

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](https://doi.org/10.22161/ijaers)

Issue DOI: [10.22161/ijaers.811](https://doi.org/10.22161/ijaers.811)

AI PUBLICATIONS

Vol.- 8 | Issue - 11 | Nov 2021

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-8, Issue-11

November, 2021

Editor in Chief

Dr. Swapnesh Taterh

Chief Executive Editor

S. Suman Rajest

Copyright © 2021 International Journal of Advanced Engineering Research and Science

Publisher

AI Publication

Email: editor.ijaers@gmail.com; editor@ijaers.com

Web: 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 Academy 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

Resilience, daily spiritual experience and self-efficacy of the university teachers: Differentiation according to postgraduate training

Maria Regina Teixeira Ferreira Capelo, Christina César Praça Brasil, Noemí Serrano-Díaz, Raimunda Magalhães Silva, Ana Maria Fontenelle Catrib, Zélia Maria de Sousa Araújo Santos, Rita Maria Lemos Baptista Silva

 DOI: [10.22161/ijaers.811.1](https://doi.org/10.22161/ijaers.811.1)

Page No: 001-009

Reflections on the meanings, experiences and perspectives of chronic kidney patients after kidney transplantation

Diogo Seiichi Umbelino Okawa, Thany Elly Vanzeler Pereira, Thayná Maria Andrade Silva, Ingrid Renny Silva Palha, Elaine Cristina Pacheco de Oliveira, Francisco Ocian de Araújo Júnior, Tarcísio Lucas Lima da Costa, Cintia da Silva Moraes, Maria Janete Nahum Gomes, Denise de Fátima Ferreira Cardoso, Sheyla Cristina Ferreira de Magalhães, Vera Lúcia Gomes de Oliveira, Milena Oliveira Saldanha Pacífico, Danielle Oliveira Maciel, Gleyce Pinto Girard, Marcio Almeida Lins, Elieni Santana de Abreu, Joyce da Silva Pantoja, Amanda do Socorro Furtado Silva, Remo Rodrigues Carneiro, Naiade Moreira de Oliveira, Ranná Barros Souza, Victória Fernanda Barbosa, Geordana Galvão Feitosa, Adams Brunno Silva, Mauro Sávio Sarmiento Pinheiro, Joelma da Silva Gualdez, Bruna Carolina da Trindade Monteiro da Silva, Ivane Pinheiro Corrêa, Natrícia Hellen Batista Afonso, Elyade Nelly Pires Rocha Camacho, Shirley Iara Martins Dourado, Rafaela Martins Dourado Gonçalves, Pedro Lucas Nahum Salgado, Meick Farias Negrão, Letícia Barbosa Alves, Hbinor Alves, Glauce Kelly Ribeiro de Souza, Josielma Neco Pina, Bruna Barros de Melo, Larissa Caroline da Silva Costa, Jéssica Fernandes Oliveira, Izabela Campos da Silva, Raquel Fernandes Costa, Wanda Carla Conde Rodrigues, Anderson Lineu Siqueira dos Santos, Michele Monteiro Sousa, Fabiano José da Silva Boulhosa, Camila da Silva Lima, Rafaela Cordeiro de Mâcedo, Barbara Silva de Assis, Raimundo Nonato da Silva Sena Rosa, Elias Costa Monteiro, Irinéia de Oliveira Bacelar Simplício, Mariana Valente de Oliveira, Lauricéia Valente de Oliveira, Simone Aguiar da Silva Figueira, Maicon de Araujo Nogueira

 DOI: [10.22161/ijaers.811.2](https://doi.org/10.22161/ijaers.811.2)

Page No: 010-019

Use of software to aid irrigation

Valtency Remígio Souto, Gertrudes Macário de Oliveira, Marcos Antônio Vanderlei Silva, Denise Costa de Araújo

 DOI: [10.22161/ijaers.811.3](https://doi.org/10.22161/ijaers.811.3)

Page No: 020-023

Measurement of Carbon and Carbondioxide Fmu Argomulyo using Biomass Approach in Community Forests, Sundul Village and Banjar Panjang, Magetan Regency

Martin Lukito, Ahadiati Rohmatiah

 DOI: [10.22161/ijaers.811.4](https://doi.org/10.22161/ijaers.811.4)

Page No: 024-039

Most prevalent oral manifestations in patients infected by the HIV virus and the importance of dentists in early diagnosis

Jennifer Letícia Moura da Silva, Rafaela de Souza Sampaio, Lívia Coutinho Varejão, Gerson de Oliveira Paiva Neto, Rebeca Luzia Solarte Barbosa, Mário Jorge Souza Ferreira Filho

 DOI: [10.22161/ijaers.811.5](https://doi.org/10.22161/ijaers.811.5)

Page No: 040-047

Pregnant Women's Perception about the Influence of Physiotherapy in Prenatal and Labor in a Neighborhood of the City of Linhares-ES

Julia Dassié Nascimento Rossetto, Daniel Rodrigues Silva

 DOI: [10.22161/ijaers.811.6](https://doi.org/10.22161/ijaers.811.6)

Page No: 048-058

Survey of the Quality of Life and Well-Being of the Teachers of Marilândia-ES in the Daily School

Janderson Bonella Sedda, Brunela Romagna De Araújo Sedda, Yolanda Aparecida De Castro Almeida Vieira

 DOI: [10.22161/ijaers.811.7](https://doi.org/10.22161/ijaers.811.7)

Page No: 059-077

Love and Psychoanalysis: A dialogue between Clinic and Literature

Aline Mattos Peruch Rigoni, Alice Melo Pessoti

 DOI: [10.22161/ijaers.811.8](https://doi.org/10.22161/ijaers.811.8)

Page No: 078-089

Bacterial and fungal colonization on metallic and ceramic orthodontic brackets: A scanning electronic microscopy study

José Columbano Neto, Flávio de Mendonça Copello, Ana Maria Bolognese, Eduardo Franzotti Sant'Anna, André Luis Souza dos Santos, Rildo da Silva Coqueiro, Margareth Maria Gomes de Souza

 DOI: [10.22161/ijaers.811.9](https://doi.org/10.22161/ijaers.811.9)

Page No: 090-101

Efficient Statistical Tools for the Estimation of the Longitudinal Dispersion Coefficient

Thiago Jordem Pereira, Daniel Maziero Verdan Curty and Wagner Rambaldi Telles

 DOI: [10.22161/ijaers.811.10](https://doi.org/10.22161/ijaers.811.10)

Page No: 102-109

Opening Area usage of Shear Wall Relating to Wall Area Used for Multistoried Building: A Review

Krishna Pal Singh

 DOI: [10.22161/ijaers.811.11](https://doi.org/10.22161/ijaers.811.11)

Page No: 110-114

Epidemiological Profile of Prostate Cancer in Brazil

Gilmar Júnior Brito Santana, Ludianne Paz Lima da Silva, Juliana Azevedo da Paixão, Isleide da Silva Santos

 DOI: [10.22161/ijaers.811.12](https://doi.org/10.22161/ijaers.811.12)

Page No: 115-125

Breast cancer associated with pregnancy: Evidence for nursing care

Anathaly Alves dos Santos Silva, Katiany Tamara Andrade Batista, Gleison Faria, Alexandra Alves de Carvalho, Gilvan Salvador Junior, Cleovanio Oliveira da Silva, Raiane Kesia de Carvalho Pereira, Andressa de Jesus Lucio, Gean Carlos da Silva Saar, Francielly Maira Bordon, Cleverson de Oliveira Santos

 DOI: [10.22161/ijaers.811.13](https://doi.org/10.22161/ijaers.811.13)

Page No: 126-133

<p><i>Optimized Manufacturing Layout and Operational Balancing - A Case Study in an Electronic Line from the Industrial Pole of Manaus/AM, to increase productivity</i> Raimundo Wenderson da Silva Figueira, Fabiana Rocha Pinto  DOI: 10.22161/ijaers.811.14</p>	<p>Page No: 134-140</p>
<p><i>Challenges of using Digital Technologies in the Context of Remote Learning for University Students with High Abilities or Giftedness</i> Thelma Helena Costa Chahini, Débora Thalita Santos Pereira  DOI: 10.22161/ijaers.811.15</p>	<p>Page No: 141-148</p>
<p><i>Normalization of Way Solepay Watershed in Mamala Village, Central Maluku Regency</i> Rudi Serang  DOI: 10.22161/ijaers.811.16</p>	<p>Page No: 149-160</p>
<p><i>The use of myofasial release in fibromyalgia: scope analysis</i> Karina Pangrácio de Oliveira, Lais Akemi Chianca Kagawa, Anselmo Cordeiro de Souza, Claudia Kumpel, Poliani de Oliveira Lima, Abrahão Augusto Joviniano Quadros  DOI: 10.22161/ijaers.811.17</p>	<p>Page No: 161-170</p>
<p><i>Fixed orthodontic technique without bracket: an alternative to conventional orthodontic treatments</i> Ewelyn Caroline Ribeiro Corrêa, Brienna Almeida Costa, Amanda Araújo Freitas, Rebeca Luzia Solarte Barbosa, Rodrigo Marocchio Pavane, Mário Jorge Souza Ferreira Filho  DOI: 10.22161/ijaers.811.18</p>	<p>Page No: 171-175</p>
<p><i>Landscape of Family Farming in the Municipality of Naviraí-MS</i> Samuel Carvalho de Aragão, Márcio Teixeira Oliveira, Viviane Lima Catelan Moreira, Renno de Abreu Araújo, Matheus Bornelli de Castro, Daniel Zimmermann Mesquita, Fabio Yoshimi Wada, Priscila Gonzales Figueiredo, Bruno Toribio de Lima Xavier, André Carvalho Baida, Cristiano Moreira Oliveira, Michely Cinquini Freire da Silva, Jorge Granja de Oliveira Junior, Anderson Sanita, Suellen Moreira de Oliveira, Ricardo Augusto Lins do Nascimento  DOI: 10.22161/ijaers.811.19</p>	<p>Page No: 176-190</p>
<p><i>Multidisciplinary treatment in cases of dental agenesis - literature review</i> Almir Angelo Ximenes da Silva, Lucielen dos Santos Sousa, Natalia Campos Bahia, Rebeca Luzia Solarte Barbosa, Rodrigo Marocchio Pavane, Mário Jorge Souza Ferreira Filho  DOI: 10.22161/ijaers.811.20</p>	<p>Page No: 191-194</p>
<p><i>Móveis Rudnick`s Successful History: Leadership and Commitment</i> Miguel Nenevé, Mário Nenevé, Celiana Hartz Varela, Aloysio Dos Santos Bahiense Junior  DOI: 10.22161/ijaers.811.21</p>	<p>Page No: 195-200</p>

Ceramic Laminates in Conoid Teeth: An integrative Literature Review

Sandy Dias Moraes, Robson dos Santos Paiva Filho, Hayssa Cunha da Silva, Ítalo Augusto da Costa Lacerda

 DOI: [10.22161/ijaers.811.22](https://doi.org/10.22161/ijaers.811.22)

Page No: 201-208

Short Commercialization Circuits: Contributions and challenges for the strengthening of Family Farming

Elson de Oliveira, Stefania Evangelista dos Santos Barros, Mauricio Oliveira da Silva Sugai, Denes Dantas Vieira, Hélder Ribeiro Freitas, José Raimundo Cordeiro Neto

 DOI: [10.22161/ijaers.811.23](https://doi.org/10.22161/ijaers.811.23)

Page No: 209-220

Social Cartography of Terreiro and Traditional Peoples' Agriculture: An Interdisciplinary Dialogue for Agroecological Transition

Luciano de Oliveira Costa, Gáudia Maria Costa Leite Pereira, José Cláudio Rocha, Jairton Fraga Araújo, Lucia Marisy Souza Ribeiro de Oliveira, Edonilce da Rocha Barros, Luzi Borges, Augusto Araújo Santos, Nayara Silva Santana, Raimundo Nunes de Oliveira

 DOI: [10.22161/ijaers.811.24](https://doi.org/10.22161/ijaers.811.24)

Page No: 221-232

Femur Fractures: Hospitalization, Deaths and Temporal Trend in the Southeast Region of Brazil

Eros Silva Cláudio, Geovana Alves Teles, João Pedro Lima Gemha, Saulo Ricardo Bueno Brescancin, Sérgio Marcolino Rosa

 DOI: [10.22161/ijaers.811.25](https://doi.org/10.22161/ijaers.811.25)

Page No: 233-241

Modeling of a new Probabilistic Education Quality Indicator - CPP_QEdu

Márcia de Freitas Siqueira Sadok Menna Barreto, Annibal Parracho Sant'Anna

 DOI: [10.22161/ijaers.811.26](https://doi.org/10.22161/ijaers.811.26)

Page No: 242-253

Evaluation of the performance of Spodoptera frugiperda caterpillars after contamination by bacteria and yeast

Sarah Lúcia Pantaleão Pereira, Wesley Botelho Sousa, Tainá Marques Sampaio, Mônica Hitomi Okura

 DOI: [10.22161/ijaers.811.27](https://doi.org/10.22161/ijaers.811.27)

Page No: 254-264

Polymerization shrinkage of composite resins: consequences and control

Sonielly Passos da Silva, Susana Hellen da Costa Lima, Raísa Castelo

 DOI: [10.22161/ijaers.811.28](https://doi.org/10.22161/ijaers.811.28)

Page No: 265-271

Analysis of the Greenhouse Gas Emissions Inventory in a Photographic Paper Finishing Industry in the Manaus city

Edfran da Cruz Magalhães, Simone da Silva

 DOI: [10.22161/ijaers.811.29](https://doi.org/10.22161/ijaers.811.29)

Page No: 272-281

Diagnosis and proposal of an alternative system for the supply and treatment of water in the Mato Stream, municipality of Simonésia-MG.

Mariza Silva Bitarães Dias, Rosane Gomes de Oliveira, Walber Gonçalves de Souza, Daniel Rodrigues Silva, Wederson Marcos Alves and João Batista Alves dos Reis

 DOI: [10.22161/ijaers.811.30](https://doi.org/10.22161/ijaers.811.30)

Page No: 282-307

Social Isolation as Risk Factor of Stroke: Protocol for Systematic Review

Laura Flavorta Billong, Jiantong Shen, Garba Betchem

 DOI: [10.22161/ijaers.811.31](https://doi.org/10.22161/ijaers.811.31)

Page No: 308-313

Statistics Education - Teacher Training in Investigative Classes

Angelo Ricardo Balduino, Albano Dias Pereira Filho, Cláudio de Sousa Galvão, Cynthia Souza Oliveira, Raphael Fontes Cloux

 DOI: [10.22161/ijaers.811.32](https://doi.org/10.22161/ijaers.811.32)

Page No: 314-317

The essence of the world as an experience of aesthetic contemplation in Arthur Schopenhauer

Luciano da Silva Façanha, Klisman Lucas de Sousa Castro Castro

 DOI: [10.22161/ijaers.811.33](https://doi.org/10.22161/ijaers.811.33)

Page No: 318-324

Risk of withdrawal of foot-and-mouth disease vaccine in Mato Grosso do Sul and consequent loss of herd immunity for reintroduction of foot-and-mouth disease virus in the State

Cristiano Moreira de Oliveira, Viviane Lima Catelan Moreira, Amanda Serrado de Almeida, Marcela Barros de Queiróz, Andressa Rossetto, Rita Jusceline Lopes de Goes, Abner Júlia Savieto, Samuel Carvalho de Aragão, Jorge Granja de Oliveira Junior, Márcio Teixeira Oliveira, Suellen Moreira de Oliveira, Geraldo Marcos de Moraes, Paulo Eduardo Ferlini Teixeira, Jefferson Pinto de Oliveira, Agnaldo Reis Pontes

 DOI: [10.22161/ijaers.811.34](https://doi.org/10.22161/ijaers.811.34)

Page No: 325-343

Laboratory study of stone matrix asphalt by using bamboo fibre

Mr Rishi Dubey, Mr. Tarun Kumar Narnaure

 DOI: [10.22161/ijaers.811.35](https://doi.org/10.22161/ijaers.811.35)

Page No: 344-351

Stories of narrations, actions and facts related to the control and eradication of foot-and-mouth disease in the state of Mato Grosso do Sul.

Angela Nunes Boni, Claudio Di Martino, Graziela Picoloto, Rodrigo Cantero Dorsa, Graziela Picoloto, Viviane Müller Dantas, Luciano Fabrízio Bariani José de Oliveira, Cynthia Nakaya Kinoshita Centurion, Odete Aparecida Pereira, Samuel Carvalhode Aragão, Jorge Granja de Oliveira Junior, Márcio Teixeira Oliveira, Geraldo Marcos de Moraes, Paulo Eduardo Ferlini Teixeira, Jefferson Pintode Oliveira, Renno de Abreu Araújo, Agnaldo Reis Pontes

 DOI: [10.22161/ijaers.811.36](https://doi.org/10.22161/ijaers.811.36)

Page No: 352-365

Framework for transition from traditional to PSS products

Eloiza Kohlbeck, Fernanda Hänsch Beuren, Alexandre Borges Fagundes, Delcio Pereira, Debora Barni de Campos

 DOI: [10.22161/ijaers.811.37](https://doi.org/10.22161/ijaers.811.37)

Page No: 366-379

Genetic divergence in corn with forage potential in the Municipality of Santa Maria of Barreiras-PA

Weder Ferreira dos Santos, Maria Angelica Oliveira Marinho, Layanni Ferreira Sodr  Santos, Jo nes Mucci Peluzio, Marcela Cristina Agustini Carneiro da Silveira Tschoeke, Guilherme Benko de Siqueira, Fernando Barnab  Cerqueira, Talita Pereira de Souza Ferreira, C cero Antonio Sobreira Fidelis, Laura Carneiro Silva, Magno de Oliveira

 DOI: [10.22161/ijaers.811.38](https://doi.org/10.22161/ijaers.811.38)

Page No: 380-386

A Quinquennial Prevention and its applicability for the coarctation of mental illnesses in the practice of prevention of the Family Health Strategy in a pandemic period

Richardson Lemos de Oliveira, Wilder Kleber Fernandes Santana, Claudemir Santos de Jesus, Heberth Almeida de Macedo, Allan Corr a Xavier, Marcelia Alves de Souza Martins, Priscila de Jesus Rosa, Carine Nunes Pereira, Camilla Del Giudice Dias, Ang lica Cristina Castro Soares, Jorge Agostinho de Farias J nior

 DOI: [10.22161/ijaers.811.39](https://doi.org/10.22161/ijaers.811.39)

Page No: 387-394

Dental treatment of children with krabbe syndrome with tracheostomy - Clinical case report

J ssica Ra ssa Sarmiento Fernandes, L via CoutinhoVarej o, Rebeca Luzia Solarte Barbosa, Rodrigo Marocchio Pavane, M rio Jorge Souza Ferreira Filho

 DOI: [10.22161/ijaers.811.40](https://doi.org/10.22161/ijaers.811.40)

Page No: 395-401

Case study on Sustainable Regional Development and Dairy Livestock: An Organic Approach to Processes

M rcia Estela Dalto  Krampe, Adriana Wachholz, Camila Pohl Frohlich

 DOI: [10.22161/ijaers.811.41](https://doi.org/10.22161/ijaers.811.41)

Page No: 402-411

Evaluation of the Infiltration of different Endodontic Cement in Simulated Channels

L gia Catarina Avelino Negre, Lucireni Moraes Costa, Nathalia Moreira De Araujo, Eduardo Fernandes Marques

 DOI: [10.22161/ijaers.811.42](https://doi.org/10.22161/ijaers.811.42)

Page No: 412-416

Gingivectomy for smile aesthetics

Gabriela Gonzalez Galv o, Naiara Souza Barbosa, Gabriela Meira, Gabriel Catunda

 DOI: [10.22161/ijaers.811.43](https://doi.org/10.22161/ijaers.811.43)

Page No: 417-425

Chronopharmacology and its importance in the therapy of Rheumatoid Arthritis: A Systematic Review

Gresiane Santos Conceição, Renata de Oliveira Gomes, Denis de Melo Soares

 DOI: [10.22161/ijaers.811.44](https://doi.org/10.22161/ijaers.811.44)

Page No: 426-434

Educational Practice in Health: Teaching and Recognition in a Playful Way About Stroke

Wenderson Melo Martins, Samily Rocha Guimarães, Fabiana Costa Mourão, Francimeiry Antunes Santos, Matyse Soares dos Anjos Souza, Karen Pantoja Oliveira Meireles, Edson Seabra da Glória Junior, Jéssika Brenda Quaresma de Freitas, Adrian Matos de Souza, Leandra Nogueira Barbosa, Yasmin Cristino Monteiro, Saul Carneiro Gusmão, André Felipe Assunção, Valdo Freire Ribeiro, Iasmin Ianne Sousa Tavares, Estephany Victoria Oliveira Pinheiro, Luiza Fernanda Ramos Soares, Letícia Barbosa Alves, Gleyssa Lene Nunes Carvalho

 DOI: [10.22161/ijaers.811.45](https://doi.org/10.22161/ijaers.811.45)

Page No: 435-440

The Conditions of Periurban Agriculture in Porto Velho, Rondônia – Brazil: The Chacareiro Setor (2007-2008)

Ana Cristina Teixeira Alves, Adnilson de Almeida Silva

 DOI: [10.22161/ijaers.811.46](https://doi.org/10.22161/ijaers.811.46)

Page No: 441-452

Augustin Ngom Jua: Political Development in Cameroon 1961-1972

Suh Hillary Sama

 DOI: [10.22161/ijaers.811.47](https://doi.org/10.22161/ijaers.811.47)

Page No: 453-461

Comparison of ultrasound Fiberglass Pin Removal using or not using Operating Microscope

Isabela Cordeiro Reis, Nathalia Vieira Alves, Tainah Soares Nestor, Eduardo Fernandes Marques

 DOI: [10.22161/ijaers.811.48](https://doi.org/10.22161/ijaers.811.48)

Page No: 462-467

Pedagogical Project of undergraduate Courses and Teacher Education

Bruno Cezar Silva, Lucia Marisy Souza Ribeiro de Oliveira, Marcia Bento Moreira

 DOI: [10.22161/ijaers.811.49](https://doi.org/10.22161/ijaers.811.49)

Page No: 468-473

Resilience, daily spiritual experience and self-efficacy of the university teachers: Differentiation according to postgraduate training

Maria Regina Teixeira Ferreira Capelo^{1*}, Christina César Praça Brasil², Noemí Serrano-Díaz³, Raimunda Magalhães Silva⁴, Ana Maria Fontenelle Catrib⁵, Zélia Maria de Sousa Araújo Santos⁶, Rita Maria Lemos Baptista Silva⁷

¹CLEPUL, Polo of University of Madeira, Portugal

²University of Fortaleza (UNIFOR), Ceará, Brasil

³University of Cádiz, Spain

^{4,5}University of Fortaleza (UNIFOR), Fortaleza-Ceará, Brasil

⁶Ministério da Saúde, Fortaleza-Ceará, Brasil

⁷University of Madeira, Portugal

*Corresponding author

Received: 04 Oct 2021,

Received in revised form: 20 Oct 2021,

Accepted: 28 Oct 2021,

Available online: 07 Nov 2021

©2021 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— *daily spiritual experience, resilience, self-efficacy, university teachers.*

Abstract— *The required training of university teachers has been increasingly affected by changes in world politics, a product of globalization that is giving new profiles to the world of work. This study analyzes the differential perceptions of resilience, daily spiritual experience and self-efficacy of Brazilian university lecturers based on postgraduate academic training. For this reason, a quantitative and cross-sectional study is presented with the participation of 189 lecturers from a private university in the northeast of Brazil. The representations of the participants were evaluated from the answers given to the scales of resilience, daily spiritual experience and self-efficacy of the university lecturers, depending on the postgraduate training. An analysis of the differences based on graduate training suggests that graduate lecturers perceive themselves to be more resilient than their non-doctoral and doctoral peers; that non-doctoral university professors perceive a greater acceptance of life than doctorates; there was no significant differentiation in everyday spiritual experience; Postdoctoral university professors stand out for feeling greater self-efficacy in relation to didactic strategies for lesson planning, didactic strategies to actively involve students, and didactic strategies to promote interaction in the classroom. It is concluded that postgraduate training influences the representations of university professors about the way in which they face the adversities of daily work and how they evaluate their teaching self-efficacy. It follows that the promotion of postgraduate training of university professors is of utmost importance, specifically at the postdoctoral level, since this variable can become a determining factor in the quality of the service provided by the university.*

I. INTRODUCCIÓN

Actualmente, la universidad está bajo presión para evolucionar de acuerdo con los cambios sociales, culturales y económicos de la sociedad moderna [1]. Este proceso afecta, inevitablemente, a los profesores universitarios que se enfrentan, en su trabajo diario, con el surgimiento de transformaciones relevantes de gran diversidad y magnitud, obligados a vivir situaciones cada vez más adversas y hostiles, que generan estrés y malestar [2]. Por otra parte, se han establecido la comprensión de la función social de la universidad y la calidad deseable que orienta su desempeño resultante de las políticas globales impuestas: la urgencia de soluciones alternativas para el mercado laboral, las nuevas configuraciones sociales y los nuevos perfiles profesionales se han convertido en condicionante para que algunos docentes reconsideren sus deberes profesionales, reflexionen sobre su desempeño laboral y busquen ampliar su formación científica y pedagógica [3].

Al parecer, se hacen fuertes aquellas concepciones que entienden que cuantos más conocimientos específicos acumule el docente, mejor será su desempeño profesional como profesor universitario [3]. En esta conjetura, es importante hacer algunas consideraciones sobre la formación de posgrado de los profesores universitarios, especialmente en relación a las dimensiones psicológicas vinculadas al trabajo, sin embargo, existe un vacío crítico en el conocimiento de las dimensiones psicológicas que involucran a este grupo profesional.

Desafiando las demandas y recursos del trabajo para el bienestar del profesor universitario, Han, Yin, Wang & Bai [4] argumentan que la vida ocupacional de los profesores universitarios está relacionada con el bienestar del docente, el desempeño laboral, el agotamiento emocional y la participación. En cuanto a los problemas que afectan el quehacer diario del profesor universitario, los estudios señalan que implican carga horaria y asignaciones excesivas; trabajo real que va más allá del trabajo prescrito; poco tiempo de descanso; tareas rutinarias; escaso uso de las habilidades creativas; poco o ningún autonomía, ni poder de decisión; falta de comunicación y apoyo de compañeros y superiores jerárquicos; incertidumbre sobre el futuro; conflictos; demasiadas responsabilidades; precariedad laboral; falta de oportunidades de ascenso, progreso o crecimiento profesional; malas condiciones físicas, dificultades de concentración y mal humor [5], resultando cada vez más costoso desempeñar su papel y gestionar la relación con los estudiantes [1]. Estas variables denuncian que, en la actualidad, los profesores universitarios experimentan el estrés laboral con mayor urgencia que los vividos por generaciones anteriores.

Las personas se enfrentan con los eventos diarios adversos de diversas maneras [6]. Es decir, algunos son resistentes a los eventos adversos porque pueden mantener un funcionamiento positivo, mientras que otros experimentan una disrupción considerable. Hay individuos capaces de “saltar hacia atrás”, volver a un estado anterior y/o volverse y retroceder [7], refiriéndose a la idea de elasticidad y capacidad de recuperación. Revelan la capacidad de adaptación, de una adaptación positiva, de recuperación, de resistencia y/o superación [8], a pesar de que las circunstancias vividas sean muy adversas [9]. Por tanto, la resiliencia es enfatizada como el producto de un proceso dinámico entre factores protectores y de riesgo o como mecanismo de defensa [10], que permite a las personas prosperar ante los reveses que ocurren tanto en la vida del individuo, como en el contexto laboral [11]. Todo ello como una respuesta cognitiva y conductual de las personas a eventos estresantes de corto a medio plazo, la resiliencia debe entenderse cuando los sucesos persisten durante un período prolongado [6]. En este sentido, el carácter de desgaste de la docencia universitaria puede ser armonizado con la capacidad de la persona para resistir o afrontar los estresores que vive en el trabajo [2, 12].

Investigaciones recientes han destacado la contribución de características individuales como la espiritualidad en la armonización del estrés laboral [13], como determinante de la felicidad [14] y el bienestar en el trabajo [15] y la probabilidad de disminución del malestar psicológico en profesores universitarios [16]. La espiritualidad y la religiosidad son prácticas y creencias vividas en todo el mundo, asociadas a la salud en general [17], tienen una influencia motivacional en el sistema psicológico humano [18] y son reconocidas como recursos que ayudan a las personas a enfrentar las adversidades diarias y los eventos traumáticos estresantes e influyen en el nivel de adaptación psicosocial general de los individuos a los eventos de la vida diaria [19-21] y probablemente en las relaciones y el desempeño laboral [14-16, 22].

En un cuestionamiento sobre las razones que llevan a profesores universitarios de diferentes instituciones a desconfiar en su competencia para enseñar. Yin, Han y Perron [23] encontraron que el estrés de la inadecuación organizacional y los nuevos desafíos se asociaron negativamente con la autoeficacia del profesor universitario.

La autoeficacia es un constructo ampliamente estudiado, ocupa un lugar destacado entre los constructos explicativos del éxito y el fracaso en los actos del ser humano [24] al referirse a creencias en las capacidades del individuo para organizar y ejecutar las acciones necesarias para producir determinados logros [25, 26]. Es decir, alude

a los juicios de cada persona sobre su capacidad para realizar una determinada actividad.

Los sentimientos de autoeficacia se destacan por la relación significativa entre el *burnout* y el rendimiento académico [27], la disponibilidad para la implicación en prácticas colaborativas [28] y por el notable impacto en el rendimiento académico de los docentes [29]. Los docentes, confiados en sus creencias y con potencial para enseñar, investigar y gestionar son los elementos clave para mejorar el proceso de aprendizaje efectivo [30] y para poner en práctica sus habilidades de aplicación de las diversas estrategias didácticas, en concreto las que se señalan como representativas de la educación universitaria, como planificar el proceso de enseñanza-aprendizaje, involucrar a los estudiantes en este proceso, interactuar y crear un clima de aprendizaje positivo en el aula y la evaluación del aprendizaje de los estudiantes [31]. Por otro lado, Bandura [25] agrega una dimensión colectiva a la individual a través de un sentimiento de eficacia compartida, ya que las personas comparten conocimientos, habilidades y recursos, se apoyan entre sí, forman alianzas y trabajan juntas para resolver sus problemas y mejorar la calidad de vida [32].

Al interferir en el ejercicio del control, las creencias de autoeficacia influyen en el desempeño, la persistencia y la motivación de las personas para realizar determinadas tareas. Es probable que los individuos realicen actividades en las que creen que tienen más capacidad de éxito que aquellas tareas en las que el sentido de competencia del individuo se evalúa como reducido. Por tanto, la autoeficacia marca la diferencia en la forma en que las personas sienten, piensan y actúan y esto se refleja en las elecciones, la conducta y el desempeño profesional [33].

Si bien la literatura destaca que el profesor universitario viene recuperando la condición antropogénica en la adaptación, recuperación y acceso a la vida productiva [34], no aclara si todos estos factores pueden ser mitigados por características personales como la resiliencia, la experiencia espiritual cotidiana, autoeficacia y otros aspectos sociodemográficos concretos como por ejemplo la formación de posgrado. Por tanto, este estudio tiene como objetivo investigar las manifestaciones diferenciales de resiliencia, vivencia espiritual diaria y autoeficacia de los profesores universitarios según la formación académica de posgrado, con especial énfasis en la perspectiva de su autopercepción.

II. MÉTHODO

Diseño del estudio

En esta investigación descriptiva, cuantitativa, transversal y inferencial, se plantan tres preguntas:

Cuestión 1 - ¿Existen diferencias en la resiliencia de los profesores universitarios debido a la formación de posgrado?

Cuestión 2 - ¿Existen diferencias en la experiencia espiritual cotidiana de los profesores universitarios debido a la formación de posgrado?

Cuestión 3 - ¿Existen diferencias en la autoeficacia laboral de los profesores universitarios debido a la formación de posgrado?

A fin de obtener respuestas a estas cuestiones, este estudio se estructuró de la siguiente manera: en primer lugar, se detalla la metodología de análisis de datos utilizada, incluyendo la descripción de la muestra y los instrumentos utilizados en el análisis. A continuación, se describen los resultados de las diferenciaciones obtenidas, que se interpretan a la luz de la literatura disponible. Finalmente, debemos resaltar que estamos ante un estudio original, vinculado a profesores universitarios que imparten docencia en el área de la salud, cuyos datos se obtuvieron de las respuestas dadas a una batería de instrumentos, en una universidad privada del noreste de Brasil.

Participantes

La muestra está formada por 189 profesores universitarios de carreras de grado en el ámbito de la salud, que trabajan en una universidad privada en el noreste brasileño, en 2019. Solo se eliminaron aquellos que no proporcionaron toda la información requerida por la batería de cuestionarios. La muestra representativa constituyó el 36% de los profesores universitarios de un universo total de 530 docentes [35], 56 hombres (29,50%) y 133 mujeres (70,40%). La edad media es de 44,75 (DE = 9,94) y se sitúa entre los 27 y los 77 años. De estos, 99 (52,40%) no son doctores (especialistas y másteres), 68 (36%) doctores y 22 (11,60%) con estudios de posdoctorado como se muestra en la tabla 1. Se unieron los “especialistas” (4 que corresponde al 2,1%) a los que habían cursado un Máster porque su reducido número podría generar problemas de estimación. Los datos, completamente anónimos, fueron proporcionados por los participantes a través de las representaciones expresadas en las respuestas dadas (Tabla 1).

Tabla. 1: Caracterización sinóptica de la muestra participante (n = 189)

Variables sociodemográficas y profesionales		N	%	M	DF
Sexo	Masculino	56	29,60		
	Femenino	133	70,40		
Edad	≤ 35	31	16,40	45,97	10,0
	36-45	75	39,70		
	46-55	55	29,10		
	≥ 56	28	14,80		
Formación de posgrado	Especialista/Máster (no doctores)	99	52,40		
	Doctor	68	36		
	Posdoctorado	22	11,60		

Instrumento

Se utilizó un cuestionario de datos sociodemográficos y profesionales construido al efecto, que incluye la variable sexo (hombre / mujer), edad (menor o igual a 35 años, de 36 a 45 años; de 46 a 55 años; y con 56 o más años) y formación de posgrado (especialista; máster; doctorado, posdoctorado). Además, el instrumento tiene tres grandes bloques de contenido de autoinforme para medir variables psicológicas. Un primer bloque se refiere a la escala de resiliencia diseñada por Wagnild y Young [36] y adaptada al portugués por Taranu [37], un segundo bloque incluye la escala de experiencia espiritual diaria de Underwood y Teresi [38], adaptada al portugués por Taranu [37] y un tercer bloque sobre la autoeficacia del profesor universitario a través de la versión portuguesa de la escala *Likert* construida por Prieto [39] de la siguiente manera:

La resiliencia de los profesores universitarios se midió mediante la escala multidimensional [36, 37], formada por 25 ítems, medidos en una escala *Likert* entre 1 (muy en desacuerdo) y 7 (muy de acuerdo). Esta evalúa el nivel de resiliencia individual en las dimensiones "autoestima", "competencia personal" y "aceptación de la vida" como características positivas de personalidad que contribuyen a la adaptación del individuo a eventos adversos cotidianos. Los índices de fiabilidad de la escala fueron $\alpha = 0,696$ para "autoestima", $\alpha = 0,822$ para "competencia personal" y $\alpha = 0,828$ para "aceptación de la vida". La proporción de variabilidad en las respuestas que resulta de diferencias en los encuestados, varía entre el débil y el bueno, por lo que su confiabilidad es admisible [40].

La experiencia espiritual cotidiana se evaluó a partir de las respuestas dadas a la escala anteriormente señalada [37, 38] que mide las experiencias espirituales que las personas experimentan en su vida diaria. De los 16 ítems que lo componen, 15 se miden en una escala *Likert* con 6 puntos (1 = muchas veces al día; 2 = todos los días; 3 = la mayoría de los días; 4 = algunos días; 5 = de vez en cuando ; 6 = nunca o casi nunca) y el último ítem, 16, intenta medir la espiritualidad global en contraposición a los primeros 15 ítems, en una escala *Likert* de 4 puntos (1 = nada, 2 = algo cercano, 3 = muy cercano , 4 = lo más

cercano posible), midiendo las dimensiones "admiración, amor y deseo de cercanía a Dios", "gratitud y conexión" y "compasión". La escala tiene una consistencia interna aceptable en la dimensión "admiración, amor y cercanía a Dios" ($\alpha = 0,663$), débil en "gratitud y conexión" ($\alpha = 0,530$) y muy buena en la dimensión "compasión" ($\alpha = 0,905$). Si bien la confiabilidad de los datos obtenidos en la dimensión "gratitud y conexión" es débil, se decidió mantenerla en el estudio [40].

La escala de autoeficacia de los profesores universitarios [39], en una escala de *Likert*, contiene 44 ítems de tipo cuantitativo, cuyas respuestas van de uno a seis y se divide en dos dominios: el primero evalúa las creencias en las capacidades de cada docente, que va desde "poco capaz" (1) hasta "muy capaz" (6); el segundo mide las creencias de autoeficacia, y cada respuesta varía entre "nunca" (1) y "siempre" (6). La proporción de variabilidad en las respuestas que resulta de las diferencias en los encuestados varía entre razonable y buena, con $\alpha = 0,836$ en la dimensión "estrategias didácticas para planificar las clases", $\alpha = 0,789$, "estrategias didácticas para involucrar activamente a los estudiantes", $\alpha = 0,823$ "Estrategias didácticas para favorecer la interacción en el aula" y $\alpha = 0,824$ "estrategias didácticas para evaluar aprendizajes", y su fiabilidad es admisible [40].

En el proceso de recogida de datos, se decidió establecer inicialmente un contacto directo y presencial en la universidad, más concretamente en la sala de trabajo de los profesores, a medida que asistían, favoreciendo un mayor acceso y un mayor compromiso de la población que conformó la muestra. En particular, se aplicó el cuestionario en papel, el cual, después de ser cumplimentado por el docente participante, fue devuelto al investigador responsable de la recolección de datos.

Procedimientos

El proceso de recolección de información se llevó a cabo en febrero de 2019, previa aprobación por parte del Comité de Ética (CAAE: 00467418.7.0000.5052), además de que los participantes firmaron un formulario de consentimiento informado. El cuestionario incluía una carta de presentación que contenía la utilidad social y pedagógica de la investigación y los criterios éticos [41]. Con la confidencialidad de los datos obtenidos asegurada, los cuestionarios fueron respondidos de forma anónima, voluntaria y amable. En todas las fases del proceso de investigación, intentamos referenciar de la manera más correcta posible y adoptar estrictamente los procedimientos éticos exigidos en la investigación con seres humanos.

Análisis de los datos

Los datos recogidos se procesaron utilizando el software SPSS - *Statistical Package for Social Science*, versión 20.0. El análisis de datos exploratorios (prueba de *Kolmogorov-Smirnov* y *Shapiro-Wilk*) reveló que se cumplieron los supuestos subyacentes al uso de pruebas paramétricas [40]. Para conocer si existe diferencia entre las dimensiones de las variables en estudio y la formación de posgrado de los profesores universitarios, se utilizó una prueba de varianza (ANOVA) *Unifactorial (One-Way Analysis of Variance, F)*, *design* inter-sujetos y test *Post Hoc* de *Tukey* porque los resultados permiten hacer inferencias. Para este estudio solo se consideraron los valores de probabilidad obtenidos, $p < 0.05$, porque permiten concluir que existen diferencias entre las variables objeto de estudio y la formación de posgrado de los profesores universitarios [42].

III. RESULTADOS

A continuación, se muestran los resultados estadísticamente significativos de los diferentes ANOVA y *post hoc de Tuckey* para cada una de las dimensiones de la resiliencia, de la experiencia espiritual diaria y de la autoeficacia laboral del docente universitario, según la variable sociodemográfica "formación de posgrado". En todos los casos se indica el estadístico *F* y su valor *p* y las medias obtenidas en todas las variables independientes.

Manifestaciones diferenciales de resiliencia de profesores universitarios en función de la formación de posgrado

Los resultados indican diferencias significativas entre grupos en la dimensión "autoestima" [$F(2,189) - 3 = 5.366, p = 0.005$]. Según la prueba de *Tuckey*, los profesores postdoctorales ($N = 22; M = 83.50; DT = 4.40$) perciben mayores niveles de resiliencia en la dimensión de "autoestima" que los no doctores ($N = 99; M = 78.51; DT = 7.34$) y que los doctores ($N = 68; M = 83.50; DT = 4.40$). En cuanto a la "competencia personal" [$F(2,189) - 3 = 5.111, p = 0.007$], los profesores universitarios postdoctorales ($N = 22; M = 38.86; DT = 2.74$) puntúan más alto que aquellos no doctores ($N = 99; M = 36.28; DE = 3.76$) y que los doctores ($N = 68; M = 36.23; DE = 3.62$). En cuanto a la "aceptación de la vida" [$F(2,189) - 3 = 10.507, p = 0.000$], los profesores postdoctorales ($N = 22; M = 29.95; DT = 3.10$) muestran niveles superiores a los no doctores ($N = 99; M = 27.29; DE = 5.08$) y a los doctores ($N = 68; M = 25.10; DE = 4.14$). Sin embargo, en esta dimensión los no doctores ($N = 99; M = 27.29; DT = 5.08$) perciben niveles más altos que los doctores ($N = 68; M = 25.10; DT = 4.14$) (Tabla 2).

Tabla. 2: Diferenciación de la resiliencia de los profesores universitarios según la formación académica de posgrado

Dimensiones	Nivel	N	M	DP	p	df	F	ANOV. Sig.
Autoestima	No Doctor	99	78,51	7,34	0,008	2	5,366	0,005
	Posdoctorado	22	83,50	4,40				
	Doctor	68	78,09	7,12	0,005			
	Posdoctorado	22	83,50	4,40				
Competencia personal	No Doctor	99	36,28	3,76	0,007	2	5,111	0,007
	Posdoctorado	22	38,86	2,47				
	Doctor	68	36,23	3,62	0,009			
	Posdoctorado	22	38,86	2,47				
Aceptación de la vida	No Doctor	99	27,29	5,08	0,008	2	10,507	0,000
	Doctor	68	25,10	4,14				
	No Doctor	99	27,29	5,08	0,038			
	Posdoctorado	22	29,95	3,10				
	Doctor	68	25,10	4,14	0,000			
	Posdoctorado	22	29,95	3,10				

Manifestaciones diferenciales de la experiencia espiritual cotidiana de los profesores universitarios en cuanto a la formación de posgrado

La diferenciación entre la experiencia espiritual diaria de los profesores universitarios y su formación académica de posgrado "admiración, amor y deseo de cercanía a Dios" [$F(2,185) - 3 = 0.755, p = 0.005$], "gratitud y conexión" [$F(2,185) - 3 = 0.009, p = 0.991$] y "compasión" [$F(2,185) - 3 = 1.080, p = 0.342$], no revelaron ningún resultado estadísticamente significativo ($p < 0.05$).

Manifestaciones diferenciales de la autoeficacia de los profesores universitarios según la formación de posgrado

En cuanto a la formación académica, los resultados sugieren diferencias significativas entre grupos [$F(2,185) - 3 = 5.497, p = 0.005$]. La prueba *Tuckey Post Hoc* reveló que los profesores postdoctorales ($N = 21; M = 136.67; DT = 6.57$) perciben creencias de autoeficacia más altas en el dominio de las estrategias didácticas para la planificación de las clases que los profesores doctorados ($N = 67; M = 127.91; SD = 10.30$) y que los no doctores ($N = 98; M = 128.79; SD = 11.87$). Con respecto a las estrategias de enseñanza para involucrar activamente a los estudiantes [$F(2,188) - 3 = 4.625, p = 0.011$], los profesores postdoctorales ($N = 22; M = 102.77; DT = 16.17$) obtienen creencias de mayor autoeficacia que los doctores ($N = 68; M = 96.94; SD = 7.30$) y los no doctores ($N = 99; M = 96.54; SD = 7.48$). El estudio también reveló diferencias significativas en términos de creencias de autoeficacia en cuanto a las estrategias didácticas para favorecer la interacción en clase [$F(2,186) - 3 = 4.638, p = 0.011$]. Es decir, los profesores postdoctorales ($N = 22; M = 91.18; DE = 6.42$) mostraron mayores creencias de autoeficacia que los doctorados ($N = 68; M = 86.99; DE = 7, 17$) (Tabla 3). Se admite, con tales resultados, que los profesores más cualificados tienden a mostrar e intentar mantener una alta conciencia de autoeficacia.

Tabla. 3: Distribución de la autoeficacia de los profesores universitarios según formación académica

Dimensiones	Nivel académico	N	M	DP	p	df	F	ANOVA Sig.
Estrategias didácticas para la planificación de las clases	No Doctor	98	128,79	11,87	0,008	2	5,497	0,005
	Posdoctorado	21	136,67	6,57				
	Doctor	67	127,91	10,30				
	Posdoctorado	21	136,67	6,57	0,004			
Estrategias didácticas para implicar activamente a los alumnos	No Doctor	99	99,54	7,48	0,009	2	4,625	0,011
	Posdoctorado	22	102,77	16,17				
	Doctor	68	96,94	7,29				
	Posdoctorado	22	102,77	16,17	0,021			
Estrategias didácticas para favorecer la interacción en el aula	Doctor	68	86,99	7,17	0,020	2	4,638	0,011
	Posdoctorado	22	91,18	6,57				

IV. DISCUSSION

Los resultados obtenidos en el estudio que aquí se presenta brindan algunas evidencias sobre las representaciones de un grupo profesional aún poco estudiado, muy relevante para el desarrollo de cualquier país, indispensable en la mejora del proceso de enseñanza-aprendizaje a través de su potencial pedagógico, investigativo y de gestión [30], que se encuentran, actualmente, sujetos a factores de riesgo y continuas adaptaciones ante los cambios en el contexto laboral [1-3, 34, 43] de los profesores universitarios.

El interés investigativo se centró en las manifestaciones diferenciales de resiliencia, vivencia espiritual cotidiana y autoeficacia de los profesores universitarios según el nivel de formación académica de los participantes. Sin embargo, existe una laguna crítica en el conocimiento sobre las variables bajo análisis que involucran a profesores universitarios, viniendo esta evidencia a reforzar la importancia de este estudio.

Con respecto a la primera cuestión, los resultados del estudio sugieren que los profesores universitarios posdoctorales se perciben a sí mismos como más resilientes en todas las dimensiones de la resiliencia, es decir, en la “autoestima”, en la “competencia personal” y en la “aceptación de vida” que sus pares que no lo son. Sin embargo, en lo que respecta a la “aceptación de la vida”, los profesores no doctores obtienen puntuaciones más altas que sus compañeros doctores, denunciando una plena conciencia de los impactos de las actitudes y elecciones. A su vez, Fontaines y Urdanteta [43], cuando analizaron la actitud resiliente del docente en entornos universitarios, detectaron niveles manifiestamente altos en la capacidad de los docentes para enfrentar y superar problemas en el contexto laboral, sin embargo, no investigaron la diferenciación según la formación del profesorado posdoctoral. Sin embargo, se considera que los hallazgos apoyan la idea de que el individuo resiliente triunfa incluso ante contratiempos en el contexto laboral [11] como lo

hace el universitario, pero es necesario percibir la resiliencia durante un período prolongado [6].

