattern and costs.

For the sympathetic block, a 15 cm 22 gauge needle was inserted under tunnel vision anterolateral to each vertebral body, and the proper positioning was checked by administration of 1-2 ml contrast. Following, it was administered a total 10 ml solution containing 5 mg dexamethasone + 15 mcg clonidine + 80 mg lidocaine.

For the L3, L4 and L5 DG modulation, sensitive test was performed in order to get stimulus < 0.7 mV, and absence of motor stimulus no less than 1.4 mV. The 10 cm needle was positioned at the superior posterior area of each foramen, just posterior to the "safe triangle", and modulation was performed during 120 sec, 45 V, 42°C, and thereafter, a total of 3.3 ml of the final solution containing total of 10 mg dexamethasone + 30 mcg clonidine + 80 mg lidocaine (final 10 ml volume) was injected.

For the RF ablation of L3, L4 and L5 sympathetic ganglions, sensitive and motor tests were performed in order to get negative results up to 1 mV sensitive test and 2 mV motor tests. The 15 cm needle was positioned anterolateral to each vertebral body, using tunnel vision technique with needle insertion just lateral to the superior vertebral plate in oblique view. The amount of 3.3 ml of the final solution containing total of 10 mg dexamethasone + 30 mcg clonidine + 80 mg lidocaine (final 10 ml volume) was then injected followed by RF ablation 80°C, 80 sec.

Demographics characteristics were described. Time of analgesia was defined as the time after the 4-weekly sequence, and from the RF treatment until pain (Visual numerical scale (VNS-pain) was classified as > 3

cm (VNS 0-10 cm) and rescue tramadol consumption. Rescue analgesics consisted of oral 50 mg tramadol up to 4 times daily. Any adverse effects were noted and treated as necessary.

Weekly Global Perceived Effect after the procedures, such as quality of sleep and quality of daily activities were evaluated by the 10 cm VNS scales, where zero meant comfortable sleep or the best capacity for routine activities up to 10 cm which meant worst and most uncomfortable sleep or most difficulties to perform routine activities.

### Statistics

The power of the study was based upon preliminary data. We hypothesised that the RF technique would increase analgesia by 100% compared to the routine 4-weekly sequence of blocks in the population studied. With a beta value of 80% and an alpha value of 0.05, these assumptions would require at least 12 patients.  $P < 0.05$  was considered significant. Data are expressed as mean  $\pm$  SD, unless otherwise stated.

The normality of the data was evaluated by the Shapiro Wilkings test. Demographic data was described. Quality of sleep, daily activities and analgesia time was evaluated by t-student for dependent groups (analgesia) and Wilcoxon Matched Pairs test (sleep and capacity).  $P < 0.05$  was considered significant. Adverse effects were described.

## III. RESULTS

The final data set included 24 subjects (Figure 2). Related to initial Treatment 1, two of the patients had incomplete data, while 3 of them could not be submitted to the treatment due to inadequate transportation back home. Regarding patients from initial Treatment 2, two of them did not have adequate transportation back home, while 5 of them did not respond to the first test block and were treated with implantation spinal cord stimulation device.

Related to demography of the 24 patients, mean age was  $46 \pm 9.6$  years;  $72 \pm 15.8$  kg;  $166 \pm 7.8$  cm. Sixteen patients were Catholics, while 8 were Presbyterians. They were 12 male and 13 female, 16 white and 8 black people, and all of them were routinely taking antidepressants (amitriptyline, sertraline or duloxetine); Twelve of them were taken methadone, 2 gabapentin and finally 8 of them were taking carbamazepine.

The time of analgesia defined as time since the end of the 4-weekly block sequence and since RF until time when pain VNS  $> 3$  cm is described in Table 3 ( $p < 0.001$ ). When patients were submitted to a 4-week

sequence of blocks, the time of analgesia was around 15 months (Table 1,  $p < 0.001$ ).

The sleep pattern and the physical routine activities were quantified by patients using the VNS (0-10 cm) and were equally improved during controlled pain for both techniques, as quantified by the VNS scale by the patients ( $p > 0.05$ ). Related to the night sleep quality, patients referred that when pain was under control, the night sleep was equally nice and comfortable for both groups (Table 2,  $p > 0.05$ ), however uncomfortable during the periods of stronger pain with many times of arousal ( $p < 0.05$ ). Similarly, the routine physical capacity was also equally improved for both treatments when pain was under control (Table 4,  $p < 0.05$  when compared to the uncontrolled pain period).

Regarding costs, annual money savings was 23% when RF was applied, compared to the sequence of 4-blocks during the same period (Table 6). From the second year forward, money saving increased to 32% and this improvement was gradually increased until the 5<sup>th</sup> year, by extrapolation data, as in the following years the test block would not be necessary to be performed, but only the RF (Figure 3).

Related to adverse effects, all patients referred difficulty to sleep during the first 2-3 nights when each block was performed, however, the following day was not tiring, and all patients referred good disposition for activities. Patients complained of pain during 3-4 days after RF technique, and all of them used oral 100 mg tramadol for 2-3 days after RF.

## IV. DISCUSSION

In the present study we have demonstrated that in CRPS-1, when ablation by RF of L3-L4-L5 sympathetic ganglions associated to L3-L4-L5 DG modulation was compared to the classical 4-weekly blocks, the time of analgesia was threefold longer (15 months) for the RF, added to a better capacity for routine physical activities, improved sleep pattern and mean of 30% annually lesser costs. As described, we kept all poly pharmacy during the conduction of the study. However, 17% of patients were refractory and benefit from spinal cord stimulation implantation. Searching the literature, we could not compare this incidence of miscarriage with other publications, as the data related to the incidence of test block failure in CRPS-1 is missing.

While Treatment 1 included epidural sacral block, Treatment 2 included RF modulation of DG of the affected region (L3-L4-L5), procedures used in order to reverse central pain sensitization. The central sensitization is partly

explained by DG hyper excitability demonstrated in CRPS. DG perineuronal glial cells produce diverse proinflammatory mediators, including microglia-derived IL-1 $\beta$ .<sup>13</sup> In addition, the microglia expressing cannabinoid receptor-2 and the chemokine fractalkine receptor (CX3CR1) plays a substantial role in microglial activation and neuroinflammation.<sup>14</sup> The induction of spinal adenosine could also participate.<sup>15</sup> This hyper excitability drives the immune response to more rostrally and caudally located DG and other spinal cord sites explaining the development of widespread pain and autonomic dysfunction.<sup>16</sup>

Inflammatory mechanisms activate the central pain sensitization.<sup>17</sup> The inflammatory process that contributes to CRPS results from two inflammatory sequences. Firstly, the classic inflammatory mechanisms through immune cells. After trauma, soft tissue, mast cells and lymphocytes release proinflammatory cytokines, including tumor necrosis factor  $\alpha$ , interleukin-1 $\beta$ , -2, and 6.<sup>18</sup> Secondly, neurogenic inflammation mechanisms through the direct release of neuropeptides mediators (calcitonin gene-related peptide, substance P, and bradykinin) and inflammatory cytokines from nociceptive fibers.<sup>19</sup> Both inflammatory cascades activate central sensitization.<sup>17</sup> In addition, expression of adrenergic receptors on nociceptive fibers after tissue damage might provide sympathetically induced pain in CRPS patients.<sup>20</sup> Also, there is a compensatory up regulation mechanism at peripheral adrenergic receptors that may lead to higher sensitivity to circulating catecholamines.<sup>21</sup>

Successful treatment for CRPS involving the lower limb was described after continuous epidural bupivacaine,<sup>22</sup> putting a role for epidural local anesthetics in central pain sensitization. In the epidural sacral block, we used the 40 mg lidocaine. However, the efficacy of this low dose could be that the DG as a prime interventional target for pain control DG ectopia and allodynia was selectively suppressed with lidocaine at concentrations too low to block only axonal impulse propagation, without blocking normal sensation or motor function.<sup>23</sup>

Apart from lidocaine, dexamethasone was the non-particulate steroid of choice,<sup>24</sup> and combining clonidine and dexamethasone for epidural injection did not form precipitates of non-aggregated smaller particles compared to dexamethasone alone, proving to be a useful combination.<sup>25,26</sup> While dexamethasone reversed central sensitization and hyperalgesia induced by L-glutamate and substance P in rats, an action dependent on the intracellular messengers nitric oxide, arachidonic acid and protein kinase C,<sup>27</sup> perineural clonidine reduced local cytokine expression by actions on alpha2 adrenoceptors, reduced

hypersensitivity in established nerve injury, likely by an immunomodulatory mechanism.<sup>28</sup> The neuroprotective effect of clonidine during ischemia may be ascribed to both a sensitization of central sympathetic activity and a reduced release of glutamate thereby reducing NMDA receptor activation.<sup>29</sup>

In the present study, when one considers that patients submitted to Treatment 1 received the total amount of 360 mg lidocaine, 30 mg dexamethasone and 75 mcg clonidine; while in Treatment 2 they received the total amount of 200 mg lidocaine, 30 mg dexamethasone and 75 mcg clonidine. However, the time elapsed until each patient was crossed to the following Treatment was always superior to 3 months (3-8 months; minimum-maximum) which would be enough for avoiding any systemic action of lidocaine,<sup>30</sup> dexamethasone,<sup>31</sup> or clonidine.<sup>32</sup> Consequently, the results obtained in the actual study would imply that all analgesia benefit observed in this study was secondary of the central action of each block or RF.