En cuanto a la segunda cuestión, el análisis de los resultados no indicó un predominio de la formación académica, en relación a la experiencia espiritual cotidiana vivida por los profesores universitarios según su formación académica de posgraduado. Se trata de un efecto interesante y sería necesario profundizarlo en futuras investigaciones, indicando que las experiencias mentales de las personas en la búsqueda de lo sagrado son un fenómeno individualizado [38, 44] que ocurre de forma independiente de las características sociodemográficas y profesionales del individuo. A su vez, estudios abogan que el profesor, al conectar con la esencia de su espiritualidad, influye en su desempeño profesional y crecimiento personal a nivel humano-interaccional, afectivo, ético, técnico y estético, asocia significado a su existencia, da sentido y expresión profesional a la identidad de la organización donde trabaja [45], siendo una condición determinante para la convivencia pacífica [46]. Al respecto, hay estudios que enfatizan que la estabilidad emocional y la espiritualidad en el lugar de trabajo predicen negativamente el estrés laboral entre los profesores universitarios [13], que la espiritualidad modera la relación negativa entre estrés y salud [22], que incrementa el compromiso, la satisfacción y el bienestar en el trabajo [15], poniendo de manifiesto la importancia de su promoción en la institución universitaria.

En cuanto a la diferenciación de la autoeficacia del docente universitario según la formación académica de posgrado (tercera cuestión), los resultados no indicaron diferencias entre profesores universitarios en función de la formación de posgrado en la dimensión “estrategias didácticas para la evaluación del aprendizaje”. Sin embargo, parecen mostrar que los profesores universitarios con posgrado se perciben a sí mismos más competentes en su práctica pedagógica que sus colegas no doctores y doctores, es decir, en las “estrategias didácticas para la planificación de clases”, en las “estrategias didácticas para involucrar activamente a los estudiantes” y en las “estrategias didácticas para favorecer la interacción en clase”, algo que coincide con la literatura de referencia que enmarca la autoeficacia en uno de los mecanismos fundamentales de la actuación humana [25]. Es decir, al interferir en el ejercicio del control, las creencias de autoeficacia influyen en el desempeño, la persistencia y la motivación de las personas para realizar determinadas tareas [47], marca la diferencia en la forma en que las personas sienten, piensan y actúan y esto se refleja en las elecciones, la conducta y la actuación [33] y en la colectividad a través de sentimientos compartidos [32]. En este contexto, los sentimientos de autoeficacia se destacan

por la relación significativa entre el *burnout* y el rendimiento académico docente [27], la disponibilidad para la implicación en prácticas colaborativas [28] y por el notable impacto en el desempeño académico de los profesores [29, 48].

Los docentes, confiados en sus creencias, con potencial para enseñar, investigar y gestionar, son los elementos clave para mejorar el proceso efectivo de los aprendizajes [30] y para poner en práctica sus habilidades de aplicación de las diversas estrategias didácticas, en concreto las que se señalan como representativas de la educación universitaria: la planificación del proceso de enseñanza-aprendizaje e involucrar a los estudiantes en este proceso, la interacción y creación de un clima de aprendizaje positivo en el aula y la evaluación del aprendizaje de los estudiantes [31].

Las representaciones preponderantes de los docentes de participantes, mostradas en este estudio, llevan a concluir que la formación docente orienta la calidad de la enseñanza que requiere el mundo actual [3]. No obstante, es fundamental para el desarrollo profesional, la mejora de la calidad de la educación universitaria y el éxito académico de los estudiantes, la realización de experiencias formativas que permitan al docente universitario reflexionar sobre su desempeño en clase y en las pruebas (orales y/o escritas), que les facilite la identificación de estrategias más adecuadas para afrontar los retos pedagógicos, a través del aprendizaje transformador, como plantean Emanuel y Cortese [49].

V. CONCLUSIÓN

En los últimos tiempos han surgido varios estudios centrados en la resiliencia, la espiritualidad y la autoeficacia, sin embargo, existe un claro vacío de investigación que se centra en los profesores universitarios y/o relaciona estas tres variables. Los hallazgos de este estudio corroboran la literatura, aunque, a su vez, muestran la necesidad de mayor investigación en profesores universitarios, ya que varios factores pueden contribuir a la explicación de los resultados alcanzados, como la cultura, el contexto, ser una institución privada, el sistema adoptado por el país, la legislación, entre otros.

Cabe señalar que los hallazgos de este estudio conducen a cuestionar y profundizar el tema en un contexto universitario, especialmente a la exploración de los beneficios individuales, colectivos y organizacionales de la resiliencia, la experiencia espiritual cotidiana y la autoeficacia defendidos en la literatura de referencia. Es necesario realizar más investigaciones al respecto para profundizar en los posibles efectos de la formación de posgrado por parte del profesor universitario.

Entrando en el campo metodológico, se debe aludir a la limitación que supone el hecho de que la muestra corresponda a un grupo de una sola universidad privada, así como a sus características, para limitar la validez externa del análisis. Las conclusiones extraídas no son directamente generalizables al mismo grupo profesional de otras universidades y no son representativas de la población docente universitaria brasileña. También es importante, como prospectiva, extender un análisis similar a profesores universitarios de diferentes áreas científicas y diferentes universidades públicas y privadas, siendo interesante realizar estudios comparados al respecto. Por las razones expuestas, creemos que los resultados obtenidos en este trabajo deben ser verificados o refutados por investigaciones similares en otras universidades y en otros contextos transnacionales, contribuyendo a revelar el conocimiento sobre el profesor universitario.

AGRADECIMIENTO

Los autores agradecen a la Universidad que acogió este estudio y a los respectivos profesores en el campo de la Salud por obtener datos para llevar a cabo esta investigación. Sobre todo, agradecen a la ilustre Profesora María Helena de Agrela Gonçalves Jardim, quien impulsó este estudio que, lamentablemente, ya ha dejado esta vida.

REFERENCIAS

- [1] Barbato, G., Moscati, R. & Turri, M. (2019). Is the role of academics as teacher changing? An exploratory analysis in Italian universities. *Tuning Journal for Higher Education*, 6(2), 97-126. [https://doi.org/10.18543/tjhe-6\(2\)-2019pp97-126](https://doi.org/10.18543/tjhe-6(2)-2019pp97-126)
- [2] Olivares-Faúndez, V. & Villalta Paucar, M. A. (2015). Burnout y resiliencia em professores universitários. In Lorena Godoy e Elisa Ansoleaga (Ed.), *Un campo en tensión o tensión entre campos*. Santiago de Chile: Ril Editores, p. 307-318.
- [3] Zanchet, B. A., Cunha, M. I. & Sousa, H. M. (2009). A pós-graduação em educação como lugar de formação e de aprendizagens de professores universitários. *Educação, Sociedade e Culturas*, 28, 93-105. Recuperado de https://www.fpce.up.pt/ciie/revistaesc/ESC28/28_beatriz.pdf
- [4] Han, J., Yin, H., Wang, J. & Bai, Y. (2019). Challenge job demands and job resources to university teacher well-being: the mediation of teacher efficacy. *Studies in Higher Education*, 45(8), 1771-1785. <https://doi.org/10.1080/030075079.2019.1594180>
- [5] Grothberg, E. H. (2006). *La resiliencia em el mundo de hoy: como superar las adversidades*. Barcelona: Gedisa.
- [6] Shepherd, D. (2020). How to circumvent adversity? Refugee-entrepreneurs' resilience in the face of substantial and persistent adversity. *Journal of business venturing*, 35(4). <https://doi.org/10.1016/j.jbusvent.2019.06.001>

- <http://www.sciencedirect.com/science/article/pii/S0883902619301168>
- [7] Brandão, J. M., Mahfoud, M. & Gianordoli-Nascimento, I. F. (2011). A construção do conceito de resiliência em psicologia: discutindo as origens. *Paidéia*, 21(49), 263-271. <http://dx.doi.org/10.1590/S0103-863X2011000200014>
- [8] Martins, M. C. F., Onça, S. S., Emílio, E. R. & Siqueira, M. M. M. (2012). Resiliência: uma breve revisão teórica do conceito. In Rezende, M. M. e Heleno, M. G. V. *Psicologia e Promoção da Saúde em Cenários Contemporâneos*. São Paulo: Vetor Editora, 97-156.
- [9] Becoña, E. (2006). Resiliência: definición, características y utilidad del concepto. *Revista de Psicopatología Clínica*, 11(3), 125-146. <https://doi.org/10.5944/rppc.vol.11.num.3.2006.4024>
- [10] Davydov, D. M., Stewart, R., Ritchie, K., & Chaudieu, I. (2010). Resilience and mental health. *Clinical Psychology Review*, v. 30, p. 479-495. <https://doi.org/10.1016/j.cpr.2010.03.003>
- [11] You-De, D., Wen-Long, Z. & Tzung-Chen, H. (2019). Engage or quit? The moderating role of abusive supervision between resilience, intention to leave and work engagement. *Tourism Management*, 70, 69-77. <https://doi.org/10.1016/j.tourman.2018.07.014>
- [12] Otero-López, J. M., Villardfrancos, E., Castro, C. & Santiago, M. J. (2014). Stress, positive personal variables and burnout: A path analytic approach. *European Journal of Education and Psychology*, 7(2), 95-106. <https://doi.org/10.30552/ejep.v7i2.105>
- [13] Wadhwa, T. & Bano, S. (2020). The role of Workplace Spirituality and Emotional Stability in Occupational Stress Among College Teachers. *IUP Journal of Organizational Behavior*, 19(3), 41-67. Recuperado de [3dad99f1fedf97cdce55642f9373e20e.pdf](https://doi.org/10.30552/ejep.v7i2.105)
- [14] Pokhariyal, G. P. (2020). Importance of Spirituality and happiness at the workplace. *International Journal on World Peace*, 37(3), 65-73. Recuperado de <https://web.b.ebscohost.com/abstract?direct=true&profile=ehost&scope=site&authtype=crawler&jnl=07423640&AN=145466770&h=os0H4x4GP4dJLR%2fw0Jh88TCZ%2byqnhn%2fOlluX2gMNvy7JVskYYb6zvT3KOOR7uOPJqilYsS2MPkO6oB1u4PCLg%3d%3d&crl=f&resultNs=AdminWebAuth&resultLocal=ErrCrlNotAuth&crhashurl=login.aspx%3fdirect%3dtrue%26profile%3dehost%26scope%3dsite%26authtype%3dcrawler%26jnl%3d07423640%26AN%3d14546>
- [15] Oliveira, D. H., Laurini, M. M. & Santos, A. S. (2020). Análise da relação entre a espiritualidade no ambiente de trabalho e o bem-estar laboral: percepções dos trabalhadores de uma cidade do interior do Rio Grande do Sul, Research, Society and Development, 9(9), e82996970 (CC By 4.0). ISSN: 2525-3409. <http://dx.doi.org/10.33448/rsd-v9i9.6970>
- [16] Ilyas, N. & Arshad, T. (2017). Spiritual Intelligence, Work-Family Conflict and Psychological Distress among University Teachers. *Bahria Journal of Professional Psychology*, 16(1), 27-41. Recuperado de <http://oaji.net/articles/2017/6066-1522395030.pdf>
- [17] Sharif, S., Moeini, M., Bromand, S. & Binayi, N. (2019). The Relationship between Daily Spiritual Experiences and General Health of the Elderly Registered in the Retirement Center of Isfahan. *Iranian Journal of Health Sciences*, 7(1), 18-25. <http://dx.doi.org/10.18502/jhs.v7i1.1021>
- [18] Piedmont, R. L. (1999). Does Spirituality Represent the sixth factor of personality? Spiritual Transcendence and the five-factor model. *Journal of Personality*, 67, 985-1013. <https://doi.org/10.1111/1467-6494.00080>
- [19] Capelo, M. R. T. F., Pocinho, M & Rodrigues, S. (2015). O sentido da vida quotidiana: religião, resiliência e espiritualidade. In José Eduardo Franco e João Paulo Oliveira e Costa (Dir.) *Diocese do funchal. A Primeira Diocese Global. História, cultura e Espiritualidade*, v. II, funchal: diocese do funchal, p. 883-896.
- [20] Chen, Y. Y. & Koenig, H. G. (2006). Do people turn to religion in times of stress? *J Nerv Mental Dis.*, 194(2), 114-20. <https://doi.org/10.1097/01.nmd.0000198143.63662.fb>
- [21] Ekwonye, A. U., Delauer, V. & Cahill, T. (2010). Effect of a spiritual retreat on perceived stress of Nigerian Catholic immigrant sisters in United States. *Mental Health, Religion & Culture*, 21(1), 49-64, 2018. <https://doi.org/10.1080/13676.2018.1447553>
- [22] Kumar, V. & Kumar, S. (2014). Workplace spirituality as a moderator in relation between stress and health: An exploratory empirical assessment. *International Review of Psychiatric*, 26(3), 344-351. <https://doi.org/10.3109/09540261.2014.924909>
- [23] Yin, H., Han, J. & Perron, B. E. (2020). Why are Chinese university teachers (not) confident in their competence to teach? The relationships between faculty-perceived stress and self-efficacy. *International Journal of Educational Research*, 100. <https://doi.org/10.1016/j.ijer.2019.101529>
- [24] Silva, J. T. & Paixão, M. P. (2007). Estudos sobre o papel da auto-eficácia em contextos educativos. *Psicologica*, 44, 7-10.
- [25] Bandura, A. (1997). *Self-efficacy: the exercise of control*. New York: Freeman.
- [26] Bandura, A. (2006). Toward a psychology of human agency. *Perspectives on Psychological Science*, 1(2), 164-180. <https://doi.org/10.1111/j.1745-6916.2006.00011.x>
- [27] Garcia Padilla, A. A., Escorcía Bonivento, C. V. & Perez Suarez, B. S. (2017). Burnout Syndrome and Self-Efficacy Beliefs in Professors. *Propós. Represent [online]*, 5(2), 65-126. ISSN 2307-7999. <http://dx.doi.org/10.20511/pyr2017.v5n2.170>
- [28] Silva, J. C. & Silva, M. M. (2015). Colaboração entre professores e autoeficácia docente: Que relações? *Revista Portuguesa de Educação*, 28(2), 87-109. <https://doi.org/10.21814/rpe.7733>
- [29] Haddad, S. & Taleb, R. A. (2016). The impact of self-efficacy on performance (An empirical study on business faculty members in Jordanian universities). *Computers in Human Behavior*, 55, 877-887. <http://dx.doi.org/10.1016/j.chb.2015.10.032>
- [30] Kiran, S., Shahzadi, E., Saher, A., & Nab, K. (2019). Teaching, Research, and Management Self-Efficacy of Agricultural Universities' Teachers. *Psychology Research*,

- 9(5) 228-234. <https://doi.org/10.17265/2159-5542/2019.05.005>
- [31] Vizcaino, A. E., López, K. M. & Klimenko, O. (2018). Creencias de autoeficácia y desempeño docente de profesores universitários. *Revista Katarsis*, 25, 75-93. Recuperado de <http://revistas.iue.edu.co/index.php/katharsis>
- [32] Fernández-Ballesteros, R., Diés-Nicolás, J., Caprara, G. V., Barabaranelli, C. & Bandura, A. (2004). Determinantes y relaciones estructurales desde la eficacia personal a la eficacia coletiva. In Salanova, Grau, Martínez, Cifre, Llorens e García-Renedo (Eds.). *Nuevos Horizontes em la Investigación sobre la autoeficácia*. Col·lecció "Psique", 8, p. 68-80.
- [33] Bernardini, P. B. & Murgo, C. S. (2017). Fontes de formação das crenças de autoeficácia de docentes do ensino superior. *Colloquium Humanarum*, 14(Especial), 361-368. ISSN: 1809-8207. <https://doi.org/10.5747/ch.2017.v14.nesp.000966>
- [34] Alvarez, M. A. (2018). Nuevas perspectivas de resiliência em el entorno de la docência universitária. *Revista Internacional de Investigación y Formación Educativa*, p. 1-20. Recuperado de <https://www.ensj.edu.mx/wp-content/uploads/2019/01/4.-Nuevas-perspectivas-de-resiliencia.pdf>
- [35] Peduzzi, P., Concato, J., Kemper, E., Holford, T. R. & Feinstein, A. R. (1996). A simulation study of the number of events per variable in logistic regression analysis. *Journal Clinical Epidemiology*, 49(12), 1373-1370. [https://doi.org/10.1016/s0895-4356\(96\)00236-3](https://doi.org/10.1016/s0895-4356(96)00236-3)
- [36] Wagnild, G. M. & Young, H. M. (1993). Development and Psychometric Evaluation of the Resilience Scale. *Journal of Nursing Measurement*, 1(2), 165-177. PMID: 7850498.
- [37] Taranu, O. (2011). *Estudo da Relação entre Resiliência e Espiritualidade numa amostra portuguesa*. Dissertação de Mestrado. Lisboa: Universidade de Lisboa. Recuperado de https://repositorio.ul.pt/bitstream/10451/4338/1/ulfpie03954_0_tm.pdf
- [38] Underwood, L. G. & Teresi, J. A. (2002). The daily Spiritual Experience Scale: development, Theoretical description, Reliability Exploratory Factor Analysis, and Preliminary Construct Validity Using Health-Related Data. *Annales of Behavioral Medicine*, 24(1), 22-33. https://doi.org/10.1207/S15324796ABM2401_04
- [39] Prieto, L. N. (2007). *Autoeficácia del professor universitário: eficácia percibida y práctica docente*. Madrid: Narcea Ediciones. ISBN: 84-277-1548-X
- [39] Pestana, M. H. & Gageiro, J. N. (2014). *Análise de dados para ciências Sociais*. Lisboa: Edições Sílabo.
- [40] Fortin, M-F (2009). *Fundamentos e etapas do processo de investigação*. Loures: Ludodidacta.
- [41] Martins, C. (2011). *Manual de análise de dados quantitativos com recurso ao IBM SPSS*. Braga: Psiquilibrios Edições.
- [42] Fontaines, T. & Urdanteta, G. (2009). Aptitud resiliente de los docentes em ambientes universitários. *Revista de Artes y Humanidades ÚNICA*, 10(1), 163-180. ISSN: 1317-102X
- [43] Zinnbauer, B. J., Pargament, K. I. & Scott, A. B. (1999). The emerging meanings of religiousness and spirituality: Problems and prospects. *Journal of Personality*, 67, 887-919. <https://doi.org/10.1111/1467-6494.00077>
- [44] Vieira, M. M. S. (2015). A dimensão da espiritualidade: Perspectivas para a formação de professores. *Educere, XII Congresso Nacional de Educação*, 3364-3381. ISSN 2176-1396.
- [45] Pandya, S. P. (2017). Spirituality and Values Education in Elementary School: Understanding views of teachers. *Children & Schools*, 39(1), 33-42. <https://doi.org/10.1093/cs/cdw042>
- [46] Fontes, A. P. & Azziz, R. G. (2012). Self-efficacy beliefs and resilience: findings of social-cognitive literature. *Estudos de Psicologia*, 105-114. <https://doi.org/10.1590/S0103-166X2012000100012>
- [47] Hernandez Jacquez, L. F. & Cenicerros Cazares, D. I. (2018). Autoeficácia docente y desempeño docente, ¿una relación entre variables? *Innovación Educativa*, 18(78), 171-192. ISSN: 1665-2673
- Emanuel, F. & Cortese, C. G. (2020). Professor's performance and the connection with teaching self-efficacy and evaluation. *Form@re – Open Journal per la formazione in rete*, 20(1), 172-186. <https://doi.org/10.13128/form-8257>
- [48] Emanuel, F. & Cortese, C. G. (2020). Professor's performance and the connection with teaching self-efficacy and evaluation. *Form@re – Open Journal per la formazione in rete*, 20(1), 172-186. <https://doi.org/10.13128/form-8257>

Reflections on the meanings, experiences and perspectives of chronic kidney patients after kidney transplantation

Diogo Seiichi Umbelino Okawa¹, Thany Elly Vanzeler Pereira¹, Thayná Maria Andrade Silva¹, Ingrid Renny Silva Palha¹, Elaine Cristina Pacheco de Oliveira¹, Francisco Ocian de Araújo Júnior¹, Tarcísio Lucas Lima da Costa¹, Cintia da Silva Moraes¹, Maria Janete Nahum Gomes¹, Denise de Fátima Ferreira Cardoso¹, Sheyla Cristina Ferreira de Magalhães¹, Vera Lúcia Gomes de Oliveira², Milena Oliveira Saldanha Pacífico³, Danielle Oliveira Maciel⁴, Gleyce Pinto Girard⁵, Marcio Almeida Lins⁶, Elieni Santana de Abreu⁶, Joyce da Silva Pantoja⁶, Amanda do Socorro Furtado Silva⁶, Remo Rodrigues Carneiro⁷, Naiade Moreira de Oliveira⁸, Ranná Barros Souza⁹, Victória Fernanda Barbosa⁹, Geordana Galvão Feitosa⁹, Adams Brunno Silva¹⁰, Mauro Sávio Sarmiento Pinheiro¹¹, Joelma da Silva Gualdez¹¹, Bruna Carolina da Trindade Monteiro da Silva¹¹, Ivane Pinheiro Corrêa¹¹, Natrícia Hellen Batista Afonso¹¹, Elyade Nelly Pires Rocha Camacho¹², Shirley Iara Martins Dourado¹³, Rafaela Martins Dourado Gonçalves¹⁴, Pedro Lucas Nahum Salgado¹⁵, Meick Farias Negrão¹⁵, Letícia Barbosa Alves¹⁵, Hbinor Alves¹⁵, Glauce Kelly Ribeiro de Souza¹⁵, Josielma Neco Pina¹⁵, Bruna Barros de Melo¹⁵, Larissa Caroline da Silva Costa¹⁵, Jéssica Fernandes Oliveira¹⁵, Izabela Campos da Silva¹⁵, Raquel Fernandes Costa¹⁶, Wanda Carla Conde Rodrigues¹⁷, Anderson Lineu Siqueira dos Santos¹⁸, Michele Monteiro Sousa¹⁹, Fabiano José da Silva Boulhosa²⁰, Camila da Silva Lima²¹, Rafaela Cordeiro de Mâcedo²⁰, Barbara Silva de Assis²², Raimundo Nonato da Silva Sena Rosa²², Elias Costa Monteiro²³, Irinéia de Oliveira Bacelar Simplício²⁴, Mariana Valente de Oliveira²⁵, Lauricéia Valente de Oliveira²⁶, Simone Aguiar da Silva Figueira²⁷, Maicon de Araujo Nogueira^{28*}

¹Nurse, State University of Para (UEPA), Belem, Para, Brazil.

²Nurse. Master of Nursing by State University of Para (UEPA), Master's Program in Nursing UEPA/UFAM. Professor at the State University of Para (UEPA). Member of the Research Group on Educational Practice in Health and Care in Amazonia (PESCA-UEPA). Belem, Para, Brazil.

³Doctor. Federal University of Para (UFPA), Belem, Pará, Brazil.

⁴Nurse, João Barros Barreto University Hospital (HUIBB), Federal University of Para (UFPA), Belem, Para, Brazil.

⁵Nurse, Master in Health Education in the Amazon (ESA), Stricto Sensu Postgraduate Program, Professional Master in Health Education in the Amazon, State University of Para (UEPA), Belem, Para, Brazil.

⁶Nurse, Metropolitan University Center of the Amazon (UniFAMAZ), Belem, Para, Brazil.

⁷Nurse, Master in Education, Training and Management for Nursing Care Practice, Stricto Sensu Graduate Program in Nursing (PPGENF), Federal University of Para (UFPA), Professor of the University of the State of Para (UEPA), Belem, Para, Brazil.

⁸Doctor, Federal University of Pará (UFPA), Belem, Para, Brazil.

⁹Physiotherapy student. Escola Superior da Amazônia (ESAMAZ), Belem, Para, Brazil.

10Nurse, Ophir Loiola Hospital (HOL). Master degree student, Nursing Master Degree Program, State University of Para (UEPA), Belem, Para, Brazil.

¹¹Nursing student, Escola Superior da Amazônia (ESAMAZ), Belem, Para, Brazil.

¹²Master in Nursing, Federal University of Pará (UFPA). PhD in Tropical Diseases, Postgraduate Program in Topical Diseases (PGDT), Nucleus of Tropical Medicine (NMT / UFPA), Belem, Para, Brazil.

¹³Nurse, PHD, Federal University of Rio de Janeiro (UFRJ), Nurse at João de Barros Barreto University Hospital (HUJBB), Federal University of Para (UFPA), Belem, Para, Brazil.

¹⁴Academic of the Bachelor of Medicine Course, State University of Para (UEPA), Belem, Para, Brazil.

¹⁵Nurse, University of the Amazon (UNAMA), Belem, Para, Brazil.

¹⁶Nurse, assistant nurse at the Hospital de Clínicas, Federal University of Minas Gerais (UFMG), Minas Gerais, Brazil.

¹⁷Physiotherapist. Master. Metropolitan University Center of the Amazon (UniFAMAZ), Belem, Para, Brazil.

¹⁸Nurse, Master in nursing. PhD student, Stricto Sensu Graduate Program, PhD in Parasitic Biology, State University of Para (UEPA), Belem, Para, Brazil.

¹⁹Nurse. Master's Student, Stricto Sensu Graduate Program, Master's Degree in Nursing, Federal University of Para (UFPA), Belem, Para, Brazil.

²⁰Physiotherapist. Doctoral Student, Postgraduate Program Stricto Sensu, Professional Doctorate in Health Education in the Amazon (ESA), State University of Para (UEPA), Belém, Pará, Brasil.

²¹Academic of the Bachelor's degree in Psychology, UNINASSAU, Belem, Para, Brazil. ²²Nurse. Faculdade Paraense de Ensino (FAPEN,), Belem, Para, Brasil.

²³Nursing student, Faculdade Pan Amazônia (FAPAN), Belém, Pará, Brasil.

²⁴Nurse. Master in Bioengineering from Camilo Castelo Branco University (UNICastelo/São José dos Campos), São Paulo, Brazil.

²⁵Medicine student. University Center of Para (CESUPA), Belem, Para, Brazil.

²⁶Anesthesiologist. Master's student in Strategic Direction and Management in Health Organizations at the European University of the Atlantic. Master's student in Strategic Management and Health Organization Management at the International Ibero-American University. Preceptor of the Graduate Program in Medicine at the Federal University of Pará (UFPA), João de Barros Barreto University Hospital (HUJBB), Belem, Para, Brazil.

²⁷Nurse, Master in Health Education in the Amazon, PhD student, Stricto Sensu Graduate Program, Professional Doctor degree in Health Education in the Amazon (ESA), State University of Para (UEPA). Professor at the State University of Para (UEPA), Campus Santarem, Para, Brazil

²⁸Nurse, Master in Health Education in the Amazon, PhD student, Stricto Sensu Postgraduate Program, Professional Doctorate in Health Education in the Amazon (ESA), State University of Para (UEPA). Professor at State University of Para (UEPA). Professor at Escola Superior da Amazônia (ESAMAZ), Belem, Para, Brazil. *E-mail: profmaiconnogueira@gmail.com +55 (91) 98043-6368

Received: 11 Oct 2021,

Received in revised form: 21 Oct 2021,

Accepted: 29 Oct 2021,

Available online: 07 Nov 2021

©2021 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— *Kidney Transplantation. Quality of Life. Emotions. Renal Insufficiency, Chronic.*

Abstract— *Objective: to investigate the meaning, experiences and perspectives of people with chronic kidney failure undergoing kidney transplantation. Method: descriptive, exploratory research of a qualitative nature. An interview script was used as an instrument and a semi-structured interview was used as a collection technique. Ten people who underwent kidney transplantation, registered with the Association of Chronic Kidneys and Transplants of the State of Pará, Brazil, participated in the research. Research conducted from October to November 2018, and for the construction of data, the thematic content analysis technique proposed by Bardin was used. Result: the participants believe that the transplantation gave them an opportunity for a new life, recognizing that it allowed them to experience well-being, satisfaction and emotional growth, which, therefore, allowed them to resume the quality of life and conditions prior to illness. Conclusion: kidney transplantation has a meaning of blessing and represents the expectation of being able to resume their lives, and continue from where it was interrupted by kidney disease; it represents, from the perspective of these individuals, the hope of a better life and of being able to envision a healthier future, which may require the collaboration of family members and health professionals, and personal care peculiar to the transplant recipient's new life condition.*

I. INTRODUCTION

Kidneys are organs located in the posterior region of the abdomen, outside the retroperitoneal cavity. They perform several important functions for body homeostasis, such as excretion of metabolites and foreign chemicals; regulation of the balance of osmolarity, water and electrolytes in the body; regulation of systemic blood pressure; the acid-base balance; regulation in the production of red blood cells among other functions. To perform these functions, the organ has the nephron as a functional unit, where each kidney contains about 800,000 to 1 million nephrons, performing the function of blood filtration. The kidney does not have the capacity to regenerate its nephrons, therefore, any kidney damage, aging, and other comorbidities have the potential to reduce the number of nephrons, without the possibility of tissue recovery¹.

Chronic kidney failure is a disease that causes structural or functional damage to the kidneys. Slowly, insidiously and irreversibly, it causes a decline in the number and function of nephrons. Such pathology can be caused by other underlying etiological factors, such as: genetic abnormalities, systemic arterial hypertension, obesity, smoking, autoimmune diseases, glomerulonephritis and other diseases².

Due to the progressive loss of renal tissue, several organic and psychosocial changes begin to appear, and this directly interferes with the quality of life of people affected by chronic renal failure. Urine color, pain or burning when urinating, urination several times a day and night, hypertension, nausea and vomiting, loss of libido, tiredness and muscle atony are common symptoms of chronic renal failure. The uremic crisis, consequence and most serious clinical condition of renal failure, occurs because the blood ends up not being filtered properly, and thus, several metabolites remain in the bloodstream, triggering a cascade reaction at the systemic level³.

This disease is currently configured as a public health problem with a global impact. This statement is due to the fact that the morbidity and mortality rate is high, in addition to the negative impact on people's quality of life. Over the years, the number of patients who have been undergoing dialysis treatment, one of the therapeutic strategies in the management of chronic renal failure, has been gradually increasing, causing direct and indirect impacts on public coffers, patients and their families. It is estimated that, worldwide, diseases of the kidney and urinary tract are responsible for approximately 850 million deaths annually, and chronic renal failure increases around 8% each year. In Brazil, about 12 million people have

some degree of Kidney Failure and approximately 95 thousand chronic kidney patients depend on dialysis to survive^{4,5}.

There are three different types of treatment for chronic renal failure, which are: hemodialysis (HD), peritoneal dialysis (PD) and kidney transplantation (TxR). Hemodialysis consists of filtering the blood through a machine, which performs the kidney function. Peritoneal dialysis is the process where the kidney function is replaced by a filter that uses the force of gravity to do this work inside the patient's body through a cavity between the organs (peritoneal cavity). TxR is a surgical option, where there is removal of a kidney, in a living or deceased person (organ donor), and its implantation in the recipient. Kidney transplantation is the most complete treatment alternative, in this sense, it is essential to understand and clarify the alternatives for the patient, considering that he has the right to choose or refuse⁶.

When opting for the treatment of chronic renal failure through kidney transplantation, patients have a tendency to believe that their lives will return to conditions prior to diagnosis. However, this therapeutic modality requires several restrictions (food, physical, and pharmacological - through immunosuppressants). When they become aware of these facts, various feelings such as guilt, remorse and hopelessness surface, mobilizing in the individual a feeling of loss of autonomy, quality of life, fragility and grief⁷.

In addition to the difficulties inherent to kidney transplantation, individuals are challenged to live with a range of negative factors, such as side effects and changes in drug dosages, psychosocial pressure to return to their autonomy and difficulties in professional (re)adaptation⁵.

In this context, conditions emerge that directly impact the quality of life, understood as the human notion about the degree of satisfaction in their family, love, socio-environmental and existential aesthetics. The set of these factors is what society considers as a standardization of comfort and well-being, which is impacted by a chronic disease such as kidney failure⁷.

Given the above, we aim to investigate the meaning, experiences and perspectives of people undergoing kidney transplantation, registered in the Association of Chronic Kidneys and Transplants of the State of Para, Brazil.

II. METHOD

Descriptive, exploratory study with a qualitative approach, carried out in an Association of Support for Chronic Kidney and Transplant People in the State of Para, Brazil, from October to November 2018.

Ten patients participated in this research, who were identified through alpha numeric codes, with the following name: “P1, P2... where the “P” means participant and the number the order in which they were addressed in the interview.

An interview script was used as an instrument for data collection, and a semi-structured interview was used as a technique, in which the interviewees' statements were recorded for transcription, analysis and interpretation. The sampling was carried out for convenience, through the snowball process, where respondents and/or service professionals indicated individuals to participate in the research.

Sampling was closed by saturation around two thematic axes. Minayo (2017), describes that in this type of research, the researcher closes the group when after the information collected from a certain number of individuals, new interviews start to present a number of repetitions in its content⁸.

The inclusion criteria were: people undergoing kidney transplantation, of both genders, aged between 18 and 60 years old, with the ability to dialogue, registered with the State Association of Chronic Kidney Transplants. The following were excluded: people who were not submitted to the kidney transplantation procedure, those who were not in full mental faculties or had speech limitation.

The content of the interviews was transcribed in an original way, preserving the expressions used by the participants. However, to use them as a unit of analysis, spelling corrections were made, excluding language vices, exchange or absence of letters, but keeping the linguistic vices that present meaning in the context of speech.

From the collection of information, it was followed to the construction of data, from the methodological

framework of thematic content analysis proposed by Bardin (BARDIN, 2016)⁹. The corpus of the study made it possible to organize the content into empirical categories, grouped according to the theme extracted from the responses. The results allowed the construction of four empirical categories, namely: Understanding of life before transplantation; Knowledge and meanings about kidney transplantation; Transplant recipients' understanding of the changes that occurred after the procedure and the main difficulties encountered, and Changes and improvement in the quality of life after the transplant.

This research was submitted to the Research Ethics Committee (CEP) of the University of the State of Pará (UEPA), Brazil, with the Certificate of Presentation and Ethical Appreciation - CAAE: 98289218.8.0000.5170, with approved opinion, number 2.997.807. All participants signed an Informed Consent Form and a Voice Recording Authorization Form before participating in the study.

The research was carried out following the norms that regulate research involving human beings contained in resolution n. 510/16 National Health Council (CNS)/ National Research Ethics Commission (CONEP).

III. RESULTS

Among the ten participants, six were male and four female. Age ranged from 35 to 56 years, mean of 48.6, median of 49.2 years, with a standard deviation of 6.4. Half of them were single (50%), 30% have high school and higher education, respectively. The predominant religion is Catholicism with 70% and the transplant time ranged from 1 to 14 years.

Participants were characterized according to marital status, gender, age, education, religion and time since transplantation (Chart 1).

Chart 1 - Characteristics of study participants, according to marital status, gender, age, education, religion, transplant time, Belem, Para, Brazil, 2018.

Participant	Gender	Age	Marital status	Education	Religion	Transplant time
P1	Female	35	Divorced	Elementary school incomplete	Catholic	7 years
P2	Male	49	Married	Elementary school incomplete	Catholic	7 years and 6 months
P3	Female	49	Single	Complete high school	Catholic	7 years and 10 months
P4	Female	50	Married	Elementary school	Catholic	14 years
P5	Male	56	Single	Incomplete high school	Catholic	1 year and 8 months
P6	Male	52	Single	University education	Catholic	5 years and 3 months
P7	Male	56	Married	University education	Spiritist	2 years and 6 months
P8	Female	41	Single	Complete high school	Catholic	6 years and 4 months

P9	Male	47	Single	Complete high school	Evangelical	3 years and 4 months
P10	Male	51	Married	University education	Evangelical	11 months and 20 days

Source: Prepared by the authors, field research, Belém, Pará, Brazil, 2018.

The results indicate aspects related to experiences, senses and meanings attributed to important and significant changes that occurred in the lives of people undergoing kidney transplantation, thus defining the following categories resulting from the research.

Understanding life before transplantation

This first category describes the meanings attributed by the participants to the experiences before the transplant, highlighting issues related to CRF and the treatment of renal replacement therapy, especially hemodialysis, considering that this is a process that causes discomfort and impacts on various aspects of life of people. Thus, the speeches allowed to understand that this therapy seems to be understood as a form of "imprisonment" that leaves marks in people's lives even after undergoing kidney transplantation, considering that the interviewees mention hemodialysis treatment as a difficult and arduous, as can be seen in the following reports:

"[...] The life of hemodialysis patients is not easy" (P3).

"[...] I say that I was hostage to a machine" (P3).

"[...] Now I have freedom. I want to do something, I go there and do it" (P5).

"[...] You need to undergo hemodialysis all the time, you have the problem of not drinking water, the problem of traveling! I couldn't travel. I had no life. I was a prisoner of that machine" (P2).

"[...] Difficult, very difficult" (P10).

Knowledge and meanings about kidney transplantation

This category analyzes people's knowledge about kidney transplantation, the meanings attributed to this therapy and how it intertwines and impacts in different ways on the continuity of life. The speeches allowed the understanding that the interviewees had no knowledge about the disease before the diagnosis, as observed in the following reports:

"[...] Nothing, I didn't know anything! Today I know a lot more, and I will be more careful" (P1).

"[...] No, I never knew (pause) anything. I found out when I got sick. I had a lot of hope in having the transplant, it was a lot of suffering to wait for the kidney, a lot of anguish" (P2).

"[...] I was ignorant in this part. I had never heard of a kidney problem, or hemodialysis, or anything. What I do know is that it was extremely distressing to wait for the transplant" (P8).

"[...] Before, I knew almost nothing, I confess" (P9).

"[...] I even attended some lectures. I asked my clinic doctor a lot, but I was always very limited in this matter" (P10).

In this study, participants highlighted kidney transplantation as significant, especially for those on hemodialysis. The expectations of a transplant are related to the hope of a new life, of improving their biopsychosocial and spiritual condition.

It is highlighted that transplantation has a meaning of hope and faith, providing the person with the opportunity to gather conditions to free themselves from the dependence of hemodialysis, resume their autonomy of life and continue their daily routines. And among the highlighted aspects that most contribute to such reframing, the time and feelings they experienced during the hemodialysis process and the changes that occurred after the transplant stand out.

Discourses were identified that allow us to understand the meaning attributed to the kidney transplantation procedure, and how it is related to the improvement in the quality of life after the procedure. People related the idea of kidney transplantation as something that set them free, as evidenced in the statements:

"[...] I was reborn. Today I know a lot more, and I will be more careful" (P1).

"[...] For me, an improvement in life. I started to know about things I didn't know, even taking certain precautions in my diet, in my way of acting" (P2).

"[...] 100% improved. I feel reborn... Because that machine over there (pause), that over there is not life! Of course we live because we have to. I feel reborn, another life." (P4).

"[...] Improved. No need is going to the hospital, stuff! It's not in a machine. Regarding health, it has changed, I am no longer a hostage to that machine" (P8).

"[...] It's like I said... the fact of being able to do those things that were prevented from doing again, right, reborn. Renewed faith" (P10).

Understanding of transplanted individuals about the changes that occurred after the procedure and the main difficulties

In this category, discourses were identified that allow us to infer that transplantation enabled significant changes in people's daily lives, as well as the main difficulties experienced by the participants. Data emerged that associate well-being and emotional growth after transplantation, and consequently significant and positive changes in quality of life. A highlight was given to changes related to food, travel, leisure, return to family life, and independence from the hemodialysis machine, as can be seen in the speeches:

"[...] It improved in relation to food and water intake, liquids in general" (P1), (P5).

"[...] The first change was that I was able to return to my house. to live again with my family (pause), because I used to live here, and the husband had to stay in my city! Many good things, I'll tell you, the first thing I know is this (pause) to be able to go home again" (P4).

"[...] Big life changes. Now I can do what I did before. Whenever I can, I still go with my friends to "ball" (P7).

"[...] Change of life. Look for a job. (P6).

"[...] I left the hemodialysis machine" (P8).

Changes and improvement in quality of life after transplantation

Results show that participants attribute a new meaning to this new life that begins with kidney transplantation. Lifestyle changes, mainly related to hemodialysis treatment, emerged as something that profoundly affects the daily lives of these individuals in family, professional and social relationships, which end up modifying habits and lifestyle.

The return to daily routines was highlighted, as they no longer needed the hemodialysis machine. From the findings, it is inferred that the quality of life was restored and resignified, with a return to their autonomy, which allowed them to perform activities that were previously impeded due to the limitations imposed by the disease. The speeches revealed show that people attribute a new meaning to life, referred to here as "new life", as they report:

"[...] I started to know about things I didn't know, even taking certain precautions in my diet, in my way of acting! New life" (P2).

"[...] Yes, it's almost normal. Can I drink water! I take medication, but now it's all reduced. I took 3, I took 2, I took 1" (P6).

"[...] Improved. There's no need to go to the hospital and stuff, it's not on a machine. Regarding health has changed, I'm no longer hostage to that machine, new life!" (P8).

"[...] It didn't get better, it was excellent". I started to eat better, the quality of life improved, I go out more, I can go on a trip, I feel reborn" (P3).

IV. DISCUSSION

Understanding life before transplantation

Feelings of uncertainty, sadness and frustration were reflected in the speeches, allowing us to understand the difficulties faced by the patients in this study, regarding the limitations and clinical manifestations underlying the chronic disease and its hemodialysis treatment, and these findings are in line with other studies^{10,11}. The statements highlight feelings of "imprisonment" or "dependence on the machine" during the hemodialysis treatment sessions, and reports of hope and freedom were associated with TxR.

A world full of rules and treatment routines surrounding the patient was something that emerged as a great nuisance and that has a profound impact on the quality of life of people with chronic kidney disease. Hemodialysis sessions take place in a period of three to four hours, on average three times a week, and this has a significant impact on the daily routines of the participants in this study¹².

In this perspective, corroborating the findings, Santos and collaborators (2016) report that kidney transplantation is a treatment that considerably improves the quality of life of people with chronic renal failure. The freedom gained after the transplant is comforting to them, as they feel free to do things they could not do before. However, it is noteworthy that in this context, the person and the family are presented with various cares that a person should have when receiving a new kidney, as the transplant does not exclude the chronic character of kidney disease¹³.

Knowledge and meanings about kidney transplantation

Regarding knowledge, it was found that prior to transplantation, participants had low levels of knowledge about the subject. From these findings, it is inferred that the topic was little discussed during the course of treatment of those surveyed, supporting the development of taboos, myths and mistaken beliefs. For Santos and collaborators (2018), every treatment performed through transplantation causes several hesitations, ambiguities and uncertainties in patients. In view of such complexity, education and awareness policies about kidney

transplantation are needed, aimed at professionals, students in the health areas and the general population⁷.

Regarding the meanings attributed by the participants, the findings allow interpreting the awareness of transplantation as a new beginning, a new chance to live. Feelings and expectations of hope emerge around the transplant, and these feelings that permeate the experiences of patients are supported by the desire to have a new life, a significant change in the quality of life and the desire to start over.

In the meantime, the possibility of transplantation is presented as a reality since when people are notified about the need and possibilities for treatment, and consequently the inclusion of this in the transplant “queue” (Single National Registry in Brazil); and this possibility is understood as the only resource and way to return to the conditions of life before the disease, a real possibility of cure and return to a so-called “normal” life⁵.

Understanding of transplanted individuals about the changes that occurred after the procedure and the main difficulties

The speeches allowed us to infer that the transplant enabled the reestablishment of the biopsychosocial and spiritual state, enabling the performance of activities of daily living, which were previously impeded by the disease and treatment routine.

Based on the findings, we consider that transplantation provided a new existential meaning to patients. We emphasize the search for new ways and means of living in the face of conditions after transplantation, taking into account that the patient still experiences the constant risk of organ rejection, requiring the daily use of immunosuppressive drugs, and adaptation to a new Lifestyle.

Silva (2015) states that the expectation that comes from performing the transplant procedure is related to the feeling of freedom that comes from not depending on hemodialysis machines and the obligation of weekly sessions of this treatment¹⁴. In the reports, it was noticeable that the feeling of hope was renewed after the transplant and that there were significant and beneficial changes, which allowed the expression of feelings of joy, reestablishment of dreams and perception of freedom.

Changes in physical fitness and health were another point reported. On this subject, Navarrete and Slomka (2014) corroborate the evidence of new horizons and hope after kidney transplantation, linked to the desire to have a new life and significant change in quality of life¹⁵.

This statement was confirmed by Brito and collaborators (2015), stating that the meaning of

transplantation involves an expectation of increased quality of life and hope for a better life, especially the belief in the freedom and independence of the hemodialysis machine⁵.

Changes and improvement in quality of life after transplantation

We can see that despite the different meanings attributed by patients to kidney transplantation, the experience after transplantation enabled a feeling of expectation for a better life. It should be noted that the expectation attributed to kidney transplantation encompasses the sociocultural dimensions existing in the life of each individual submitted to it.

Although kidney transplantation improves the patient's life in several aspects, it is necessary to understand that this procedure does not exclude the chronic nature of the disease, since the person will still have certain limitations and dependencies on care, medications, professional monitoring and institutions of health. It is understood that the person needs to reinvent themselves in the way they will live, looking for other ways to deal with their limitations and at the same time being more autonomous than they were before the transplant. Therefore, it is essential to monitor health professionals, especially nurses, to assist in this path of seeking to improve quality of life⁵.

Kidney transplantation allows the patient to ingest a less rigorous diet, compared to before the transplant, and thus can ingest water normally. Water is a vital element for human beings. One of the factors that increase the quality of life is the possibility of this person being able to ingest this fluid without worry, since during dialysis treatment, they remained with restrictions on the amount of fluid ingested in a certain period¹⁶.

In this study, we showed that after kidney transplantation, people had a significant improvement in their quality of life in its broadest dimension. Discourses emerged with reports of returning to activities of daily living which were impossible before the transplant. Participants consider that their autonomies were almost completely restored, which also contributed to an improvement in their quality of life.

Corroborating these findings, Brito and collaborators (2018) describe that kidney transplantation, in addition to allowing the rehabilitation of the patient to a normal lifestyle, also allows for significant savings for the health system. It is worth mentioning that, although transplantation has been considered the most cost-effective treatment, one must consider the setback in organ harvesting and the need for a well-structured and

equipped transplant center, in addition to a clearly defined and competent multidisciplinary team⁵.

Thus, the disease process caused by pathologies, in this case, kidney, gives the possibility for individuals to reflect on their lives and values, since they were between life and death, and now, they are receiving new opportunities conquered after the transplant. Transplant recipients, in most cases, believe that they have been given a new encounter with life, a moment in which the values previously learned are rethought; understand and recognize the real meaning of being alive, assuming a personal commitment to valuing life⁷.

Regardless of the various positive and negative characteristics that transplantation produces in patients with chronic renal failure, it is evident that the performance of this procedure enables a new meaning in their lives, which were marked by the realization of dialysis sessions for a long period. Quality of life is directly related to hope and spirituality, the greater the tranquility and happiness of a person, the greater the chance of having a high quality of life, which we believe that in the context of life of people with chronic kidney disease is a very affected dimension due to the strenuous treatment routine and the limitations imposed by the disease^{5,17}.

V. CONCLUSION

The methodological resource applied allowed the understanding of the meaning, experiences and perspectives of people with chronic renal failure undergoing kidney transplantation, thus responding to the objective proposed in this study. In the meantime, we found that kidney transplantation aims to promote quality of life and enable greater autonomy, despite the need for care in the follow-up of treatment after transplantation, given the chronic nature of kidney disease that does not end with realization of this therapeutic modality.

The view of transplant recipients indicated that expectations in relation to kidney transplantation were achieved after the procedure was performed, giving rise to the feeling of rebirth and change in life. It was observed that the understanding of chronic renal failure and kidney transplantation were deficient, and that only after the start of treatment, this understanding was made possible.

This study provided understanding that kidney transplantation has a meaning of blessing for the person with chronic renal failure, and represents the expectation of being able to return to a healthy life and continue from where it was interrupted; it represents the hope of a better life and of being able to see a healthier future again, which

requires the collaboration of family members and health professionals, and personal care peculiar to the new condition of life, thus characterizing the network of care and support for the person transplanted.

We evidence that the independence of hemodialysis treatment, the fact of being able to better plan life, making it calm and normal, the feeling of well-being, the adoption of health care and the inexistence of some restrictions in the activities to be performed, counterbalanced with factors related to changes in dreams, changes in interpersonal relationships, obligation to use immunosuppressive medication, non-performance, the realization that the durability of the transplanted organ is not eternal, in addition to the constant search for knowledge of rights and way people should act.

We found in the testimonies that, although there were changes in the person's life, the transplantation process did not represent significant changes that would lead to suffering or despair. On the contrary, it represented a new way of life, which was permeated by a better quality of life.

Regarding what the transplantation process provided in people's lives, we highlight, based on the speeches, the independence of hemodialysis treatment, the existence of a quiet and normal life and the feeling of well-being. The transplant promoted changes that led to a new reality. Although important changes have taken place in the person's life, kidney transplantation did not represent significant changes that would lead to suffering.

The illness experience of kidney transplant recipients integrates meanings about the disease to the meanings constructed throughout their narrated life trajectories, based on the meanings of the phase in which they experienced hemodialysis, the way the transplant was performed and, now, as transplanted.

We highlight the importance of a network of health services that offer care to people in this condition, as they need continuous monitoring. The contribution of this study, in the voice of kidney transplant recipients, reveals their health needs, from the moment the need for the procedure is identified, until the moment they start living in the transplanted condition, in addition to highlighting that the nursing and a multidisciplinary team play a key role in the construction of positive meanings in the lives of kidney transplant recipients.

With the results of this study, we understand that it is necessary to train new professionals in this area, so that there is greater attention to patients who will undergo such procedures, and thus, proper awareness of this topic is given. Further studies are also needed, addressing the health professionals who provide care for these people, in

order to better understand the process of sensitization between professionals and patients.

In this sense, it is expected that this study will contribute to the construction of knowledge related to the person's life after kidney transplantation. And so, health professionals, especially nurses, have theoretical support to assist in this experience, which is permeated by positive and negative consequences.

It should be noted that, like all scientific studies, this research has some limitations that can be minimized in future work. One of them is the small number of participants, from a specific region of Brazil, making it difficult to generalize the results obtained, which, however, enabled us to reach the proposed objective. Another limitation, despite all the precautions, concerns the possible information biases on the part of the interviewees, such as lack of attention or understanding, rush to respond, self-censorship and fear of being identified through the statements, considering the fact of being few participants in this scenario in the State.

However, these limitations in no way devalued the results obtained and the conclusions we reached. The work records the meaning, experiences and perspectives of people undergoing kidney transplantation, and its results can serve to raise discussions and future comparisons, as this type of study should try to cover a greater number of institutions, states and people who experience chronic renal failure undergoing kidney transplantation in Brazil and worldwide. It is concluded that this study corroborates to reveal the vision and meaning of the experiences of kidney transplanted people on the importance and impacts of transplantation in their lives.

REFERENCES

- [1] Rodrigues, D. M. C. (2019) Influence of the Calculation Formula in the Renal Function at Pharmacotherapy in the Elderly. Dissertação de mestrado em Farmacologia Aplicada. Coimbra: Faculdade de Farmácia da Universidade de Coimbra. 06th August 2021.
- [2] Jesus N. M. et al. (2019) Quality of life of individuals with chronic kidney disease on dialysis. Brazilian Journal of Nephrology. Retrieved from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0101-28002019000300364 18th August 2021.
- [3] Marçal, G. R. et al. (2019) Quality of life of patients bearing chronic kidney disease undergoing hemodialysis. Cuidado é fundamental. Retrieved from: <http://www.seer.unirio.br/index.php/cuidadofundamental/article/view/6716/pdf> 20th August 2021.
- [4] Silva R. A. R. et al. (2016) Estratégias de enfrentamento utilizadas por pacientes renais crônicos em tratamento hemodialítico. Esc Anna Nery. Retrieved from: <http://www.scielo.br/pdf/ean/v20n1/1414-8145-ean-20-01-0147.pdf> 21th August 2021.
- [5] Brito E. V. S. et al. (2019) O significado, as vivências e perspectivas de pacientes submetidos ao transplante renal. Acervo Saúde. Retrieved from: <https://acervomais.com.br/index.php/saude/article/view/223> 22th August 2021.
- [6] Fernandes N. M. S. et al. (2015) Nomogram for estimating glomerular filtration rate in elderly people. Brazilian Journal of Nephrology. Retrieved from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0101-28002015000300379&lng=en&nrm=iso&tlng=en 22th August 2021.
- [7] Santos L. F. et al. (2018) Qualidade de Vida em Transplantados Renais. Psico-USF. Retrieved from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1413-82712018000100163&lng=pt&tlng=pt 26th August 2021.
- [8] Minayo M. C. S. (2017) Amostragem e saturação em pesquisa qualitativa: consensos e controvérsias. Revista Pesquisa Qualitativa. 27th August 2021.
- [9] Bardin L. (2016) Análise de Conteúdo. 70th. São Paulo.
- [10] Santos B. P. D. (2016) Situações vivenciadas após o transplante de rim. Saúde em Revista. Retrieved from: <https://www.metodista.br/revistas/revistas-unimep/index.php/sr/article/view/2676/1730> 27th August 2021.
- [11] Galvão, A. A. F (2019) The difficulties found by patients with chronic renal failure to start the treatment. Rev Inic Cient Ex. Retrieved from: <https://revistasfasesa.senaaires.com.br/index.php/iniciacao-cientifica/article/view/254/195> 27th August 2021.
- [12] Riegel, F. Sertório, F. C. Siqueira, D. S. (2018) Nursing interventions in relation to hemodialysis complications. Rev Enferm UFPI. Retrieved from: <https://revistas.ufpi.br/index.php/reufpi/article/view/6806/pdf> 27th August 2021.
- [13] Santos B. P. S.; Viegas, A. C.; Guanilo, M. E. C.; Schwartz, E. (2016) Situações vivenciadas após o transplante de rim. Saúde em Revista. Retrieved from: <https://www.metodista.br/revistas/revistas-unimep/index.php/sr/article/view/2676/1730> 27th August 2021.
- [14] Silva, J. S. (2015) Representações Sociais de Clientes em Hemodiálise e Familiares sobre o Transplante Renal. Dissertação de Mestrado no Programa de Pós-Graduação em Enfermagem e Saúde. Jequié: Universidade Estadual do Sudoeste da Bahia. 27th August 2021.
- [15] Navarrete S. S. and Slomka L. (2014) Aspectos emocionais e psicossociais em pacientes renais pós-transplantados. Diaphora. Retrieved from: <http://www.sprgs.org.br/diaphora/ojs/index.php/diaphora/article/view/37/37> 27th August 2021.
- [16] Santos J. B. N. (2017) Aspectos éticos e legais dos transplantes de órgãos e tecidos no Brasil? revisão sistemática. Universidade Federal da Bahia. 27th August 2021.

- [17] Malaguti L. et al. (2015) Relação entre qualidade de vida e espiritualidade em pacientes renais crônicos que realizam hemodiálise. Faculdade de Medicina de Ribeirão Preto. Retrieved from: <https://pdfs.semanticscholar.org/3308/b06a08044b876441de48eadfa80331488078.pdf> 27th August 2021.

Use of software to aid irrigation

Valtency Remígio Souto¹, Gertrudes Macário de Oliveira², Marcos Antônio Vanderlei Silva³, Denise Costa de Araújo⁴

¹PhD Student, UNEB – Bahia State University, Brazil

^{2,3}PhD professor, UNEB – Bahia State University, Brazil

⁴Postgraduate free researcher, Brazil

Received: 07 Oct 2021,

Received in revised form: 22 Oct 2021,

Accepted: 30 Oct 2021,

Available online: 07 Nov 2021

©2021 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— *application, evapotranspiration, irrigation, software, water balance.*

Abstract— *Irrigation is a resource used by farmers to guarantee their production in regions where the rainfall regime is marked by extreme rainfall irregularity in time and space. Considering the great importance irrigation has for agriculture, especially in regions where the frequency of rainfall is irregular, it becomes as important as the knowledge of technical parameters of the crop, soil and climate to help producers in carrying out irrigation in a precise and less costly manner. There are different types of irrigation and different techniques used for good water management and resource saving. However, many of these tools and knowledge are not available to small producers because they are too expensive, not widespread or difficult to handle. Some technological tools have been emerging in recent years to help producers to perform irrigation based on technical parameters, one of these tools is software and applications that become a cheap and accessible alternative to the vast majority of producers. However, such software must be simple and intuitive so that it can be used by producers with little or no instruction.*

I. INTRODUCTION

The rainfall regime in arid and semi-arid regions is marked by extreme irregularity of rainfall in time and space. In this scenario, water scarcity constitutes a strong obstacle to socioeconomic development and even to the population's livelihood. Due to a history of inadequate use of water resources, associated with an increase in demand by various social and economic actors, as well as climate vulnerabilities, some areas of Brazil face situations of water scarcity, thus increasingly demonstrating the need for efficient planning of this common good - water, so important for the maintenance of life on planet Earth. Freshwater sources have suffered over the past hundred years from a set of human activities unprecedented in history. Irrigated agriculture is considered the human activity with the greatest consumption of water, and in-depth studies and specific research are increasingly

necessary, so that they can effectively contribute to the sustainability of irrigated agriculture.

Irrigation is a tool through which producers find a way to ensure their production, in the face of climatic phenomena and variations such as global warming. It is a costly tool when poorly sized and managed, which can reduce the company's profitability, as well as making its use unfeasible in certain cases [2]. The proper dimensioning of the irrigation system is of great importance, as the application of little water can lead to inadequate plant development, resulting in low productivity. On the other hand, providing more water than the crop needs can generate other problems for producers, such as the emergence and spread of diseases, waste of materials such as fertilizers and the increase in water and energy consumption, that is, an increase in production cost as a whole.

Irrigation has several technical parameters that, when combined with it, guarantee a better performance in execution, generating great benefits and little waste of resources. One of these parameters is evapotranspiration. Evapotranspiration is a natural process of loss of water from the soil and from the plant to the atmosphere, constituting a parameter of great relevance for the design and management of an irrigation system [9]. It is known that, for the proper management of irrigation water, it is necessary to control soil moisture and/or knowledge of evapotranspiration throughout the crop cycle. One of the main irrigation systems today is based on the calculation of evapotranspiration and water balance. An estimate of the evapotranspiration associated with the water balance equation allows the calculation of the soil water deficit, which is then compared to readily available water (RAW). When water depletion exceeds RAW, individual irrigation events generally return soil water content (θ) to field capacity (θ_{fc}). When correctly applied, evapotranspiration-based irrigation scheduling practices have a long history of conserving water and maintaining crop yield and quality [Gu]. Therefore, knowledge of evapotranspiration enables the rational planning of the irrigation technique, which, associated with other meteorological elements, provides basic subsidies for the delimitation of areas more suitable for the development of certain groups of plant species [11].

Assessing the agroclimatic behavior of a certain location is the main step in agricultural scientific planning. Estimating the climatic water balance and climate classification are essential agroclimatic tools in determining the suitability of areas for agricultural crops and in planning irrigation systems [7]. Even with the water capacity of the region providing a great potential for irrigation, it is useless if the climatic behavior of the region is not previously studied and not even the quality of the soil analyzed. Thus, it is essential that parameters related to plants, soil and climate are known in order to determine the opportune time to irrigate and the amount of water to be applied.

Several technological innovations have been applied to agriculture as a whole. Automated control systems, autonomous harvesting machines, among others. In water management it is no different. Large standalone systems perform complex calculations and carry out irrigation accurately and efficiently. But systems like this come at a high price and are not accessible to all producers. So, some more economical alternatives have been appearing in the market, such as the use of applications to estimate calculations related to irrigation and water balance. These easy-to-access tools can produce valuable and accurate

information for producers. Applications can collect data from various sources over the internet, even if they require little or no user/producer intervention. Some possibilities arise when the producer shares his location with one of these apps (that is, the location of his farm), the app can then automatically search for data about the soil in the region, check rain forecast and collect it through the meteorological stations in the region, important data for the calculation of technical parameters that will certainly help and make irrigation more accurate and efficient.

II. MATERIALS AND METHODS

This research was based on a literary review, where scientific publications in related areas were consulted, valuing the multidisciplinary of the proposed theme. The main databases used were: IEEE, ResearchGate, Embrapa, Science Direct, among others.

The main keywords for the consolidation of this research were: water resources, software, application, irrigation, water balance, evapotranspiration. With the results obtained, a filter was made, framing the researched articles with the main focus of this work.

It was also appreciated, for the possibility of testing the analyzed applications, in addition to the main requirement of being free and available to the general public.

III. RESULTS AND DISCUSSION

Some apps provide data about a specific crop, others about the soil in a region. There are also those who propose to calculate the evapotranspiration of a given culture. Although disconnected, they are important information for irrigation management and bring enormous benefits to producers.

Considering all these data and calculations, climatological data, evapotranspiration, water balance, it is possible to gather them in a set of software with great application in irrigated agriculture. In this way, it enables producers to carry out water management based on technical parameters, providing better precision and greater savings in water and energy resources, among others.

[5] proposes a software for calculating evapotranspiration that uses the data entered in the program to calculate the reference evapotranspiration using the Penman-Monteith method. In Fig. 1, the main screen of the application is shown for the manual entry of climatological data relevant to the calculation of the equation.

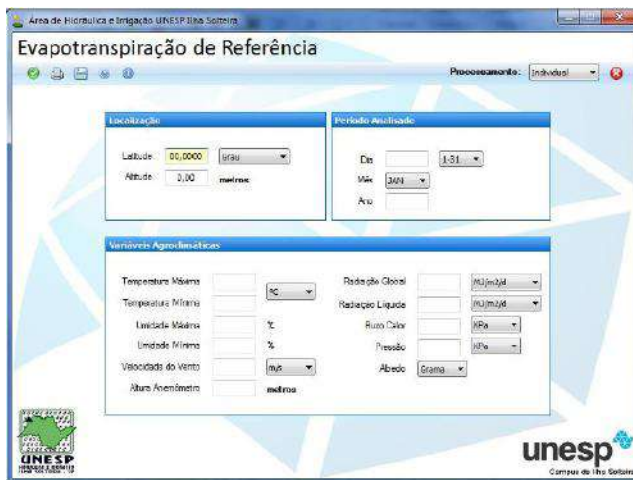


Fig. 1: SMAI - Application proposed by [5]

The SMAI – Irrigated Agriculture Management System (*Sistema para Manejo da Agricultura Irrigada*, in portuguese) can be found through the link: <http://clima.feis.unesp.br/smai>. This software was developed during a research project by researchers from UNESP – Universidade Estadual Paulista and works exclusively on Windows platform. As it is a computer software, SMAI does not have great mobility or precision when it comes to localized data. Even using a notebook, the weather data must be entered manually, allowing for typing errors or even the insertion of data not corresponding to the desired area.

[10], in turn, presents an application for Android smartphones with the objective of calculating the climatological water balance. The application is no longer available on the platform's app store, however the author makes all the application's source code available through the website: <https://github.com/lucianoedipo/bhcmovel>. The application BHCMóvel - climatological water balance mobile (*Balanço Hídrico Climatológico Móvel*, in portuguese), follows some software engineering standards and good practices that were adopted during its development. However, as it is no longer available in an official store, its use and dissemination among producers is difficult. In Fig. 2, it is possible to see two distinct screens where the first is intended to receive the crop data and the second part, the soil data. However, all data must be manually entered by the user, which may lead the user to an error in data entry, either by typing or erroneous data collection, and possible propagation to the calculation results.



Fig. 2: Application proposed by [10]

Many applications have emerged in recent years for these purposes, achieving satisfactory results for the purposes of each application. As explained by [6], (the application) demonstrates to contribute to the execution of the various calculations, making the entire process, from obtaining the data to the generation of the final calculations, much more interactive and simple. And as demonstrated by [3], the application (...) worked satisfactorily, meeting all expectations, performing the Climatological Water Balance calculations correctly, presenting a simple interface for both data entry and display of results, also enabling the display of results in the form of tables or graphs.

Some applications provide data on a specific crop, others on the soil of a region and others, propose to calculate the evapotranspiration of a particular crop. Although disconnected, they are important information for irrigation management and would bring enormous benefits to producers. However, these applications can become unfeasible, when manipulated by people with low educational level, or with little contact with digital tools, a very common situation among family producers in Brazil. These applications do not have good usability as software engineering preaches, that is, they are not easy to use. As the author [3] explains in his work: the application makes it possible to calculate the Water Balance of Cultures, but for that it requires the user to have greater knowledge of the subject. This question, apparently forgotten by researchers and software developers, is extremely important so that the applications that will be developed are actually used by the target audience, that is, they will contribute and facilitate decision-making by producers, whether these are big or small producers.

IV. CONCLUSION

Surface irrigation is the widely used method of applying water to agricultural land where water is distributed to the field by surface flow. Despite its wide use, the method is characterized by low irrigation efficiencies and uniformity that can result in reduced crop productivity [1]. As discussed above, this efficiency can be increased with the use of tools that support decision making based on technical parameters.

For [8], the decision of when to irrigate can rarely be made using a single simple tool, but it is made through the integration of a range of different sources of information, such as:

- Soil moisture monitoring equipment;
- Experience and assessment of historical trends in river flow and precipitation;
- Symptoms of stress in plants, such as change in leaf color, withered plant, leaf temperature, among others;
- Current crop growth, fruit development, rooting depth and future climate.

The preservation of water resources concerns society as a whole. It is important to preserve these resources for the well-being of current society and future generations. In the same way that you have good ways to save water inside the homes in daily activities, it is necessary to transport these good ways to economic activities. And agriculture has a prominent role in this regard, as it is the human activity that consumes the most water in the world, and has a significant potential, if it adopts good practices, in the economy of water resources.

Therefore, technology has an important role to play in favoring the dissemination of accurate and direct information in favor of efficient irrigation management. The use of easily accessible technological tools can greatly contribute to the preservation of water resources. In the form of applications, these technological tools can be highly complex, gathering information from different databases and performing complex calculations, but for the user/farmer, all this complexity is transparent and the application is easy to handle and the information received be simple and straightforward.

Thus, it is undeniable the technological advances that agriculture has had in recent years, especially in the control of irrigation through the use of applications. They are low-cost alternatives that can significantly impact the lives of producers, especially small producers and family farmers. However, these alternatives must be accompanied by well-constructed software, not focusing exclusively on

the generation of data for water management, but taking care to obtain an extremely simple and intuitive product so that anyone can use it, even if this person has little or no education.

REFERENCES

- [1] Adamala, S., Raghuvanshi, N. S., & Mishra, A. (2014). Development of surface irrigation systems design and evaluation software (SIDES). *Computers and electronics in agriculture*, 100, 100-109.
- [2] Alves Junior, J., Sales, D., Pereira, R., Rodrigues, W., Casaroli, D., & Evagelista, A. (2018). Viabilidade econômica da irrigação por pivô central nas culturas de soja, milho e tomate, em diferentes demandas hídricas. *Pesquisa Agropecuária Pernambucana*, Recife, 22, e201703.
- [3] Favela Junior, J. A. (2019). Desenvolvimento de aplicativo para dispositivo móvel para realização de balanço hídrico.
- [4] Gu, Z., Qi, Z., Ma, L., Gui, D., Xu, J., Fang, Q., ... & Feng, G. (2017). Development of an irrigation scheduling software based on model predicted crop water stress. *Computers and Electronics in Agriculture*, 143, 208-221.
- [5] Mariano, J. C. Q., Hernandez, F., Santos, G., & Teixeira, A. D. C. (2011). Software para cálculo da evapotranspiração de referência diária pelo método de Penman-Monteith. In *Embrapa Semiárido-Artigo em anais de congresso (ALICE)*. In: CONGRESSO NACIONAL DE IRRIGAÇÃO E DRENAGEM, 21., 2011, Petrolina. As oportunidades de empreendedorismo na agricultura irrigada: anais. Petrolina: ABID, 2011.
- [6] Melo, D. P., Vieira, G. H. S., Miranda, L. Q., & Redighieri, T. (2017). Aplicativo web para cálculo de balanço hídrico no manejo da irrigação. *Revista Brasileira de Agricultura Irrigada*, 11(2), 1302-1309.
- [7] Passos, M. L. V., Zambrzycki, G. C., & Pereira, R. S. (2016). Balanço hídrico e classificação climática para uma determinada região de Chapadinha-MA. *Revista Brasileira de Agricultura Irrigada*, 10(4), 758-766.
- [8] Richards, Q. D., Bange, M. P., & Johnston, S. B. (2008). HydroLOGIC: An irrigation management system for Australian cotton. *Agricultural Systems*, 98(1), 40-49.
- [9] Santos, F. X. D., Rodrigues, J. J., Montenegro, A. A. D. A., & Moura, R. F. D. (2008). Desempenho de lisímetro de pesagem hidráulica de baixo custo no semi-árido nordestino. *Engenharia Agrícola*, 28, 115-124.
- [10] da Silva, L. É. P., & Bracht, E. C. (2010). Uma nova abordagem para o Cálculo de Balanço Hídrico Climatológico. *Revista Brasileira de Computação Aplicada*, 2(1), 2-16.
- [11] Teixeira, G., Beltrão, D., & Evangelista, A. W. (2011). Estudos de evapotranspiração em casa de vegetação. *Enciclopédia Biosfera*, 7(13).

Measurement of Carbon and Carbondioxide Fmu Argomulyo using Biomass Approach in Community Forests, Sundul Village and Banjar Panjang, Magetan Regency

Martin Lukito^{1*}, Ahadiati Rohmatiah²

¹Faculty of Agriculture, Agrotechnology Program, Merdeka Madiun University, Indonesia.

²Faculty of Economics, Management Program, Merdeka Madiun University, Indonesia.

Received: 02 Sept 2021,

Received in revised form: 23 Sept 2021,

Accepted: 06 Nov 2021,

Available online: 09 Nov 2021

©2021 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— Biomass, Carbon Content, C02 Absorption, Inventory,

Abstract— The existence of community forests today has provided real benefits, especially the economic value of communities around the forest and a real contribution to environmental services with the ability to reduce greenhouse gas emissions in the context of mitigation and adaptation to climate change. Sustainable Forest Management facilitates efforts to reduce emissions in the forestry sector more economically than other sectors, which later became the forerunner to the birth of the concept of REDD+. This study aims to calculate the potential for standing stands in the villages of Sundul and Bandarpanjang Forest Management Unit. (FMU) Argomulyo, Magetan regency, looking at the ability of the forest to produce biomass, carbon content and the ability to absorb C02 content, including an allometric estimation model, by means of an inventory, for the potential destructive sampling method on samples of tree species to be measured Biomass, stored carbon and carbon dioxide uptake. The results showed that the average standing potential was 54.25 m3/ha, or a total volume of 26.732.831 m3, the average forest biomass content per ha was 955.32 tons or total of 1.944.178 tons. The average carbon content is 467.80 tons C/ha or the total available is 913.763 tons Carbon The ability to absorb carbon dioxide (C02) is 1,716.82 tons C/ha, with an area of community forest management capable of absorbing C02 content of 3,353.512 tons C02.

I. INTRODUCTION

Forest is an ecosystem unit in the form of a stretch of land containing biological natural resources which are dominated by trees in their natural environment which cannot be separated from one another. Based on the land status, it is divided into two types, namely state forest and private forest. One example of a private forest is a private forest where the forest is located on land that is

encumbered with common property rights Anonymous (1999).

The function of community forests is one of the alternative solutions to the problem of pressure on forest resources/forest areas. In its development, it has provided many positive benefits, both directly and indirectly, among them for the owner, namely being able to provide forest products obtained directly, either in the form of a source of wood tools, firewood, food, animal feed

The positive benefits of community forests indirectly are the maintenance of hydrological, climatological, aesthetic and other functions which are the basic needs of the community (Dako, 2019)

The role of forests is very important in human life, in terms of products, forests produce three groups of products: wood, non-timber forest products and environmental services. The environmental benefits of forests are indirect and difficult to measure in value but are easy to feel in their absence due to damage. Another environmental benefit is that forests protect and at the same time serve as a source of biodiversity, both flora and fauna. Puspitojati Triono M. et al, (2014)

Forest is an ecosystem unit in the form of a stretch of land containing biological natural resources which are dominated by trees in their natural environment which cannot be separated from one another. An example of a private forest is a private forest where the forest is located on land that is encumbered with common property rights Anonymous (1999). One of the roles of community forests in environmental services is the ecological pressure of forest resources. Natural disasters and global warming occur partly because of the destruction of forests. The pressure on high carbon dioxide gas emissions has made the forest sector play a strategic role, including community forests.

Reducing emissions in the forestry sector has a high selling price compared to other sectors, which became the forerunner to the birth of the concept of REDD+ (Reducing Emissions from Deforestation and Forest Degradation plus). Forests are the main determinant of global climate change mitigation. Making forestry a part of world politics. from the perspective of global climate change Stern (2007).

The agenda for sustainable forest management has become a major global issue in the context of climate change. The role of forests in mitigating and adapting to climate change. priority on mitigation in developing countries. Sustainable Forest Management is evolving to facilitate the concept and implementation of REDD+. play a role in mitigating climate change and increasing adaptation to climate change. as well as, function for carbon conservation, sequestration and substitution. REDD as carbon conservation has its main role in carbon sequestration. Sustainable forest management is intended to increase carpentry and construction wood products or tools as well as carbon storage outside the forest. Purbawiyatna, et al (2012) Adaptation of sustainable forest management is used to reduce the openness of forest communities to the effects of climate change, as well as

reduce sensitivity and increase community adaptive capacity.

Increasing forest development as a material for increasing CO₂ absorption can be carried out in state forest areas or private forests, including community forests. Darusman and Suharjito (1998), the high potential of community forests both in terms of tree population and species will result in a large accumulation of CO₂ absorption. However, with the high rate of forest degradation and deforestation, CO₂ absorption has decreased. Degraded forests will gradually lose their function as CO₂ absorbers Junaedi, (2008).

The aim of the study was to calculate the above-ground biomass in community forests, Sudul and Bandar Panjang villages, FMU Argomulyo, Magetan Regency, to estimate the potential for carbon content (C) and carbon dioxide Absorption (CO₂). The benefits of this research can provide scientific information, and become a reference for local government policies in regional development and conservation plans, and can become data and information that can be a reference for further research. The issue of global warming has become the hottest discussion from the 20th decade until now, the main cause is the increase in greenhouse gases such as CO₂, CH₄, N₂O, and CF₄. (IPPC 2001) which has an impact on increasing global temperatures and changes in rainfall IPPC. (2007). Carbon dioxide gas is the biggest problem where the main cause of Greenhouse Gases.

Forests with tree components can absorb atmospheric carbon (carbon sequestration), converted into biomass (carbon sinks) as well as stored in the system as carbon stocks or carbon stocks Hairiah and Rahayu, (2007). The more trees there are, the more carbon dioxide is absorbed. If Indonesia's forest development is increased, Indonesia has helped reduce CO₂ concentrations. The absorptive capacity of tree stands in the forest is influenced by tree physiology, such as the rate of photosynthesis which is influenced by atmospheric CO₂ concentration, air temperature, air humidity, chlorophyll content, and stomata. The content of chlorophyll and the number of stomata per leaf area can determine the rate of photosynthesis. Thus, the larger the leaf area per unit of land, the greater the CO₂ absorbed. However, leaf area will increase in line with the age of the stand, therefore it can be assumed that the age of the stand will affect CO₂ absorption. However, leaf area will increase in line with the age of the stand, therefore it can be assumed that the age of the stand will affect CO₂ absorption. .

Half of the biomass in forests is made up of carbon. So that currently the main function of forests is important, especially related to global warming, especially forests

have a role as a source of emissions and absorption Brown (1997). Emission reduction from forests is carried out through 2 main stages, namely increasing carbon sequestration and forest carbon conservation. Carbon calculations can also be used to support forestry policies both at the national and regional levels, especially Community Forests. Where the amount of carbon from forest stands is determined by the right policy direction for sustainable forestry development.

Carbon accounting is also an effort to find out the real condition of forests in Indonesia, which is very wide and diverse. For this reason, it is recommended that carbon calculations be carried out with a combination of ground survey and remote sensing activities. in order to maintain the accuracy of the numbers and the efficiency of carbon calculations. one of which has been stated in the application to calculate emission reductions through the IPCC (GL) application, IPCC (2003)

The introduction of the paper should explain the nature of the problem, previous work, purpose, and the contribution of the paper. The contents of each section may be provided to understand easily about the paper.

II. MATERIALS AND METHODS

A. Inventory of Community Forest Stands

Inventory of community forest stands of the Argomulyo FMU group was carried out by determining Measurement Plots in 2 village locations, namely Sundul Village and Banjarpanjang Village. Each village was determined to measure 16 plots with a size of 25 x 25 m, so that the area of each Measurement Plot is 1 hectare. The steps for data collection on each Measurement Plot, Measurement Plot Plan and Unit can be seen in the following figure-1. and figure-2.

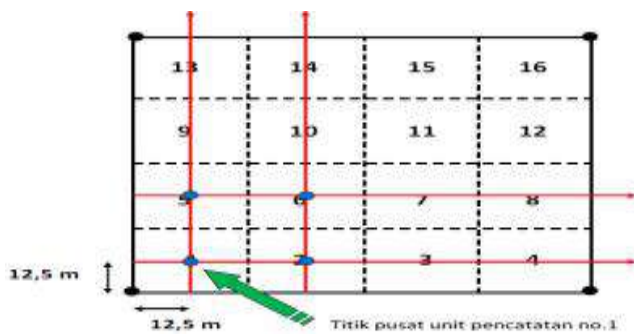


Fig. 1: Making a stand inventory plot

Caption Figure 1:

- = recording unit center point
- = the outer boundary of the sample plot
- - - = sample plot angle sign
- = inner limit between recording units



Fig. 2: Measuring sample Plot and Recording Unit

Caption Figure 2:

- A: Inventory Plot Sample,
- B : Measuring Deameter at Breast High (dbh),
- C : Measuring High Tree,
- D : Destructife Sample tree,
- E : Measuring total leaf,
- F : Measurng total root and
- G : Measuring total Branch

Determination of the volume of each tree included in the PU, based on the results of measurements of height and diameter, then determined the volume. Determination of tree volume using the formula.

The measurement of standing trees is done by the formula:

$$V = \frac{1}{4} \pi \times d^2 \times t \times f \times n \dots\dots\dots(1)$$

- V = volume standing stock
- π = phi (22/7)
- d = diameter breast hight (dbh)
- t = tree height
- n = number of trees per hectare (n/ha)

Actual Trunk Volume

From the basic formula above, it is reduced to:

$$V = \pi/8 (Dp^2 + Du^2) . p \dots\dots\dots (2)$$

- Dp = Average base diameter
- Du = Average end diameter
- p = Segment length

B. Measurement of the Biomass

Calculation of biomass Biomass above ground (above ground) Sach Village Sundul and Banjar Long done by destructive sampling of the entire organ tree (roots, trunk, branches and leaves) the model used to extrapolate a

snapshot of data to wider area. Mathematically, it is done allometrically. Standard allometric equations that have been published are often used, but because the coefficients of this allometric equation vary for each location and species, it is necessary to make a special equation that is significant in estimating the biomass of a vegetation (Heiskanen, 2006).

C. Tree Organ Biomass (BOP)

Lukito Martin (2020) said the calculation of plant tree organ biomass above ground is known based on formula:

$$\text{Tree Organ} = \text{BOP} = \frac{\text{BKS}}{\text{BBS}} \times \text{BOT} = \dots\dots\dots(4)$$

- Biomass BOP= Tree organ biomass (g, kg)
- BKS = Dry weight of sample (g,kg)
- BBS = Wet weight of sample (g,kg)
- BBT = wet weight total organ trees (g, kg)

Measurement every dry weight carried by drying the samples taken from the field using an oven at 103 ± 2 OC to obtain a constant weight (Nelson et al, 1999, in Losi, 2003). Biomass total trees can be calculated by adding up all the tree component biomass. The formula used

$$Wt = Ws + WL + WB + Wt\dots\dots\dots(5)$$

- Wt = above ground (total weight)
- Ws = Stem weight
- WL = leaf weight)
- WB = branch weight

D. Carbon Measurement

Source of greenhouse gases in the forestry sector and land change is carbon dioxide. Forest Carbon Stocks are stored in vegetation, namely in stems, shoots and roots, other biomass and in the soil Dharmawan, et al (2013) The carbon content obtained from each tree organ multiplies the biomass of each plant organ by the weight percentage of the total carbon content

$$Ct = Wt \times \% \text{ carbon content (CC)}\dots\dots\dots(6)$$

- Ct = Weight of carbon content of tree organs (g, kg)
- wt = weight biomass of plant organs (g, kg)
- % CC = Total carbon content (C total %)

Guidelines for calculating carbon are available including the national standard for calculating carbon (SNI 7724/7725 of 2011). used as an understanding and

implementation of carbon measurement and calculation, supporting climate change mitigation in the forestry sector. Carbon content was calculated by multiplying the biomass of trees, necromas, litter and undergrowth by 47% (Anonymous, 2011).

Absorption CO₂ through conversion of C and O Atomic Masses. Comparison of CO₂ Atomic Mass to C (Carbon)= 3.67. The potential of forests to absorb CO₂ from the atmosphere varies according to the type, age and level of plant density (Heriansyah, 2005). Approach to the calculation of absorption of CO₂ can be approached by the formula:

$$WCO_2 = Wtc \times 3.67 \dots\dots\dots(7)$$

- WCO₂ = amount of CO₂ absorbed (tons / ha)
- Wtc = the total weight of carbon stand a certain type and age (t / ha)
- 3.67 = Score equivalence / conversion element carbon (C) to CO₂

Measurement of the ability to absorb carbon dioxide by multiplying the value of stored carbon by a constant with a large value of C and O atoms of 3.67, so that the value of forest carbon dioxide absorption can be known. Manuri et al (2011).

E. Allometric Equations

Data from such felling, tree height, dbh, sought correlation with fresh weight of plant organs, biomass, carbon dioxide, as well as CO₂ sequestration order was made in an allometric equation regression model. From the regression models that have been developed in Indonesia, tree biomass estimation models are generally presented in rank (Krisnawati Haruni, et al, 2012)

$$Y = aX^b\dots\dots\dots(8)$$

- X = Independent Variable (Diameter, Height)
- Y = Independent Variable (biomass)
- a = Coefficient of allometric model
- b = exponent of allometric model

Selection of the regression model based on the value of the coefficient of determination (R²), the highest as well as the sum of squared errors (residual sum of square) is the smallest. In addition, the significance test of the resulting equation was also carried out. The number of deviations residual error minimum indicates the level of regression error that occurs is also getting smaller (Walpole, 1995).

III. RESULTS AND DISCUSSION

A. Community Forest Stands

Inventory of community forest stands of the Argomulyo FMU group was carried out by determining Measurement Plots in 2 village locations, namely Sundul Village and Banjarpanjang Village. One Plot Measurement is 1 hectare. The steps for data collection on each Measurement Plot, Measurement Plot Plan and Unit can be seen in the following figure-3.

Borders Village	Sundul Village	Banjarpanjang village
North	Bandarr Panjang Village	Banjarejo Village
East	Giripurno Village	Giripurno Village
South	Krowe Village	Sundul Village
West	Krajan Village	Banyudono Village
Geographical Position	Sundul Village	Banjarpanjang Village
North	70 42'12.46" S, 1110 22'24.42" E	70 41' 11.15" S, 1110 21'36.4" E
East	70 42' 38.84" S, 1110 22'59.95" E	70 41' 42.25" S, 1110 22'34.46" E
South	70 45' 7.78" S, 1110 21'59.83" E	70 42'13.79" S, 1110 22' 26.4" E
West	70 42' 4.59" S, 1110 21'51.12" E	70 46'8.92" S, 1110 21' 19.4" E



Fig. 3: Location of the sample plots in the villages of Sundul and Bandar Panjang, Argomulyo FMU, Magetan Regency

Sundul Village is 310,435 Ha with a combination showing varying conditions, namely sloping conditions to mountainous conditions, in terms of soil depth, the effective dominance of soil is less than 30 cm located in Parang, Lembeyan, Kawedanan, The type of soil in the village of Sundul consists of grumosol, latosol, mediteran, and andosol. enter the mountainous region of western Bancak. Parang and Ngariboyo sub-districts have a C climate type, the altitude is between 300-1,100 above sea level, with an average rainfall of 1,453 mm/year with a hilly topograph.

Forest Management Unit Argomulyo is a combination of community forest management organizations (OPHR) consisting of seven (7) villages namely Balerejo Village, Garon, Giripurno, Ngente, Tladan sub-district. Kawedanan, Banjar Panjang Village, Ngariboyo District and Sundul Village, District. Magetan Regency Parang. FMU "Argomulyo" Kawedanan District Magetan Regency was established on June 24, 2010.

B. FMU Argomulyo Working Area

In accordance with the agreement of the members of the Argomulyo FMU, that the working area of the Argomulyo FMU is 966,251 Ha, including 199,144 Ha in the Banjarpanjang and Sundul Village areas as presented in Table 1:

Table.1: Recaptulation of Community Forest Area of Sundul Village and Bandar Panjang FMU Argomulyo, Magetan Regency

NO	Village/District	Village	Area of community forest (HA)			Number of Members
			Yard	Moore	Total	
1	BanJar Panjang Ngariboyo district	Panjang	7,800	35,734	43,533	202
		Pulutan		50,166	50,166	131
	Total-1		7,800	85,900	93,699	333
2	Sundul	Sundul I	0,07	0,515	0,585	12

	Parang District	Sundul II	5,242	59,989	65,231	227
		jambu	3,418	32,239	35,657	109
		Sulurejo	0,721		0,721	8
		Brumbung	3,25		3,25	24
	Total-2		12,701	92,743	105,444	380
	Total 1+2		20,501	178,643	199,144	613

Inventory stands in the community forest of the villages of Sundul and Banjar Panjang in the Argomulyo FMU area, the average potential of community forest per ha forstands is *Acacia auricuriformis* 16 trees with a standing stock volume of 5.706 m³, *Swietenia mahagoni* is

8.825 m³ with an average of 46 trees per ha, *Tectona grandis* Lf is 186 trees with a standing stock volume of 153.98 m³, and the potential for *Dalbergia latifolia roxb* is 1.229 M³ with an average of 10 trees per Ha. As seen in Table 2, Table 3. and Table 4:

Table. 2: Inventory of Stands at Pole Level per Ha Community Forest of Sundul and Banjar Panjang Villages FMU Argomulyo Magetan Regency

Village	Pole level									
	<i>Acacia auricuriformis</i>		<i>Swietenia mahagoni</i>		<i>Tectona grandis</i> Lf		<i>Dalbergia latifolia roxb</i>		Total	
PU	N	V	N	V	N	V	N	V	N	V
Sundul	22	2,774	101	12,635	306	40,067	25	2,5827	454	58,058
Bandar panjang	20	3,280	43	5,248	274	29,598			337	38,125
Total	42	6,054	144	17,882	580	69,665	25	2,5827	791	96,184
Per Ha	11	1,513	36	4,471	145	17,416	6	0,6457	197,75	24,046

Caption = N= Number of Trees, V= Volume

Source: Primary data processed in 2021

Table. 3: Inventory of Stands Tree Level per Ha Community Forest of Sundul and Banjar Panjang Village FMU Argomulyo Magetan Regency

Desa	Tree Level									
	<i>Acacia auricuriformis</i>		<i>Swietenia mahagoni</i>		<i>Tectona grandis</i> Lf		<i>Dalbergia latifolia roxb</i>		Total	
PU	N	V	N	V	N	V	N	V	N	V
Sundul	10	5,03	34	14,778	119	60,709	15	3,0228	178	83,54
Bandar panjang	13	14,064	6	2,639	43	23,608			62	40,311
Total	23	19,094	40	17,417	162	84,317	15	3,0228	240	123,85
Per Ha	6	4,7735	10	4,354	41	21,079	4	0,7557	60	30,963

Caption = N= Number of Trees, V= Volume

Source: Primary data processed in 2021

Table.4: Inventory of Community Forest Stands per Ha in Sundul Village and Banjar Panjang FMU Argomulyo Magetan Regency

Village	Total number									
	Acacia <i>Acacia auricuriformis</i>		Swietenia mahagoni		Tectona grandis Lf		Dalbergia latifolia roxb		Total	
PU	N	V	N	V	N	V	N	V	N	V
Sundul	32	7,804	135	27,413	425	100,78	40	4,917	632	141,6
Bandar panjang	33	15,018	49	7,887	317	53,206			399	78,437
Total	65	22,822	184	35,299	742	153,98	40	4,917	1.031	220,03
Per Ha	16	5,706	46	8,825	186	38,495	10	1,229	258	55,009

Caption = N= Number of Trees, V= Volume

Source: Primary data processed in 2021

Table.5: Number of trees Inventory of Community Forest Stands in Sundul and Banjar Panjang Villages, Argomulyo FMU, Magetan Regency

Village	District	Area (Ha)	<i>Acacia auricuriformis</i>	Swietenia mahagoni	Tectona grandis Lf	Dalbergia latifolia roxb	Total
			N	N	N	N	N
Banjar Panjang	Ngariboyo	20,501	677	1.005	6.499		8.180
Sundul	Parang	178,643	5.717	24.117	75.923	7.146	112.902
jumlah total		199,144	6.393	25.121	82.422	7.146	121.082

Caption = N= Number of Trees

Source: Primary data processed in 2021

Table. 6: Volume Total Inventory of Community Forest Stands in Sundul and Banjar Panjang Villages, Argomulyo FMU, Magetan Regency

Village	District	Area (Ha)	<i>Acacia auricuriformis</i>	Swietenia mahagoni	Tectona grandis Lf	Dalbergia latifolia roxb	Total
			Volume	Volume	Volume	Volume	Volume
Banjar Panjang	Ngariboyo	20,501	307,890	161,681	1.090,781		1.560,353
Sundul	Parang	178,643	1.394,163	4.897,107	18.002,856	878,334	25.172,460
Total Number		199,144	1.702,053	5.058,789	19.093,638	878,334	26.732,813

Source: Primary data processed in 2021

C. Potential Biomass of Community Forest Stands

Amount of forest biomass is carried out for all parts Trees consist of above-ground biomass including stem organs, branches, and leaves, and below-ground biomass including tree roots. The results of the inventory per segment are presented in Table 7 as follows:

Table. 7: Biomass (kg) Per Segment of Community Forests in Sundul Village and Bandar Panjang FMU Argomulyo Magetan Regency

Type	Dbh (cm)	H (m)	Vol (M3)	Wet Weight (Kg)				Total (KG)
				Root	Stem	Branch	Leaf	
<i>Acacia auriculiformis</i>	15,037	16,65	0,014	31,329	47,323	10,300	8,869	97,821
<i>Swietenia mahagoni</i>	17,957	19,75	0,020	27,169	75,848	14,706	11,273	128,996
<i>Tectona grandis Lf</i>	20,203	19,57	0,022	50,921	95,221	12,020	10,083	168,245
<i>Dalbergia latifolia roxb</i>	13,630	15,63	0,012	31,329	47,323	9,585	8,869	97,106
Average	16,707	17,90	0,017	35,187	66,429	11,653	9,774	123,042

Source: Primary data processed in 2021

The average weight per tree for the *Acacia auriculiformis* species was 97.821 kg/tree, the *Swietenia mahagoni* species was 128.996 kg/tree and the *Tectona grandis Lf* species was 168.245 kg/tree and *Dalbergia latifolia roxb* 97.106 kg/tree. the average wet weight in the villages of Sundul and Bandar Panjang is 123,042 kg/tree. The average biomass per ha is for *Acacia auriculiformis*

148.41 tons/ha, *Swietenia mahagoni* is 213.87 tons/ha and for *Tectona grandis Lf* is 611.56 tons/ha and *Dalbergia latifolia roxb* of 21.48 tons/ha, the average biomass per ha of 995.32 tons ha. The Biomass Potential of Community Forests in Sundul and Banjar Panjang Villages in the Argomulyo FMU Management Area is presented in Table 8, figure-4

Table. 8: Biomass Potential Per Ha in Sundul Village and Bandar Panjang Management Area of FMU Argomulyo Magetan Regency

Average per Ha	Total Biomass Total per Hectare Type						
	N	V (M3)	Root	Stem	Branch	Leaf	Total (Ton)
<i>Acacia auriculiformis</i>	16	5,706	46.199,66	72.627,07	16.132,75	13.450,99	148,41
<i>Swietenia mahagoni</i>	46	8,825	64.779,76	121.014,74	15.479,50	12.596,20	213,87
<i>Tectona grandis Lf</i>	186	38,474	132.647,90	351.388,35	73.523,74	53.997,32	611,56
<i>Dalbergia latifolia roxb</i>	10	1,229	6.735,66	10.588,63	2.191,68	1.961,08	21,48
Total	258	54,234	250.362,98	555.618,79	107.327,68	82.005,60	995,32

Caption = N= Number of Trees, V= Volume

Source: Primary data processed in 2021

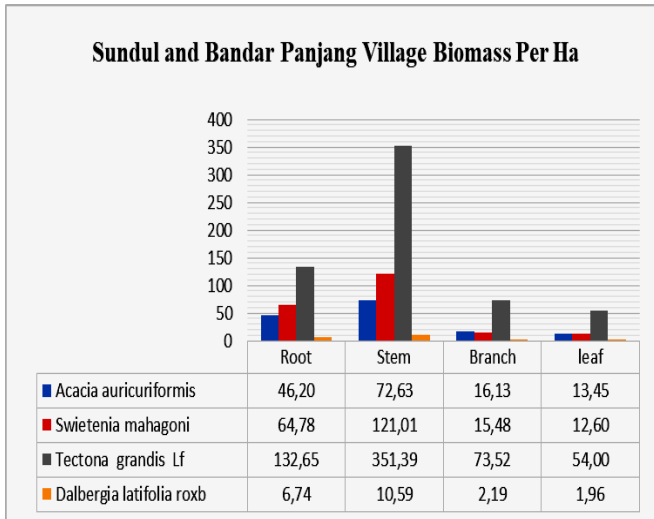


Fig. 4: Biomass Potential Per ha of Community Forests in Sundul Village and Bandar Panjang FMU Argomulyo Kec. Kawedanan, Magetan Regency

The village community forest area Sundul and Banjar length within the territory of the region manage FMU Argomulyo covering an area of 199,144 ha, the distribution of species and potential based on the type of

Table. 9: Total Biomass Potential of Sundul Village and Bandar Panjang Management Area of FMU Argomulyo Magetan Regency

Village/Type	Total Biomass per species (Kg)/Ton						
	N	V (M3)	Root	Stem	Branch	Leaf	Total (Ton)
Sundul Village							
<i>Acacia auricuriformis</i>	5.717	1.394,163	87.677,10	137.830,69	30.616,52	25.527,12	281,651
<i>Swietenia mahagoni</i>	24.117	4.897,107	127.079,76	238.131,22	30.093,08	24.470,43	419,77
<i>Tectona grandis Lf</i>	75.923	18.002,856	250.162,64	662.688,49	138.659,52	101.834,34	1.153,34
<i>Dalbergia latifolia roxb</i>	7.146	878,334	13.471,31	21.177,26	4.383,37	3.922,16	42,95
Total-1 (Ton)	112.902	25.172,460	478,39	1.059,83	203,75	155,75	1.897,72
Bandar Panjang Village							
<i>Acacia auricuriformis</i>	677	307,890	4.722,22	7.423,45	1.648,98	1.374,87	15
<i>Swietenia mahagoni</i>	1.005	161,681	2.479,76	3.898,25	865,92	721,98	8
<i>Tectona grandis Lf</i>	6.499	1.089,052	15.133,16	40.088,21	8.387,97	6.160,29	70
Total-2 (Ton)	8.180	1.558,624	22,34	51,41	10,90	8,26	92,91
Total Number	121.082	26.731,084	500,73	1.111,24	214,66	164,01	1.990,63
Average	116.992	25.951,772	489,56	1.085,53	209,20	159,88	1.944,18

Caption = N= Number of Trees, V= Volume

Source: Primary data processed in 2021

Tectona grandis Lf looks very dominant in the area of community forest and is almost evenly distributed in every village in the management area, namely 82,422 trees with a total volume of standing stock of stands *Tectona grandis Lf* of 19,093,638 m³, species *Swieteniamahogany* amounting to 25.121 trees 5.058,789 m³ is also almost evenly, the type of *Acaciaauricuriformis* tree of 6393 with a total volume of standing stock amounted to 1702.053 M³, the kind *Dalbergia lati Folia Roxb* of 7.146 trees (878.334 m³) is only found in the village Sundul Table 5 and Table 6.