Regarding quality of life, the 4-weekly intervention technique resulted in 5-month analgesia while RF resulted in 15-month analgesia accompanied of improved capacity of daily activities and better sleep pattern, which certainly reflected a better quality of life during the controlled analgesia period,<sup>33</sup> and a decreased waiting list for treatment. Imani F et al (2016) described 5-6 months of analgesia after stellate ganglion block in CRPS,<sup>34</sup> what would be similar to our findings in the classical sequence of sympathetic ganglion, however in lower extremities. In our study, RF modulation of GD combined to the classical ablation of sympathetic ganglions at the same levels (L3-L4-L5) resulted in 15-month analgesia. However, a third group of study where patients would be submitted to only classical L3-L4-L5 sympathetic ganglion ablation was missing. We did not intend at the time to do a threefold cross-match study, and also could not to carry on a double blind three independent groups which would be subject to bias.

Importantly, the costs were reduced since the first year of treatment, reflecting that when the traditional 4-weekly treatment for CRPS-I was applied, each patient came 8-9 times per year to the hospital, meaning personal costs apart the government costs. In addition, more patients per year would have the opportunity to be treated, and each patient would be less expense for the Public Health System if RF was adopted as part of public health treatment.

As conclusions, the RF technique of the same levels for both sympathetic ablation and DR modulation (L3-L4-L5) was cost-effective and resulted in 15-month

analgesia compared to 5-month for the traditional sequence of blocks. Also, patients described better sleep pattern and improved routine physical capacity during the period of analgesia. The data suggest that treating the central pain sensitization should be evaluated in this population.

### ACKNOWLEDGMENTS

The authors thank the Foundation Coordination of the Improvement of Higher Level Personnel (CAPES-Brazil) for financial support regarding radiofrequency apparatus, to make possible this project.