Image above shows that 75% of the tree biomass in the study is accumulated above ground. This study noted that the average ratio between aboveground and belowground tree biomass in the study was 4:1 where the amount of above-ground biomass was much higher than below ground. Which is consistently similar to studies conducted in different forest areas (Mendoza-Ponce and Galicia 2010; Ekoungoulou et al. 2015; Nam et al. (2016)

Lukito Martin, Rohmatiah, 2013 Plant Biomass JUN (Jati Unggul Nusantara) Krowe Village Kab. Magetan averages 183.870 kg/tree. The total potential biomass content of JUN stands is 27.30 tons per hectare, Lukito Martin, Romatiah (2014) Potential biomass of JUN stands in Trosono Village. Magetan regency amounted to 56.2 tons. Or 17,295 tons per hectare. Judging from the potential for biomass in community forests around the Magetan district, Madiun Regency Rohmatiah, Lukito martin, 2015. The amount of biomass potential of JUN stands in Dungus Village, Kab. Madiun averages 27.30 tons per hectare, or a total of 121.1 tons in an area of 131.4

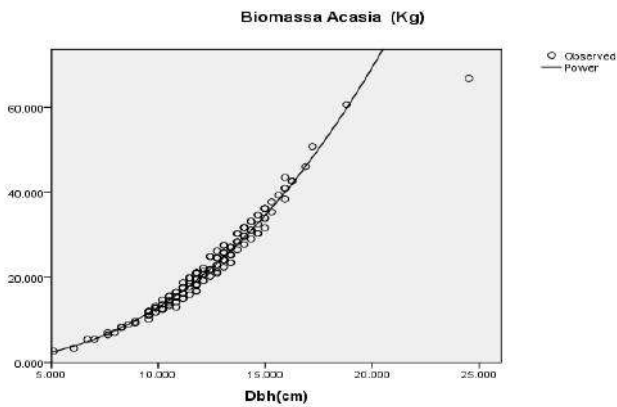
ha Rohmatiah, Lukito Martin, 2015. Estimated volume, biomass and carbon of the community forest of Jati Unggul Nusantara Kare Village. Madiun regency. JUN's biomass content is 168.35 tons per ha. Total of 6,462.67 Tons.

D. Biomass estimation model

The model for estimating the biomass of Community Forest species on the diameter at breast height (Dbh) in the villages of Sundul and Bandar Panjang FMU Argomulyo, Magetan Regency is described in the form of a scatter plot, presented in Table 10 and Figure -5 as follows:

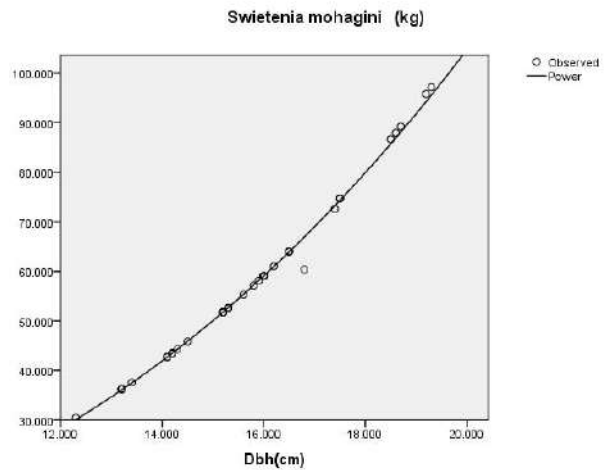
Table. 10: Biomass Allometry Model for Community Forests in Sundul and Bandar Panjang Villages, Argomulyo FMU, Magetan Regency

No.	Type	Model	Equation	R ²	RSS	Std Error
1.	<i>Acacia auriculiformis</i>	Power	$Y = 0,50 dbh^{2,416}$	0,977	1.108	0,070
2	<i>Swietenia mahagoni</i>	Power	$Y = 0,092 dbh^{2,565}$	0,997	0.007	0,016
3	<i>Tectona grandis lf</i>	Power	$Y = 0,092 dbh^{2,565}$	0,997	0.007	0,016
4	<i>Dalbergia latifolia roxb</i>	Power	$Y = 0,115 dbh^{2,065}$	0,792	1.456	0,204
5	Biomass	Power	$Y = 0,048 dbh^{2,442}$	0,979	1.121	0,064



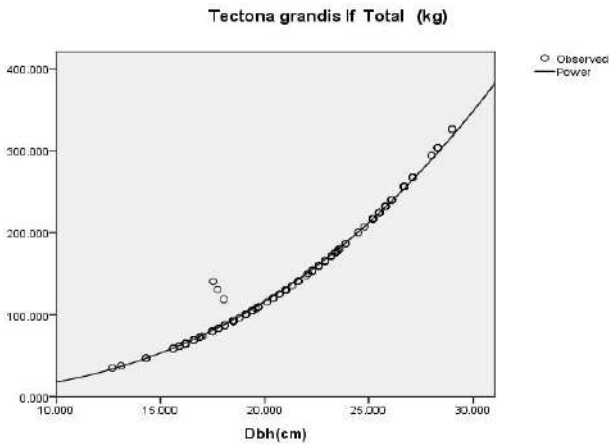
Biomass *Acacia auriculiformis*. Power $Y = 0,50 dbh^{2,416}$
 $R^2 = 0,977$, RSS 1.108, Std Error 0,07

Fig. 5a: Estimation Model of Content (kg) of Community Forest Segments in Sundul Village and Bandar Panjang FMU Argomulyo, Magetan Regency



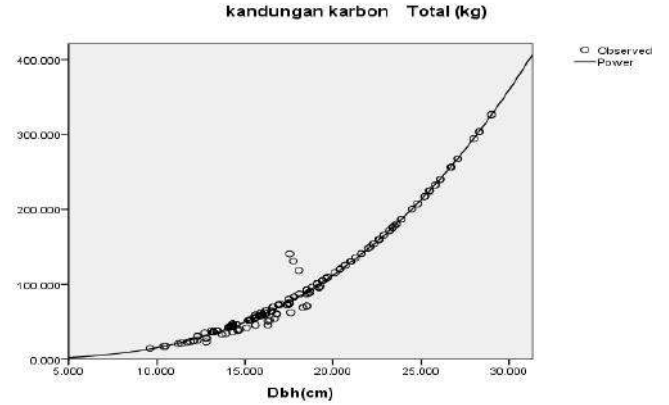
Carbon *Swietenia mahagoni*. Power $Y = 0,048 dbh^{2,564}$ $R^2 = 0,917$, RSS=0,022, Std Error 0,0213

Fig. 5b: Estimation Model of Content (kg) of Community Forest Segments in Sundul Village and Bandar Panjang FMU Argomulyo, Magetan Regency



Carbon *Tectona grandis lf*. Power $Y = 0,035 dbh^{2710} R^2 = 0,987$, RSS = 0,062, Std Error 0,058

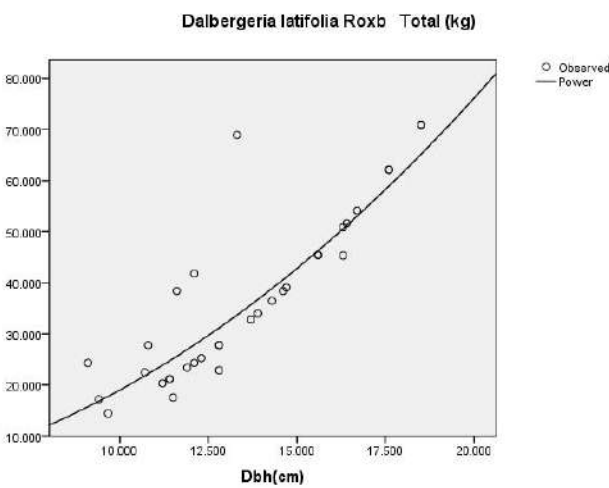
Fig. 5c: Estimation Model of Content (kg) of Community Forest Segments in Sundul Village and Bandar Panjang FMU Argomulyo, Magetan Regency



Carbon Total . Power $Y = 0,021 dbh^{2873} R^2 = 0,971$, RSS1.876, Std Error 0,093

Fig. 5e: Estimation Model of Content (kg) of Community Forest Segments in Sundul Village and Bandar Panjang FMU Argomulyo, Magetan Regency

Table 11. Carbon Content (kg) Per Segment of Community Forests in Sundul Village and Bandar Panjang FMU Argomulyo Magetan Regency



Carbon *Dalbergia latifolia roxb*. Power $Y = 0,190 dbh^{2001} R^2 = 0,767$, RSS= 1,586, Std Error 0,216

Fig. 5d: Estimation Model of Content (kg) of Community Forest Segments in Sundul Village and Bandar Panjang FMU Argomulyo, Magetan Regency

Average Per Ha	Carbon (Kg)				
	Root	Stem	Branch	Leaf	Total (Ton)
<i>Acacia auriculiformis</i>	43.42 7,68	68.26 9,45	15.16 4,78	12.64 3,93	139,5 1
<i>Swietenia mahagoni</i>	60.89 2,98	113.7 53,85	14.55 0,73	11.84 0,43	201,0 4
<i>Tectona grandis lf</i>	124.6 89,03	330.3 05,05	69.11 2,32	50.75 7,48	574,8 6
<i>Dalbergia latifolia roxb</i>	6.331, 52	9.953, 31	2.060, 18	1.843 ,42	20,19
Total	235.3 41,20	522.2 81,66	100.8 88,02	77.08 5,26	935,6 0

Source: Primary data processed in 2021

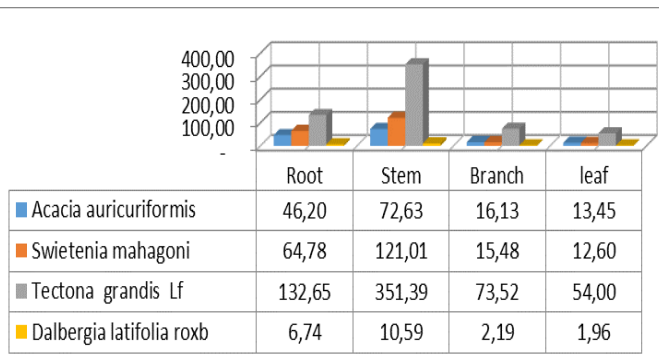


Fig. 6. Carbon Content (kg) Per Segment of Community Forests in the Villages of Sundul and Bandar Panjang FMU Argomulyo Magetan Regency

E. Carbon Potential

Research on the carbon content of community forest stands is limited to living plants. The measurement method used, the carbon value is calculated by multiplying the tree biomass, 47% (Anonymous, 2011). The results of the calculation of the carbon content are presented in Table 11 as follows:

Table 11 shows the highest carbon content per ha for Tectona grandis Lf was 574 tons/ha (61.44%), Swietenia mahagoni 21.48%, Acacia auricuriformis 14.91% and Dalbergia latifolia roxb 2.15%. With an average percentage of carbon (C organic) content of 47%. Based on the carbon content per organ of community forest plants for stem organs it is 55.82%, for root organs it is 25.15% for branch organs 10.78 % and for leaf organs 8.25% as shown in Figure 6.

The average carbon content of community forest plant organs in the villages of Sundul and Bandar Panjang FMU Argomulyo is 47.12%. the need to calculate total community forest carbon depends on the needs and ease of data collection, the average percentage of carbon content (organic C) is 47% Ravindranath, et al, 2008. The total carbon content of the community forest stands of Sundul Village and Bandar Panjang FMU Argomulyo Magetan Regency is 57.983 tons/ha. The area of community forest management area of FMU Argomulyo Kec. Kawedanan Magetan Regency is 199.144 Ha by looking at the types of stands that are in the management area, the carbon content is 46,130.7 tons. Where Sundul has the greatest potential 52.24%. As seen in Table 12:

Table 12. Total Carbon Content (Tons) of Community Forest FMU Argomulyo Magetan Regency

Village/type	Total of Carbon dioxide per species (Kg)						
	N	V (M3)	Root	Stem	Branch	Leaf	Total (Ton)
Sundul Village							
Acacia auricuriformis	5.717	1.394,163	41.208,24	64.780,43	14.389,76	11.997,75	132,38
Swietenia mahagoni	24.117	4.897,107	59.727,49	111.921,67	14.143,75	11.501,10	197,29
Tectona grandis Lf	75.923	18.002,856	117.576,44	311.463,59	65.169,97	47.862,14	542,07
Dalbergia latifolia roxb	7.146	878,334	6.331,52	9.953,31	2.060,18	1.843,42	20,19
Total-1 (Ton)	112.902	25.172,460	224,84	498,12	95,76	73,20	891,93
Bandar Panjang Village							
Acacia auricuriformis	677	307,890	2.219,44	3.489,02	775,02	646,19	7,13
Swietenia mahagoni	1.005	161,681	1.165,49	1.832,18	406,98	339,33	3,74
Tectona grandis Lf	6.499	1.089,052	7.112,59	18.841,46	3.942,35	2.895,34	32,79
Total-2 (Ton)	8.180	1.558,624	10,50	24,16	5,12	3,88	43,67
Total Number	121.082	26.731,084	235,34	522,28	100,89	77,09	935,60
Average	116.992	25.951,772	230,09	510,20	98,33	75,14	913,76

Source: Primary data processed in 2021

The carbon content of stands Jun Krowe Village, Magetan Regency averaged 13.65 tons Ca/Ha, Lukito Martin, Rohmatiah, 2013. The carbon potential of Jati Unggul Nusantara Trosono Village, Magetan Regency was 8.73 tons carbon/ha. The total is 26.1 tons. Rohmatiah, Lukito Martin, 2015 said the total potential carbon content of the JUN (Jati Unggul Nusantara) stands of Dungus Village, District. Madiun amounted to 46.61 tons of carbon. volume per hectare 12.45 – 13.65 tons of carbon per hectare, Rohmatiah, Lukito Martin, 2015 said the total potential carbon content of the JUN stands of the community forest of Kare Village, Madiun Regency is

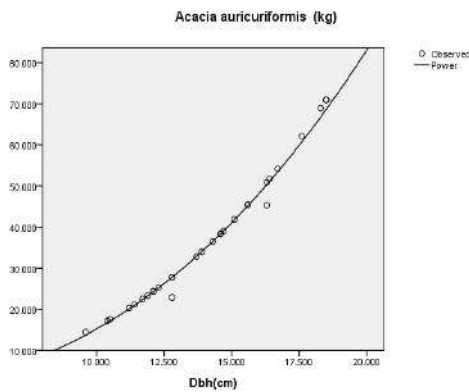
3,180.71 tons of carbon. Per hectare is around 84.175 tons. The carbon content of the UPHR Kare Lestari community forest covering an area of 625.82 hectares totaling 48,709.92 tons or an average of 77.833 tons carbon/ha. Setiahadi, et al (2014).

F. Carbon Estimation Model

The carbon estimation model for Sundul and Bandar Panjang villages in the Argomulyo FMU area, Magetan district for the total carbon of community forest species against diameter at Breast height (Dbh) is presented in Table 13, and the scatter plot is shown in Figure 7:

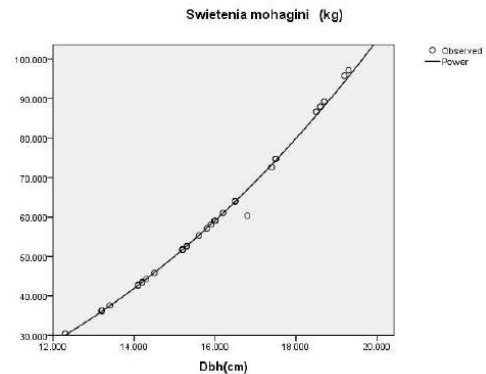
Table 13. Carbon Allometry Model for Community Forests in Sundul and Bandar Panjang Villages, Argomulyo FMU, District. Magetan

No	Type	Model	Equation	R ²	RSS	Std Error
1	<i>Acacia auriculiformis</i>	Power	$Y = 0,0540 dbh^{2,416}$	0,990	0,057	0,045
2	<i>Swietenia mahagoni</i>	Power	$Y = 0,048 dbh^{2,564}$	0,917	0,022	0,021
3	<i>Tectona grandis lf</i>	Power	$Y = 0,035 dbh^{2,710}$	0,987	0,062	0,058
4	<i>Dalbergia latifolia roxb</i>	Power	$Y = 0,190 dbh^{2,001}$	0,767	1,586	0,216
5	Carbon	Power	$Y = 0,021 dbh^{2873}$	0,971	1,876	0,093



Carbon *Acacia auriculiformis*. Power $Y = 0,0540 dbh^{2,416}$
 $R^2 = 0,990$, RSS 0,057, Std Error

Fig. 6a: Estimation Model of Content (kg) of Community Forest Segments in Sundul Village and Bandar Panjang FMU Argomulyo, Magetan Regency



Carbon *Swietenia mahagoni*. Power $Y = 0,048 dbh^{2,564}$
 $R^2 = 0,917$, RSS=0,022, Std Error 0,0213

Fig. 6b: Estimation Model of Content (kg) of Community Forest Segments in Sundul Village and Bandar Panjang FMU Argomulyo, Magetan Regency

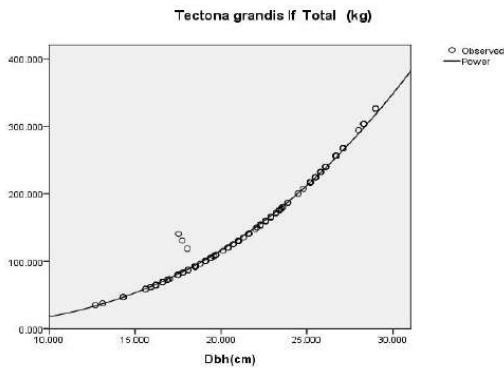
IV. CONCLUSION

1. Average standing stock of 54.25 m³/ha with a total volume of 26,732,831 m³ consisting of *Acacia auriculiformis* stands potential of 5,706 m³/ha, total volume of 1,702,053 m³, *Swietenia mahagoni* of 8,825 m³/ha, total volume of 5,508,789 m³, *Tectona grandis Lf* of 38,495 m³/ha total volume of 19,093,638 m³, and *Dalbergia latifolia roxb* of 1,229 m³/ha total volume of 878,334 m³
2. Biomass content per hectare is 955.32 tons/ha, during from *Acacia auriculiformis* is 148.41 tons/ha, *Swietenia mahagoni* is 213.87 tons/ha, *Tectona grandis Lf* is 611.56 tons/ha, and *Dalbergia latifolia roxb* of 21.48 tons/ha. Total Biomass based on Community forest area 1,944,178 tons.
3. The average carbon content is 467.80 tons C/ha with an area of 199.44 ha, so the potential available carbon dioxide is 913,763 tons of carbon.
4. The carbon absorption capacity of the community forests of Sundul Village and Bandar Panjang FMU Argomulyo to absorb carbon dioxide is 1,716.82 tons C/ha, or is able to absorb CO₂ content of 3,353.512 tons C.
5. Relationship of Biomass, Carbon, and Carbon Uptake with Variable Diameter at Breast height (Dbh) Allometric power model with model:

Model Equation	Allometrik	R ²	RSS
Biomass Allometry	WT = 0,048 Dbh ^{2,442}	0,979	0,064
Carbon Allometry	WT = 0,021 Dbh ^{2,873}	0,971	0,093
CO ₂ absorption allometry	WT = 0,021 Dbh ^{2,6358}	0,973	0,086

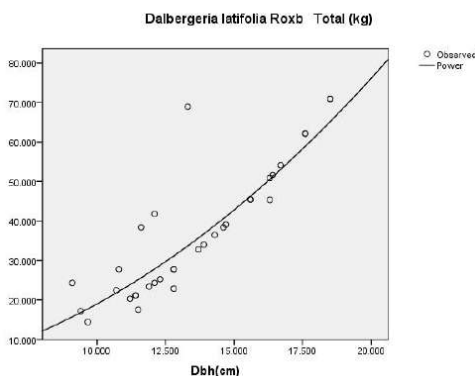
Caption: WT = Total Wight, Dbh = Diameter Brigt High, R = Koef Diterminasi ,RSS = Residual Some Of Square

Measurement of carbon potential in people's forests, when this research was carried out only used the above and bellows ground methods. In the future, it is necessary to measure all aspects (trees, soil, necro-mass, litter) and carbon analysis using all organs/variables with the creation of a comprehensive allometric model.



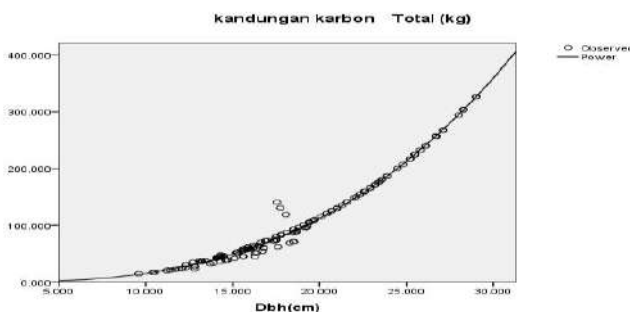
Carbon *Tectona grandis lf*. Power $Y = 0,035 dbh^{2710}$ $R^2 = 0,987$, $RSS = 0,062$, $Std Error 0,058$

Fig. 6c: Estimation Model of Content (kg) of Community Forest Segments in Sundul Village and Bandar Panjang FMU Argomulyo, Magetan Regency



Carbon *Dalbergia latifolia roxb*. Power $Y = 0,190 dbh^{2001}$ $R^2 = 0,767$, $RSS = 1,586$, $Std Error 0,216$

Fig. 6d: Estimation Model of Content (kg) of Community Forest Segments in Sundul Village and Bandar Panjang FMU Argomulyo, Magetan Regency



Carbon Total . Power $Y = 0,021 dbh^{2873}$ $R^2 = 0,971$, $RSS 1.876$, $Std Error 0,093$

Fig. 6d: Estimation Model of Content (kg) of Community Forest Segments in Sundul Village and Bandar Panjang FMU Argomulyo, Magetan Regency

V. ACKNOWLEDGEMENTS

This research was funded by Contract Agreement for the Assignment of Multiple Basic Research Programs for Leading Higher Education Research Programs for Fiscal Year 2021. Nomor 008/SKP2DJ/PFUPT/Unmer.Mdn/LPPM/IV/2021, date April 6, 2021.

REFERENCES

- [1] Basic Law of Forestry of the Republic of Indonesia No. 41 of 1999.
- [2] SNI 7724:2011, National Standardization Body (BSN), "Measurement and Calculation of Carbon Stock. Field Measurement for Appraisal forest Carbon Stock (Ground Based Forest Carbon Accounting)". Book. Jakarta, 16p, 2011
- [3] I. W. S. Dharmawan, N. D. Atmojo, A. Wibowo, T. Partiani, "Set Up Institutional System For Monitoring Forest Carbon Stocks in Meru Betiri National Park", Center for Climate Change and Policy Research and Development Forestry Research and Development Agency Ministry of Forestry, Indonesia, 2013.
- [4] Brown, Sandra, "Estimating Biomass and Biomass Change of Tropical Forests: a Primer". (FAO Forestry Paper - 134). FAO, Rome, 1997
- [5] X.F. Dako, "Design of Community Forest Development in Indonesia", Partners, Vol.1, No. 1, pp. 73-84, 2019.
- [6] D. Darusman, Suharjo D, "Community Forestry: Various Patterns of Community Participation in Forest Management, Book. Bogor Agricultural Institute, Bogor, Indonesia, 1998.
- [7] R. Ekoungoulou, S. Niu, J. J. Loumeto, S. A. Ifo, E. Y. Bocko, F. E. K. Mikieleko, E. D. M. Guiekisse, H. Senou, X. Lium, "Evaluating the carbon stock in above-and below ground biomass in a Moist Central African Forest", Appl Ecol Environ Sci, Vol. 3, No. 2, pp. 51-59, 2015.
- [8] K. Hairiah, S. Rahayu, "Measurement of Stored Carbon in Various Land Uses", World Agroforestry Centre, ICRAF Southeast Asia Regional Office, Bogor, Indonesia, 2007.
- [9] Heiskanen, "BIOMASS ECV REPORT", 2006. [Twww.fao.org/GTOS/doc/ECVs/T12-biomass-standards-report-v01.doc](http://www.fao.org/GTOS/doc/ECVs/T12-biomass-standards-report-v01.doc)
- [10] H. Ika, "Potential of Industrial Plantation Forest in Carbon Sequester: A case study in Acacia auriculiformis and Pinus Plantation Forests", Science and Technology, Vol.3, XVII, March 2005.
- [11] IPCC, "The carbon cycle and atmospheric carbon dioxide", The scientific basis, In Climate change, pp. 185 – 237, 2001.
- [12] J. Penman, M. Gytarsky, T. Hiraiishi, T. Krug, D. Kruger, R. Pipatti, L. Buendia, K. Miwa, T. Ngara, K. Tanabe, F. Wagner, "Good Practice Guidance for Land Use, Land-Use Change and Forestry", Intergovernmental Panel on Climate Change National Greenhouse Gas Inventories Programme, 2003. www.ipcc-nggip.iges.or.jp/lulucf/gpplulucf/unedit.html
- [13] S. Solomon, D. Qin, M. Manning, M. Marquis, K. Averyt, M. M. B. Tignor, H. L. Miller, Z. Chen, "The Physical Science Basis Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel in Climate Change", Cambridge University Press, pp. 96, 2007.
- [14] A. Junaedi, "Contribution of forests as carbon dioxide sinks", Journal of Forest Info, Vol. 5, No. 1, pp.1-7, 2008.
- [15] H. W. C. Krisnawati, R. Adinugroho, Imanuddin, "Monograph Allometric model for estimating tree biomass in different types of forest ecosystems in Indonesia", Center for Research and Development Conservation and Rehabilitation, Forestry Research and Development Agency, Bogor, Indonesia, 2012.
- [16] C. J. Losi, G. S. Thomas, C. Richard, E. M. Juan, "Analysis of Alternative Methods for Estimating Carbon Stock in Young Tropical Plantations", Forest Ecology and Management, Vol. 184, pp. 355 – 368, 2003.
- [17] M. Lukito, "Inventory of eucalyptus plantation forest (Mellaleuca cajuputi subsp cajuputi powell) in producing forest biomass and carbon: Case in eucalyptus plantation forest BKP Sukun, KPH Madiun Perum Perhutani Unit II East Java", Thesis of Universitas Gadjah Mada, Yogyakarta, Indonesia, 2010.
- [18] M. Lukito, A. Rohmatiah, "Biomass and Carbon Estimation of 5 Years Old Tectona grandis Lf Plant (Case of Plantation Forest Area of Jati Unggul Nusantara (JUN) Krowe Village, Lembeyan District, Magetan Regency)", Agri-Tek Journal Vol. 14, No. 1, March 2013.
- [19] M. Lukito, A. Rohmatiah, "Biomass and Carbon Estimation Model of Community Forest Jati Unggul Nusantara Case of Community Forest Jati Unggul Nusantara (JUN) Age 5 Years Trosono Village, Parang District, Magetan Regency)", Agri-Text Journal Vol. 15, No. 1, March 2014.
- [20] S. Manuri, C. A. S Putra, A. D. Saputra, "Forest Carbon Stock Estimation Techniques", Merang REDD Pilot Project, German International Cooperation – GIZ, Palembang, Indonesia, 2011.
- [21] A. Mendoza-Ponce, L. Galicia, "Aboveground and belowground biomass and carbon pools in highland temperate forest landscape in Central Mexico", Forestry, Vol. 83, No. 5, pp. 497-506, 2011.
- [22] V. T. Nam, M. V. Kuyk, N. P. R. Anten, "Allometric equations for aboveground and belowground biomass estimations in an evergreen forest in Vietnam", PLoS ONE, Vol. 11. No. 6, pp. e0156827, 2016.
- [23] A. Purbawiyatna, F. Agung Prasetyo, H. Purnomo, "Studi Penyusunan Panduan Penyiapan Unit Pengelolaan Hutan Alam Untuk Pembangunan Program Redd+", Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH Forests and Climate Change Programme (FORCLIME), Jakarta: Indonesia, 2012.
- [24] Puspitojati T, Mile Y, Fauziah E and Darusman D, "Community Forests Contribution of Rural Communities for Plantation Forests", PT. Kanisius Yogyakarta, 2014.
- [25] Dako XF, "Design of Community Forest Development in Indonesia", Partner, Vol. 1, No. 1, pp. 73-84, 2019.
- [26] R. Setiahadi, Martono, M. Lukito, "Carbon Stock Calculation Model (Carbon Stock) Certified Community Forest SVLK (Timber Legality Verification System) for

- PDD (Project Document Design) Preparation”, 2014
Competitive Grant Research Report, 2014.
- [27] N. H. Ravindranat, R. K. Caturverdi, I. K. Murthy, “Forest conservation afforestation and reforestation in India: Implications for forest carbon stocks”, JSTORE, Vol. 95, No. 2, pp. 216-222, July 2008.
- [28] A. Rohmatiah, M. Lukito. “Volume, Biomass and Carbon Estimation of Community Forest *Tectona grandis* Lf Unggul Nusantara Dungus Village, Dagangan District, Madiun Regency” in Journal of Agri-Tek, Vol. 16, No. 1, 2015
- [29] N. H. Stern, “The Economic of Climate Change”, Cambridge University Press: Cambridge, England, 2007.
- [30] R. E. Walpole, “Introduction to Statistics 3rd Edition”, PT. Main Library Gramedia: Jakarta, Indonesia, 1995

Most prevalent oral manifestations in patients infected by the HIV virus and the importance of dentists in early diagnosis

Jennifer Letícia Moura da Silva¹, Rafaela de Souza Sampaio¹, Lívia Coutinho Varejão¹, Gerson de Oliveira Paiva Neto¹, Rebeca Luzia Solarte Barbosa², Mário Jorge Souza Ferreira Filho²

¹Centro Universitário FAMETRO

²Centro Universitário do Norte - UNINORTE

Received: 03 Oct 2021,

Received in revised form: 25 Oct 2021,

Accepted: 03 Nov 2021,

Available online: 09 Nov 2021

©2021 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—Oral manifestations, HIV,
dentists, early diagnosis.

Abstract—The Human Immunodeficiency Virus (HIV) promotes chronic infection of TCD4+ lymphocytes, resulting in depression of the immune system and making the body susceptible to the development of opportunistic infections, yet it can evolve into Acquired Immunodeficiency Syndrome (AIDS). The oral cavity of the HIV-infected patient is constantly affected by pathologies and neoplasms of different origins, which makes the dentist essential for the early diagnosis of these lesions, treatment and, consequently, for the promotion of the quality of life of this individual. The present work aims to portray the most prevalent oral manifestations in HIV-infected patients and emphasize the importance of the dentist in early diagnosis. After reviewing the literature, it is concluded that the most prevalent manifestations are: candidiasis (pseudomembranous, erythematous, angular and hyperplastic cheilitis), oral hairy leukoplakia, Kaposi's sarcoma, non-Hodgkin lymphoma and periodontal disease (linear gingival erythema, periodontitis necrotizing ulcerative and necrotizing ulcerative gingivitis).

I. INTRODUCTION

The first cases of acquired immunodeficiency syndrome (AIDS) were reported by the Centers for Diseases and Control and Prevention (CDC) in the United States in 1981. The report described Pneumocystis carinii pneumonia and Kaposi's sarcoma in five men previously healthy and from Los Angeles, California, however, it was only listed as the cause of the disease in 1984 (PAULIQUE et al., 2017).

As the number of cases grew, social stigma also took root in society and as a result of the lack of knowledge about the new pathology, the media published news full of prejudice and without scientific evidence that associated the

disease with homosexuals. It is now known that AIDS is caused by the Human Immunodeficiency Virus (HIV), which promotes chronic infection of TDC4+ lymphocytes, resulting in depression of the immune system and making the body vulnerable to the development of various opportunistic infections. (NASCIMENTO et al., 2020).

According to Paulique et al. (2017), the oral cavity of patients with HIV/AIDS is frequently affected by pathologies and neoplasms of different etiologies. In addition, the manifestations of the oral cavity can be one of the first signs of infection, making the dentist an extremely important actor in the early diagnosis of HIV infection.

For Barros et al. (2017), the manifestations of oral lesions or their absence has been an effective marker of the effectiveness of highly active antiretroviral therapy (HAART). Several studies have shown the most common pathologies found in the oral environment of seropositive patients, namely candidiasis in its pseudomembranous, erythematous and angular cheilitis forms, followed by periodontal diseases, hairy leukoplakia (PAULIQUE et al., 2017), Kaposi's sarcoma and non-Hodgkin lymphoma (NEVILLE, 2016).

Given the above, this work aims to portray the main oral manifestations associated with HIV and emphasize the importance of the dentist in the early diagnosis of these lesions.

II. LITERATURE REVIEW

According to Brito (2011), it is known that HIV was discovered in 1981, in the United States, and the origin of the disease is still unknown. After the first diagnosis, studies found two types of HIV: HIV-1, which is more prevalent, with a high mutation rate and more spread around the world, and HIV-2, which has a lower degree of pathogenicity and transmission compared to HIV-1. The HIV-2 transmission rate is so much lower that it is more restricted in West Africa, in countries like Guinea, Senegal, Cape Verde and Gambia.

HIV is a retrovirus that affects the immune system, which causes AIDS. This virus mainly affects the TCD4+ lymphocytes, which are the body's defense cells. After the virus enters the organism, it has a replicative cycle divided into five stages: (1) fusion, when the virus fuses with the cell molecule; (2) reverse transcription, when there is reverse transcription in the formation of a DNA from an RNA; (3) integration, after the retrotranscription of the proviral DNA double strand, incorporation into the cell nucleus occurs; (4) transcription is the time when proviral DNA is transcribed into viral RNA; (5) translation, is the moment when the immature virus undergoes maturation and budding through the cell membrane (BRITO, 2011).

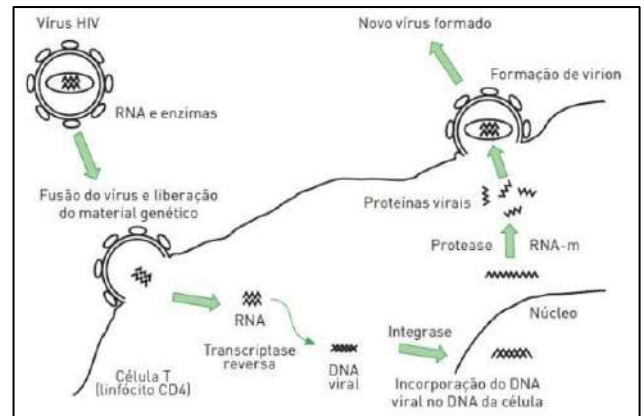


Image1 - Summary life cycle of HIV viral replication Source: BRITO, 2011.

In the view of Dominguez Filho et al. (2021), HIV cannot progress on its own, so it infects any cell that has CD4 as a receptor. Helper T lymphocytes are greatly affected, as are macrophages, monocytes, Langerhans cells, neurons, and glial cells. In addition, the level of CD4+ cells (1,000 to 1,200/mm³) drops to less than 200/mm³ in the later stages of AIDS. Initially, HIV infection may be asymptomatic and may last for about 8 to 10 years. But this asymptomatic period can vary according to external factors stimuli or immune reaction that can accelerate or delay the process. Still, an acute response resembling infectious mononucleosis can occur with the manifestation of generalized lymphadenopathy, headache, diarrhea, sore throat, fever, arthralgia, and myalgia. In the oral cavity, the presence of focal ulcerations and mucosal erythema can be noted. And this acute phase disappears within a few weeks, and the need to investigate the cause may go unnoticed (NEVILLE, 2016). As the virus multiplies and destroys TCD4+ lymphocytes, it depresses the host's immune system, leading to the development of opportunistic infections. This is when the acquired immunodeficiency syndrome (AIDS) occurs. The process from HIV infection to an individual reaching the AIDS stage can take many years. The means of HIV transmission are: unprotected sex, contaminated blood transfusion, accidents with sharp instruments, through mother to child during the perinatal period and breastfeeding (QUARESMA et al., 2019). As described by Neville (2016), oral manifestations can be among the first clinical signs of HIV infection and can also guide its progression to AIDS. Since the signs in the oral cavity are very common, the dentist is the first to find them, becoming responsible for the early diagnosis or diagnostic hypothesis that will refer the patient to the proper treatment.

However, there is still a lot of lack of information and prejudice from some professionals, which leads patients who are already aware of their serological condition to stop seeking dental care. Therefore, it is essential that the dentist is

prepared to identify the oral manifestations of the pathology and treat them properly in order to improve the quality of life of people living with HIV (PLHIV) (NASCIMENTO et al., 2020).

Despite the existence of many studies and prevention campaigns, HIV infection is still an important public health problem. However, the use of Highly Active Antiretroviral Therapy (HAART) increased the life expectancy of PLHIV, enabling the reduction of viral load to undetectable levels and, consequently, the improvement of the effects of immunosuppression, increasing the number of TCD4+ lymphocytes, resulting in a reduction in the appearance of lesions in the oral cavity (ARAÚJO-JÚNIOR et al., 2018). Oral manifestations are one of the first signs of infection by this pathogen and help in the early diagnosis of those who are unaware of their serological condition. Furthermore, the lesions function as a clinical marker of new virus infections, therapeutic failure or disease progression. Among the lesions strongly associated with HIV, the following stand out: candidiasis (erythematous, pseudomembranous, angular and hyperplastic cheilitis), hairy leukoplakia, Kaposi's sarcoma, non-Hodgkin's lymphoma and periodontal disease (linear gingival erythema, necrotizing ulcerative periodontitis and necrotizing ulcerative gingivitis) (NEVILLE, 2016).

GROUP 1: INJURIES STRONGLY ASSOCIATED WITH HIV INFECTION	GROUP 2: LESS COMMON INJURIES ASSOCIATED WITH HIV INFECTION	GROUP 3: INJURIES SEEN IN HIV INFECTION
Erythematous; pseudomembranous candidiasis; angular cheilitis; Hairy leukoplast; Kaposi's Sarcoma; Non-Hodgkin's Lymphoma Periodontal disease: linear gingival erythema, necrotizing gingivitis, necrotizing periodontitis	Bacterial infections Mycobacterium avium intracellulare, Mycobacterium tuberculosis; Melanin hyperpigmentation; Necrotizing ulcerative stomatitis; Salivary gland disease: dry mouth, unilateral or bilateral enlargement of the major salivary glands;	Bacterial infections: Actinomyces israelii, Escherichia coli, Klebsiella pneumoniae; Cat Scratch Disease (Bartonella henselae); Epithelioid (bacillary) angiomatosis (Bartonella henselae); Drug reactions: ulcerations, erythema multiforme,

	Thrombocytopenic purpura; Nonspecific ulcers; Viral infections herpes simplex human papillomavirus, chickenpox zoster.	lichenoid reactions, toxic epidermolysis; Fungal infections except candidiasis: Cryptococci neoformans, Geotrichum candidum, Histoplasma capsulatum, Mucoraceae (mucormycosis/zygomycosis) Aspergillus flavus Neurological disorders: facial palsy, trigeminal neuralgia; Recurrent aphthous stomatitis Viral infections: cytomegalovirus, molluscum contagiosum
--	--	--

II. CANDIDIASIS

Candidiasis is an infection of fungal origin, whose etiologic agent of greatest incidence is *Candida albicans*. This microorganism lives in the oral mucosa of most individuals, waiting for an opportunity to present its pathogenicity (MARCUCCI et al., 2005). The presence of candidiasis in a patient affected by HIV by itself does not indicate progression to AIDS, but often leads to the initial diagnosis of HIV infection (NEVILLE, 2016). According to a study by Paulique et al. (2017), candidiasis can be found in four clinical patterns: pseudomembranous candidiasis, erythematous candidiasis, angular cheilitis and hyperplastic candidiasis. And this pathology is commonly found in patients with HIV/AIDS, resulting from depression of the immune system. Pseudomembranous candidiasis has a white or yellowish surface that can be removed through the semiotechnical scraping maneuver (PAULIQUE et al., 2017). When the pseudomembranous aspect occurs, the CD4+ lymphocyte count is often below 200 cells/mm³ (NEVILLE, et al., 2016).

In the erythematous form, the lesion is reddish with a burning sensation in the middle posterior dorsum of the tongue, soft palate and mucous membranes (GOMES; SOARES; FELIPE, 2020). And this starts when the CD4+

lymphocyte count drops to less than 400 cells/mm³ (NEVILLE, 2016).

As highlighted by Gomes, Soares and Felipe (2020), it is known that angular cheilitis is usually associated with the use of prostheses. This lesion causes pain resulting from the formation of cracks in the labial commissure, due to the junction of bacteria and fungi (*Staphylococcus aureus* and *Candida albicans*). The immunocompromised patient is susceptible to the involvement of angular cheilitis due to low immunity, poor oral hygiene, loss of vertical dimension and nutritional deficiencies.

The hyperplastic form has a hard and rough appearance on palpation, with a whitish color. It occurs mainly in the retrocommissural mucosa and is not removed by scraping, unlike pseudomembranous candidiasis (NASCIMENTO et al., 2020).

HIV infection, as highlighted by Pires et al. (2017), is often associated with psychiatric disorders, the most common being depression and tricyclic antidepressants (nortriptyline, amitriptyline) are used to treat it, but they have low flow as a side effect. salivary. And these medications can make the mucosa more susceptible to the appearance of candidiasis due to a common side effect of these medications, which is xerostomia.

The diagnosis is made through the clinical aspects of the lesion, which can also use exfoliative cytology with PAS or Grocott staining, and sometimes it is necessary to use a biopsy to rule out the possibility of other lesions (ALMEIDA, 2016). Treatment is through topical and systemic antifungal agents. Nystatin (100,000UI/ml) can be used as an oral suspension, nystatin in tablets, oral gel base such as 1% clotrimazole and miconazole. Furthermore, when the patient does not respond to topical therapy, systemic azoles such as fluconazole (150mg) and itraconazole (100mg) can be used (GOMES; SOARES; FELIPE, 2020).

It is noteworthy that individuals who have harmful habits, poor oral hygiene, wear removable dentures and have reduced salivary flow tend to have greater resistance to the usual therapies and this fact can lead to the evolution of oral candidiasis to the pharynx, esophagus and trachea (GOMES; SOARES; FELIPE, 2020).

According to Izoton and Israel (2020), topical and systemic therapies have some limitations and adverse effects that lead to resistance of these microorganisms, leading to an increase in relapses in a short period of time. Therefore, photodynamic therapy (PDT) has been studied and proved to be effective in the treatment of candidiasis in people living with HIV/AIDS. PDT consists of associating a light source and a photosensitizing dye

compatible with this light, applying them to tissue that has oxygen, thus promoting the death by photo-oxidation of pathogenic agents.

III. ORAL LEUKOPLAKIA

Oral hairy leukoplakia is an opportunistic infection associated with the Epstein-Barr virus (EBV) and clinically presents as a white mucosal plaque that does not show a scaling. According to Gomes, Soares and Felipe (2020), it usually affects the lateral edge of the tongue with clinical features that can range from white, faint streaks to thick, corrugated leucoplastic areas, with a rough cerotic surface. However, these aspects are not pathognomonic. Rarely, the buccal mucosa, soft palate, esophagus and pharynx are affected (NEVILLE, 2016).

As reported by Paulique et al. (2017), its clinical appearance is often enough to make the diagnosis, but even so, cytopathology, histopathology, immunohistochemistry, in situ hybridization, PCR, and electron microscopy can be used. The treatment of OLP is often not necessary, although discomfort in the region and aesthetic needs may require therapy (NEVILLE, 2016). Therefore, it can be treated through cryotherapy or surgery, and anti-herpes virus drugs such as acyclovir and desiclovir generate rapid resolution.

Gomes, Soares and Felipe (2020) highlight that oral manifestation is considered a predictor of progression to AIDS and the identification of oral hairy leukoplakia in immunocompetent patients requires dentists to investigate the patient's serological status.

IV. KAPOSI SARCOMA

KS is a multifocal neoplasm that originates from vascular endothelial cells. It manifests clinically with multiple lesions in the skin and oral cavity, although a single lesion is identified first. Commonly affected areas of the skin are the arms, trunk, head and neck. In the oral cavity, the most affected structures are the hard palate, gums and tongue, however, any region can be affected (NEVILLE, 2016).

They are clinically characterized as red or purple plaques, focal or diffuse, may be completely asymptomatic and may go unnoticed by professionals. They can even affect simple activities such as speaking and eating. In addition, they can lead to tooth loss and airway compromise (PAULIQUE et al., 2017).

Human herpes virus type 8 appears to be the infectious agent responsible for its development. Diagnosis is made through incisional biopsy, with the possibility of

performing immunohistochemistry, PCR or in situ hybridization to identify HHV-8 (GOMES; SOARES; FELIPE, 2020).

Borges, Real and Schreiner (2019) clarify that there are several treatment modalities for KS. Existing treatments include radiotherapy, laser therapy, cryotherapy, vincristine injections or surgical excision. It is noteworthy that most of these treatments do not cure, but reduce the size and number of lesions.

For patients who do not use antiretroviral drugs, they should start as soon as they are aware of their serological status, since these drugs act to control the replication of the virus and consequently improve the immune system, increasing the survival of these individuals (BORGES ; REAL; SCHREINER, 2019).

V. NON-HODGKIN LYMPHOMA

Lymphoma is a neoplastic change where its precursors are divided into Hodgkin's Lymphoma (LH) and Non-Hodgkin's Lymphoma (NHL), usually this manifestation occurs in lymph nodes, and can also be extranodal, when it happens in extranodal it is usually found in the stomach, glands salivary, skin, bone and rarely in the oral cavity (GOMES; PIAZZA; CASTELO, 2019).

Non-Hodgkin's lymphoma is a malignant neoplasm that originates in lymphoid tissue, most commonly from cells of the series of B lymphocytes that have been transformed, but extranodal lymphomas are also found (KUMAR; ABBAS; FAUSTO, 2010).

The lymphoid tissue plays a fundamental role in the recognition and processing of non-environmental antigens, such as: fungi, viruses and bacteria. The highest prevalence of this disease is in patients with immunological alterations (NEVILLE, 2016).

According to Neville (2016), Non-Hodgkin Lymphoma has two types of presentation: nodal and extranodal. Nodal lymphoma that has slow growth with painless bulging, where the lesion covers local lymph nodes, considered a low-grade lymphoma, but with disease progression.

The other form of presentation is extranodal lymphoma, which, when in the mouth, affects soft tissue, causing an increase in volume, without painful and diffuse symptoms. The most common region in the mouth is the gingiva, followed by the palate, maxilla, amygdala, parotid, tongue, lip, oral mucosa, Waldeyer's ring, paranasal sinuses, laryngeal tissues and bone structure (GOMES; PIAZZA; CASTELO, 2019).

Clinical signs of NHL in the mouth include toothache, numbness, tooth mobility, cervical lymphadenopathy, ulcerated masses or lesions, with nonspecific radiographic exams (GOMES; PIAZZA; CASTELO, 2019).

Gomes, Piazza and Castelo (2019) note that this diagnosis of NHL is difficult to make, as it can be confused with other pathological entities, such as dentoalveolar and periodontal abscess, among others. For an assertive diagnosis it is necessary to perform an incisional biopsy and anatomopathological and immunohistochemical tests.

When diagnosed in a low degree (nodal), some experts recommend "wait and observe", as the progression is slow, and even when treated with chemotherapy, the tumor has a high rate of recurrence (NEVILLE, 2016).

Knowing this, to make the proper treatment, several factors must be considered, such as: the patient's medical history, systemic condition, stage and degree of lymphoma, surgical treatment is not recommended in NHL cases (NEVILLE, 2016).

According to Gomes, Soares and Felipe (2020), for extranodal NHL, treatment must be done with chemotherapy associated with radiotherapy, and a regimen of cyclophosphamide, doxorubicin, adriamycin, vincristine and prednisone. For Petroianu et al. (2020), CHOP chemotherapy is the best long-term treatment to be used when the disease is already generalized.

It is worth mentioning that NHL has different etiologies, where the disease may be related to heredity, environmental, occupational, dietary, immunological, and HIV factors, and this relationship is still poorly established in the literature (PETROIANU et al., 2020).

VI. LINEAR GINGIVAL ERYTHEMA

According to Neville (2016), linear gingival erythema is an oral manifestation strongly associated with HIV. Sometimes ELG is confused with conventional marginal gingivitis. The disease is believed to be an abnormality in the host's immune response to bacteria. However, it is known that this lesion is associated with other pathologies and is not restricted to PLHIV.

According to Dominguez Filho et al. (2021), linear gingival erythema is associated with the Acquired Immunodeficiency Virus. In a cross-sectional study with 100 HIV-positive patients, 6 of them had the pathology. Its characteristics in the bacterial origin are presented as a linear erythematous and edematous band, persistent and easily bleeding, and in the marginal gingiva a distance of 2

to 3 mm from the free gingiva, which may extend to the alveolar mucosa (BARROS et al., 2017).

Oral candidiasis and linear gingival erythema have been diagnosed together, assuming that *Candida* spp has a strong association as an etiologic agent. Monitoring with an interval of two to three months is essential to check whether the patient is developing more severe periodontal diseases, it is known that marginal gingivitis that responds easily to treatment are not ELG (BARROS et al., 2017).

Treatment consists of debridement of the lesion, irrigation with iodinated alcohol, chlorhexidine and antifungal agents (NEVILLE, 2016).

VII. NECROTIZING ULCERATIVE PERIODONTITIS

Periodontal disease is one of the most common pathologies found in PLHIV patients, even those undergoing treatment. This lesion can often be found in the oral cavity before diagnosis, as several authors point out that this oral manifestation may be the first sign of the disease (BARROS et al., 2017).

According to Gomes, Soares and Felipe (2020), the main difference between Necrotizing Ulcerative Periodontitis (PUN) and Necrotizing Ulcerative Gingivitis (GUN) is the loss of periodontal attachment and bone, where periodontal pockets are hardly found, the exposure of tubercles Bone, ulcerated and necrotic lesions with spontaneous bleeding are similar to GUN.

The symptomatology of the disease is intense pain, edema, spontaneous hemorrhage, loss of more than 6 mm of attachment within a period of six months, periodontal pockets are rarely found due to the progression of necrosis in gingival tissue and adjacent alveolar bone loss (NEVILLE, 2016).

Periodontal disease can act as an operant for the reactivation of HIV as it can be linked to systemic changes, so the treatment is extremely important so that there is no immunosuppression due to an opportunistic infection, the protocol used does not differ from the patients who do not have HIV (BARROS et al., 2017).

Control of bacterial plaque, probing periodontal pockets, debridement of necrotic tissue, pain control, antimicrobial treatment and use of metranidazole as immediate treatment for a prolonged period. Initially, mouthwashes with chlorhexidine should be done, after the initial debridement, the removal of other compromised tissues follows, where the interval should be 24 hours and repeated every 10 days in two or three consultations,

depending on the patient's systemic response (PAULIQUE et al., 2017).

It is recommended that, starting from this first improvement, the consultation with the patient should be monthly, and observing how the pathology is progressing, these visits extend to three months (NEVILLE, 2016).

VIII. NECROTIZING ULCERATIVE GINGIVITES

According to Sartori et al. (2019), 11% of the population living with HIV is affected by necrotizing ulcerative gingivitis, with young adults being the most affected. Paulique et al. (2017) point out that in the normal population the index is less than 0.1%.

Necrotizing ulcerative gingivitis is an infection by gram-negative bacteria such as spirochetes, spindle bacteria and *Prevotella intermedia* that cause inflammation in the region of free gingiva, attached gingiva and vestibular and jugmental mucosa (NEVILLE, 2016; PAULIQUE et al., 2017 ; SARTORI et al., 2019).

Patients with GUN have profuse and spontaneous bleeding, severe edema, necrotic lesions, painful symptoms, foul odor and no loss of periodontal attachment (NEVILLE, 2016; PAULIQUE et al., 2017).

As a treatment plan in more acute cases of the disease, the debridement of lesions and root and coronary planing are formulated (SARTORI et al., 2019) with hydrogen peroxide irrigation (NEVILLE, 2016), as the main colonies of micro-organisms are gram-negative and are close to the external gingiva region (PAULIQUE et al., 2017), the use of gauze soaked in 0.12% corhexidine is necessary for the removal of necrotic tissue associated with chlorhexidine mouthrinse GOMES; SOARES; FELIPE, 2020), make a prescription with the use of antibiotics, after the first clinical sequence, follow-up is followed every 1 month, with a satisfactory immune response, extend the visits to every 3 months.

IX. DISCUSSION

The HIV virus is a retrovirus that infects CD4+ T cells, causing depression of the immune system and making it vulnerable to the involvement of opportunistic infections and neoplasms of different etiologies (BORGES; REAL; SCHREINER, 2019).

According to Quaresma et al. (2019), the individual can develop the most advanced stage of the disease, which

is AIDS, and this can take many years. The author emphasizes that the means of HIV transmission are: unprotected sex, contaminated blood transfusion, occupational accidents, through mother to child during the perinatal period and breastfeeding.

Neville (2016) argues that oral manifestations are among the first symptoms of HIV infection, where its progression alerts to the most acute phase of the disease, AIDS. Aitken-Saavedra et al. (2021) support that it is one of the first appearances associated with the disease and emphasizes the importance of the dentist in early diagnosis.

The classification of oral manifestations shows that candidiasis is a lesion with the highest rate in patients infected by the pathology (MARCUCCI, 2005), not being a marker of disease progression (NEVILLE, 2016), but being an indicative lesion for initial diagnosis, it can affect up to 94% of patients (AITKEN-SAAVEDRA et al., 2021). As described by Izoton and Israel (2020), candidiasis can be treated through topical and systemic therapies, however, these methods have some limitations and can be associated with photodynamic therapy (PDT).

Pizzolato et al. (2018) point out that oral manifestations can be bacterial, viral, fungal, neoplastic and of idiopathic etiology. Its most common manifestations are Candidiasis (pseudomembranous, erythematous, angular and hyperplastic cheilitis), Hairy Leukoplakia, Kaposi's Sarcoma, Non-Hodgkin Lymphoma and presentations of periodontal diseases, which is one of the lesions often associated with HIV, manifestations such as linear erythema gingival, GUN and PUN mark the progression (NEVILLE, 2016) without the effectiveness of HAART (GOMES; SOARES; FELIPE, 2020), where periodontal disease can be an operant for the reactivation of HIV and contribute to the progression to AIDS (AITKEN -SAAVEDRA et al., 2021).

HIV is still a public health problem and still has no cure. However, Highly Active Antiretroviral Therapy (HAART) enables the increase of TCD4+ lymphocytes, reducing the appearance of lesions in the oral cavity (ARAÚJO-JÚNIOR et al., 2018). However, Paulique et al. (2017) report that even with current treatments, the susceptibility to oral lesions is still high in these patients. However, the dentist must be able to diagnose and treat these injuries early.

X. CONCLUSION

The present work shows which are the most frequent lesions in patients infected with the HIV virus and that even when undergoing therapy, these individuals may

be more susceptible to opportunistic infections due to depression of the immune system. It is observed that the appearance of these lesions function as a clinical marker of new virus infections, therapeutic failure or disease progression. Given the above, the dentist has a fundamental role in the recognition of these pathologies and must be able to carry out an early diagnosis, which may indicate the first symptoms of the disease and assist in treatment, promoting quality of life for people affected by the HIV virus.

REFERENCES

- [1] Paulique, n. c. et al. manifestações bucais de pacientes soropositivos para hiv/aids. **arch. health invest.**, v. 6, n. 6, p. 240-244, 2017. disponível em: <<http://dx.doi.org/10.21270/archi.v6i6.2067>>. acesso em: 21 ago. 2021.
- [2] Nascimento, c. f. do et al. desmistificando o atendimento odontológico para paciente soropositivo: revisão de literatura. **braz. j. of develop.**, v. 6, n. 11, p. 91634-91652, 2020. disponível em: <<https://www.brazilianjournals.com/index.php/brjd/article/view/20425>>. acesso em: 28 ago. 2021.
- [3] Barros, a. v. m. de et al. doenças periodontais em pacientes hiv positivos: uma revisão da literatura. **revista periodontia**, v. 27, n. 2, p. 54-60, 2017. disponível em: <<https://pesquisa.bvsalud.org/portal/resource/pt/biblio-847103>>. acesso em: 10 set. 2021.
- [4] Neville, b. **patologia oral e maxilofacial**. rio de janeiro: elsevier, 2016.
- [5] Brito, m. a. de. fármacos recentes usados para o tratamento da infecção pelo hiv-1: enfuvirtida, maraviroc, raltegravir e etravirina. **rev. ciênc. farm. básica apl.**, v. 32, n. 2, p. 159-168, 2011. disponível em: <<https://rcfba.fcfar.unesp.br/index.php/ojs/article/view/340>>. acesso em: 21 ago. 2021.
- [6] Dominguez filho, o. de j. l. et al. manifestações orais em pacientes imunodeprimidos pelo vírus da imunodeficiência humana (hiv): revisão da literatura. **revista eletrônica acervo saúde**, v. 13, n. 2, p. 1-7, 2021. disponível em: <<https://doi.org/10.25248/reas.e6034.2021>>. acesso em: 21 ago. 2021.
- [7] Quaresma, m. do s. m. et al. prevalência de doenças oportunistas em pacientes hiv positivos em uma unidade de referência da amazônia. **revista eletrônica acervo saúde**, v. 11, n. 5, p. 1-9, 2019. disponível em: <<https://doi.org/10.25248/reas.e306.2019>>. acesso em: 21 ago. 2021.
- [8] Araújo-júnior, j. l. de et al. perfil clínico e epidemiológico das alterações bucais em portadores do hiv. **arch. health invest.**, v. 7, n. 8, p. 339-343, 2018. disponível em: <<http://dx.doi.org/10.21270/archi.v7i8.3022>>. acesso em: 21 ago. 2021.
- [9] Gomes, m. a. b.; soares, m. v. s.; felipe, l. c. da s. manifestações orais e tratamento em pacientes decorrentes da síndrome imunodeficiência adquirida: revisão de literatura. **facit business and technology journal**, v. 1, n. 21, p. 88-104, 2020. disponível em: <<http://revistas.faculdadefacit.edu.br/index.php/jnt/article/view/770>>. acesso em: 28 ago. 2021.

- [10] Pires, a. b. et al. reações adversas na cavidade oral em decorrência do uso de medicamentos. **rev. salusvita**, v. 36, n. 1, p. 157-185, 2017. disponível em: <https://secure.unisagrado.edu.br/static/biblioteca/salusvita/salusvita_v36_n1_2017_art_12.pdf>. acesso em: 28 ago. 2021.
- [11] Almeida, o. p. **patologia oral**. são paulo: artes médicas, 2016.
- [12] Izoton, c. f. g.; israel, m. s. eficácia antimicrobiana da terapia fotodinâmica no tratamento da candidíase oral em pessoas vivendo com hiv/aids. **rev. pesqui.(univ. fed. estado rio j. online)**, v. 12: p. 505-509, 2020. disponível em: <<https://doi.org/10.9789/2175-5361.rpcfo.v12.8598>>. acesso em: 10 set. 2021.
- [13] Borges, s. a. l.; real, l. h. g.; schreiner, r. b. sarcoma de kaposi em pacientes hiv: novamente uma realidade. **revista eletrônica acervo saúde**, v. 11, n. 6, p. 1-6, 2019. disponível em: <<https://doi.org/10.25248/reas.e352.2019>>. acesso em: 21 ago. 2021.
- [14] Gomes, r. f. t.; piazza, j. l.; castelo, e. f. linfoma não-hodgkin, manifestação no sistema estomatognático: relato de caso clínico. **revista saúde**, v. 45, n. 3, p. 1-7, 2019. disponível em: <<https://periodicos.ufsm.br/revistasaude/article/view/32478/0>>. acesso em: 28 ago. 2021.
- [15] Kumar, v.; abbas, a.; fausto, n. **robbins e cotran – patologia: bases patológicas das doenças**. rio de janeiro: elsevier, 2010.
- [16] Petroianu, a. et al. etiopathogenic, epidemiologic and clinical-therapeutic comparison of non-hodgkin's lymphoma and kaposi's sarcoma. **arq. bras. cir. dig.**, v. 33, n. 2, p. 1-4, 2020. disponível em: <<https://doi.org/10.1590/0102-672020200002e1521>>. acesso em: 10 set. 2021.
- [17] Sartori, l. r. m. et al. gengivite ulcerativa necrosante: um relato de caso. **revista da faculdade de odontologia de lins**, v. 29, n. 1, p. 39-46, 2019. disponível em: <<https://www.metodista.br/revistas/revistas-unimep/index.php/fo/article/download/4099/2322>>. acesso em: 21 ago. 2021.
- [18] Marcucci, g. et. al. **fundamentos de odontologia: estomatologia**. rio de janeiro: guanabara koogan, 2005.
- [19] Aitken-saavedra, j. et al. oral lesions diagnosis associated with hiv: report of 3 clinical cases. **revista estomatológica hereditaria**, v. 31, n. 2, p. 140-147, 2021. disponível em: <<https://doi.org/10.20453/reh.v31i2.3975>>. acesso em: 21 ago. 2021.
- [20] Pizzolato, b. et al. oral manifestations in hiv patients. **j. interdiscipl. med. dent. sci.**, v. 6, n. 1, p. 1-4, 2018. disponível em: <10.4172/2376-032x.1000228>. acesso em: 10 set. 2021.

Pregnant Women's Perception about the Influence of Physiotherapy in Prenatal and Labor in a Neighborhood of the City of Linhares-ES

Julia Dassié Nascimento Rossetto, Daniel Rodrigues Silva

Received: 24 Sep 2021,

Received in revised form: 25 Oct 2021,

Accepted: 02 Nov 2021,

Available online: 11 Nov 2021

©2021 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— *Natural childbirth, Cesarean delivery, Obstetric physiotherapy, gestation.*

Abstract— *Pregnancy is an important phase in the life of any woman, as it represents a complex and full of changes evidenced from conception to postpartum. In this moment of intense changes, the body changes daily bringing physical and emotional repercussions. The physiological changes in pregnancy are due to the necessary adaptations specific to the maternal-fetal complex and childbirth. Initially, the first changes are due to hormonal action and generate significant impacts on the woman's body and routine. The main changes in maternal physiology occur in the cardiocirculatory, respiratory and gastrointestinal systems, in addition to metabolic and hematological changes.*

The preparation of the body for pregnancy involves adjustments of the most varied systems, depending on a complete multidisciplinary team that will be able to offer the pregnant woman quality support to the varied body systems.

The physiotherapist is an essential health professional who works both in the prevention and rehabilitation of the population's health. The insertion of this professional in several areas of health tends to happen due to the profession evolving clinically and scientifically contributing to a large scale in the health of the individual in its entirety.

The present study is justified by the need to verify the knowledge of pregnant women in relation to the benefits of physical therapy in prenatal care and during labor. The knowledge generated from this study will serve as important support material for physical therapists and pregnant women, favoring the insertion of this professional in this area.

I. INTRODUCTION

Pregnancy is an important stage in any woman's life, as it represents a complex moment full of changes evidenced from conception to postpartum. In this moment of intense changes, the body is transformed daily, bringing physical and emotional repercussions. (SILVA, 2018)

The physiological changes in pregnancy are due to the necessary adaptations of the maternal-fetal complex and childbirth. Initially, the first changes are due to hormonal

action and generate significant impacts on the woman's body and routine. The main changes in maternal physiology occur in the cardiocirculatory, respiratory and gastrointestinal systems, in addition to metabolic and hematological changes. (QUEVEDO, 2010)

The preparation of the body for pregnancy involves adjustments of the most varied systems, depending on a complete multidisciplinary team that will be able to offer

the pregnant woman quality support to the various bodily systems. (BRANDÃO, et al, 2008)

Physiotherapy is a health science that studies, prevents and treats various functional kinetic disorders that result from alterations in the organs and system of the human body. (VALENCIO and RODRIGUES, 2015)

The physiotherapist is an essential health professional who works both in the prevention and rehabilitation of the population's health. The insertion of this professional in several areas of health tends to happen because the profession evolves clinically and scientifically, contributing on a large scale to the individual's health in its entirety. (OLIVEIRA, 2018)

One of the specialties of physiotherapy is Women's Health, whose area mainly covers urogynecology and gynecological disorders, post-mastectomy women, obstetrics and changes associated with sexuality. (PADILHA, et al. 2015)

Currently, the presence of the physiotherapist in the care of pregnant women and in labor is little observed. Not only on the part of pregnant women, but among health professionals, there is little knowledge about the role of this professional in this field, as well as the evidence of benefits in the health of pregnant women. (GOMES and OLIVEIRA, 2005)

It is observed that most hospitals and maternity hospitals still do not offer their pregnant women a welcoming and humanized obstetric care that is concerned with meeting the needs of pregnant women, respecting their individuality, desire and providing security for the family. A complete and well-educated multidisciplinary team can significantly contribute to a woman's life and her experience acquired during this period. (VELHO, et al. 2014)

In obstetrics, the physiotherapist has several techniques that contribute to the well-being of pregnant women, including the therapeutic exercise that is widely used in prenatal, delivery and postpartum work. (SANTOS, et al. 2019)

During the gestational period, this professional is indispensable, because through the assessment and monitoring of physiological changes, he is able to promote the well-being of the woman and the baby. (SOUZA, et al. 2017)

During labor, whether by vaginal or cesarean delivery, this professional is able to help the mother and baby through techniques that favor analgesia, decrease tension, relaxation and safety, making this moment more special and less traumatic. (SANTOS and OLIVEIRA, 2016)

This study is justified by the need to verify the knowledge of pregnant women in relation to the benefits of physiotherapy in prenatal care and during labor.

The knowledge generated from this study will serve as important support material for physical therapists and pregnant women, favoring the insertion of this professional in this area.

II. UNDERSTANDING THE MENSTRUAL CYCLE AND FERTILIZATION

Pregnancy is an important and complex stage in any woman's life and corresponds to the period before childbirth with numerous changes in the body, as it is constantly changing day after day. Knowing the physiological basis of these changes helps the physiotherapist in decision making for treatment, exercise prescription and identification of their role in obstetrics. (BARACHO, 2007)

For a woman to become pregnant, fertilization must take place through an encounter of a sperm with a secondary oocyte. Every month the woman's body prepares for this encounter to occur, but when it doesn't happen, an episode called menstruation occurs. (STEPHENSON and CONNOR, 2004)

Knowing a woman's menstrual cycle is the first step to understand the process of fertilization and, consequently, the process of development of pregnancy.

The menstrual cycle usually occurs every 28 days, starting at menarche and ending at menopause. Cyclic changes in ovarian function that occur monthly cause variation in the secretion of female hormones and in the structure of the inner lining of the uterus. This cycle can be divided into three phases: follicular, ovulatory and luteal. (POLDEN and MANTLE, 2005)

The follicular phase starts on the first day of menstruation with an average duration of 14 days, and can be subdivided into primordial, pre-antral and pre-ovulatory phases. At the beginning of the follicular phase, the concentration of estrogen and progesterone is still low, and as a result, the upper layers of the thick endometrium break and leak, starting menstrual bleeding. At this stage, the concentration of follicle-stimulating hormone (FSH) increases progressively, stimulating the development of many follicles in the ovaries. As the concentration of follicle-stimulating hormone drops, only one follicle continues to develop and produce estrogen. (SILVA, 2018)

In the ovulatory phase, the main event is ovulation and it occurs in the middle of the menstrual cycle, on the 14th day. The increased production of luteinizing hormone (LH) finalizes the egg's maturation, which in a few hours

will be released and directed to the fallopian tubes. At this stage, testosterone and estrogen levels are high and the woman enters the fertile period, which occurs about 2-3 days before and 2-3 days after ovulation. During this phase, it is possible to observe thicker and more elastic cervical mucus due to the influence of estrogen and LH. (BIRTH, 2013)

The luteal phase begins after ovulation due to the release of the egg and the closing of the follicle, thus forming the corpus luteum, a structure that produces large amounts of the hormone progesterone. This hormone has numerous functions such as preparing the uterus for the implantation of an embryo and causing the endometrium to thicken to favor the nourishment of the implanted embryo. (DUTRA, 2005)

When the released egg is not fertilized or when it is fertilized but cannot implant itself, the corpus luteum undergoes degeneration with a drop in the concentration of estrogen and progesterone, favoring the beginning of a new menstrual cycle. (CARLSON, 2014)

However, when the sperm meets the secondary oocyte, fertilization occurs. After fertilization the egg begins to undergo dividing processes and for approximately the next 6 to 8 days a group of cells will be fed by secretions from the fallopian tube as it is pushed into and forward from the uterine cavity. (CARLSON, 2014)

When the embryo reaches the uterus, the production of a hormone called chorionic gonadotropic hormone (HCG) starts, inducing the ovary to produce progesterone and estrogen that will favor the stability of the fetus during pregnancy. (MOORE and PERSAUD, 2008)

The pituitary gland is an endocrine gland with multiple functions, which, when receiving information about high levels of progesterone and estrogen production, stops producing the hormones FSH and LH, preventing a new ovulation with consequent suspension of the menstrual cycle. (MOORE and PERSAUD, 2008)

III. PHYSIOLOGICAL ADAPTATIONS IN THE PREGNANCY PERIOD

Knowing the mechanisms of physiological adaptations of the maternal organism during the gestational period is an excellent strategy for obstetric care and humanized care.

The various physiological changes of pregnancy involve all bodily systems with biological, bodily, mental and social repercussions that depend on adequate professional monitoring so that women feel safe and able to go through this moment. (SILVA, et al. 2015)

IV. HUMANIZED BIRTH

The humanization of health care is a continuous process and demands permanent reflection on the acts, behaviors and behaviors of each person involved in the relationship. Greater self-knowledge is needed to better understand the other with their specificities and to be able to help without trying to impose values, opinions or decisions (Brasil, 2004).

The humanization of care with a focus on women's health comes as a consequence of the construction of policies aimed at this audience. Such policies began to be thought of in the 20th century, between the 30s and 70s, specifically in the 60s the Maternal and Child Health Program (PSMI) was created, at a time when the government was still under the power of the President Getúlio Vargas. The Ministry of Health and Education were combined, and their initial attention permeated the collection of data that could express what needs this public could present and had a purely curative character. (Brazil, 2018).

According to the Aurélio dictionary, the word humanize means: To inspire, to sweeten, to smooth, to civilize, to become human, to be compassionate. The national humanization policy (PHN) aims to humanize childbirth is to rescue the role of women at the time of giving birth. The childbirth humanization program (PHNP) understands that childbirth is a complex event and that over the years it has become a medical and institutionalized matter, completely separate from family and community life. (Mônica, BM, 2010).

Special attention to labor and birth is marked by excessive medicalization, intervention methods that prove and prove unnecessary and potentially iatrogenic, and abusive practices of cesarean section. There are still issues such as the isolation of pregnant women from their families, lack of privacy and disrespect for their anatomy. Situations like this contribute to increased maternal and perinatal risks (Brasil, 2004).

The main strategy of the Program for Humanization in Prenatal, Delivery and Birth (PHPN) is to ensure improved access, coverage and quality of prenatal care, delivery and postpartum care for pregnant women and newborns, from the perspective of citizenship rights. The program is based on the right to humanize obstetric and neonatal care as a condition for adequate monitoring of childbirth and the puerperium. (Mônica, BM, 2010).

V. PERFORMANCE OF OBSTETRIC PHYSIOTHERAPY IN PRENATAL AND LABOR

Pregnancy causes a series of changes in the woman's body that are necessary for the baby's development. These sudden changes can generate pain in different parts of the body, followed by discomfort and limitations in performing activities of daily living. The physiotherapist presents himself as one of the main professionals to be sought when a woman becomes pregnant, because through obstetric physiotherapy the pregnant woman can go through the processes of changes arising from pregnancy with comfort and safety. (SOUZA, et al. 2017)

Care in obstetric physiotherapy is based on stretching exercises, breathing, relaxation, in addition to strengthening specific muscles overloaded during pregnancy, preparing the abdominal muscles and pelvic floor, and raising awareness of the pregnant woman about the physiology of pregnancy and labor. (BAVARESCO, et al. 2011)

Obstetric Physiotherapy helps patients with several common complaints of pregnancy such as cramps, shortness of breath, edema, low back pain, lumbar sciatic pain, overactive bladder, among others. With the relief of these complaints, the services provide comfort and a better quality of life for these women. (LUIZ, et al. 2010)

With the increase in weight and development of the baby, the pelvic floor muscles become overloaded and, therefore, they depend on a great preparatory work so that the pregnant woman does not suffer from this discomfort and that she is also prepared for the labor, whatever it may be. (POLDEN and MANTLE, 2005)

In the case where the pregnant woman makes the choice for vaginal delivery, the physiotherapist is essential to specifically prepare the muscles in this region so that they are active and strong in the expulsive period of birth, avoiding muscle injuries, lacerations or medical interventions, as in the case of episiotomy.

During labor, it is important for the pregnant woman to know and perform exercises that favor the baby's good positioning and descent, take walks, squat exercises and with the Pilates ball to increase the diameter of the pelvis and promote the descent and exit of the fetus. Pains are also very present in labor and can be reduced through resources such as thermotherapy, massage, cutaneous electrical stimulation (TENS) and breathing exercises. (STEPHENSON and CONNOR, 2004)

The obstetric physiotherapy service prepares the body and controls the pregnant woman's anxiety, providing

unique experiences in one of the most sublime moments in a woman's life.

VI. EXERCISES IN PREGNANCY

In order for an exercise program to be started with a pregnant woman, it is necessary that she undergo a good physical therapy evaluation. This assessment will involve anamnesis to get to know the pregnant woman and survey her main complaints. In addition to anamnesis, it is necessary to perform a physical examination, which will involve static examination, dynamic examination, neurological assessment, muscle assessment, palpation and functional assessment.

Regular exercises are extremely important and recommended by the American College of Obstetrics and Gynecology (ACOG) for pregnant women, even sedentary ones, as they present benefits to global health and improve physical fitness. When they are practiced regularly and properly monitored by the professional in the area, they will have numerous benefits for the mother and baby. Pregnant women with good aerobic fitness experience the bodily changes arising from pregnancy more easily and tend to have a faster and more uncomplicated labor. (BARACHO, 2007)

For each pregnant woman, the physiotherapist will design an individualized care program that will be built according to the data collected in the evaluation, which will influence the type of exercise, frequency, intensity and duration. Some resources are used to measure the intensity of the exercise that will be proposed as verification of heart rate (HR), using the Borg Scale and Talk test. (BARACHO, 2014)

The physiotherapist must always be aware that the exercises are pleasant and safe for the pregnant woman and must do this through some precautions such as: inserting the exercises position, avoiding positions that cause gastroesophageal reflux, avoiding hot and poorly ventilated environments, guiding on the adequate food and liquid intake, avoid waltzing maneuvers and monitor vital signs. (GOMES, 2010)

Walks are indicated and beneficial when they are carried out on appropriate terrain with appropriate shoes, correct posture and harmonious muscle movements. Initially, they are done three times a week, lasting approximately 30 to 45 minutes. After a few weeks they can evolve to a period of 60 minutes, as they will improve aerobic condition, prevent excess weight and improve blood circulation. (BRANDÃO, et al. 2008)

Exercises performed in water are an excellent option for pregnant women, as they promote a relaxing

effect, allow the body weight to be better supported, reduce the impact on joints and favor the performance of ample exercises. Generally, the hydrotherapy program for pregnant women is based on aerobic and localized muscle exercises, stimulation of the respiratory system, maintenance of the pelvic floor function, maintenance of balance and proprioception, postural re-education and stretching and global relaxation. In general, hydrotherapy is indicated to be performed at a frequency of 1 to 3 times a week, lasting 45 minutes each session. (ALVES, 2012)

Exercises to strengthen the pelvic floor are recommended during pregnancy because they increase the chances that a woman will have healthy muscles after vaginal delivery. They consist of sustained contractions of the pelvic floor muscles, whether fast or slow, in different postures that promote gains in strength, endurance and improvement in the pre-contraction ability of the musculature, when in response to an increase in intra-abdominal tension. In addition to exercises, vaginal cones that recruit type I fibers (slow contraction) can be associated with training, helping to gain muscle strength as a resistance training. (SANTOS, 2018)

Perineal massages are indicated to increase the flexibility of the pelvic floor muscles and perineal soft tissue to prevent lacerations during labor and reduce resistance in the baby's passage.

O Epi-No® is a device made of inflatable silicone, connected to a pressure gauge, which simulates the baby's head to train the pelvic floor of the vagina until the time of delivery. (MENDES, et al. 2018) It was created in the 1990s, by a German doctor, to prevent episiotomy from being performed in normal delivery. It has a proprioceptive function, as it simulates the expulsive period, allowing the patient to become familiar with the time of delivery, understanding how she should act. It promotes the lengthening of the vaginal canal and, as well as perineal massage, its use is indicated from the thirty-fourth week of pregnancy and continue like this until the pregnant woman has a ruptured bag, its use being contraindicated at this time. (SILVA, 2015)

VII. METHODOLOGY

This is an exploratory and descriptive field study with a quali-quantitative approach. Exploratory for the search for knowledge of each pregnant woman interviewed on the subject and descriptive for the possibility of describing the characteristics and correlating the variables of data coming from the pregnant women about the performance of obstetric physiotherapy. For the composition of this research, there were articles, books, websites, magazines and dissertations that addressed

themes relevant to the subject discussed. The study will be carried out with women from the São José neighborhood of Linhares - ES who are pregnant during the research period. The researcher disseminated the research online to invite pregnant women to participate in the study.

Will be included in the sample 11 women, who are pregnant during the research period and who live in the São José neighborhood. Those who are interested may participate in the research by signing the Informed Consent Form (TCLE). And women who are not pregnant and who for any reason cannot answer the questionnaire or refuse to participate in the study will be excluded from the sample.

The Microsoft Forms platform will be used with a questionnaire containing objective questions through closed questions referring to the proposed theme. Participation will be voluntary, not involving risks, since no invasive or potentially harmful procedure will be applied. Pregnant women may refuse at any time to participate or fail to answer questions that for any reason is not convenient, without causing any personal harm, such freedom will be guaranteed based on CNS Resolution No. 196/96-IV.3.b .

As for the methodological instrument, a questionnaire with semi-structured questions will be used (APPENDIX A) for pregnant women, disclosed via the WhatsApp application.

The instrument will be based on specific subjects about physiotherapy in prenatal care and labor and your knowledge about it, with a total of 22 (twenty-two) objective questions.

Prior to data collection, the researcher will contact the participants to explain the research objectives, inform the ethical aspects of the study and request the signature of the Informed Consent Form present in the questionnaire and to guide the correct completion of the instrument .

It is noteworthy that the steps of this research will comply with resolution 466 of December 12, 2012 of the National Health Council of the Ministry of Health.

The data will be analyzed using simple descriptive statistics, transferred to electronic spreadsheets and tabulated with the aid of the Microsoft Excel 2016 Program. The analysis will be displayed in absolute frequency and percentages, organized in table and graph form, and discussed according to the theme in question.

The research project will be submitted for evaluation by the Ethics Committee for Research on Human Beings at Faculdade Vale do Cricaré (FVC).

In this work, we will present the results of 22 questions contained in a semi-structured questionnaire applied to 11 women from the São José neighborhood of Linhares-ES.

Regarding the women interviewed, 46% were aged between 26-35 years (FIGURE 1-A), all of them underwent

prenatal care and 73% (FIGURE 1-B) started prenatal care in the first trimester of pregnancy.

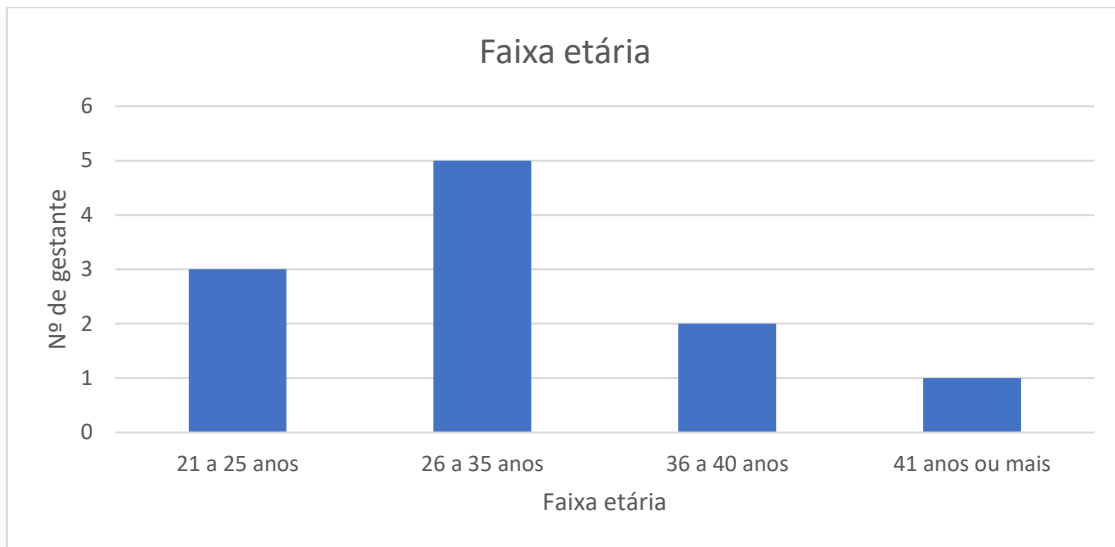


Fig.1 - A

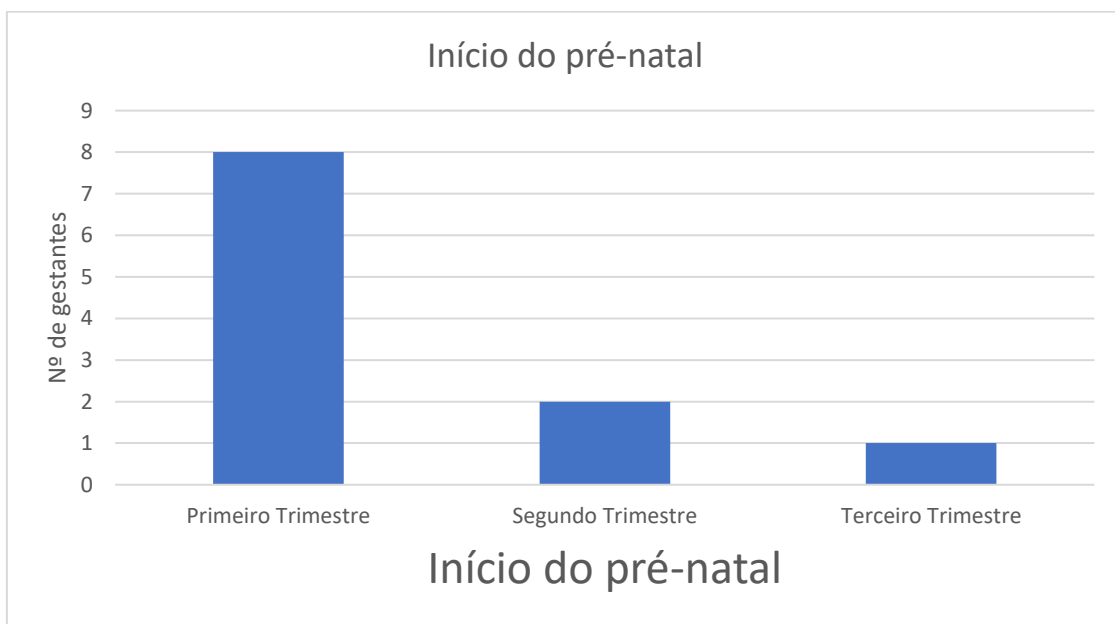


Fig.1 - B

Prenatal care is an essential factor in the protection and prevention of adverse events on obstetric health, as it enables the identification and clinical handling of interventions on potential risk factors for complications to the health of mothers and their newborns. born. (NUNES, et al. 2016)

In Brazil, the Ministry of Health instituted the Prenatal and Birth Humanization Program (PHPN) through Ordinance/GM n°. 569, of 06/01/2000, with the aim of reducing maternal and child mortality rates. With PHPN, municipalities are responsible for ensuring access to and

improving the coverage and quality of prenatal care, delivery and postpartum care, and neonatal care. (BARBIERI, et al. 2012)

It is important that every pregnant woman undergoes quality prenatal care and that this follow-up is carried out by a multidisciplinary team, so that together these professionals contribute to reducing maternal and child morbidity and mortality rates and promote satisfactory experiences for the pregnant woman during pregnancy and during labor.

Of those interviewed in the survey, 64% had already undergone physical therapy treatment during their

lifetime (FIGURE 2-A), but only 19% were seen by a physical therapist during pregnancy (FIGURE 2-B).

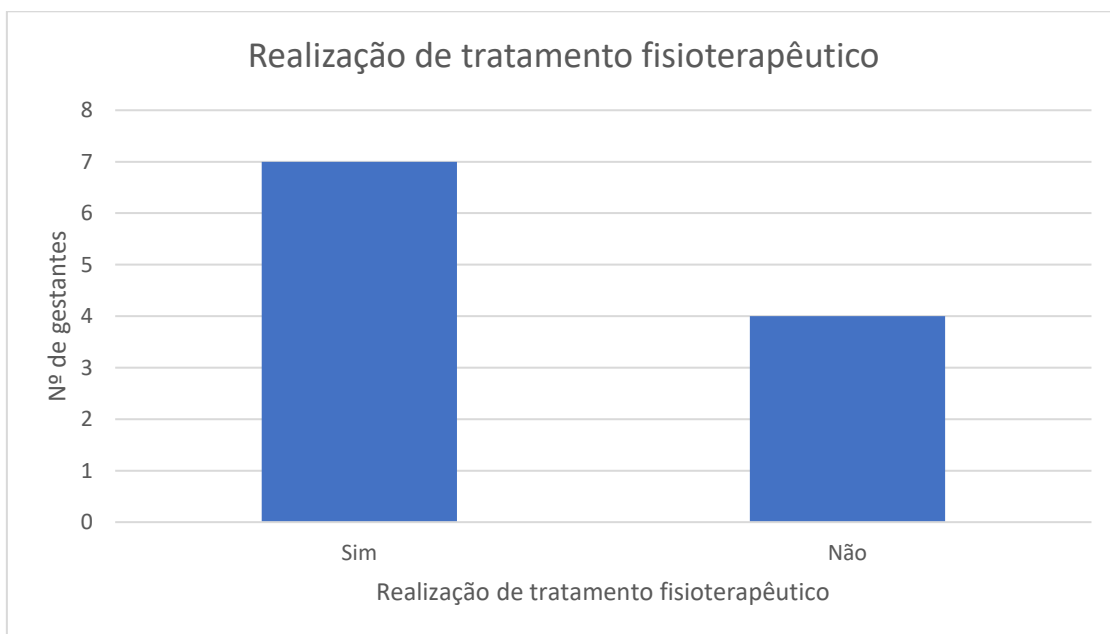


Fig.2 - A

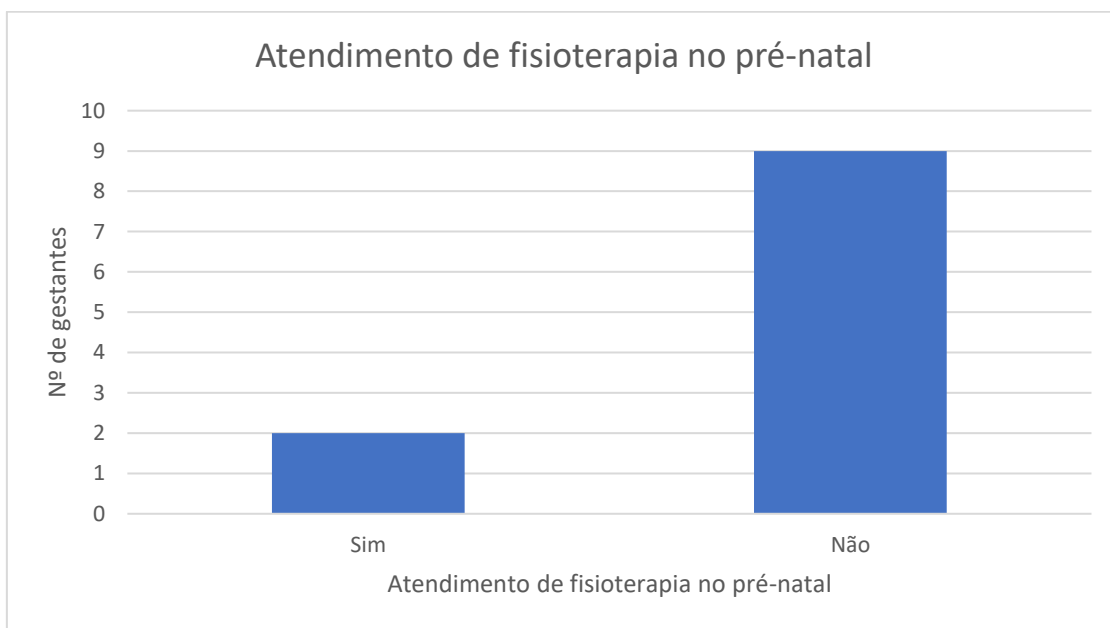


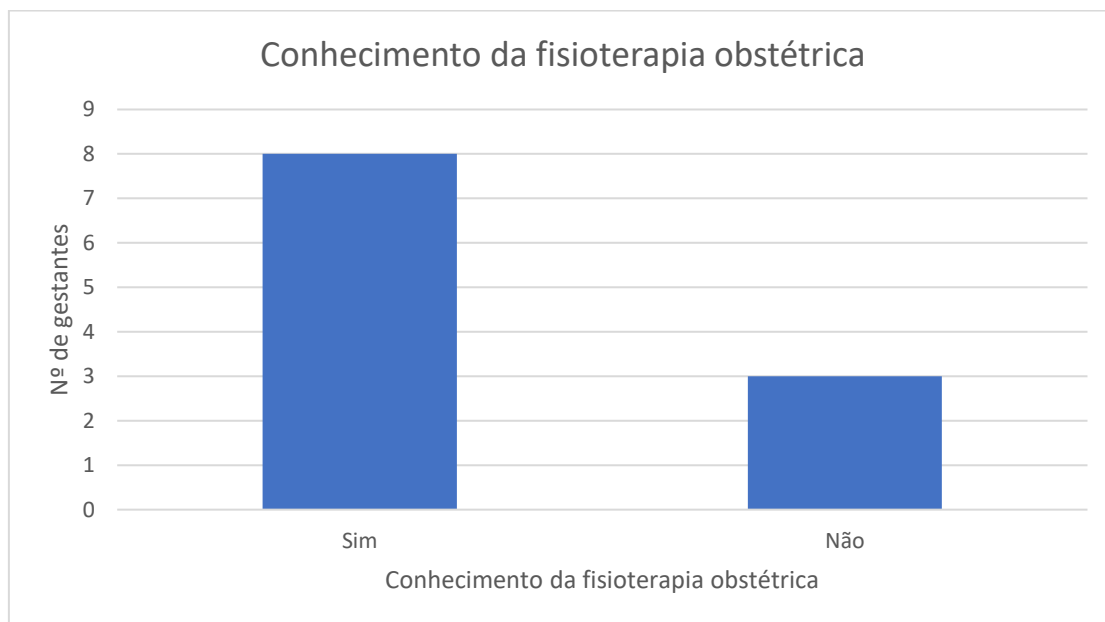
Fig.2 - B

Currently, the presence of the physiotherapist in the care of pregnant women and in labor is little observed. Not only on the part of pregnant women, but among health professionals, there is little knowledge about the role of this professional in this field, as well as the evidence of benefits in the health of pregnant women. (GOMES and OLIVEIRA, 2005)

Although the research showed that pregnant women were aware of obstetric physiotherapy (FIGURE 3), few were taking advantage of these services. What stands out is that most hospitals and maternity hospitals still do not offer their pregnant women a welcoming and humanized obstetric care that is concerned with meeting the needs of pregnant women, respecting their individuality, desire and providing security for the family. The presence of the

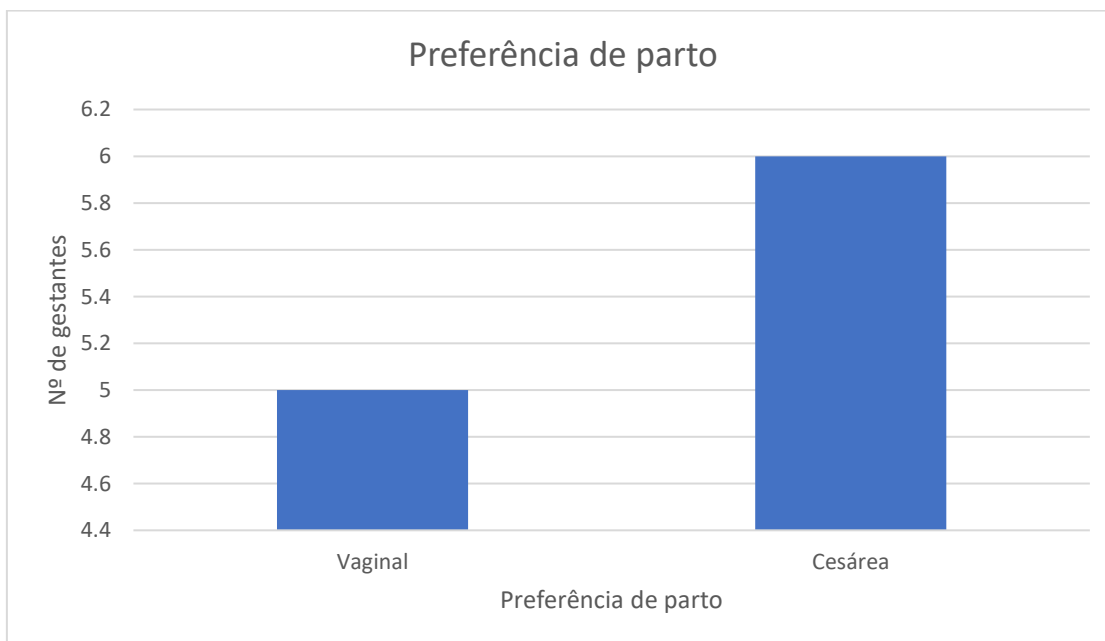
physiotherapist during pregnancy and during labor can significantly contribute to a woman's life and her experience acquired during this period, so it is important that this

professional is inserted in this context and that his/her performance is widely publicized and made available to these women. (VELHO, et al. 2014)



Regarding the preference of the type of delivery, cesarean delivery prevailed with 55% of responses (FIGURE 4). The decision about the mode of delivery is influenced by several factors such as risks and benefits, possible complications and future repercussions (COSTA, SP, 2014). These factors influence the expectations of women regarding the choice of the type of delivery, being

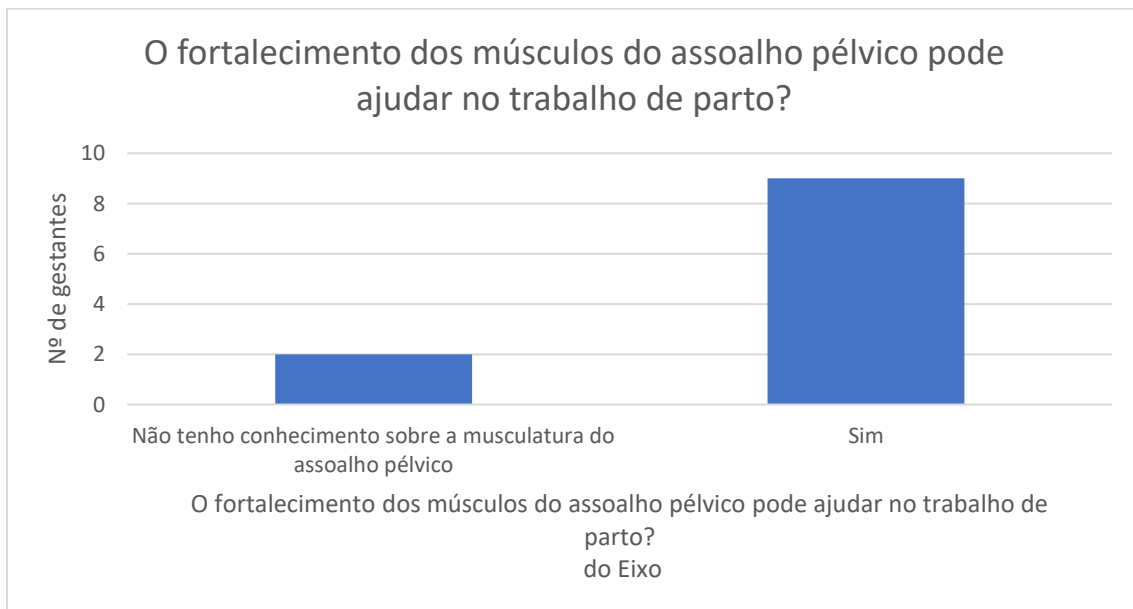
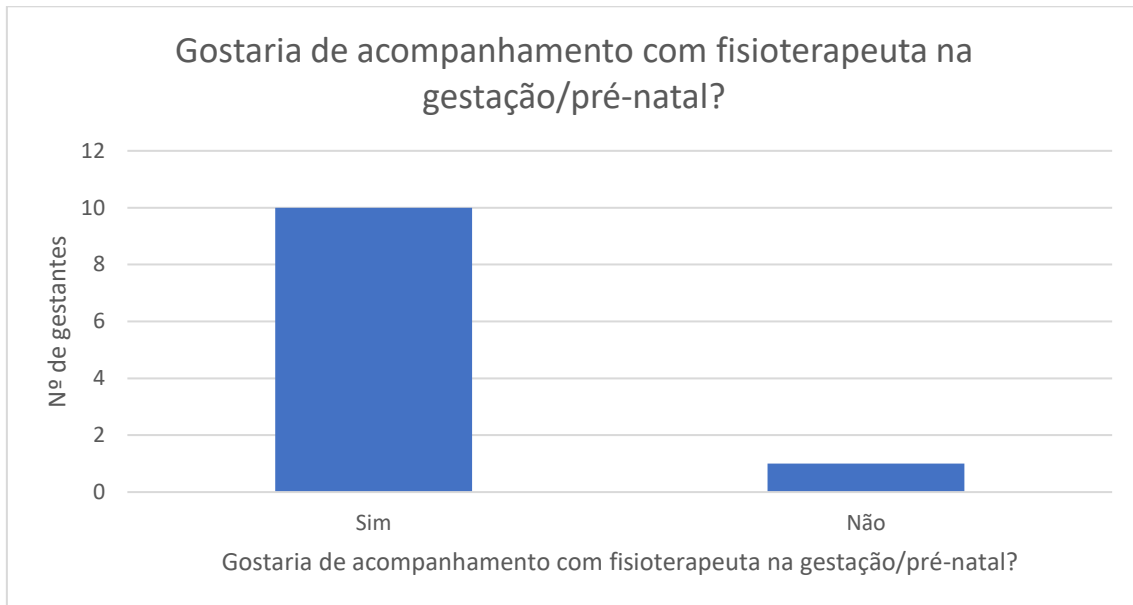
related to their knowledge about the subject and the information that is passed on by health professionals during prenatal care. The decision is due to her approach to the health professional, the culture and medical influence in Brazil, the lack of comprehensive care for women and the lack of support from professionals and family members (COSTA, 2014).