### REFERENCES

- [1] Nicholas A Zacharias, Jay Karri, Carol Garcia, Laura K Lachman, Alaa Abd-Elseyed. Interventional Radiofrequency Treatment for the Sympathetic Nervous System: A Review Article. *Pain Ther.* 2021;10(1):115-141.
- [2] Ozcan A, Conermann T. Lumbar Sympatholysis. Review. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 Jan–.
- [3] Knudsen LF, Terkelsen AJ, Drummond PD, Birklein F. Complex regional pain syndrome: a focus on the autonomic nervous system. *Clin Auton Res.* 2019;29:457-467.
- [4] Reimer M, Rempe T, Diedrichs C, Baron R, Gierthmühlen J. Sensitization of the Nociceptive System in Complex Regional Pain Syndrome. *PLoS One.* 2016;11:e0154553.
- [5] Roh YH, Gong HS, Baek GH. Prognostic Value of Pain Sensitization During Early Recovery After Distal Radius Fracture in Complex Regional Pain Syndrome. *Pain Med.* 2019 ;20:1066-1071.
- [6] Morris P, Ali K, Merritt M, Pelletier J, Macedo LG. A systematic review of the role of inflammatory biomarkers in acute, subacute and chronic non-specific low back pain. *BMC Musculoskelet Disord.* 2020;21:142.
- [7] Nijs J, Apeldoorn A, Hallegraef H, et al. Low back pain: guidelines for the clinical classification of predominant neuropathic, nociceptive, or central sensitization pain. *Pain Physician.* 2015;18:E333-346.
- [8] Mehta V, Snidvongs S, Ghai B, Langford R, Wodehouse T. Characterization of peripheral and central sensitization after dorsal root ganglion intervention in patients with unilateral lumbosacral radicular pain: a prospective pilot study. *Br J Anaesth.* 2017;118:924-931.
- [9] Huygen FJPM, Kallewaard JW, Nijhuis H, et al. Effectiveness and Safety of Dorsal Root Ganglion Stimulation for the Treatment of Chronic Pain: A Pooled Analysis. *Neuromodulation.* 2020;23:213-221.
- [10] Goebel A, Lewis S, Phillip R, Sharma M. Dorsal Root Ganglion Stimulation for Complex Regional Pain Syndrome (CRPS) Recurrence after Amputation for CRPS, and Failure of Conventional Spinal Cord Stimulation. *Pain Pract.* 2018;18:104-108.
- [11] Harden RN, Bruehl S, Stanton-Hicks M, Wilson PR. Proposed new diagnostic criteria for complex regional pain syndrome. *Pain Med.* 2007;8:326-31.
- [12] Helyes Z, Tékus V, Szentés N, et al. Transfer of complex regional pain syndrome to mice via human autoantibodies is mediated by interleukin-1-induced mechanisms. *Proc Natl Acad Sci U S A.* 2019;116:13067-13076.
- [13] Xu J, Tang Y, Xie M, et al. Activation of cannabinoid receptor 2 attenuates mechanical allodynia and neuroinflammatory responses in a chronic post-ischemic pain model of complex regional pain syndrome type I in rats. *Eur J Neurosci.* 2016;44:3046-3055.
- [14] Roldan CJ, Lo TC, Huh B. Recurrence of complex regional pain syndrome after administration of adenosine. *Pain Manag.* 2019;9:233-237.
- [15] Martínez-Lavín M, Vargas A, Silveira LH, Amezcua-Guerra LM, Martínez-Martínez LA, Pineda C. Complex Regional Pain Syndrome Evolving to Full-Blown Fibromyalgia: A Proposal of Common Mechanisms. *J Clin Rheumatol.* 2020 [Epub ahead of print].
- [16] Eldufani J, Elahmer N, Blaiseb G. A medical mystery of complex regional pain syndrome. *Heliyon.* 2020; 6:e03329.
- [17] Cheng J.K., Ji R.R. Intracellular signaling in primary sensory neurons and persistent pain. *Neurochem. Res.* 2008;33:1970–1978.
- [18] Birklein F., Schmelz M. Neuropeptides, neurogenic inflammation and complex regional pain syndrome (CRPS) *Neurosci. Lett.* 2008;437:199–202.
- [19] Bruehl S. An update on the pathophysiology of complex regional pain syndrome. *Anesthesiology.* 2010;113:713-725
- [20] Schlereth T, Drummond PD, Birklein F. Inflammation in CRPS: role of the sympathetic supply. *Auton Neurosci.* 2014;182:102-107.
- [21] Zyluk A, Puchalski P. Successful treatment of paediatric lower limb CRPS by continuous epidural anaesthesia: a report of 2 cases. *Handchir Mikrochir Plast Chir.* 2018;50:359-362.
- [22] Yatziv SL, Devor M. Suppression of neuropathic pain by selective silencing of dorsal root ganglion ectopia using nonblocking concentrations of lidocaine. *Pain.* 2019;160:2105-2114.
- [23] Derby R, Lee SH, Date ES, Lee JH, Lee CH. Size and aggregation of corticosteroids used for epidural injections. *Pain Med.* 2008;9:227-234.
- [24] Gazelka HM, Burgher AH, Huntoon MA, Mantilla CB, Hoelzer BC. Determination of the particulate size and aggregation of clonidine and corticosteroids for epidural steroid injection. *Pain Physician.* 2012;15:87-93.
- [25] Hwang H, Park J, Lee WK, et al. Crystallization of Local Anesthetics When Mixed With Corticosteroid Solutions. *Ann Rehabil Med.* 2016;40:21-7.
- [26] Coderre TJ, Yashpal K. Intracellular messengers contributing to persistent nociception and hyperalgesia induced by L-glutamate and substance P in the rat formalin pain model. *Eur J Neurosci.* 1994;6:1328-34.
- [27] Romero-Sandoval A, Eisenach JC. Perineural clonidine reduces mechanical hypersensitivity and cytokine

production in established nerve injury. *Anesthesiology*. 2006;104:351-5.

[28] Jellish WS, Murdoch J, Kindel G, Zhang X, White FA. The effect of clonidine on cell survival, glutamate, and aspartate release in normo- and hyperglycemic rats after near complete forebrain ischemia. *Exp Brain Res*. 2005;167:526-34.

[29] Beaussier M, Delbos A, Maurice-Szamburski A, Ecoffey C, Mercadal L. Perioperative Use of Intravenous Lidocaine. *Drugs*. 2018;78:1229-1246.

[30] Friedly JL, Comstock BA, Heagerty PJ, et al. Systemic effects of epidural steroid injections for spinal stenosis. *Pain*. 2018;159:876-883.

[31] Nielsen BN, Anderson BJ, Falcon L, et al. Pharmacokinetics of an intravenous bolus dose of clonidine in children undergoing surgery. *Paediatr Anaesth*. 2020 [Epub ahead of print].

[32] Mouraux D, Lenoir C, Tuna T, Brassinne E, Sobczak S. The long-term effect of complex regional pain syndrome type 1 on disability and quality of life after foot injury. *Disabil Rehabil*. 2020 (Epub ahead of print)

[33] Imani F, Hemati K, Rahimzadeh P, Kazemi MR, Hejazian K. Effectiveness of Stellate Ganglion Block Under Fluoroscopy or Ultrasound Guidance in Upper Extremity CRPS. *J Clin Diagn Res*. 2016;10:UC09-12.

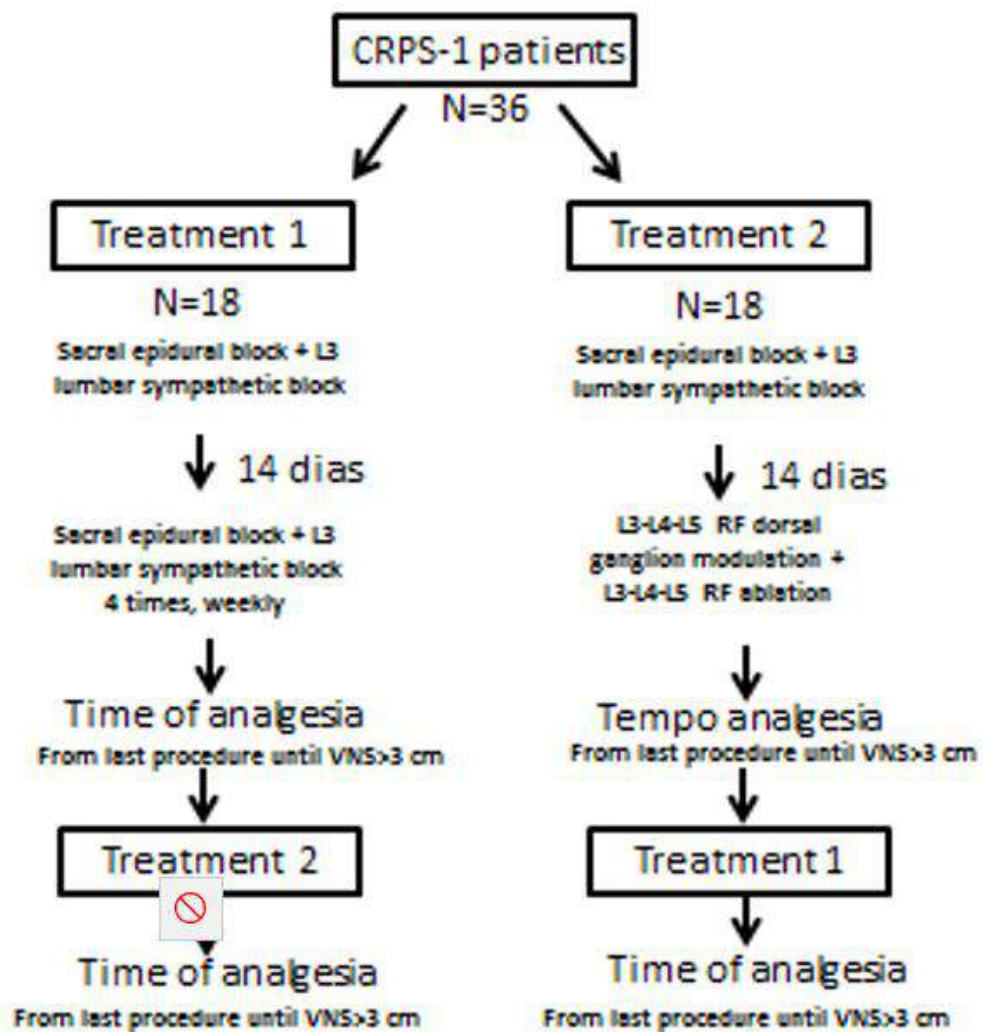


Fig. 1. Chart of the study.