The previous experiences of the women themselves or of those close to them also end up serving as a mirror and inducing the woman to choose her type of delivery, not taking into account that each woman and each pregnancy is different, and that over the years and with insertion of new health professionals in this scenario, the woman will be able to experience the physiological

experience of vaginal birth without any problems and safely.

As for the desire to be assisted by an obstetrical physiotherapist in the prenatal period, 90% expressed the desire to be assisted by this professional (FIGURE 5-A) and 73% agreed that strengthening the pelvic floor muscles can help in labor (FIGURE 5-B).



The pelvic floor (PA) is composed of several muscles (puborectal, pubococcygeus, iliococcygeus and ischiococcygeus) and connective tissues that support the pelvic organs, control urinary and fecal continence, and contain the increase in intra-abdominal pressure. When pregnant, a woman experiences hormonal changes that

cause differentiation of connective tissues, which, when not followed up, can evolve into urinary incontinence, pelvic pain, prolapses, sexual dysfunction and lacerations during labor.

Physical therapy monitoring during pregnancy promotes the training of these muscles through selective contraction and relaxation exercises of the perineal muscles that can be stimulated by means of devices such as electromyographic biofeedback or methods such as Pilates.

The Pilates method, in addition to working the pelvic muscles, can also provide pregnant women with a complete training of the global musculature through

exercises that stimulate the various physical capacities (balance, motor coordination, cardiorespiratory performance, muscle strength and endurance, flexibility and stability) necessary for pregnant women.

In the study, 64% (FIGURE 6) of the pregnant women reported feeling pain or discomfort in the back region, which can be easily controlled through the inclusion of physical therapy in their prenatal routine.



VIII. FINAL CONSIDERATIONS

The results of this study allow us to conclude that the pregnant women interviewed have already heard about obstetric physiotherapy, they believe that it can contribute positively to labor, but most of them are not being treated by this professional.

Other studies will be needed to elucidate the factors that influence the inclusion of physical therapy in the prenatal routine and its wide dissemination in obstetrics.

REFERENCES

[1] BARACHO, E. Physiotherapy applied to obstetrics, urogynecology and aspects of mastology. 4th Ed. Rio de Janeiro: Guanabara, 2007. p. 131-136.
 [2] BARACHO, E. Physiotherapy applied to women's health. 5th Ed. Rio de Janeiro: Guanabara Koogan, 2014. p.13-20.
 [3] BAVARESCO, Z, G, et al. The physiotherapist as a support professional for the parturient. Science and Public Health. 3259-3266, 2011.
 [4] BRANDÃO, A, C, S, et al. Physical therapy in primary care: acting with pregnant women in a collective nature. Physiotherapy Brazil, v9, n2, 2008.

[5] CAMACHO, K, G, et al. Experiencing repercussions and transformations of a pregnancy: perspectives of pregnant women. Science and Infirmiry XVI, 2010.
 [6] COSTA, E, S, et al. Physiological changes in the perception of women during pregnancy. Rene Fortaleza Magazine, v 11, n 2, p. 86-93, 2010.
 [7] DUTRA, L, I. Natural, normal and humanized childbirth: the polysemy of terms and its effects on childbirth care. Dissertation, UFRS. Porto Alegre, 2005.
 [8] GOMES, A, A. Urogynecological Physiotherapy in pregnancy and labor: Literature review. TCC, Faculdade Ávila, 2010.
 [9] GUILLEMEAU, J. Childbirth or the happy delivery of women. London: A Hartfield, 161. Humanization of childbirth public policy, organizational behavior and professional ethos Mônica Bara Maia;
 [10] MAIA, MB. Humanization of childbirth: public policy, organizational and ethosprofessional behavior [online]. Rio de Janeiro: Publisher
 [11] FIOCRUZ, 2010. 189 p. ISBN 978-85-7541-328-9. Available from SciELO Books <http://books.scielo.org>.
 [12] LOW, J. Caesarean section-past and present. J Obstet Gynaecol Can. 2009;31(12): 1131-6.
 [13] LUIS, A, L, et al. Physiotherapeutic intervention in the preparation and during natural labor. Integrated Faculty of Florianópolis, 2010.

- [14] MENDES, NA, Mazzaia, MC, & Zanetti, MRD (2018). Critical analysis on the use of Epi-No in pregnancy and childbirth. ABCS Health Sciences, 43(2). <https://doi.org/10.7322/abcshs.v43i2.1091>. Ministry of Health; HUMANIZATION OF BIRTH PROGRAM, HUMANIZATION IN PRE-NATAL AND BIRTH, Brasília DF, 2002, page 06, 07. <http://bvsmms.saude.gov.br/bvs/publicacoes/parto.pdf>
- [15] BIRTH, A, P, M, et al. Perceptions of pregnant women about the care received in prenatal care in two basic health units. Dissertation, UFSC. Florianópolis, 2013.
- [16] OLIVEIRA, B, S. Performance of obstetric physiotherapy: an analysis of the knowledge level of Brazilian pregnant women. Dissertation, UFB. Minas Gerais, 2018.
- [17] PADILHA, J, F, et al. Physiotherapy performance in a maternity hospital: perception of the multidisciplinary health team. Physiotherapy Brazil, v16, n1, 2015.
- [18] POLDEN, M; MANTLE, E, J. Physical therapy in gynecology and obstetrics. 2nd Ed. São Paulo: Editora Santos, 2005. p.22-45.
- [19] National Policy on Comprehensive Child Health Care, Ministry of Health, 2018, page 15.
- [20] National Policy for Comprehensive Care for Women's Health Principles and Guidelines, Brazil, 2004, page 29, 60,
- [21] QUEVEDO, M, P. Experiences, perceptions and meanings of motherhood for women with high-risk pregnancy. Thesis, University of São Paulo Faculty of Public Health, 2010.
- [22] REZENDE, J. Cesarean Operation. 3rd ed. Rio de Janeiro: Guanabara Koogan; 2006. Sewell JE. Cesarean Section: a brief history. The American College of Obstetricians and Gynecologists in cooperation with the National Library of Medicine. 1993.
- [23] SANTOS, E, R, S. Influence of kinesiotherapy in the active phase of labor in the pre-partum and postpartum center of the Instituto da Mulher Dona Lindu. TCC, Faculdade Ávila, 2018.
- [24] SANTOS, S, G, et al. Pregnant women's level of knowledge about physical therapy during pregnancy and labor. Proceedings of the XVII Academic Exhibition of the Physiotherapy Course, v7, n2, 2019.
- [25] SILVA, A, A. Prenatal care for pregnant women at usual risk: strengths and weaknesses in the consultation. Postgraduate Program in Nursing, UFM, São Luís, 2018.
- [26] SILVA, J, A. The efficiency of using EPI-NO®: A literature review. TCC, Faculty of Education and Health Sciences – FACES, 2015.
- [27] SILVA, L, S, et al. Analysis of physiological changes during pregnancy: unraveling myths. Revista Faculdade Montes Belos, v8, n1, 2015, p. 1-16.
- [28] SILVANI, J. Impact of binge eating on gestational weight gain and postpartum weight in women who had gestational diabetes – Linda Brasil Study. Dissertation, UFRS. Porto Alegre, 2019.
- [29] Brazilian Society of the History of Medicine; São Paulo: 1997. Guimarães M, 1808: A Pernambuco man at the Court. Updated February 2008. Available at: <http://www.sbhbm.org.br/index.asp?p=noticias&codigo=156>
- [30] SOUZA, V, P, S, et al. Perception of participants in a course for pregnant women on the multidisciplinary approach to health. Journal of Research in Physiotherapy, 79-86, 207.
- [31] STEPHENSON, R, G; CONNOR, L, J. Physical therapy applied to gynecology and obstetrics. 2nd Ed. Barueri, SP: Manole, 2004. p.153-191.
- [32] TEDESCO, PR. MAIA SON, NL. MATHIAS, L. BENEZ, AL. CASTRO, VCL. BOURROUL, GM. Determining factors for the expectations of primigravid women about the mode of delivery. Rev Bras Ginecol Obstet. 2004;26(10):791-8.
- [33] TEMKIN, O (trans). Soranus. Gynecology. Baltimore, MD: The Johns Hopkins Press, 1956.
- [34] VALENTIAN, C, M, V, S; RODRIGUES, M, F. The importance of physical therapy intervention in labor assistance. Dissertation, Unisaeslan. São Paulo, 2015.
- [35] OLD, M, B, et al. Normal birth and Cesarean delivery: social representations of women who experienced them. BrazilianJournalofNursing, 282-9, 2014.

Survey of the Quality of Life and Well-Being of the Teachers of Marilândia-ES in the Daily School

Janderson Bonella Sedda, Brunela Romagna De Araújo Sedda, Yolanda Aparecida De Castro Almeida Vieira

Received: 15 Sep 2021,

Received in revised form: 22 Oct 2021,

Accepted: 01 Nov 2021,

Available online: 11 Nov 2021

©2021 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— *Teaching. Welfare Pentacle. Child education. Elementary School. Physical activity.*

Abstract— *Quality of life and teacher well-being in relation to everyday school life. Knowing that quality of life and well-being are terms whose definitions are subjective and cover different areas (physical, mental, emotional and spiritual), the research problem aims to consider a question for the teacher about their quality of life, which elements or aspects are perceived as well-being. Thus, the objective was to understand how the teacher perceives himself in face of his own quality of life and well-being, relating this perception to everyday school life. For that, a bibliographical investigation was carried out first, reifying establishing the conceptual bases for this research. Afterwards, having as research subjects teachers of Kindergarten and Elementary Education from public schools in the city of Marilândia, ES, an applied and descriptive field research was carried out to know their self-perception about quality of life and well-being, through a semi-open questionnaire, based on the Well-Being Pentacle. By analyzing the profile of the sample and how teachers perceived themselves in relation to quality of life and well-being, it was concluded that teachers who exercise less perceived themselves as having a lower quality of life, while at the same time having body mass indexes taller. Finally, an intervention proposal was elaborated aiming to respond to the needs of the evaluated group, proposing the inclusion of physical activities in the teachers' routine, favoring the improvement of their well-being, thus collaborating to increase the quality of life and, consequently, the perception of its improvement. through a semi-open questionnaire, based on the Pentacle of Well-Being. By analyzing the profile of the sample and how teachers perceived themselves in relation to quality of life and well-being, it was concluded that teachers who exercise less perceived themselves as having a lower quality of life, while at the same time having body mass indexes taller. Finally, an intervention proposal was elaborated aiming to respond to the needs of the evaluated group, proposing the inclusion of physical activities in the teachers' routine, favoring the improvement of their well-being, thus collaborating to increase the quality of life and, consequently, the perception of its improvement. through a semi-open questionnaire, based on the Pentacle of Well-Being. By analyzing the profile of the sample and how teachers perceived themselves in relation to quality of life and well-being, it was concluded that teachers who exercise less perceived themselves as having a lower quality of life, while at the same time having body mass indexes taller. Finally, an intervention proposal was elaborated aiming to respond to the needs of the evaluated group, proposing*

the inclusion of physical activities in the teachers' routine, favoring the improvement of their well-being, thus collaborating to increase the quality of life and, consequently, the perception of its improvement. By analyzing the profile of the sample and how teachers perceived themselves in relation to quality of life and well-being, it was concluded that teachers who exercise less perceived themselves as having a lower quality of life, while at the same time having body mass indexes taller. Finally, an intervention proposal was elaborated aiming to respond to the needs of the evaluated group, proposing the inclusion of physical activities in the teachers' routine, favoring the improvement of their well-being, thus collaborating to increase the quality of life and, consequently, the perception of its improvement. By analyzing the profile of the sample and how teachers perceived themselves in relation to quality of life and well-being, it was concluded that teachers who exercise less perceived themselves as having a lower quality of life, while at the same time having body mass indexes taller. Finally, an intervention proposal was elaborated aiming to respond to the needs of the evaluated group, proposing the inclusion of physical activities in the teachers' routine, favoring the improvement of their well-being, thus collaborating to increase the quality of life and, consequently, the perception of its improvement.

I. INTRODUCTION

Well-being and quality of life are terms that are often confused by the common goal, they are common expressions in the Brazilian vocabulary, whether in colloquial or technical use, as the concern with these two aspects of human life has intensified in recent years.

The World Health Organization (WHO) defines quality of life as an individual's perception of how life itself is embedded in the culture and values of the environment in which they live and also in relation to goals, concerns, expectations and standards (WHO, 1995).

Well-being, on the other hand, is understood as a harmonic association between the physical, mental, spiritual and emotional parts (NAHAS; BARROS; FRANCALACCI, 2000).

Thus, it is understood that there are numerous factors that can influence the quality of life and well-being perceived by individuals, such as health, education, housing, emotional state and also professional life.

During a good part of adult life, most people have a job in companies and/or government agencies or, as self-employed, with workloads that can exceed 40 hours per week, which means that a good part of the time is spent on the job. and consequently, with an influence on quality of life and well-being in general.

In Brazil, according to a survey conducted in 2018 by the Locomotiva Institute in partnership with the Loyalt& Trade Management (LTM) group, 56% of workers are dissatisfied with their occupation and would like to change jobs (GIOVANELLI, 2018).

When only the teaching profession is analyzed, the results are similar. The "Teacher Survey", carried out by IbopeInteligência in 2018 with an initiative of Itaú Social and Todos pela Educação, showed that a third of the 2,160 Basic Education teachers who were interviewed are totally dissatisfied with the profession and only 23% of them would certainly recommend the profession for someone (IBOPE, 2018).

The dissatisfaction presented adds to more serious problems, such as the high number of teachers on leave due to illness, 66% of professionals have already had to leave due to health issues. Conditions such as anxiety, stress, headaches and even depression are reported as coming from or intensified by the routine at work (TEIXEIRA, 2018).

When the themes of quality of life and well-being are addressed, it is likely that most people relate them to issues that involve the health of individuals.

According to Nahas, Barros and Francalacci (2000), well-being comprises a harmonious relationship between the various areas that make up human beings, namely: physical, mental, emotional and spiritual. It differs from health as it cannot be evaluated objectively, but only subjectively, taking into account physical conditions, spirituality, material comfort and convenience, security, financial tranquility, emotional stability, among others.

It can be observed, however, that the definitions are similar and even overlapping, as they have in common the subjective character and a breadth over the various spheres that make up humans.

According to Seild and Zannon (2004), quality of life has outstanding characteristics such as subjectivity, multidimensionality, and positive and negative dimensions, with subjectivity being the need for analysis by the individual, with a subjective character, and multidimensionality the influences received from all spheres experienced and felt by a person, which added up result in a total feeling arising from external factors such as social, economic and family environments, as well as internal factors, such as mental and psychological.

The positive and negative dimensions come from the fact that they add good and bad situations to the concept, to define the subjective quality of life.

Therefore, an instrument that aims to measure the quality of life must be able to cover all the complexity that makes up an individual and its connections with its exterior and interior.

It can be noted that quality of life and well-being are very similar terms, both of which seek to score the living conditions of an individual, but it is possible to note through the aforementioned authors that the definition of the term quality of life does not contain the words “good” or “bad”, but rather the living conditions of a human being, thus indicating a form of perception.

Despite the many attempts to find a standard definition of quality of life that is widely accepted, there is still no consensus, but it is quite clear that it does not only involve issues related to physical health factors.

It is also important to highlight Bircher's concept of health, defined as

“dynamic state of well-being characterized by physical and mental potential that satisfies vital demands compatible with age, culture and personal responsibility. ” (BIRCHER, 2005).

In recent decades, much has been seen and heard in the media about quality of life, quality of life relationships are almost always made with advertisements for some types of food, houses in gated communities, high-tech cars, fitness centers. high performance, political speeches, among others.

These assumptions indicate that quality of life is centered on a particular “object” to be achieved and is not available to everyone. According to Almeida, Gutierrez and Marques (2012, p.16):

In view of this colonization, practically everything around expresses quality of life and this has become something of extreme desire and many live in search of this object.

According to Almeida, Gutierrez and Marques (2012), terminology that is not specific can cause misunderstandings by implying that quality of life is an object, and its reach depends directly on the subject who seeks it, with no need for others. factors for success to occur.

It is clear that a complete definition of quality of life is extremely important, in order to defragment the topic and provide more precise information about the term in question.

According to WHO (1997), the perception of quality of life involves spiritual, physical, mental, psychological and emotional well-being, in addition to social relationships, such as family and friends, and also health, education, housing, basic sanitation and others circumstances of life.

Therefore, such term encompasses multifactorial elements of human beings' lives and a definition, no matter how complete, would still be simplistic on the subject.

According to the view of Pereira, Teixeira and Santos (2012), there needs to be a reflection on how the factors that are important to acquire quality of life were obtained individually, as they depend on the context in which people are inserted, be this historical, environmental, cultural and social.

That is, when defining quality of life, specific aspects of a given population or group must be taken into account, in order not to create a definition centered on some values, such as: having comfort, pleasure, good food at the table, being at the fashion, travel, car of the year, state-of-the-art household appliances, modern telephones and computers, consumption of culture and art, use of technologies that reduce manual labor, wealth and a good physique.

Within this perspective, Almeida, Gutierrez and Marques (2012, p.18) argue that quality of life is not an object, but a perception, and that it has always been present in the lives of human beings:

The fact is that, based on this type of analysis, all subjects have quality of life, which is not an element to be achieved through actions embedded in the standard of good life in contemporary society; however, what is interesting for the life of each one is to look for a good quality in relation to their individual possibilities of action.

In this line of thought, quality of life should not be seen as an object and each individual should be able to seek to achieve their quality of life compared to what they can, with their possibilities.

Therefore, it is not possible to create a single and closed concept regarding quality of life, mainly due to individuality and subjectivity in relation to what the individual considers for himself as good or bad, in terms of quality of life.

Quality of life is influenced by all spheres experienced and felt by a person, which together result in a total feeling arising from external factors such as social, economic and family environments, as well as internal factors, such as mental and psychological.

Therefore, when assessing the quality of life, an instrument must be used that is capable of covering as much of the layers that make up the complexity of an individual and their connections with their exterior and interior as possible, with the premise that quality of life of an individual needs to be analyzed by himself, with a subjective character.

II. METHODOLOGY

To compose this chapter, the materials and methods selected to carry out this work were addressed, following work models found in the scientific literature related to this work.

The chosen population was composed of Basic Education teachers: Kindergarten and Elementary School Early Years from public schools in the city of Marilândia/ES. According to the Municipal Department of Education, the municipality has

23 schools, 3 in Kindergarten, 4 in Elementary School and 16 Rural Schools (SEMED, 2020).

According to the statistical synopsis, published by the Ministry of Education (INEP, 2020), the municipality where this work was developed has 137 teachers in Kindergarten and Elementary Education, so the sample of this work evaluated approximately 37% of the population of teachers for these levels, with a total of 51 teachers.

In this way, the sample group was selected from four schools, of these, all teachers who voluntarily accepted to be part of the study were selected, having as inclusion criteria teachers from any discipline or class of Elementary School I and II, active in the period of data collection. As exclusion criteria, teachers who were on leave or away from school and those who, perhaps, perform administrative activities, in addition to those who did not agree to participate in the research.

The respective total number of teachers from each school is described in Table 3 below:

Table 1 - Total teachers from schools participating in the research

School	teachers	Teaching	Location
school 1	27	elementary school years Initials	Urban area
school 2	14	Child education	Urban area
school 3	16	early childhood education and teaching Elementary Initial and Final Years	Countryside
school 4	8	Kindergarten and Elementary School Early Years	Countryside
Total	65		

Source: Field Research (2020)

2.1 DATA COLLECTION INSTRUMENT

To carry out the research, data collection was performed using a semi-open questionnaire applied in May 2020. The questionnaire (Appendix A) containing 30 questions was divided into sections. The first section (with a total of 5 questions) refers to questions essential to the characterization of the sample, of a demographic and socioeconomic nature.

Section two (with a total of 11 questions) was about the participant's professional performance, with the intention of characterizing the area of training and performance, teaching career, hours worked, etc.

Finally, the last section (with a total of 13 questions) addressed the lifestyle, through an adaptation of the instrument developed by Nahas, Barros and Francalacci (2000), called Lifestyle Profile, derived from the Pentacle model of Well-Being (Figure 3), with questions covering

the following main themes: Nutrition, Physical Activity, Preventive Behavior, Social Relationships and Stress Control.

Teachers were also asked about their weight and height and these data were the basis for calculating the BMI.

The analysis of quantitative data obtained from the results of this research was performed using descriptive statistics, using graphs and tables, summarizing the main characteristics of the data.

Descriptive analysis is often used in observational studies and facilitates the understanding of raw data obtained from cross-sectional observational studies, as they present data in a more significant way, favoring the interpretation of results.

As previously presented, to analyze the part corresponding to the Pentacle of Well-Being, the Likert Scale (LIKERT, 1932) was used, which allows the measurement of the individual's degree of agreement regarding the questions asked. The advantage of using this scale is that it is not restricted to yes or no answers (SULLIVAN and ARTINO, 2014). For the Likert scale analysis, the variation of the answers goes from 1 to 5, where 1 means the lowest level for the answer, and 5, the maximum for the questioning.

The results that served as the basis for the formulation of the Well-Being Pentacle were presented as mean and standard deviation of the mean, and are individually presented in Appendix B. The means (quantitative) were converted into classifications

(qualitative), according to WHO guidelines for questionnaires that assess quality of life (FLECK et. al., 1999), being: needs to improve (when it goes from 1 to 2.9); regular (3 to 3.9); good (4 to 4.9) and very good (5). Graphs and tables were prepared using Excel software, version 2019, from the company Microsoft® and plotted in the spreadsheet Word, version 2019, from the same company.

Therefore, the results obtained from the data analysis are presented in the next chapter, and were the basis for the creation of the intervention program with labor gymnastics, focusing on teachers to be implemented and executed in schools. The program was created taking into account the sample group, age group, Body Mass Index (BMI), habits and behaviors considered relevant after analyzing the collected data, as well as what already exists in the scientific literature on the subject in question.

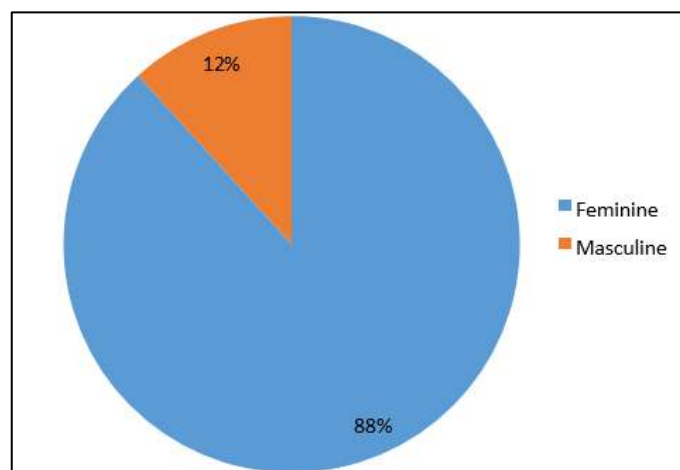
III. RESULTS AND DISCUSSION

In this chapter the results obtained through data collection are presented, as well as the discussion of the same in relation to what the literature presents in relation to the subject object of this work.

At first, a profile of the sample was presented, followed by the results and discussions related to the theme of physical activity and well-being of teachers, using the methodology of the Pentacle of Well-Being.

In Graph 2, below, the profile of the sample of professors distributed by gender is presented.

Graph 2 - Distribution of professors by gender



Source: Field Research (2020).

By analyzing Graph 2, it can be seen that the majority of individuals in the sample are female, corresponding to 88% (n=45) and a minority of males, 12% (n=6), of the total of 51 teachers.

According to Souza (2013, p. 56): “women, according to the 2010 Demographic Census of the Brazilian Institute of Geography and Statistics (IBGE), make up 51% of the Brazilian population. But it is known that in the teaching

profession they have been an even wider majority for a long time.”

Data presented by the Ministry of Education (BRASIL, 2018), published in 2018, on the Census of Education in Brazil, in 2017 indicated that there were about 2.2 million teachers working in Basic Education, of which 80% they were women. These data are similar to those found in this research.

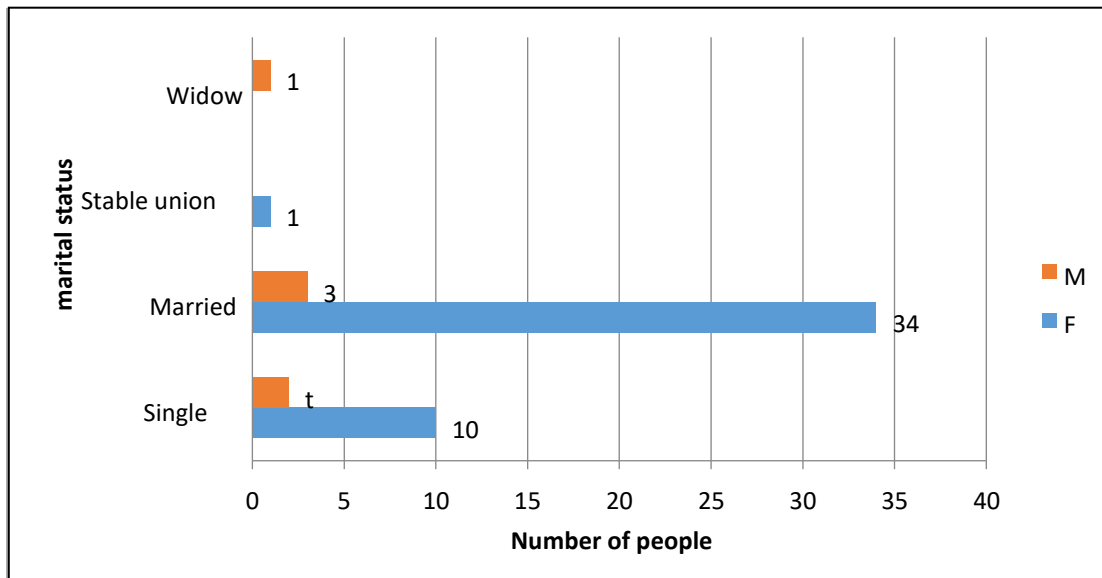
It can be observed that the phenomenon of feminization of basic education is present in the sample of this work, showing that most teachers are female and in this line of thought Prá (2016, p.224) discusses this aspect:

Problems related to discrimination segregate women in the work sphere and tend to generate wage inequalities, in addition to making it difficult to obtain jobs and occupy

decision-making positions in the professional hierarchy. Thus, the trend towards the presence of women in the different stages of education is inversely proportional to the value given to each level of education; higher education teachers, mostly men, masters and doctors, receive higher salaries and have greater social prestige, while basic education teachers, mostly women, with less training, receive lower salaries and little recognition for their profession.

In Graph 3, the data on the distribution of the marital status of the sample are presented. The condition of being married can have an impact on well-being and quality of life in different ways, by influencing the daily routine and emotional state.

Graph 3 - Distribution of the marital status of teachers



Source: Field Research (2020).

It can be noticed, observing the results of Graph 3, in both sexes, that the marital status that appears most is married people, being 72.5% of the sample.

This variable is followed by single people, with 23.5%, with only one person in a stable relationship (Female) and one widowed man. According to Rocha Sobrinho (2012, p. 265):

[...] in studies of general well-being, research has shown that married people tend to have greater well-being than divorced, separated, widowed or single people. Among adults who are not married, those who live with a partner have greater well-being.

In a systematic review of 35 studies (SANTOS, 2011), evaluating the prevalence of Burnout syndrome in elementary and high school teachers, a similar profile was observed in relation to gender, with most teachers being female, married and with sons. This same study indicated that "women have greater emotional exhaustion than men and singles have a higher rate of depersonalization than married people."

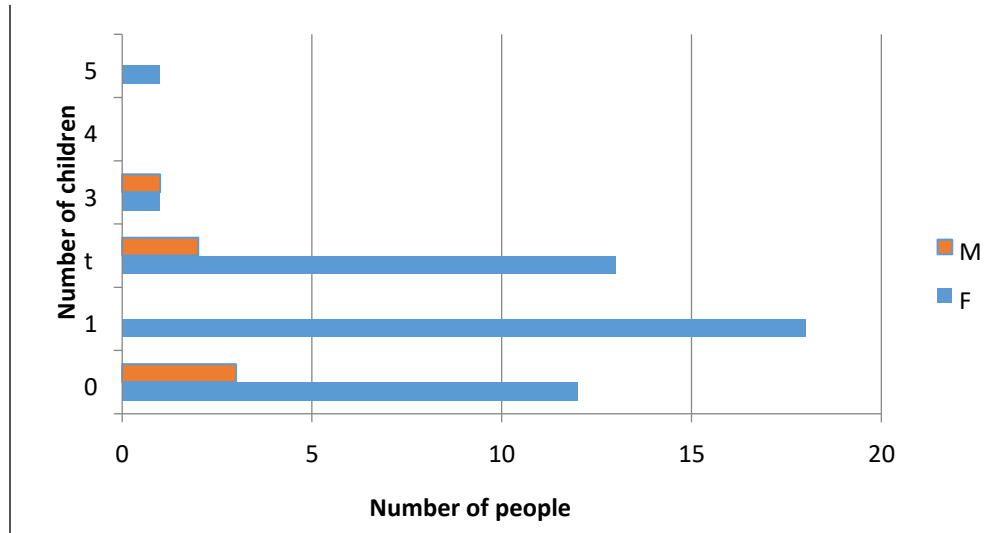
News broadcast by the website Globo, presenting IBGE data for the year of

2011, indicated that this year, in Brazil, 48.1% of the population declared themselves single, 39.9% married, 5.9% divorced and 6.1% widowed.

Therefore, the data from the profile of the sample in this work are not similar to the data from the IBGE census, indicating that the profile of elementary school teachers is formed mostly by married people, signaling a peculiar characteristic of the profession.

Considering that the profile of the sample in this work is formed by married women, we tried to assess whether they had children and how many there would be. The results are shown in Graph 4, with the distribution of the number of teachers' children.

Graph 4 -Distribution of the number of teachers' children



Source: Field Research (2020).

It was observed in Graph 4 that most teachers have between 1 and 2 children, with a total of 33 people (64.7%), as those who do not have children are in second place, with 15 individuals (29.4%), 3 people said they had more than 3 children (5.9%). According to IBGE estimates (2018), in relation to the fertility rate of women, the value is 1.77 children per woman, that is, less than two children, and it is estimated that in 2060 this value will be 1, 66 children/woman. These data indicate a halt in population growth in 2047 and a gradual reduction in population each year. According to this information, the teachers in the sample of this work fit within the profile of the number of children in the Brazilian average.

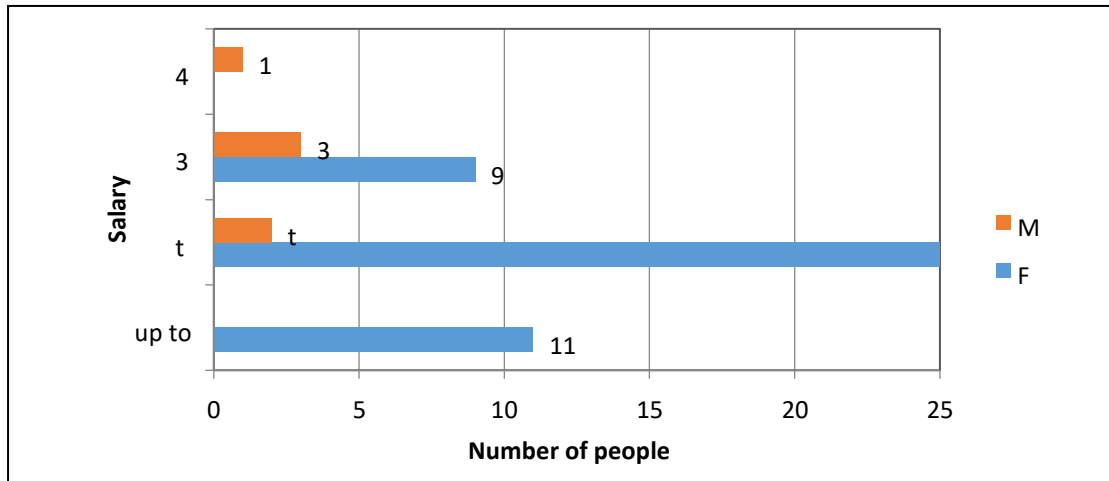
Since most people in the sample are married, it would be natural to expect them to have children. These

data may indicate that, in addition to the strenuous tasks inherent in the teaching profession, other factors can influence well-being, considering that, in parallel with the profession, they can play the role of caring for children and with household maintenance tasks.

In the sample of this research there was no teacher who reported being divorced, and of the 10 teachers are single, of these, only two have children and work more than 25 hours a week in up to two schools. Among the single male teachers, none of them reported having children.

In this context, we tried to estimate the average salary of teachers and Graph 5 shows the results of this variable, considering the current minimum wage for the year 2020, namely, R\$ 1,045.

Graph 5 -Distribution of the amount of minimum wages received monthly by teachers



Source: Field Research (2020)

Assessing Graph 5, it can be seen that most teachers receive 2 minimum wages (52.9%), 23.5% receive 3 salaries, 21.6% receive up to 1 salary and only one receives 4 salaries (2.0%).

According to information published on the Ministry of Education and Culture (MEC) website, in Brazil there is a minimum salary for basic education teachers of R\$ 2,886.24 for those who exercise 40 hours of activities per week, as established in the Floor Law (Law 11.738, of 2008) (MENEZES, 2020).

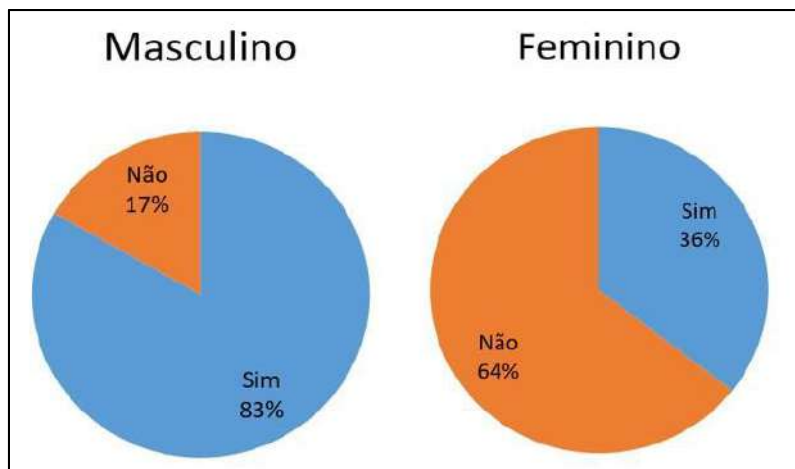
The teacher salary issue is a matter of long debate and it is known that salaries are really low. According to the data presented, approximately 53% of the sample receives little more than R\$ 2 thousand per month, having an average of 1 to 2 children (67% of the sample), with the majority of the sample being formed by married women.

In this line of discussion and the second presents Barbosa (2014, p. 512):

When discussing improving the quality of education, issues related to teachers' work and salaries often arise. And, as the payment of salaries represents the largest percentage of spending on education, dealing with teacher remuneration raises the debate on education funding and, consequently, its relationship with the quality of education.

The subject is of extensive debate and unfortunately, in Brazil, an appreciation of the teaching career is not seen, which may reflect on the quality of teaching, negatively influencing the well-being and quality of life of teachers. In the next question, teachers were asked whether or not they think about changing their profession (Graph 6).

Graph 6 - Percentage of teachers who think or not about changing their profession



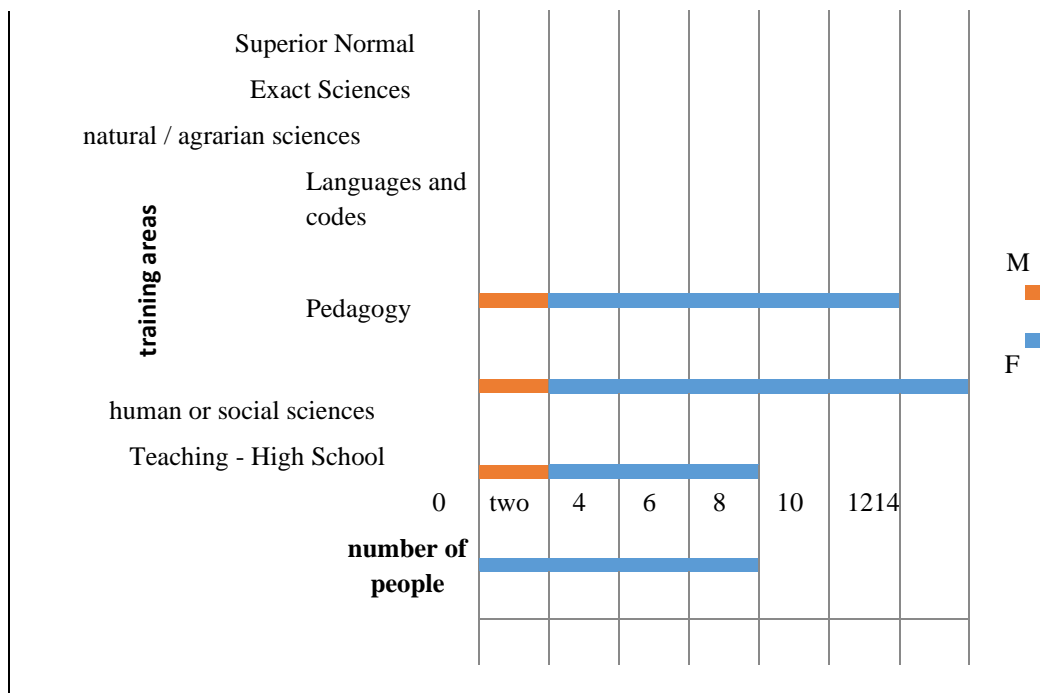
Source: Field research(2020).

It can be noted in the results presented (Graph 6), that of the teachers, 36% think about changing their profession and 83% of the men have the same thought. This is an aspect that deserves attention, considering that this issue is directly related to the welfare state of teachers. When performing the average between the sexes, there is the result of 60% of the sample that thinks about changing profession.

As shown in the initial chapters of this work, there are numerous factors that can lead teachers to dissatisfaction with the profession, among these, low salaries and the exhausting characteristic of teaching stand out.

Graph 7 presents data from the areas of teacher training, considering the maximum teacher training in this question.

Graph 7 - Distribution of professors in relation to the training area.



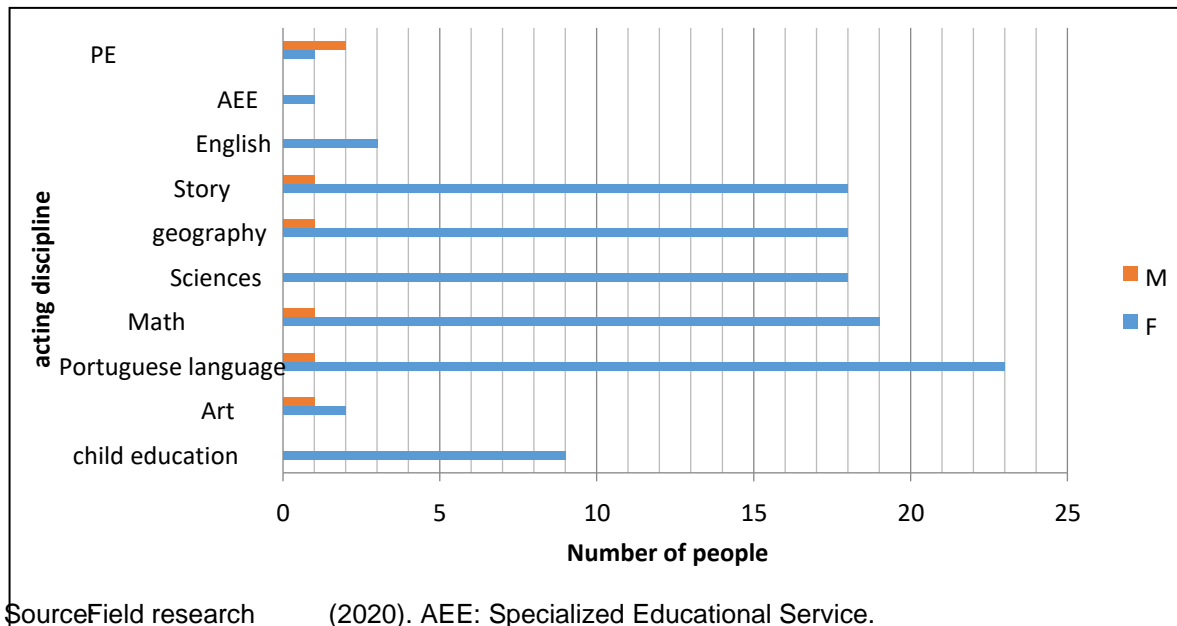
Source: Field Research (2020).

It can be seen in Graph 7 that most teachers are trained in the area of Pedagogy, with 16 teachers, the second area that most appeared was Languages and Codes, with 15 teachers. It is noted that 9 teachers have high school education in the area of teaching and do not have higher education, making up 20% of the sample of teachers. In fourth place are teachers with training in Humanities or Social Sciences, with 11 people. The other areas have 5 teachers. Two teachers presented more than one training area. The average salary of teachers who have only secondary education was 1.88 minimum wages and for graduates it was 2.12 salaries, being approximately 11% lower for non-graduated teachers, indicating that there is a relationship between the undergraduate level and the salary received.

Data from the Ministry of Education (BRASIL, 2018) for the year 2017, in primary education, the rate of teachers who did not have higher education was 15.2% and those who had high school with a teacher training were 10.4%. Those who had completed higher education were 78.4%. In this work, the percentage of teachers who have higher education was 82.4%.

In Graph 8, there are the answers when asked about the disciplines they work. It is noteworthy, at this time, that the sample was composed of teachers of kindergarten and elementary school, in the early and final years, therefore, most teachers (Kindergarten and Elementary School - Early Years) teach several subjects to the same classes, belonging to the common core. Only active in early childhood education, the sample had 9 teachers.

Graph 8 - Distribution of professors in relation to the discipline of action.



Delivering several disciplines requires that the teacher has to move in different areas of knowledge, which may require more time to prepare classes and more knowledge. This factor can be an element that causes the reduction in the well-being of teachers at this level of

education, especially when they do not have adequate pedagogical training.

Table 4 presents the data referring to the issues of teaching time in general and the time spent in the school where they work.

Table 4 - Time in teaching and in activity at the evaluated school.

Tempo (anos)	tempo total (anos)				%	na mesma escola (anos)			
	F	M	Total			F	M	Total	%
< 1	3	0	3	5,9	14	1	15	29,4	
1 a 4	9	0	9	17,6	18	4	22	43,1	
5 a 9	8	3	11	21,6	4	1	5	9,8	
10 a 14	10	2	12	23,5	2	0	2	3,9	
15 a 19	7	1	8	15,7	3	0	3	5,9	
20 a 24	4	0	4	7,8	0	0	0	0,0	
26 a 29	1	0	1	2,0	3	0	3	5,9	
30 a 34	3	0	3	5,9	1	0	1	2,0	
Total	45	6	51	100,0	45	6	51	100,0	

Source: Field Research (2020).

It is observed in Table 4 that most teachers work between 5 to 14 years in teaching and in the same school are working for up to 4 years, indicating a short time spent in the same school. When adding the percentage of teachers who have been working for more than 10 years, there is a total of approximately 55% of the sample. When evaluating a possible correlation between teaching time and the intention to change profession, it was noted that teachers who answered yes, have an average of 8.6 years of teaching, whereas those who do not intend to change

profession have approximately 13.6 years of teaching. For men, of those who intend to change profession, the average time in teaching was 11 years and the only one who does not intend to change profession has about 7 years in the teaching activity. These data indicate a positive correlation only in the male sample, that is,

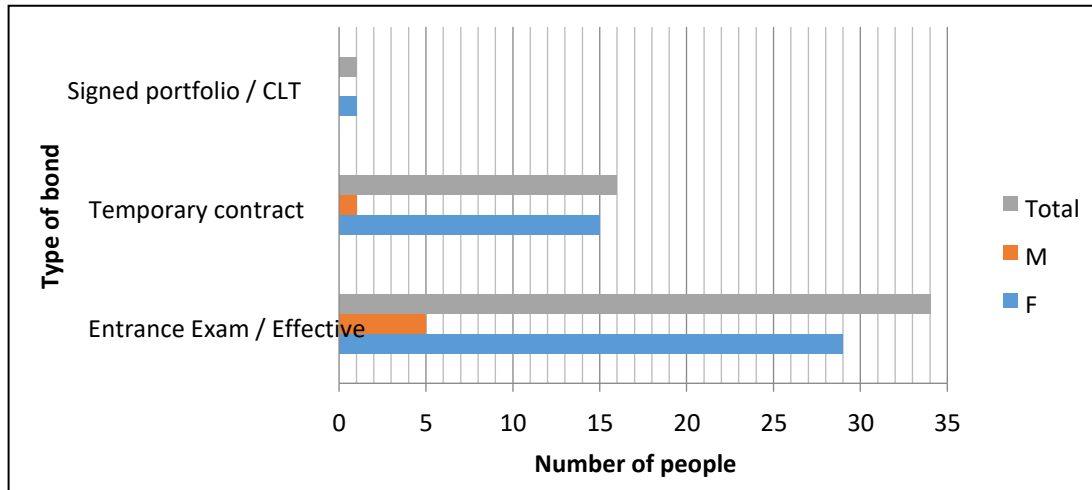
According to Souza (2013, p. 57):

Most basic education teachers in Brazil are people with work experience. This means that, even with the renewal of

staff, with the expansion in hiring, teachers are staying longer in the profession.

Graph 9 shows the profile of teachers' responses in relation to employment.

Graph 9 - Teacher employment relationship



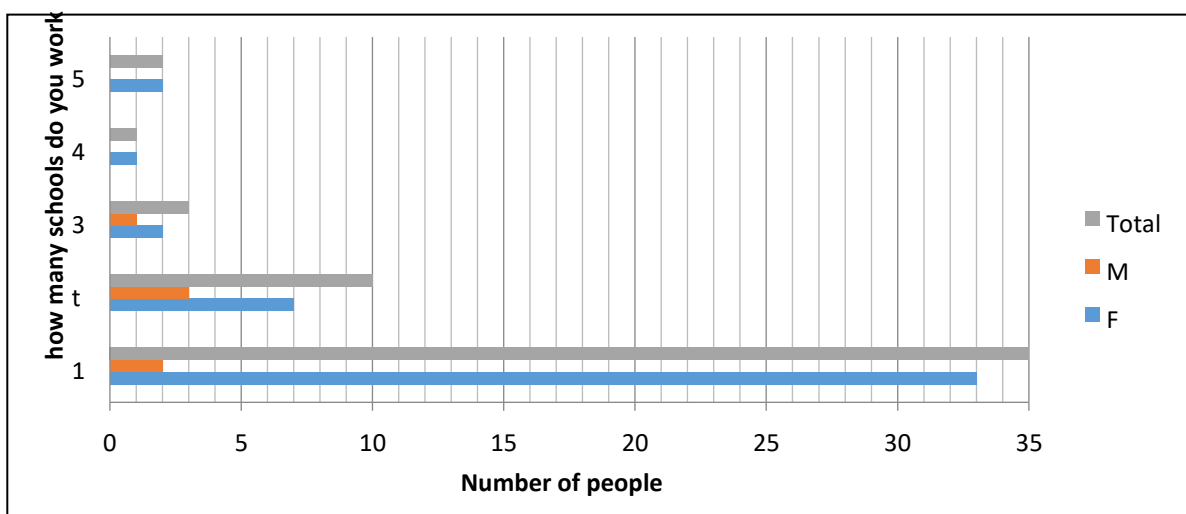
Source: Field Research (2020).

It is observed in Graph 9 that most teachers are permanent/tenured, with 34 teachers (66.7%), while those hired on a temporary basis are 16 (31.4%), with only 1 teacher (2%) with signed portfolio/CLT. There is a common consensus that public/tenured teachers have greater job stability, on the other hand, those who have a temporary contract do not have such a guarantee. For the professor who is under contract via CLT, he is covered by

legislative guarantees, but without job stability. The stability factor can lead teachers to perceive more well-being when compared to others, who do not have the same stability.

Graph 10 presents data referring to the number of schools where teachers work.

Graph 10 -Current number of schools in which teachers work



Source: Field Research (2020).

When evaluating Graph 10, it can be seen that most teachers work only in one school, with about 35 people

(68%), in second place there are 10 (19%) teachers who work in two schools .Working in 3 schools, there are 3

teachers, one teacher in 4 schools and two teachers working in 5 schools. In a study carried out in Santa Catarina (BIGATON, 2005), evaluating 442 preschool and elementary school teachers, it was found that approximately 303 (68%) teachers worked in one school and 115 (26%) in two schools. It is quite common for teachers to perform activities in more than one educational institution, in order to complement the workload and also the family income.

For teachers who work in more than one school, it is to be expected that they will need a greater displacement compared to those who work only in one educational institution, usually without specific remuneration for this. This factor may be one of the elements that reduce the well-being of these teachers, in this study, 32% of the sample worked in more than one school. Regarding the weekly workload exercised by teachers, Table 5 shows the results of activities carried out in the classroom and outside the classroom.

Table 5 - Weekly workload in the classroom and outside the school environment

carga horária (h/a)	em aula			fora da sala		
	F	M	Total	F	M	Total
< 5	2	0	2	19	2	21
6 a 10	2	0	2	17	2	19
11 a 15	0	1	1	5	2	7
16 a 20	2	0	2	3	0	3
21 a 24	1	1	2	1	0	1
25 a 29	29	2	31	0	0	0
30 a 34	4	0	4	0	0	0
35 a 39	1	1	2	0	0	0
40 a 44	2	0	2	0	0	0
> 44	2	1	3	0	0	0
Total	45	6	51	45	6	51

Source: Field Research (2020).

It is observed in Table 5 that most teachers (60.7%) exercise between 25 and 29 hours per week of activities in the classroom and outside the classroom, 21 teachers reported using less than 5 hours for related activities. It is also observed in this same table that 19 teachers reported using between 6 to 10 hours outside the classroom environment and another 11 teachers reported using between 11 and 24 hours for these activities.

In the study mentioned above, conducted in Santa Catarina (BIGATON, 2005), it was found that about 54% of the teachers evaluated had a workload of 31 to 40 hours of classes per week. Comparing this study, with the data from this work we have approximately 86% of the sample with a workload between 21 and 44

class hours.

Considering this aspect, Faria (2015, p. 164) discusses in relation to the tasks of teachers that:

In addition to the hours in the classroom, the teacher must dedicate himself to extra-class activities, such as: preparing classes, correcting tests and collective pedagogical work hours (HTPC), provided for planning and exchanging experiences with colleagues. Thus, there is a marked

difference between teaching time and working time.

As already shown, most of the teachers evaluated are married women with children, which may indicate that, in addition to teaching, they perform activities inherent to the home, reducing free time for the development of regular physical activity. This aspect may be directly related to the well-being of these teachers, considering that the development of regular physical activity is one of the pillars of well-being.

In this sense, Faria (2015, p.164) presents:

It is observed that the teaching activity takes place in the public space, at school, and also in the private space, at home, with no barriers that prevent its overflowing into leisure time, rest, child care, activities with family members and household chores.

Most of the time, teachers use their free time to develop activities related to teaching, even using the weekends for these activities, leaving no time to invest in actions that promote their quality of life.

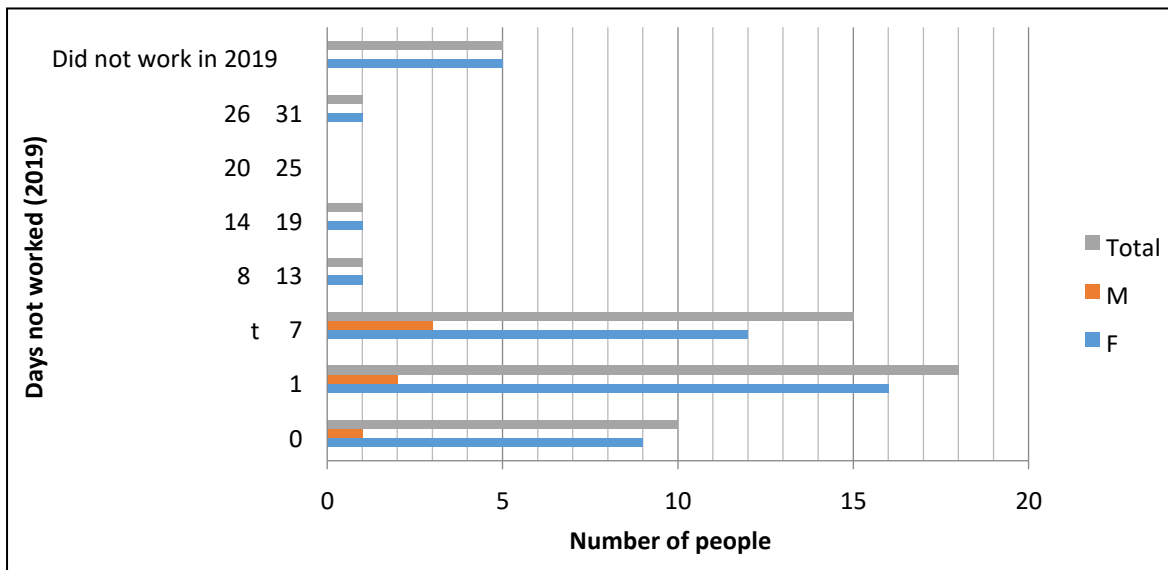
Almeida, Gutierrez and Marques (2012, p. 36) discuss this aspect, considering other lifestyle issues:

The adoption of a lifestyle considered healthy is taken, in contemporary society, as a determining factor in the health and life situation of the subjects. However, this often does not occur, not because of the subject's lack of will, but because of the absence of favorable socioeconomic conditions. Habits such as adequate nutrition, rest hours, periodic and prophylactic visits

to the doctor, and frequent physical activity are not always possible for all individuals, due to lifestyles and conditions that do not allow such actions.

Graph 11 presents data referring to days of absence of teachers, caused by health problems in the year prior to this research (2019).

Graph 11 - Number of days of absence of teachers in 2019, due to health problems



Source: Field Research (2020).

It is possible to observe in Graph 11 that 5 teachers were unemployed in the year 2019, due to lack of attribution in schools, of these, 3 are thinking about changing their profession. From the total sample, 18 professors needed to be away for at least 1 day due to health problems, 15 professors from 2 to 7 days and only 3 professors between 8 and 31 days. 10 teachers reported that they did not take a day off for health reasons. The causes of absences were not asked in the questionnaire, but only absences for reasons related to the health of the professors were computed.

It is known that mental disorders (depression, anxiety, Burnout Syndrome) are among the main causes of absence among teachers, mainly due to employment conditions (DIEHL, 2016; GOUVÊA, 2016).

According to Teixeira (2018, p. 1):

In an online survey carried out by Associação Nova Escola with more than five thousand educators, between the months of June and July 2018, it gathered more information about the

problem and identified that 66% of teachers have already needed to leave work for reasons of health.

Of the professors who have already had to leave for some reason, 87% believe that the problem that motivated the leave is either caused by work or intensified (TEIXEIRA, 2018). In this same study, the main problems of educators' leave were listed:

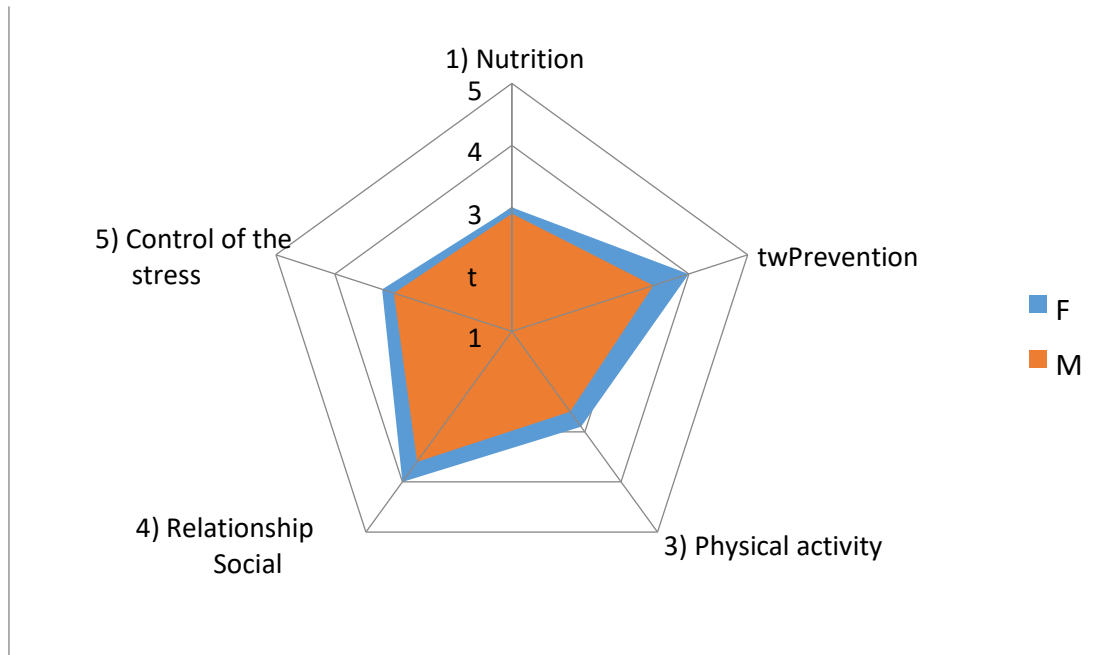
Among the problems that appear more frequently than anxiety, which affects 68% of educators; stress and headaches (63%); insomnia (39%); limb pain (38%) and allergies (38%). In addition, 28% of them stated that they suffer or have already suffered from depression (TEIXEIRA, p. 4).

It is noted, in these cases, that it is not possible to establish the well-being of these teachers, in view of the problems that affect educators.

Teachers, in addition to the normal demands of the profession, are required to work to change the educational scenario and the life of the public they serve, often without the necessary structure, unfold to meet these expectations and some end up depleting their health, compromising their well-being and quality of life.

Graph 12 presents the data referring to the questions of the teachers' well-being profile, according to the Well-Being Pentacle methodology. The complete data with answers to the Pentacle questions are presented in Appendix B.

Graph 12 - Average values of the Teachers' Well-Being Pentacle



Source: Field Research (2020).

It is observed in Graph 12 that the profile of responses in relation to gender has a similar pattern, but females (blue) have higher averages than males (red) in both components evaluated, especially in the parameters of prevention and relationship Social.

Table 6 presents the averages for each component of the Pentacle and the framework in the qualitative assessment, according to the WHO (FLECK et. al., 1999).

Table 6 - Welfare Pentagram Average and Assessment

Componente do Pentáculo	F	Avaliação	M	Avaliação
1) Nutrição	3	regular	2,9	necessita melhorar
2) Prevenção	4	boa	3,4	regular
3) Atividade Física	2,9	necessita melhorar	2,6	necessita melhorar
4) Relacionamento Social	4	boa	3,6	regular
5) Controle do estresse	3,2	regular	3	regular

Source: Field Research (2020).

As shown in Graph 12 and Table 6, according to the components of the Pentacle, in relation to nutrition, teachers are in a regular situation and teachers need to improve. In the prevention parameter, the teachers are in a good situation, while the men are regular. Regarding the physical activity component, both need to improve.

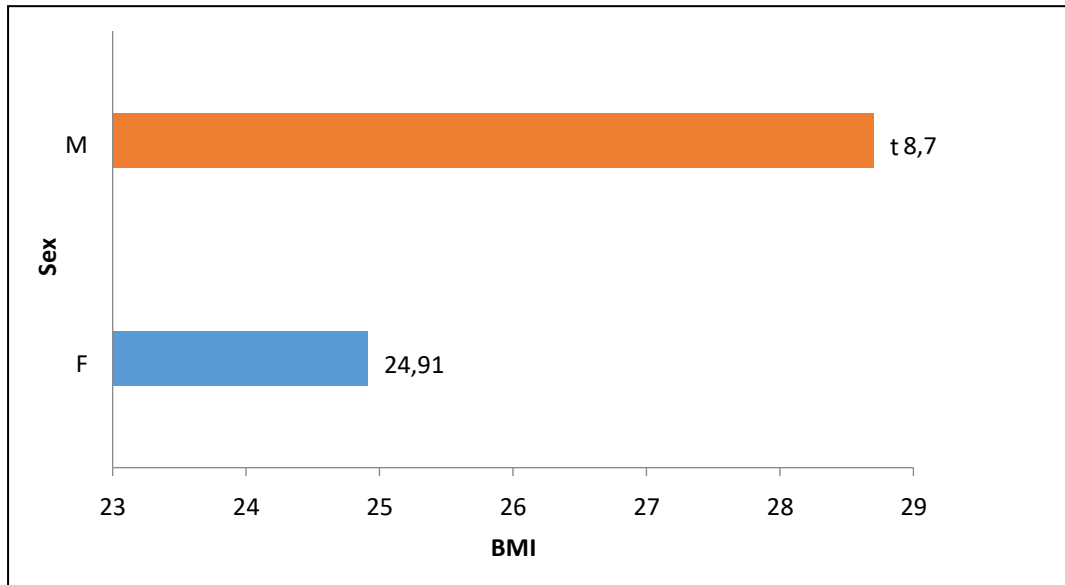
In social relationships, the teachers have a good evaluation, while the men are in a regular situation. In the last component, about stress control, both sexes have a regular situation. None of the components of the Pentacle were rated 5.

In a study that evaluated 111 public school educators in the city of Uruguaiana, in Rio Grande do Sul, using the Well-

Being Pentacle, it was found that the biggest problems for a healthy lifestyle for teachers are related to physical activity components. and preventive behavior (COUTINHO et. al., 2012). In this same study, they concluded that the difficulties related to physical activity are related to the workload of teachers. Another study also

evaluating teachers in a municipal school in the city of Santa Maria, in Rio Grande do Sul, using the Pentacle of Well-Being, found that the physical activity component, in the evaluated sample, had negative results, requiring attention (CASAROTTO et. al., 2015). In Graph 13, we have the results of the Body Mass Index (BMI) of teachers.

Graph 13 - Body Mass Index of teachers.



Source: Field Research (2020).

It is possible to observe in Graph 13 that the BMI of the teachers was lower than that of the teachers and, according to the classification of the Brazilian Society of Nutrition, the results of the BMI of the teachers are classified as adequate for females (24.9 Kg/m²) and for pre-obese men (28.7 Kg/m²). The results of the teachers indicate a fine

limit between the adequate and the degree of pre-obesity and for men, indicating a proximity to the classification of obesity grade I. When the data were classified individually, it is possible to calculate the percentage of the classification of all teachers and these data are presented in Table 7, below.

Table 7 - BMI and percentage of ratings among teachers.

IMC	Classificação	F	%	M	%	Total	% total
≤18,5	Magreza	1	2,2	0	0,0	1,0	2,0
18,5 a 24,9	Adequado	21	46,7	1	16,7	22,0	43,1
25,0 a 29,9	Pré-obeso/sobrepeso	21	46,7	4	66,7	25,0	49,0
30,0 a 39,9	Obesidade I e II	2	4,4	0	0,0	2,0	3,9
≥ 40,0	Obesidade III	0	0,0	1	16,7	1,0	2,0
Total		45	100	6	100	51	100,0

Source: Survey data (2020).

The results presented in Table 7 indicate that, on average, 43.1% of the sample of teachers have normal or adequate levels of BMI and

2% below. In the classification of overweight/obesity, 51.1% of the sample of women and 83.4% of men are found, making up an approximate total of 55% of the sample with overweight/obesity.

The results found in this work are similar to a study developed by Rocha et. al (2015), who evaluated 300 state

teachers in northeastern Brazil, showed that 47.2% of teachers were obesity/overweight, with the male population (58.2%) having the highest rates compared to women (36 ,two%).

Obesity is a pathological state that leads the individual to numerous disorders, such as cardiovascular problems, dyslipidemia, diabetes, some types of cancers, hypertension, etc., being a serious public health problem (ROCHA et. al, 2015). In the evaluated sample, teachers

were asked about the presence of any health disorder in men, none of them reported having diseases of this nature. In women, four reported having problems related to the cardiovascular system, among them, one reported heart problems and dyslipidemia and the other three, arterial hypertension. Two professors reported having thyroid-related problems, one with asthma and one with sinusitis, rhinitis and migraine. Considering eight teachers with reports, approximately 17% of the sample have pathological disorders,

Teachers' BMI data corroborate the results obtained in the Well-Being Pentacle, where aspects related to physical activity need improvement and others related to health are in a regular state or also in need of improvement.

There are numerous factors that generate well-being and quality of life and the regular practice of physical activity is one of the elements that can contribute to the reduction

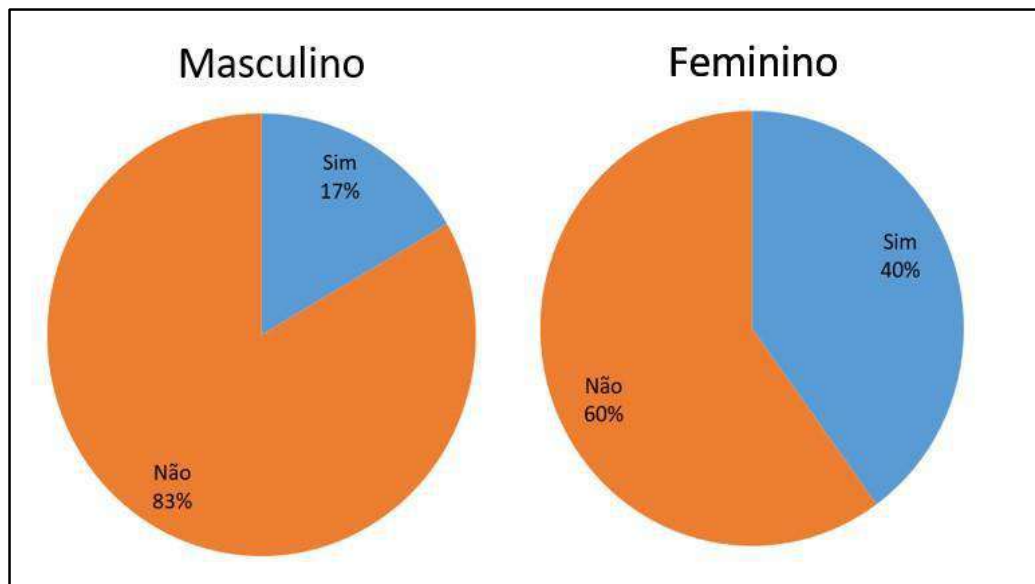
of obesity and consequently chronic diseases associated with this pathology and as reported by Ciolac (2004), sedentary lifestyle is one of the factors that trigger these diseases.

In the Wellness Pentacle there are issues related to alcohol consumption and tobacco use, these issues were adapted by the author and addressed separately in this work.

It is noteworthy, at this point, that none of the teachers reported using tobacco, which is a very relevant aspect, considering that the use of tobacco leads to numerous diseases.

Teachers were asked about their habitual use of alcohol in moderation (up to three glasses of draft beer, just under two cans of beer, or a shot of pint or whiskey). The results are shown in Graph 14, which shows the profile of teachers in relation to alcohol use.

Graph 14 - Teachers who habitually use alcohol



Source: Field Research (2020).

It was possible to observe in the previous Graph that 40% of women use alcohol habitually and 17% of men use it.

In terms of classification, Penido (2019) presents the following aspects in relation to the abusive use of alcohol:

It is considered “abusive use of alcohol”, the ingestion of four or more doses among women and five or more doses of alcoholic beverages among men, on the same occasion, in the last 30 days.

Data from the Ministry of Health indicate that in 2018 the abusive consumption of alcohol by the adult population was 17.9%, with an increase in the percentage of women between 2006 (7.7%) and 2018 (11%) of approximately 43% in the alcohol use, whereas for men the values went from 24.8% in 2006 to 26% in 2018 (PENIDO, 2019).

The results presented in the sampling of this study, in relation to the habitual use of alcohol for the group of teachers is above the national average for females, which was 11% in 2018, whereas for males, the results are below the average for sex, which in 2018 was 26%.

Coutinho et. al. (2012, p.1) discuss the aspect of alcohol use in a sample similar to this work, involving teachers:

Regarding the consumption of alcoholic beverages and smoking, we can point out that, despite being unfavorable aspects for health, the use of alcohol, mainly, is socially accepted and considered by many teachers, according to its manifestations in the lectures, as a moment of relaxation, leisure and relaxation. In this way, these behaviors are not seen as something bad (by teachers), with a compensation for the harm of these habits by the pleasure they provide.

The negative effects of alcohol use on mental and cognitive aspects are widely known, especially the impairment of memory and reasoning functions (OLIVEIRA, LARANJEIRA; JAEGER, 2002).

In this regard, Penido (2019, online) reiterates about the effects of alcohol on the body:

According to the WHO, there is no safe volume of alcohol to be consumed, because it is toxic to the human body and can cause mental illnesses, various cancers, liver problems such as cirrhosis, cardiovascular changes, with risk of heart attack and stroke and the decrease in immunity. In addition to being responsible for episodes of physical violence against you or other people.

It is known that the role of the educator requires the constant use of brain functions in the performance of activities inherent to the profession and the use of alcohol can be an important factor in a reduction in the performance of these functions.

It is noteworthy, at this point, that the present study did not aim to investigate the effects of alcohol on the cognitive functions of teachers, but aimed to trace the well-being profile, and habitual alcohol use may be one of the factors with a negative influence on welfare state of teachers.

Women tend to be more sensitive to the effects of alcohol when compared to men, due to less muscle mass and lower blood volumes. According to Costa (2003, p. 12):

Society as a whole is not very flexible and receptive to the conception of alcohol consumption by women, reacting with exclusion and evident discrimination. As a result of this social isolation, the woman proposes to feed the addiction

clandestinely, where she experiences the fastest development of dependence and has greater contact with risk factors.

Finally, in the final question of the questionnaire, teachers had the opportunity to openly express their opinions about items they deem important for the well-being and quality of life in the school environment, these items are listed below:

- 6 professors suggested psychological care;
- 4 suggested having a moment to relax when we were stressed with students and the insertion of relaxing moments with group dynamics;
- 2 indicated ethics as a suggestive element;
- 1 indicated longer interval time;
- 1 suggested more planning time to avoid having to plan at home;
- 2 suggested adapting to the planning hours that are not being fulfilled, with a third of the workload;
- 1 suggested better quality of technological tools;
- 1 suggested decreasing the amount of useless paper required as records;
- 1 suggested having fewer students;
- 1 suggested a break room at the planning time (at least 20 minutes);

Among some of the teachers' suggestions, it is observed that among the items are moments for relaxation and group dynamics. Within the intervention proposal presented below, the objective is to contemplate these aspects, inserted together with physical activities.

Therefore, in the next chapter, the proposal for intervention with physical activity and relaxation programs is presented, in order to be practiced by teachers.

IV. CONCLUSION

Quality of life and well-being are key terms when evaluating individuals in terms of how they feel, whether in relation to themselves or their professional lives. In Brazil, the teaching profession faces several and constant challenges, such as strenuous workload, low pay and conflicts between students and teachers, which together can interfere with quality of life and well-being. In addition, factors related to health and eating habits are also relevant in this assessment.

Therefore, inserting proposals in everyday school life that are aimed at improving the quality of life of these

teachers, whether physical or psychological approaches, are important to change the existing conception that the school for the teacher is, at times, a stressful and tiring environment.

Therefore, the main purpose of this work was to try to understand how the teacher perceives himself in face of his own quality of life and well-being, relating this perception to everyday school life.

Through studies in the literature and based on the results obtained in the questionnaires answered by the teachers and their analyses, it was possible to trace the profile of the teachers of Early Childhood Education and Elementary School, that is: most are married women who they have 1 to 2 children, with an average salary of 2 minimum wages, a value close to the average salary for the entire population of the municipality. A profile that allows us to conjecture that teachers spend a lot of time taking care of the house and children, which can reduce the time and spirit dedicated to the practice of physical activities.

Regarding professional performance, they have an average weekly workload of 25 to 29 hours in the classroom, with greater training in pedagogy, probably due to the fact that most of the schools covered in this study are Kindergarten and Elementary School Early Years .

The vast majority have a higher education degree and have been working as teachers for over 10 years, with an average length of stay of 4 years in the same school and working in only one school.

It was observed that more than half of the teachers reported having been away due to health problems for 1 to 7 days in the last year (2019) and most male teachers are seriously considering changing their profession, which may demonstrate dissatisfaction with teaching or factors related to it.

In addition to teaching activities, women also tend to perform domestic tasks and take care of their children, but teachers perceived themselves as having better well-being than men, in all aspects of the Pentacle of Well-Being. This fact opens the way for future studies, in order to investigate in more detail what causes may influence these differences.

In general, teachers need to improve in relation to the practice of physical activities and stress control, especially because the majority of those studied are overweight/obese, and again men are more overweight.

Habits such as alcohol intake can also be seen as an aspect that deserves more detailed studies. Together, these results showed that the quality of life and well-being of teachers need to be addressed.

The hypothesis, therefore, was confirmed, when results were obtained that showed that when they exercise less, teachers perceive themselves with lower quality of life and well-being, in addition to presenting higher BMI.

It is concluded, in view of the results obtained in this work, that its proposal meets the real needs of the evaluated group, proposing the inclusion of physical activity in the routine of teachers, favoring the improvement of their well-being, thus contributing to the increase in the quality of life.

Further studies are needed in order to investigate the effects of inserting this long-term intervention in this group of evaluated teachers, with a view to contributing to the advancement of research in this area, thus providing an improvement in aspects involving quality of life and well-being. -being of the teachers.

Another suggestion is the inclusion of the school community as a whole in intervention projects: school employees, students and family members can be included in similar studies, also offering the same space for practices and guidance on quality of life.

For further research and further research, evaluations and analysis of the emotional pillars of teachers, fixed and growth mindsets, application of meditation and Yoga techniques and the relationship between neurosciences and quality of life in educators are also suggested.

REFERENCES

- [1] ALMEIDA, MAB; GUTIERREZ, GL; MARQUES, RFR Quality of life: definition, concepts and interfaces with other research areas. São Paulo: School of Arts, Sciences and Humanities - EACH/USP. 142 p. 2012.
- [2] ANIBAL, Cíntia; ROMANO, Luis Henrique. Relationship between physical activity and depression: review study. Revista Saúde em Foco, n. 9, p. 190-199, 2017. Available in: <http://portal.unisepe.com.br/unifia/wp-content/uploads/sites/10001/2018/06/021_artigo_cintia.pdf> . Accessed on: June 29 2020.
- [3] ARAÚJO, DSMS of; ARAÚJO, CGS of. Physical fitness, health and health-related quality of life in adults. Brazilian Journal of Sports Medicine, vol. 6, no. 5, p. 194–203, Oct. 2000.
- [4] BALL, S.; GAMMON, R. My activity pyramid for adults. ACSM's Health & Fitness Journal, 13(6), pp.24-27, 2009.
- [5] BARBOSA, Andreza. Teaching Salaries, Financing and Quality of Education in Brazil. Education Reality Magazine, v. 39, n.2, Apr./Jun. 2014.
- [6] BEZERRA, GR; FELIX, KD The benefits of labor gymnastics for the prevention of musculoskeletal pain in teachers at the Gesner Teixeira/Gama-DF school. UNICELAC Health Journal, vol. 2, n. 1, 2015.

- [7] BIGATON, RAS Profile of basic education teachers and multidimensional analysis. Master's thesis. Center for Human Sciences and Communication. University of Vale do Itajaí. Santa Catarina, 2005.
- [8] BIRCHER J. Towards a dynamic definition of health and disease. *Medicine, Health Care and Philosophy*, vol. 8, n. 3, p. 335-341, 2005.
- [9] BOTH, Jorge et al. Well-being of physical education teaching workers in southern Brazil according to vital cycles. *Rev. bras. education Ph.D. sport*, São Paulo, v. 28, no. 1, p. 77-93, Sea. 2014 . Available in http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1807-55092014000100077&lng=en&nrm=iso. accessed on April 4, 2020. <https://doi.org/10.1590/S1807-55092014000100077>.
- [10] BRANCO, AE Labor Gymnastics: Prerogative of the Physical Education Professional. Rio de Janeiro: CONFEF, 2015. 64p. ISBN. 978-85-61892-07-4
- [11] BRAZIL. National Institute of Educational Studies and Research Anísio Teixeira (Inep). 2020. Census of basic education: 2019 statistical notes. Available in <http://portal.inep.gov.br/documents/186968/0/Notes+Estat%20C3%ADsticac+-+Census+da+Educa%C3%A7%C3%A3o+B%C3%A1sica+2019/43bf4c5b-b478-4c5dae17-7d55ced4c37d?version=1.0>
- [12] BRAZIL, CONSTITUTION OF THE FEDERATIVE REPUBLIC OF BRAZIL, 1988. Available at: http://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm. Accessed on: 10 Feb. 2020.
- [13] BRAZIL, Ministry of Education. Census of Higher Education 2016. Brasília – DF, 2016.
- [14] BRAZIL, Ministry of Education. 2017 School Census. Brasília – DF, January 2018.
- [15] BRITO, Wellington Fabiano et al. Physical activity level in state school teachers. *Journal of Public Health*, vol. 46, no. 1, p. 104-109, 2012.
- [16] CARDOSO, Berta Leni Costa et al. Lifestyle and physical activity level in university professors. *Unimontes Scientific Magazine*, vol. 18, no. 1, p. 15-23, Jan/June 2006.
- [17] CARVALHO, Ana Júlia Frazão Panzeri de; ALEXANDRE, NMC Musculoskeletal symptoms in elementary school teachers. *Brazilian Journal of Physiotherapy*, vol. 10, n.1, p. 35-41, 2006.
- [18] CASAROTTO, V. The lifestyle profile through the evaluation of the Well-Being Pentacle in teachers and interns at a municipal school located in Santa Maria, RS. *EFDeportes.com, Digital Magazine*. Year 19, No. 201, February 2015. Buenos Aires.
- [19] CIOLAC, Emmanuel Gomes; GUIMARAES, Guilherme Veiga. physical exercise and metabolic syndrome. *Rev Bras Med Esporte*, Niterói, v. 10, no. 4, p. 319-324, Aug. 2004 . Available in: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1517-86922004000400009&lng=en&nrm=iso. Accessed on March 13, 2020.
- [20] COSTA, RMR Alcohol and its effects on the nervous system. Graduation Monograph. Faculty of Health Sciences. University Center of Brasília. Brasília – DF, 2003.
- [21] COUTINHO, RX et. al. Health-related lifestyle profile of teachers. *EFDeportes.com, Digital Magazine*. Year 17- N° 168 - May 2012. Buenos Aires.
- [22] D'AGOSTINI, Ana Carolina. Brazil leads the rate of violence against teachers. What can we do? *New School*, 05 Jun. 2019. Available at: <https://novaescola.org.br/conteudo/17609/brasil-leads-index-in-violence-against-teachers-O-what-we-can-do>. Accessed on: 03 May 2020.
- [23] DIAS, Jaqueline et al. Physical activity practice in higher education teachers: focus on quality of life. *Anna Nery School*, v. 21, no. 4, p. 1-6, 2017.
- [24] DIEHL, Liciane; MARIN, Angela Helena. Mental illness in Brazilian teachers: systematic literature review. *Intern. Psicol.*, Londrina, v. 7, n.2, p. 64-85, Dec. 2016 . Available in http://pepsic.bvsalud.org/scielo.php?script=sci_arttext&pid=S223664072016000200005&lng=pt&nrm=iso. access on April 4 2020.
- [25] EDUARD, Maury-Sintjago; JULIO, Parra-Flores; ALEJANDRA, Rodríguez-Fernández. Co-occurrence of Risk Factors for Cardiometabolic Diseases: Unhealthy Eating, Tobacco, Alcohol, Sedentary Lifestyle and Aspects Socioeconomic. *Arch. Bras. Cardiol.*, São Paulo, vol. 113, no. 4, p. 710-711, Oct. 2019 . Available in http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0066-782X2019001000710&lng=en&nrm=iso. Accessed on: April 4, 2020.
- [27] FARIA, Graciela SanjutáSaores; RACHID, Alessandra. Workday for public school teachers. *Revist FAE*, v.18, n.2, p. 162-177, Jul./Dec., 2015.
- [28] FERREIRA, Paula. Minimum salary paid to teachers in Brazil is one of the worst in the world. *Jornal O Globo*, September 11 2019. Available in: <https://oglobo.globo.com/sociedade/educacao/salario-Minimum-paid-out-to-teacher-at-the-Brazil-a-From-worst-of-world-23056381>. Accessed on: 3 May 2020.
- [29] FLECK, Marcelo Pio de Almeida et al. Development of the Portuguese version of the WHO quality of life assessment instrument (WHOQOL-100). *Rev. Bras. Psychiatr.*, São Paulo, v. 21, no. 1, p. 19-28, Mar. 1999
- [30] FLORES, Maria Assunção. Tendencies and tensions in teaching work: reflections from the voice of teachers. *Perspectiva Magazine*, v.29, n. 1, p. 161-191, Jan./Jun.2011.
- [31] FOLLE, Alexandra; FARIAS, Gustavo de. Level of quality of life and physical activity of teachers from state public schools in the city of Palhoça (SC). *Mackenzie Magazine of Physical Education and Sport*, v. 11, no. 1, p. 11-21, 2012.
- [32] GIL, Antonio Carlos. *Methods and techniques of social research*. 6 Ed. São Paulo: Atlas, 2008.

Love and Psychoanalysis: A dialogue between Clinic and Literature

Aline Mattos Peruch Rigoni, Alice Melo Pessoti

Received: 11 Sep 2021,

Received in revised form: 20 Oct 2021,

Accepted: 02 Nov 2021,

Available online: 11 Nov 2021

©2021 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— Love, Philosophy,
Psychoanalysis, Literature, Madame Bovary.

Abstract— This approaches love, through the lenses of Psychoanalysis, within the literary work *Madame Bovary* (1856). The proposal aims to describe and discuss the construction of the concept of love in psychoanalytic theory, through the analysis of the literary work of Gustave Flaubert, presenting the relationship between love and Philosophy; describing relationships between love and Psychoanalysis; analyzing the subjective position of the character Emma towards love; conducting field research with psychoanalysts in private practice, asking them about the demand for love in their daily work; all with the aim of producing a handout to be used in the classroom, in the Special Topics in Psychoanalysis discipline. These objectives were operationalized through qualitative, exploratory and descriptive research, and the work consisting of a bibliographic survey phase; construction and analysis of the theoretical framework; preliminary study; analysis of literary work, and field study. Data collection was carried out through the Microsoft Forms platform, with a questionnaire containing open questions. At the end, it is concluded that, based on Emma Bovary's analysis, the love experience can present the confluence of life and death drives; it appears that the demands that come to the private practice clinics are mostly related to the theme of love, and that many contradictory emotions are associated with this theme; it appears that literature is a field of great possibilities, serving as a source of knowledge about the human soul and assisting the work of clinical psychoanalysts; it is shown that the use of literary works as a supportive practice for the formation of psychoanalysts provides greater learning about the psychic apparatus of the subject of the unconscious, since it reveals one of the ways of thinking about man and his psyche; it is clear that the reflection on love in the literary work *Madame Bovary* incites an almost singular elaboration, as each subject faces love in a certain way, in the most diverse situations and contexts of life.

I. INTRODUCTION

Love touches us from the moment we perceive ourselves as people. It is the central plot of the lives of many, and has always been present in the studies of Psychoanalysis, being the Oedipus Complex itself, a fundamental concept of this knowledge, a position in face

of Castration, an event that subjectifies the way each one will love. Thus, for Psychoanalysis, our first love relationships determine who we are. Therefore, the search for an object of love, as well as its understanding, always goes through a choice made by the unconscious.

For Freud (1914), the love relationship begins

with the experience of a child who suckles the mother's breast, the experience of primordial satisfaction. Based on this experience, each encounter with an object is, in reality, a meeting of satisfaction. In this sense, every object of love is a replacement for a primordial object, prior to the incest barrier, love being a replacement for a repressed object, a repeating love. For the author, the choice of the love object is based on Primary Narcissism; he clearly says that whoever renounces Narcissism launches himself in search of love and will transfer this narcissistic love to the beloved object, with an overvaluation of the object or himself.

In *Civilization and its Discontents*, Freud (1929) points out that, although love is considered the most powerful source of pleasure, it is never so defenseless against suffering as when one loves; never so helplessly unhappy as when the beloved object or its love is lost.

Love is present in several central concepts of psychoanalytic theory, such as Castration (FREUD, 1905), Narcissism (FREUD, 1914), Drive (FREUD, 1915), Oedipus Complex (FREUD, 1924). In fact, love, in both Freud's and Lacan's work, is multifaceted, linked to Narcissism (FREUD, 1914; LACAN, 1949), to idealization (FREUD, 1921; LACAN, 1953-1954); as an engine that constitutes civilization (FREUD, 1929); as a gift (LACAN, 1956-1957); to substitution (LACAN, 1972-1973), to poetry (LACAN, 1976), among others.

Since the beginning, love has been in Psychoanalysis and Literature, these intertwined knowledges. Freud, throughout his life, evaluated and analyzed literary works by great authors such as Dostoevski, Thomas Mann, Schnitzler, Shakespeare, Goethe and others. Maintaining a dialogue with Literature, according to Campos (2013), Freud did this when he wanted to explain something of his theory, understand the process of artistic creation and interpret a work.

In 1929, Freud wins the Goethe Prize, his only award for his writings. Upon receiving the tribute, his speech reveals the importance he gives to writing: "Since my childhood, my secret hero is Goethe (...) I was able to overcome my destiny in an indirect way and fulfill my dream: to remain a man of letters under the guise of a doctor" (FREUD apud KON, 2003, p. 314).

Mannoni (1994) considers that Freud's research in the literary field should not be examined from the point of view of aesthetics or literary criticism, but as a conversation between Psychoanalysis and Literature (CAMPOS, 2013).

In this sense, the purpose of this work is to interpret a literary work based on the Freudian premise

that, when analyzing a literary work, the very manifestation of the unconscious is analyzed. Thus, this dissertation is based on the work of Gustave Flaubert (1856), in the light of the writings of Freud and Lacan, as well as *The Banquet* of Plato, and others.

The dissertation is structured by an introduction, in which a brief contextualization about love is presented, the justification for choosing the theme and the problem to be analyzed. The literature review is divided into three parts: in the first, it is intended to present how Philosophy thinks about love; in the second, love in Psychoanalysis is approached, verifying how this concept is constructed in the works of Freud and Lacan; the third part presents the literary work *Madame Bovary* (1856) by Gustave Flaubert and the relationship that the character Emma has with love. Furthermore, the work indicates its methodology, configured in a field study, exploratory and descriptive with a qualitative approach with clinical psychoanalysts. Furthermore, love will be analyzed within the work *Madame Bovary*, following with the discussion of the results, in which a relationship is traced, on the theme of love, between research with professionals, literary work and Psychoanalytic theorists. Finally, in the last chapter, the final considerations remain.

II. DEVELOPMENT

The desire to know what love is comes across something ineffable. However, talking about love is what has been done since ancient times. Plato, in *The Banquet* (427-347 BC), talks about Eros (love), about who he is and about his nature.

The birth of Love is portrayed in the myth of the birth of Aphrodite (beauty). When this one was born, there was a feast among the gods; at the banquet, there was Poros (resource) who, intoxicated, fell asleep; Pênia (beggar), lacking resources, had the idea of having a child with Poros; then she lay with him and conceived Eros (love). Therefore, love is indigent, like the mother, and courageous, audacious, and steadfast, like the father. So Eros lacks, on account of his mother; however, because of his father, he feels longing for.

At Plato's banquet, some guests are gathered to discourse on Love, the most beautiful of the gods; the host was Agathon, and his guests were Phaedrus, Pausanias, Eryximachus, Aristophanes, Socrates, and Alcibiades, who does not speak but makes a declaration of love for Socrates. Plato presents the various speeches before the final speech, that of Socrates, which is based on the account of a woman, Diotima.

In the course of the speeches, each philosopher gathered clarifies how Love gives reason to human existence. The first to speak is Phaedrus, a sophist disciple, professor of rhetoric. For Phaedrus, Eros is one of the oldest gods on Olympus; he is created; it has neither father nor mother, and every birth is by virtue of Eros; therefore, it has a fundamental role in human life, bravery and courage being among its most praiseworthy virtues. In his conception of love, there is the figure of the lover and the beloved. In this sense, one loves and the other lets himself be loved; in a love situation, for Phaedrus, the lover must do everything to please the beloved, believing that the perfect world should consist only of the lover and the beloved.