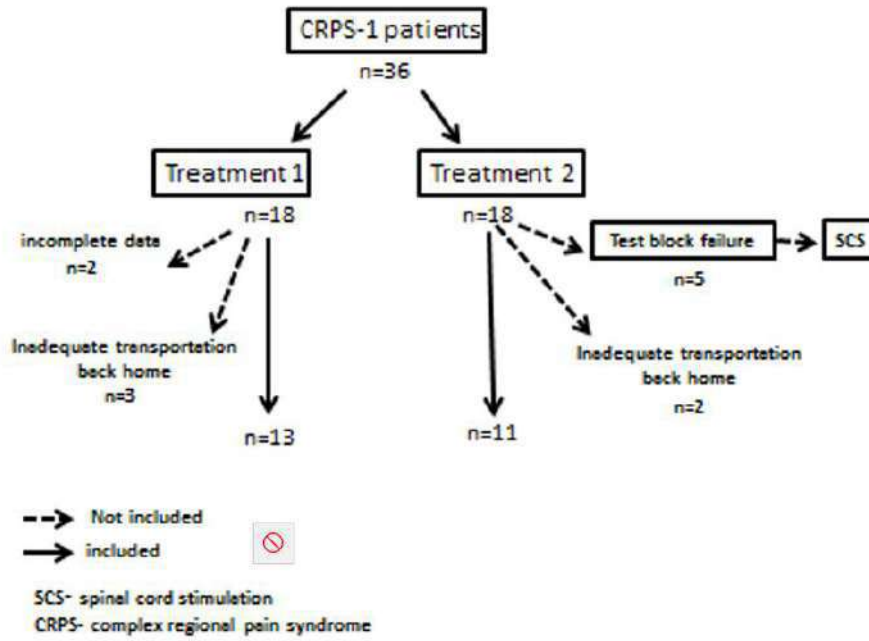


Fig.2. Flowchart of the study.

Treatment 1- test block + 4-weekly blocks; Treatment 2- test blocks + RF.

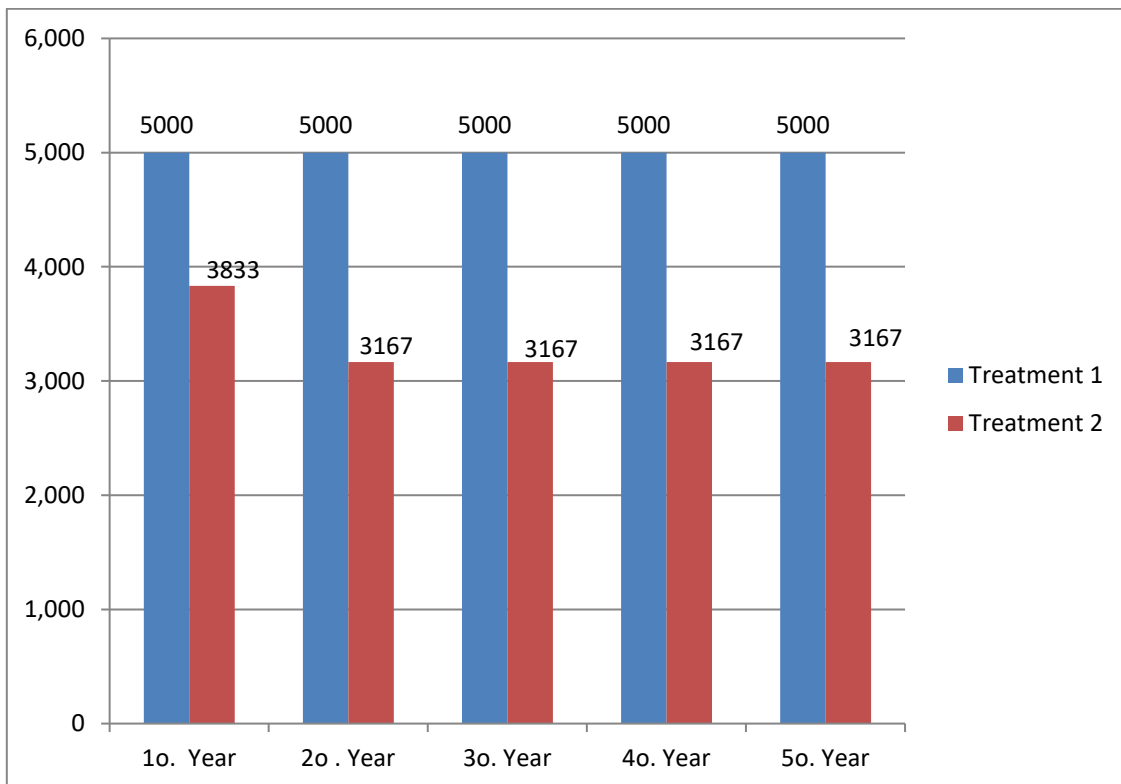


Fig.3. Annual costs (USA\$ dollars) during five-years extrapolation for Treatment 1 and 2. Treatment 1- test block + 4-weekly blocks; Treatment 2- test blocks + RF.



Table 1. Time of analgesia (until VNS &gt; 3 cm).

|             | <b>Time of analgesia<br/>Treatment 1<br/>(months)</b> | <b>Time of analgesia<br/>Treatment 2<br/>(months)</b> |
|-------------|-------------------------------------------------------|-------------------------------------------------------|
| <b>Mean</b> | 5.5                                                   | 15.5                                                  |
| <b>STD</b>  | 1.47442                                               | 2.340568                                              |

Treatment 1- test block + 4-weekly blocks

Treatment 2- test blocks + RF

Wilcoxon test,  $P < 0.001$ , STD- Standard deviation.

Table 2. Sleep pattern graded by patients during the period of adequate analgesia and inadequate analgesia.

|             | <b>Sleep pattern<br/>Inadequate analgesia<br/>(VNS 0-10 cm)</b> | <b>Sleep pattern<br/>Adequate analgesia<br/>(VNS- 0-10 cm)</b> |
|-------------|-----------------------------------------------------------------|----------------------------------------------------------------|
| <b>Mean</b> | 6.208333                                                        | 2.916667                                                       |
| <b>STD</b>  | 1.841058                                                        | 0.974308                                                       |

Wilcoxon rank test,  $P < 0.05$

STD- standard deviation

VNS 0-10 cm- zero meant comfortable sleep up to 10 cm which meant worst, uncomfortable sleep.

Table 3. Capacity of performing routine activities during adequate analgesia and inadequate analgesia.

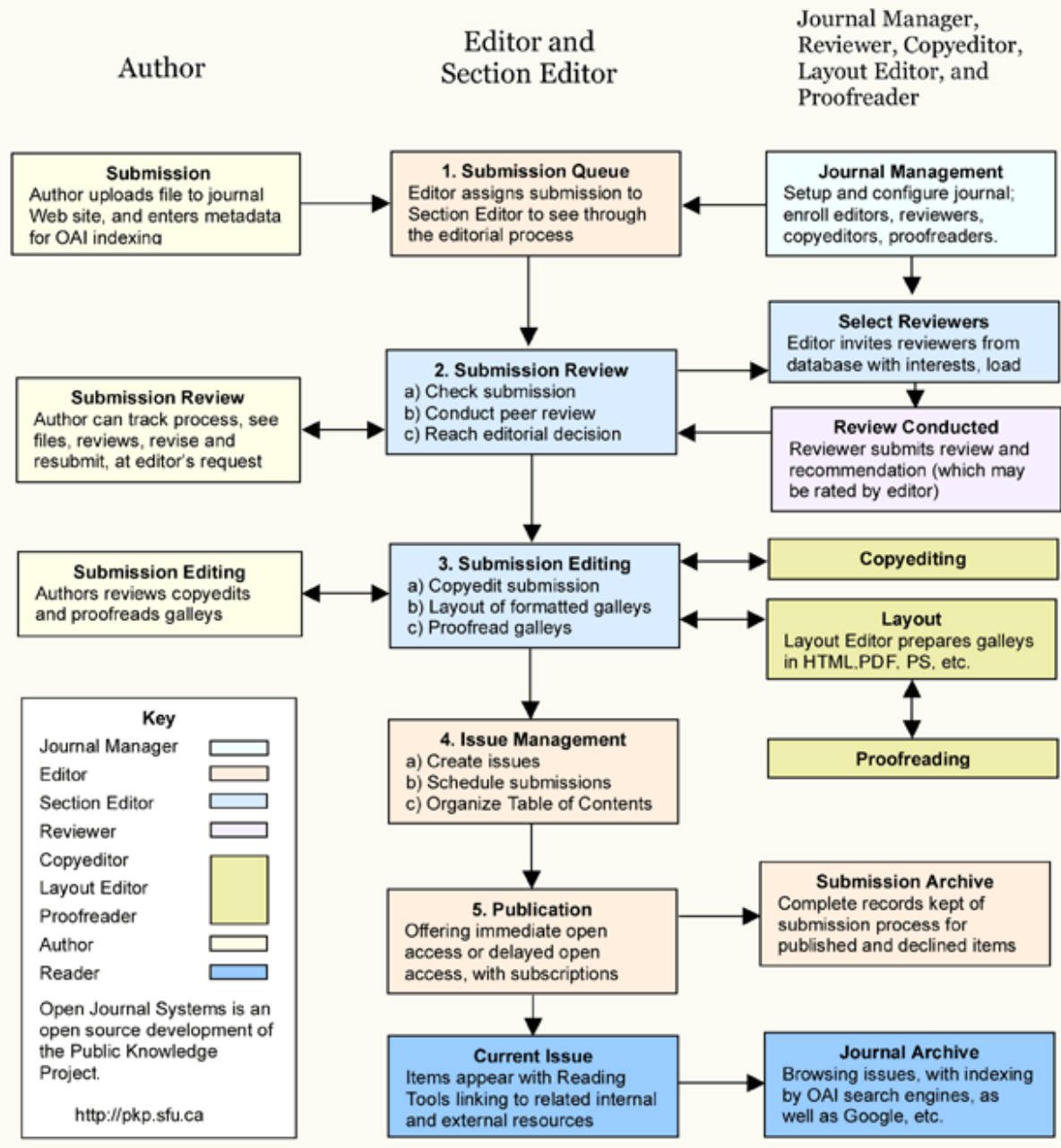
|             | <b>Capacity for activities<br/>Adequate analgesia</b> | <b>Capacity of activities<br/>Inadequate analgesia</b> |
|-------------|-------------------------------------------------------|--------------------------------------------------------|
| <b>Mean</b> | 6.375                                                 | 3.5                                                    |
| <b>STD</b>  | 1.714706                                              | 0.978019                                               |

Wilcoxon rank test  $P < 0.05$

STD- standard deviation

ENV 10 cm- zero meant the best capacity to perform routine activities up to 10 cm which meant worst most difficulties to perform routine activities.

# OJS Editorial and Publishing Process



~JAERS Workflow~

## Important links:

### Paper Submission Link:

<https://ijaers.com/submit-paper/>

### Editorial Team:

<https://ijaers.com/editorial-board/>

### Peer Review Process:

<https://ijaers.com/peer-review-process/>

### Publication Ethics:

<https://ijaers.com/publication-ethics-and-publication-malpractice-statement/>

### Author Guidelines:

<https://ijaers.com/instruction-to-author/>

### Reviewer Guidelines:

<https://ijaers.com/review-guidelines/>

---

## Journal Indexed and Abstracted in:

- Qualis-CAPES (A2)-Brazil
- Normatiza (Under Review- Ref.020191511)
- NAAS Score: 3.18
- Bielefeld Academic Search Engine(BASE)
- Aalborg University Library (Denmark)
- WorldCat: The World's Largest Library Catalog
- Semantic Scholar
- J-Gate
- Open J-Gate
- CORE-The world's largest collection of open access research papers
- JURN
- Microsoft Academic Search
- Google Scholar
- Kopernio - powered by Web of Science
- Pol-Index
- PBN(Polish Scholarly Bibliography) Nauka Polaska
- Scilit, MDPI AG (Basel, Switzerland)
- Tyndale University College & Seminary
- Indiana Library WorldCat
- CrossRef DOI-10.22161/ijaers
- Neliti - Indonesia's Research Repository
- Journal TOC
- WIKI-CFP
- Scinapse- Academic Search Engine
- Mendeley-Reference Management Software & Researcher Network
- Dimensions.ai: Re-imagining discovery and access to research
- Index Copernicus Value(ICV): 81.49
- Citeseerx
- Massachusetts Institute of Technology (USA)
- Simpson University (USA)
- University of Louisville (USA)
- Biola University (USA)
- IE Library (Spain)
- Mount Saint Vincent University Library ( Halifax, Nova Scotia Canada)
- University Of Arizona (USA)
- INDIANA UNIVERSITY-PURDUE UNIVERSITY INDIANAPOLIS (USA)
- Roderic Bowen Library and Archives (United Kingdom)
- University Library of Skövde (Sweden)
- Indiana University East (campuslibrary (USA))
- Tilburg University (The Netherlands)
- Williams College (USA)
- University of Connecticut (USA)
- Brandeis University (USA)
- Tufts University (USA)
- Boston University (USA)
- McGill University (Canada)
- Northeastern University (USA)
- BibSonomy-The blue social bookmark and publication sharing system
- Slide Share
- Academia
- Archive
- Scribd
- ISRJIF
- Cite Factor
- SJIF-InnoSpace
- ISSUU
- Research Bib
- infobaseindex
- I2OR
- DRJI journal-repository



### AI Publication

International Journal of Advanced Engineering Research and Science (IJAERS)

104/108, Sector-10, Pratap Nagar, Jaipur, India