Pausanias is the second to speak; he is also a sophist and begins with a strong criticism of Phaedrus; for him there are two types of Eros: Celestial Eros and Vulgar Eros. Attending to Vulgar Eros is to attend to the selfishness of matter and, to attend to Eros Heavenly, man needs to respond to the perfect models of justice and virtue. In addition to this conception, Pausanias praises the practice of pederasty, as an element of social convention, with the lover being insidious with the loved one, persisting in the seduction of his soul; as for the beloved, he must be resistant to what is fleeting, able to escape the appeals of false lovers.

Eryximachus, the third speaker, is a physician and presents Love as a harmony, associating Eros with Medicine. It presents two Eros: Health and Disease; one, it brings balance and harmony; the other brings imbalance and ruin to body and soul. The philosopher draws a parallel between Medicine and Music; uses the semantic elements of Music to make an analogy with Medicine; he claims that harmony results from opposing elements, like the notes that dictate the rhythm of a song, making it pleasant. There is only love if there is this harmony of body and soul.

The fourth guest to speak is Aristophanes, comedigrapher, who delivers his speech in poetic language. He says that, first of all, it was necessary to know the history of human nature and use a myth to portray it. At the beginning of the principles, there were three genera of human beings, which were double in themselves: andros, gynos and androgen. These beings were self-sufficient and perfect, of great strength and vigor; they had four hands, four feet, two organs of generation and a head, which had two opposite faces; the male sex descended from the Sun; the feminine from Earth, and the androgen from the Moon. With great presumption they turned against the gods, and they, to make them weaker, split them in two, throwing each half into a part of the world, condemning them. those to eternal

unhappiness, incomplete. From then on,

According to Plato (2015), this would be the explanation of the love that men feel for each other, trying to recompose the old nature of two making one, thus restoring the old perfection. In this sense, the author leads us to think that love is based on lack.

It is interesting to note that, in this line of thought, the character of Aristophanes justifies both male and female homosexuality, as well as heterosexuality.

Agathon, the fifth speaker, is a poet and host of the banquet. He starts by criticizing the speech of everyone else before him. Eros is young, always young, and a proof of this is that it manifests itself mainly among young people; a being so powerful, it makes us better. Thus, man loves the other because Eros is within him, it is impossible to give to the other what one does not have. For Agathon, Eros is possessed of all virtues and the most beautiful of all gods.

The sixth and last to speak is Socrates; he refutes Agathon's idea and says that what he learned about Eros was from the priestess Diotima. So, based on the lessons of the priestess, Socrates asserts that love is desire and that you only want what you don't have. In this sense, there is love only in absence, not in presence. The philosopher says that love is the desire for something, but you only want something you don't have. For the thinker, love is a quest, a dynamic process, never static.

In turn, Plato states that love evolves: you start by loving one person, then several, until you reach a purer and truer point of love, which is love for Beauty itself. In this sense, he brings love and philosophy together, concluding that they are both a search for the good and the beautiful.

Lacan (1960), in *The Transference*, takes up Plato's work to speak of love. Socrates, when asked about love, says he doesn't know anything about the subject, except what he has heard from a woman and, who speaks in his place, is Diotima. Using his method, the Socratic interrogation, he questions Agathon whether Eros wants what he already has, or whether he wants what he doesn't have; if it is love for something; whether to love and desire something is to possess it or not; whether it is possible to desire what you already have.

It may be noted that Socrates replaces the term Eros (love) with the term desire. When substitution takes place, we understand that the idea of lack is produced at the heart of the question of love. If desire is linked to lack, and the term replaces love, then love can only be articulated around lack.

According to Ferreira lessons (2017), the

Socratic method legitimizes the substitution, since the theme of the discourse will revolve around Eros (love) and Eros (desire). With great skill, Socrates handles the interlocutor with dexterity, leading him to the conclusion that the object of desire is something that is not available to him; it is something that is not present, that is, it is something he is devoid of.

Socrates continues with his game of signifiers until Agathon reveals that he no longer knows what was said. For Socrates to speak of love, he asks the priestess Diotima.

In this subtitle, the stories of the characters in Madame Bovary's work are portrayed, without the intention of pathologizing the central character, although it seeks to highlight the articulations of her life, her loving partnerships and her disorganization. Thus, it makes use of an analysis that can offer elements to identify how love can be understood by Psychoanalysis in the context of the book in question.

Madame Bovary it is expressive to us precisely because the characters in the work are realistic, as I said before. It is a fundamental literary work to this research, and it is important to discuss what Psychoanalysis does in face of a literary work.

Literature appears throughout the construction process of the works of Freud and Lacan. According to Souza (2002), these authors' approach to Literature is different. However, what is most special in this construction is Freud's understanding, which makes a relationship between the artist and the unconscious, extolling his ability to give form to it in such a way that the reader identifies with the characters created. In this sense, whoever reads Madame Bovary can identify with the work, just as Emma Bovary read her books and identified with the characters.

Freud's bet was that Psychoanalysis could explain the sources of creation, without being able to explain, however, creation itself. Psychoanalysts learn from writers about the unconscious and the human being, so much so that Freud himself recommended knowledge of literary texts as part of the analyst's training process (SOUZA, 2002).

There are two distinct positions, however important to our discussion, and that Souza (2002) tried to report. The author differentiates Literature and Psychoanalysis from Psychoanalysis and Literature. The first would be linked to the critical reader, who approaches the position of analyst; the second, Psychoanalysis and Literature, would be a clinician who seeks, in the literary text, a viewpoint as an illustration of aspects already elaborated in the theory, based on the

clinic, and which are found as an opportunity for confirmation from another field.

Campos (2013) emphasizes that the psychoanalytic analysis of a literary work is not interested in diminishing it from the aesthetic experience it offers, but rather in increasing our knowledge about Psychoanalysis itself.

Freud (1925) states that Psychoanalysis went beyond the exclusively medical interest, citing that, in France, it was men of letters who were first interested in the doctrine of the unconscious, associating and applying it to literature and aesthetics; to the history of religions and prehistory; to mythology, to education, and so on.

Murando (2007, apud CAMPOS, 2013), in a footnote, states that, in Brazil, Psychoanalysis took place primarily with intellectuals and artists, as well as among representatives of Modernism, including Mário and Oswald de Andrade, a fact that reiterates the intertwining between Psychoanalysis and Literature.

Therefore, the researcher continues as a critical analyst reader, with the aim of bringing the concept of love closer to Psychoanalysis within Literature.

The year 1856 is of great importance and symbolism, being the date when Gustave Flaubert publishes his book Madame Bovary and Freud is born. The first denounces Emma Bovary's dissatisfaction, and the second, later, creates Psychoanalysis based on female listening. Freud begins to listen to the hysteric's discourse, which, until then, was associated with female whims linked to their sexuality, which, in turn, would drive women crazy (AGRA, 2015).

According to Agra (2015), when Freud began to outline Psychoanalysis, it was already designed and published in Gustave's book. Reiterating what Freud said, knowledge of the arts is far beyond its time. Freud gave voice to the suffering of the hysteric, against a world that ignored women; announced female dissatisfaction, shedding light on how the body became the stage to dramatize the grievances and resentments of these women.

At the beginning of his book, Flaubert introduces us to Charles, Emma's husband, showing the fragility of his figure. Charles Bovary is a very peaceful man, without dreams, without goals, incompetent.

Charles has a troubled marriage. Flaubert describes him as someone who struggles with school activities. When he leaves to study medicine, he takes a liking to the bohemian life. Added to his academic difficulties, he ends up failing the exam for a health officer. After a while, he takes a new test, memorizing all

the questions, and passes mediocre.

Charles has an average career, without ambition, and is married for convenience to an older widow. A controlling woman and owner of some possessions. With the death of his first wife, he is free to remarry, and finds a beautiful woman named Emma Rouault.

On the day of the daughter's wedding, Emma's father, even though he is a man with limited education, considers the groom to be more frail, without attitude. After the wedding, Flaubert's book begins the grand narrative about Emma, giving full visibility to this character. Emma was a young peasant girl, raised in a convent, her head full of romantic fantasies and ideas. To occupy his time, he fed his soul from many novels and idealized a perfect love, just as in the books he read. Expecting a life full of riches, Emma is willing to do anything to get off her father's farm. She and Charles end up getting married, after a short engagement. The couple go to live in a small town called Tostes, where Charles begins to work shyly in his profession as a doctor. Emma's wish was to get married, but when she accepts Charles' proposal, the doctor does not show great enthusiasm or annoyance. Emma's eccentric desire is to get married "at midnight by candlelight" (FLAUBERT, 1856, p. 103).

Before marrying, she thought she had love; but having not arrived at the happiness that should result from that love, she must have been mistaken, she thought. And Emma wanted to know exactly if she understood in life the words happiness, passion and drunkenness, which had seemed so beautiful to her in books (FLAUBERT, 1856, p. 114).

A short time later, however, Emma is bored, tired of Charles, and depressed. Thus, Emma's frustrations don't take long to show up. In the beginning, marriage was, without a doubt, a honeymoon, the most beautiful days. However, Emma only knows romances to mark out marriage and the level of love in which she is inserted, and, therefore, Charles becomes the reasons for her disappointments. Emma had been wrong about the man she had married; he was "neither more loving nor more involved" (FLAUBERT, 1856, p. 125). Charles had no great ambitions, despite being kind and considerate to his wife. Emma lived in a world of poetry and romance, while Charles had the simplest and most modest desires.

As for Emma, she didn't

wonder if she loved him. Love, she believed, must be suddenly, with great sparkles and fulgurations – a typhoon of the sky that falls on life, overturns it, pulls out wills like leaves and carries the whole heart to the abyss (FLAUBERT, 1856, p. 192).

The couple attend a ball given at the castle of the Marquis D'Andervilliers, a local aristocrat, and Emma is dazzled by the opulent lifestyle she so craves. You start to notice that the guests are very well dressed, that the food served is magnificent and that the dancing is contagious. His desire for the life of novels from the convent era is immediately rekindled. As you eat the delicious food, waltz to the infectious music and taste the sophisticated drinks, feeling like you belong to the bourgeoisie, and farther away from Charles.

After the ball, she starts to think that her life would be very different if she were married to a Marquis or even a Viscount. Emma knew that such a thing was not possible and did the only viable thing: trying to include in her daily life the fantasy life she lived that night, starting to buy magazines, expensive objects that she considers refined, and incessantly wanting to go to Paris (AGRA, 2014).

Time passes and Emma is faced with her reality, far from the Castle of the Marquis. Not accepting her provincial condition, she consumes more and more expensive objects, in an attempt to get closer to this aristocratic fantasy world. Emma no longer enjoys doing anything in her daily life: she doesn't play the piano anymore, doesn't embroider, doesn't take care of the house, or take care of her appearance.

Emma falls ill and, after Charles takes her to a consultation with her former teacher and finds out that it was a disease of the nerves, he is instructed to change his air (NOBRE, 2007, p. 57). The young couple move to a slightly larger town, Yonville-l'Abbaye, in an attempt to make Emma feel better. However, the narrow routine continues.

Emma arrives in town pregnant and is invited by the pharmacist Homais to dinner. There, she meets León, a young clerk with whom she has a pleasant conversation. León lives with Monsieur Homais' family. Emma longed to be pregnant with a boy, who would be named Jorge. However, when giving birth, Emma is disappointed for having generated a girl, and rejects her all the time (FLAUBERT, 1856).

After Emma has the baby, the relationship

between her and Léon grows even more. The two realize they're in love, but they're both too shy to do anything about it.

When Léon, tired of loving without result, leaves for a bigger city to resume his studies, Emma is even sadder and crestfallen, as she has lost the chance to compose her new character; now, he no longer has anyone to dream of, he has no one to seduce. She turns to chores such as learning Italian, buying new and expensive clothes and household items. However, none of this satisfies her, and she becomes depressed again.

A new and exciting fact then takes place in Emma's life: Rodolphe's visit to her home. Rodolphe is a very different man from her husband; lives in a castle on the outskirts of town; is intelligent and insightful, and has a vast knowledge of the female field. Rodolphe is a skilled, experienced seducer. Emma is beautiful and Rodolphe decides to seduce her, starting to create situations in which he can woo this woman. First, Rodolphe plays the poor man, who needs comfort and care. Thus begins to awaken Emma's desires. Rodolphe devises a detailed plan and strategically leaves for a while. She returns to visit Emma and proposes a horseback ride, which even her husband encourages her to go. On the walk, Emma is even more vulnerable to Rodolphe's flirtatious speech and can't resist his charms,

In the meantime, Emma receives a letter from her father assuming she is happy and fulfilled, and that the family finances are thriving. She begins to realize how much her life doesn't match her reality. However, reality could change when the city's pharmacist offers her husband a case of surgery on a humble worker (FLAUBERT, 1856).

The doctor performs the surgery because of his wife's great influence, but fails in the process, and the patient's leg has to be amputated by another doctor in a nearby town. Once again, Emma is frustrated with her husband and the life he leads; regrets for the luxury life she does not have and for all the desires of which she is always deprived (FLAUBERT, 1856).

Emma Starts Making Huge Loans From A Merchant local, which makes it indebted. However, Emma doesn't seem to mind. She is in love with Rodolphe and that's all she cares about. Emma turns to her lover more eagerly than ever. They have a tumultuous relationship for two years, but finally there comes a time when Rodolphe is bored with Emma's romanticism. She, on one occasion, even asked him to run away with her and, without considering that this was not Rodolphe's wish, she began to fantasize

that this would be the salvation of her mediocre and provincial life. Rodolphe, however, does not make her goals clear and allows her to fantasize about the escape. On the day chosen for such an act, he says goodbye to Emma with a letter in which he says he would rather sacrifice his love than disgrace her life with the planned escape. Depart alone. Emma receives Rodolphe's letter through her employees; the shock is violent, and then she falls, convulsing, thus sustaining her fanciful desire until the last moment. Flaubert, once again, narrates that she faints, screams, becomes pale and anorexic, like the girls in books when they lose their lover (AGRA, 2014).

Emma, distraught, rapidly deteriorates in health. Charles, not knowing what to do, prescribes medication that is useless for Emma.

The Bovary family's finances get worse and worse, and Charles is forced to borrow more.

Emma slowly recovers, and as part of the treatment, Monsieur Homais suggests that Charles take Emma to the opera in Reuen, the nearest town. During the break, Emma meets Léon, who finished law school and moved to Rouen. He became more laid-back and outgoing, no longer afraid to get involved with Emma.

Emma stays in town on the pretext of watching the second part of the performance. Charles returns to town to see his patients. Léon, now more experienced, when he is alone with Madame Bovary, decides to declare himself, and this feeling leads Emma to think that, after so many years, she would be more experienced, she would be a connoisseur of love. They have an affair and the relationship grows. Emma, increasingly skilled at lying, discovers different reasons to visit the city and see her lover.

After a while, the extramarital affair starts to cool off. Emma has growing debts, which are transferred to a new merchant, whom she can no longer deceive, so she starts looking for ways to pay them off. She resorts to everything and everyone, trying to ask for the money. The answer you hear is "no".

With no means to make the payment, she asks her lover Léon to steal the Notary's office in order to pay off his debt, which, however, moves away from her, as he has no obligation as a husband. Emma still looks for the notary, without success either. Finally, she goes after Rodolphe, who is supposed to be her savior, and he rejects her.

Emma is desperate and afraid to tell Charles. Completely helpless, Emma poisons herself with arsenic stolen from Homais's pharmacy. She dies, in a slow and

horrible way, as she feels a lot of pain, with her friends and family staring at her, a scene of horror.

After Emma's death, things get even worse for Charles and Berthe, the couple's daughter. They are completely broke, and Charles, suffering the pain of his beloved's death, refuses to sell some of Emma's belongings. Charles dies poor and lonely, sitting on the bench in his house, which was once a meeting place for Emma and her lover. Berthe is sent to live with her grandmother, who also dies.

Finally, Berthe ends up living with a poor aunt and, as a child, working as a factory worker in a cotton factory.

III. METHODOLOGY

During the construction of the Research Project, research with the psychoanalytic method was thought of as the best proposal in Methodology. However, when the researcher completed a mandatory subject, which consisted of a seminar to present the Project, the review board emphasized that the Methodology chosen and presented would not be suitable for this Master's program, which was an impasse in the construction of the initial research proposal, since Psychoanalysis was consolidated with the need for knowledge not to be rigid, having as an investigation method an open structure.

In the first stage, the results related to the psychological elements of love in Madame Bovary's characters are presented, focusing our attention mainly on Emma Bovary. In the second stage, the interviews with Psychoanalytic professionals, who work at the clinic and at the university, are presented and discussed, about how they think about love and Literature in the psychoanalytic clinic.

ANALYSIS OF PSYCHOLOGICAL ELEMENTS IN MADAME BOVARY

Charles Bovary, throughout the narrative, shows himself to be a loose man, without great charms, especially when related to Emma. Despite the main character's desires and yearnings, Charles, since the beginning of Flaubert's novel, still in his childhood, is shy, incompetent and insensitive in various situations.

The great inability that accompanies him since childhood and that translates into an average and unambitious career, also present during his marriage to Emma Bovary, affects his narcissistic search for love, which, for Charles, seems not to be found. In Emma, as if he had lost or left his romantic longing in his relationship with his dead ex-wife; or even, as if he were in the place, again, of an unhappy marriage, only this time, with a

passionate Emma and fantasized from the short stories and romance books on which she based her life.

Charles' apathy makes him an average doctor, a mediocre husband, and a man unable to see Emma as object a. Charles Bovary does not achieve reciprocity through love. As it had been in childhood, Charles' apathy towards life makes him want nothing more than what he has, what he is. A man who craves nothing and is absolutely content and content with the prosaic life he leads. Charles seems to us to be a man without passion.

Emma Bovary spent her life wrapped up in romance books, which constituted

your imaginary with a dreamy behavior. Emma's fantasies are all about perfect love, following the path of romantic belief taught to women at the time in which Flaubert's romance takes place.

The departure of the young peasant girl, educated in a convent, with a head full of romantic ideals and who was willing to do anything to leave her father's farm, had her marriage to Charles Bovary as the first moment she was faced with the reality and face life together in fact, outside the books. For the character, the reality that had never knocked on her door before, arrives and becomes a great, heavy, unending dissatisfaction, which, driven by fanciful and romantic desires, reinforced by a bland marriage, has her romantic adventures as a way out.

In the beginning, Emma even struggles to feel for her husband what she felt when reading the novels, emotions that she considered compatible with passion, however, to no avail. She comes to think that what she feels for Charles is love, but since what she feels is not ecstasy, as in the books, Emma quickly concludes that it is not really love. She doesn't love Charles, and, unable to name what she feels, the young woman continues to search her marriage for the meaning of the words happiness and passion, previously seen in books. However, in the words of Flaubert (1856), describing Emma's thinking: "Charles's conversations were boring (...). He didn't teach anything, he didn't know anything, he didn't want anything" (p. 124).

For our character, her husband's passion was anything but exorbitant. As Agra (2015) reminds us, the man she married was far from awakening the love the girl wanted. Thus, the character cannot explain what is happening to her.

Emma cannot understand what she lacks; he cannot name the uneasiness that settles in him, nor does he have anyone to confide in such feelings. The character, as she used to do in the convent, seeks in Literature a way

to fill the void that consumes her, since her bland life with Charles, without challenges and devoid of emotions, is far from satisfying her own fantasies.

The character's journey, once trapped on a farm, in a convent, and now in a dull marriage with a prosaic husband, became unbearable. Emma wanted to live a romance, a passion, experience pleasures.

But as the intimacy of their lives became closer, there was an inner detachment that disconnected her from him. Charles' conversation was boring (...). He didn't know how to swim, fight, or shoot with a gun (...). She was angry at him (FLAUBERT, 1856, p.122).

Emma starts to question the choice she made, but still tries to sustain her place as a married and dedicated woman, playing a character for herself. However, she denies her own reality and projects onto her husband everything that for her represented a failure, a castration.

Thus, the character spent her days wandering around the house, always prostrate and complaining about everything that happened around her. In an attempt to soothe her suffering, she seeks the church, where the priest, as the representative of the Most High, could provide her with the answers she so longed for. To her sadness, the priest did not listen to her suffering, did not give voice to her pain, and, in view of this fact, she returns home totally frustrated (KEHL, 1998).

We learn from Lacan (1975) that entering the symbolic chain, in which a significant representative of desire is chosen, is an impossible task for women. When looking more closely at Emma, it is understood that she has imaginary identifications as the construction of her femininity. The women she meets and takes as a reference are the young ladies of the novels. As her mother died very early, she lacked a real meaning for the construction of her feminine identity (AGRA, 2015).

Lacan (1975) also teaches that the not-all side of the woman, since she is not fully included in the phallic norm, has a supplementary jouissance, impossible to signify, since it is disjoint from the signifier.

Thus, when looking at Emma from a Lacanian perspective, it can be seen that, throughout the course of the character, she is focused on an imaginary object, in an attempt to recover the totality that she lacks. Here we have a structuring of hysterical neurosis, which wants love. Fantasies about romances with other men she meets in the

course of her marriage, men who differ from her husband and cause her ecstasy and furor; happiness and passion, all for the imaginary possibility. It can be seen that in the neurotic's fantasy there is a void, which the love of another must fill. Lacan (1975) tells us that love is a discourse; transforms the unspeakable into the sayable. However, it does not fit into words; your transmission does not fit in I-love-you. In contrast, Badiou (2013) states that

declaration of love is necessary for lovers, for it fixes chance in eternity and is bound to be re-declared.

To portray this Lacanian inscription, we transcribe a part of Emma's dialogue with one of the lovers, which we believe is very important and illustrative of what was said above (FLAUBERT, 1856, p.296).

- You love Me?
- Well yes, I love you! – he replied.
- Very?
- Certainly! (...)
- Oh! It's just that I love you!
- she resumed - I love so much that I can't bear to go without you, you know? Sometimes I want to see you again, because every yearning for love tears me apart.

Emma returns home feeling like a hero in the books she read. After so much suffering, she finally triumphed and savored the repressed love she had been waiting for, without any remorse or restlessness.

It is noteworthy that the romance with Rodolphe is for Emma a realization of a literary fantasy, far from a love experience with which she could mature. Fantasy is not simply sexual. Emma somehow puts herself in the place of heroine in the novels read at the convent. The character in the novels she has always longed for is now intensely lived with her lover, and she fails to see that for Rodolphe it was just another adventure, not a love affair as she intended. Rodolphe would continue with Emma only as long as she was new and had fulfilled his desires (AGRA, 2007).

As Kehl (1998) portrays us, Emma Bovary, as a person who desires, who loves and who is based on the girls in the books, ends up, by herself, becoming her own tragic heroine; who is a prisoner of language many times and hostage to romantic love, enough to take her own life.

Emma demands love, to be rescued from the life

she was destined to live. She was increasingly aware that it should be done by a manly man. This shapes the paths Emma takes towards passion, paths that could only be offered by a lover, who would produce the meaning of love.

Emma Bovary's relationships outside of marriage speak volumes about her psychic structure and about the place men occupy in her life.

character. The frustrated marriage to Charles and the search for passion, love and happiness in Léon and Rodolphe move Emma towards what she desires. Emma Bovary leaves the convent to get married and continues in the incessant search for what she lacks. The character deposits her passions in the men with whom she relates, becoming hostage and prisoner, humiliating and rebelling, depressing and falling ill, devastating herself.

Following the path of Emma Bovary's concept of phallic logic and female jouissance, also called mystical jouissance – only women are able to enjoy this way – Lacan associates his formulation to the woman's erotomania of loving that, in a way, evokes madness. Lacan infers that women, more often, go crazy with and for love. Zalcberg (2007) reports that the woman who loves in an erotomaniac way, so trapped by an unquestionable certainty of loving and being loved, compromises all the possibilities and even the demands that love can invent. This would explain to us how affected Emma is by loving and being loved, as it would be an erotomania.

It is also argued that Emma Bovary, as a woman who fantasizes about her love life based on the romantic references of the stories she reads, understands love as completeness and imagines that the love of two can become one. The only way out for her is to find her prince charming, who will rescue her from her boring life, offering her love and passion. Always affected by this romantic ideal, Emma rules her love life based on what she wants, which definitely does not exist with her husband, and, therefore, she is always in affected relationships with men whom she relates outside of marriage. In search of the love she thought she had found in her marriage to Charles Bovary, but soon concluding that it wasn't, Emma plays the ideal for the extramarital relationships she has.

So, the appetites of the flesh, the greed for money and the melancholies of passion, all merged into the same suffering - and, instead of diverting the thought, it became more and more

attached to it, inciting pain and searching everywhere the occasions (FLAUBERT, 1856, p.201).

Emma's desire to find a love that fuses her and completes her in all her dissatisfactions will face the impossibility of the subject's completeness, since love does not eliminate the lack, as this is part of the subject's psychic constitution and is inherent to the human being, finding in the reality that he lives

the barriers to be constituted.

Badiou (2013) argues that love will always happen in the encounter. However, the author believes that love takes place, in fact, within its duration as a relationship between two.

Emma Bovary, as an irremediable lover, bases her life on a radical love, which distances itself from a legitimate reality, as it seems that the character cannot afford to be lacking in a relationship. Emma is capable of anything to find romantic love, ending up always playing the field of ideals over herself when she meets and relates to her lovers. Emma's relationships with Léon Dupuis and Rodolphe Boulanger tell us about the desire to break the barriers that prevent her from living the life she wants, letting herself be carried away by her own loving beliefs, which irrationally overlap the other's desire, and they leave them vulnerable to the unpleasantness she tries so hard to avoid.

Now, it is about the fusional conception of love: the two lovers meet and something like a heroism of the One takes place in opposition to the world. This melting point, which is the meeting between two, often leads to death, according to romantic mythology. Note that the existence of an intimate relationship between love and death comes from before, notably from the bible itself, from mythologies, from literary stories, the latter two being the ones that almost always portray love tragedies.

In return to Bauman (2004), who tells us that, due to the great offer of love experiences, there can be a conviction that love is a skill that can be acquired and mastered by the constant practice of falling in love, we can relate to Emma Bovary in this constancy, as she seeks the possibility of relating with passion and, consequently, seeks such desires in different partners.

On the other hand, although Emma is an irremediable romantic, she is also a woman who, judging by the time, courageously reflects her insecurities and moves stimulated by her desires, which, although conflicting, do not prevent her from seeking to strengthen ties with other men, in an attempt to find what she lacks,

despite the fact that, in contrast to Bauman (2004), the character does not keep her loose ties waiting for the next one. She really wants to change her life through love.

We saw with Bauman (2004) that it is not impossible for someone to fall in love more than once, or even with more than one person. In fact, some people they brag about or complain about falling in love or falling out of love too easily and quickly, just like with people who come and go in their lives; a liquid love.

However, we do not understand that it is a superficial relationship that Emma experiences; on the contrary, it is an Other, deep enjoyment.

It is important to highlight that, between the two lovers, what Emma experiences with Leon is a change of position, assuming the male position that was once Rodolphe's, while Léon assumes the passive position. It can be observed that it is not only in the erotic relationship that this evolution takes place, but throughout your entire life; she goes from passive reader of literary novels to active by becoming Rodolphe's lover, being, however, manipulated by him. With Léon, however, it is she who manipulates, becoming the heroine for both herself and the other, making the lover a character.

Throughout Emma Bovary's journey, the various concessions in the name of love and passion that the character makes are often taken by the lovers themselves as too much. In her relationship with Rodolphe, the fact that she is excessively sentimental, offers him locks of hair, proposes exchanging rings as symbols of eternal love, planning escapes to distant countries and going so far as to suggest that he must have a weapon to defend himself, if Charles appears in the office where the two are, ends up contributing to the estrangement of the lover. For Rodolphe, Emma was going a bit over the top, overflowing with a demand for love, which, by not being reciprocated in the same measure, ends up making devastation present.

Flaubert (1856) describes to us a numb, scantily clad Emma; often terror seized her and she let out a cry of despair; at other times she experienced unremitting lassitude.

You can see how intense the experience of love devastation is when the author describes what happens with Emma moments before she kills herself:

Madness took hold of her (...). She just suffered from his love, and felt her soul abandoning her for this memory, as the wounded, agonizing, feel the existence

that goes through the bleeding wound (FLAUBERT, 1856, p. 437).

It is possible to understand that the situation of being abandoned is, for Emma, like death. We associate this when Lacan (1975) informs us that there is an enjoyment about the which you don't know unless you try it. He adds that this does not happen with all, meaning not all women will experience the devastation.

The supplementary enjoyment that, for Lacan (1975), women only know when they experience it, in Emma Bovary, occurs precisely when she, faced with all the denials received in the face of her attempts to pay off her debts, sees in arsenic the solution to your situation, and you are headed for your death without any reflection or hesitation. Emma decides to commit suicide, dying slowly and horribly, giving her a lot of pain in front of her friends and family, who watch her walking towards her death.

After recounting, in detail, an entire chapter to describe Emma's death, at the end of chapter 8, Flaubert (1856) writes: "A convulsion knocked her to the mattress. Everyone approaches. It no longer existed" (p.452).

Observing Emma's experience, who arrived shaped by Literature and made her shape her ideas of love, passion, adventure and madness, the arsenic that the character takes to kill himself, through the author's own language, can be understood as his own definitive rescue of a mediocre life, from which she spent years trying to escape, achieving, thus and finally, by way of death. Kehl (1998) adds that suicide is inscribed, a posteriori, leaving meanings in the life of those who took the extreme decision to kill themselves.

The provincial girl who, full of dreams fueled by the reading of nineteenth-century literary novels, makes the decision to commit suicide, literally ends up in the accomplished act, just like a heroine of a romantic mythology she has always desired (KEHL, 1998).

ANALYSIS OF INTERVIEWS WITH PSYCHOANALYSTS

In this analysis, the results obtained from the psychoanalyst professionals working in the clinic and at the university are presented and discussed, about how they think about love and Literature in the psychoanalytic clinic. With this, there is the intention to reiterate the importance of the theme Love in clinical Psychoanalysis, as well as the use of Literature for the formation of the analyst. Therefore, this presentation was divided into two stages: one to portray love in the clinic and the other to

address the formation of the analyst, according to the questions formulated in the questionnaire.

In the first stage, the results related to the perception of professionals about love in the psychoanalytic clinic are presented, based on the following: 1) concept of love; 2) demands that appear in the clinic and revolve around love; 3) emotions that patients bring to the clinic and that are associated with love; 4) clinical experience that each professional had/has with the theme of love.

In the second stage, the enumerated themes are presented and discussed: 1) the formation of the analyst to guide the practice with the theme of love; 2) the relationship between Psychoanalysis and Literature in the formation of the analyst.

The analysis of the results of the interviews was carried out using the content analysis method. At first, there was a floating reading and then the exploration of the material from the interviews.

Our field survey consisted of seven questions made available in an online form. The study involved seven professionals from three states, namely: Tocantins, Santa Catarina and Espírito Santo. All are clinical psychoanalysts, working in the office for three and a half to twenty years, with an average of nine years of experience. The professionals chosen were, or still are, university professors in the Psychoanalysis discipline as well.

The results found will be presented and analyzed below.

IV. FINAL CONSIDERATIONS

Philosophy tells us that love gives reason to human existence and it is love that moves the world, whether through friendly relationships, within the family, with loving partnerships and even with yourself. Plato relates it to Philosophy stating that whoever does not know love will never know what Philosophy is. In our research, it appears that love is many names, but, without a single word to define it, we concluded that it permeates the field of feeling rather than knowledge.

In *Madame Bovary*, it appears that lack is inherent in the subject. Love bumps into the subject's own weaknesses and sometimes runs over the other's weaknesses. Do one, do two. Furthermore, from Emma onwards, it is observed that the love experience can make the drives of life and death converge, being fully feasible to love and suffer at the same time, as Charles Bovary; or being able to make unimaginable concessions, in the name of love and passion, like Emma Bovary.

In the clinic, love appears as a set of demands that will change.

forming in the subject's life from the moment he meets and weaves his loving partnership. From that point onwards, there is a shift from investment to another. Since love is one of the most intense experiences there is, a perspective is created from two. However, making this experience is very difficult for the human subject, precisely because a certain detachment from their own illusions is necessary. Therefore, the clinical analyst must be attentive to listening to this missing remnant, chasing a meaning that is constantly changing, and that is being built along with the world of the one who allows himself to be analyzed.

REFERENCES

- [1] AGRA, Ana Maria. *Madame Bovary: a death of gender*. Artemis Magazine, Vol. XIX; Jan-July 2015, pp. 82-89.
- [2] ALLOUCH, Jean. *Lacan love*. Rio de Janeiro: Company of Freud, 2010. 528 p.
- [3] BADIOU, Alain; TRUONG, Nicolas. *Praise to love*. São Paulo: Martins Fontes, 2013.
- [4] BAUMAN, Zygmunt. *Liquid Love: about the fragility of human bonds*. Rio de Janeiro: Jorge Zahar, 2004.
- [5] CAMPOS, Marcelo Gonçalves. 'Life – Literary Work': Interlacing a Psychoanalytic Reading. 2013. 82 f. Dissertation (Masters in Psychology) – Federal University of São João Del Rei, São João Del Rei, 2013.
- [6] BLACKSMITH. Camilla MR Love said by a woman – the transmission from Diotima to Socrates. *Trivium: Interdisciplinary Studies*. Year IX, 2017, Ed.1, p. 184-191.
- [7] FLAUBERT, Gustave (1856). *Madame Bovary*. Trans. Mario Laranjeira. São Paulo: *Penguin Classics* Companhia das Letras, 2011.
- [8] FREUD, Sigmund. On narcissism: an introduction. In: . *Studies on hysteria*. (1893). Rio de Janeiro: Imago, 1996. (Standard Brazilian Edition of the Complete Psychological Works of Sigmund Freud, v. 2).
- [9] . (1905). *The three essays on the theory of sexuality*. (Rio de Janeiro: Imago, 1996. v. 12).
- [10] . (1906/1907). *Delusions and dreams in Jensen's Gradiva*. Rio de Janeiro: Imago, 1996. v.9.
- [11] . (1912). *On the universal tendency to depreciation in the sphere of love (contributions to love psychology II)*. Rio de Janeiro: Imago, 1996. v. 11.
- [12] . (1912). *Types of triggering neurosis*. Rio de Janeiro: Imago, 1996c. v.11
- [13] . (1914). *Michelangelo's Moses*. Rio de Janeiro: Imago, 1996. v.13.
- [14] . (1914). *Introduction to narcissism, metapsychology essays and other texts*. Rio de Janeiro: Imago, 1996. v.14.
- [15] . (1925). *An autobiographical study*. Rio de Janeiro: Imago, 1996. v.20.
- [16] . (1929). *The future of an illusion, the malaise in civilization*

- and other works. Rio de Janeiro: Imago, 1996. v. 21.
- [16] . (1933). *Femininity*. Rio de Janeiro: Imago, 1996. v. 22.
- [17] GIL, Carlos Antonio. *How to prepare a research project*. 6th ed. São Paulo: Atlas, 2017.
- [18] GODOY, AS *Introduction to qualitative research and its possibilities*. Magazine
- [19] **of Business Administration**. São Paulo, v. 35, no. 2, p. 57-63, Mar./Apr., 1995. KEHL, Maria Rita. *Displacements of the Feminine*. Rio de Janeiro, Imago, 1998.
- [20] KON, Naomi Moritz. *The journey from literature to psychoanalysis*. São Paulo: Companhia das Letras, 2003.
- [21] KUSS, Ana Suy Sesarino. *Love, Desire and Psychoanalysis*. Juruá Publisher. Curitiba. 2014.
- [22] LACAN, Jacques. *The Seminar, Book 4: The Object Relation [1956-1957]*. Rio de Janeiro: Zahar, 1995.
- [23] . *The Seminar, Book 6: Desire and Its Interpretation [1958-1959]*. Rio de Janeiro: Jorge Zahar, 2016.
- [24] *The Seminar, Book 8: The Transfer [1960-1961]* 2. ed. Rio de Janeiro: Jorge Zahar, 2010.
- [25] *The Seminar, Book 10: The Anguish [1962-1963]* 2. ed. Rio de Janeiro: Jorge Zahar, 2005.
- [26] *The Seminar, Book 11: The Four Fundamental Concepts of Psychoanalysis*. [1964]. Rio de Janeiro: Jorge Zahar, 1988.
- [27] *Television*. In: *Other Writings*. [1974]. Rio de Janeiro: Jorge Zahar, p. 508-549, 2003.
- [28] *The Seminar, Book 20: even more*. [1975]. Rio de Janeiro: Jorge Zahar, 1982.
- [29] *The Seminar, Book 23: the sinthome*. [1975-76]. Rio de Janeiro: Jorge Zahar, 2007.
- [30] LAKATOS, Eva Maria; MARCONI, Marina de Andrade. *Methodology of scientific work*. 9th ed. São Paulo: Atlas, 2010.
- [31] LISPECTOR, Clarice. *Clandestine Happiness*. In: *The Egg and the Chicken*. 8th ed. Rio de Janeiro: Rocco, 1971.
- [32] LOPES, Mary Magdalene de Freitas. *The concept of Love in Psychoanalysis*. São Paulo: Centauro, 2009.
- [33] MANNONI, Octave. (1994). *Freud: an illustrated biography*. (MLXA Borges, Trans.). Rio de Janeiro: Jorge Zahar, 1994.
- [34] MARQUES, NLR; BUSS, C. da S.; MÜLLER, MG; SILVA, MABV da.
- [35] (2020). *Conceptions about the Final Work of the Professional Master's Degree in Science Teaching*. *Educar Mais Magazine*, 4(1), 172-187.
- [36] MILLER, Jacques-Alain. *Interview with Hanna Waar*. *Psychologies Magazine*. No. 278; Oct 2008. Trans: Maria do Carmo Dias Batista.
- [37] *The bone of an analysis*. *Journal of the Brazilian School of Psychoanalysis, Bahia, Library – agent*, 1998.
- [38] MOREIRA, Adriano da Silva. *The multiple faces of the Other/Other in Lacan: between love, desire and jouissance*. Victory: UFES, 2017.
- [39] NASIO, Juan-David. *The Book of Pain and Love*. Rio de Janeiro: Jorge Zahar, 1997. NOBRE, Thalita Lacerda. *Madame Bovary and hysteria: a psychoanalytic reading*. São Paulo, 2007.
- [40] PAGLIARI, Danieli; SOUZA, Tânia Maria de. *Love and its consequences*. Unijuí, Rio Grande do Sul, 2019.
- [41] PEACE, Beatriz Coelho. *Freud and love: from the ideal to the impossible – A dialogue between psychoanalysis and romanticism*. Rio de Janeiro: UFRJ/IP, 2009.
- [42] PLATO. *The banquet*. 2. ed. São Paulo: Publisher Martin Claret, 2015.
- [43] QUELHAS, OLG; SON, JRF; FRANCE, SLB *The professional master's degree in the context of the Brazilian postgraduate system*. *Brazilian Journal of Graduate Studies*, vol. 2, n. 4, 11, 2005.
- [44] SOUZA, Danuza Effegem. *Devastation and its Relation with the Unrepresentable in the Female Body: some considerations in the Psychoanalysis and Literature bond*.
- [45] *Dissertation (Masters in Psychology) - Universidade Federal Fluminense*. Niteroi. p.114. 2016.
- [46] SOUZA, Olga Maria. *MC Psychoanalysis and Letters*. In: MORAES, Alexandre. (Org.) *Modernities and Post-Modernities: literature in two stages*. UFES. Victory. 2002.
- [47] TODOROV, Tzvetan. *Literature in danger*. 2nd ed. Trans. Caio Meira. Rio de Janeiro: DIFEL, 2009, p. 89-94.
- [48] ZAIDAN, Samira; FERREIRA, Maria Cristina Costa; KAWASAKI, Terezinha Fumi. *The research of the practice itself in the professional master's degree*. *Plurals Revista Multidisciplinar, Salvador*, v. 3, n. 1, p. 88-103, 2018.
- [49] ZALCBERG, Malvine. *Love female passion*. Rio de Janeiro/São Paulo: Editora Campus/Elsevier, 2007.

Efficient Statistical Tools for the Estimation of the Longitudinal Dispersion Coefficient

Thiago Jordem Pereira, Daniel Maziero Verdan Curty and Wagner Rambaldi Telles

Fluminense Northwest Institute of Higher Education (INFES), Fluminense Federal University (UFF), Santo Antônio de Pádua, RJ, Brazil

Received: 21 Oct 2021,

Received in revised form: 06 Nov 2021,

Accepted: 10 Nov 2021,

Available online: 14 Nov 2021

©2021 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 — *Bayesian approach, Longitudinal dispersion coefficient, Markov Chain Monte Carlo method, Tracer flow, Transporting pollutants.*

Abstract — *The problem of transporting pollutants in natural rivers can be modeled using saline tracer injection techniques, which are very useful for obtaining important information related to water quality in river stretches, such as the physical parameter longitudinal dispersion coefficient. The objectives of this work are to formulate an inverse problem for the tracer flow process in natural rivers using a Bayesian approach to update the longitudinal dispersion coefficient, and use the Markov Chain Monte Carlo (MCMC) to solve the inverse problem formulated.*

I. INTRODUCTION

The possibility of applying techniques favorable to a behavioral prognosis in several areas of knowledge motivates the use of statistics as a tool to support decision-making, which is justified by its ability to help in the analysis and interpretation of data. Thus, statistics are present in several studies and applications in the areas of engineering, exact sciences, biological sciences, and health sciences [1, 8, 10, 13, 14, 15, 16, 17, 20, 21, 22, 26, 27, 31], given that the Probabilistic analysis can be understood as the study of predicting the behavior of a single variable, or a set of variables in a specific scenario. Therefore, its conception consists of quantifying the uncertainty associated with the occurrence phenomenon.

Currently, the preservation of natural systems is considered one of the challenges of Brazilian society, with water being one of the environmental factors that have caused considerable concern among professionals working in this area [29]. It is known that the quality of water depends on the actions of man and various natural conditions, and knowledge of its information becomes essential for the

management of water resources. Lack of knowledge of water quality increases uncertainties in future decision-making, which in turn has negative consequences in the management of water resources [29].

The use of tracer injection techniques in a given location of the watercourse has been widely used in studies of problems related to the transport of pollutants in natural rivers, to seek important information on water quality, such as, for example, the physical parameter longitudinal dispersion coefficient. The mathematical model that describes this physical flow process is composed of a partial differential equation subject to the certain boundary and initial conditions.

Several methods in the literature can be used to determine the longitudinal dispersion coefficient [25, 26] present in the mathematical model that describes the physical process of tracer flow in natural rivers. However, this work proposes a Bayesian methodology together with the Markov Chains Monte Carlo method as an alternative to traditional methods for estimating the parameter of unknown interest.

The Bayesian methodology is based on one of the most important mathematical formulations of probability theory,

known as Bayes' theorem, which updates the information of the parameter of unknown interest, taking into account the a priori information about the parameter of interest and the known information about the observed sample [2, 5, 9, 15, 23].

To solve the inverse Bayesian problem of transporting pollutants in natural rivers, the Markov Chain Monte Carlo (MCMC) stochastic method can be used, which is based on specific algorithms to simulate ergodic Markov Chains whose stationary distribution (or equilibrium distribution) is the posterior probability distribution of interest [5, 9, 15, 23]. Among the various specific algorithms used by the MCMC method to generate the Markov Chains, the special case of the Metropolis-Hastings algorithm [13, 21] based on random walk [4, 5, 9, 15, 23] is used in this work, which proposes the new point candidate (longitudinal dispersion coefficient) considering the current previously simulated longitudinal dispersion coefficient value plus a random increment.

The motivation of this proposal is that the Bayesian methodology together with the Markov Chain Monte Carlo method is an attractive and efficient statistical tool, which has significantly contributed to the scientific and technological development of several areas of knowledge, for example, in the estimation of the physical parameter (permeability) in fluid flow problems in porous media [3, 4, 5, 6, 7, 11, 12, 15, 20].

In this sense, it is expected that the study presented in this research paper can significantly contribute to problems related to the monitoring and preservation of natural rivers that receive some type of liquid waste with harmful properties to the environment, which can cause changes in the ecosystem and negatively impact the entire its dependent chain. More details on the environmental problems described above can be found in the literature [24, 29, 30].

II. MATHEMATICAL MODELING

Considering a rectangular domain $\Omega \in R$ limited in region $[0, L_x] \times [0, L_y]$ in the contour $\partial\Omega$, with $L_x[m]$ and $L_y[m]$ the physical dimensions of the river in the and directions x e y , respectively. Here $c = c(x, t)[mg/l]$ is the concentration of the tracer at the point $\mathbf{x} = (x, y)$ in the instant of time $t[s]$.

The mathematical model that describes the physical process of transporting contaminants in river with domain Ω , over a span of time $I = [0, T]$, with $t \in I$, is described by the following partial differential equation [28]:

$$\frac{\partial c}{\partial t} + u \frac{\partial c}{\partial x} = E_l \frac{\partial}{\partial x} \left(\frac{\partial c}{\partial x} \right) + E_t \frac{\partial}{\partial y} \left(\frac{\partial c}{\partial y} \right), \quad (1)$$

where in this equation u is velocity river water, expressed in m/s ; E_l is longitudinal dispersion coefficient, expressed in m^2/s ; e E_t é o longitudinal dispersion cross, expressed in m^2/s . The Eq. (1) is subject to the following boundary conditions [28]:

$$\begin{aligned} c(x, y, t) &= c_0; x = 0, 0 \leq y \leq L_y, t > 0, \\ \frac{\partial c(x, y, t)}{\partial x} &= 0; x = L_x, 0 \leq y \leq L_y, t > 0, \\ \frac{\partial c(x, y, t)}{\partial y} &= 0; y = 0, 0 \leq x \leq L_x, t > 0, \\ \frac{\partial c(x, y, t)}{\partial y} &= 0; y = L_y, 0 \leq x \leq L_x, t > 0, \end{aligned} \quad (2)$$

and initial

$$c(x, y, 0) = c_1(x, y); 0 \leq x \leq L_x, 0 \leq y \leq L_y. \quad (3)$$

In Fig. 1 we find the schematically represents the flow problem in geometry Ω , subject to boundary conditions (2).

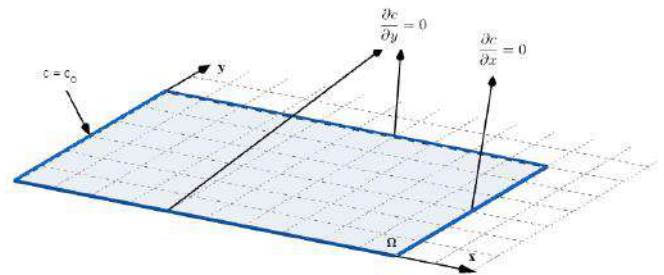


Fig. 1: Discretization and boundary conditions in the domain.

To solve the partial differential equation (1) subject to conditions (2) - (3), which governs the transport of pollutants in river stretches, the Finite Volume method is used, with implicit formulation, which performs the spatial and temporal integration in each volume of control v_c . It is the variables to be calculated are located at the center and borders of each v_c , resulting in a linear system [18,19]. In the advective term, an interpolation of the type is used Upwind (UDS), to calculate the values of the variables of each border in relation to the variable located in the center of the volume of control [18, 19]. To solve the linear system resulting from the discretization of the Finite Volumes method, whose coefficient matrix presents a characteristic of a sparse matrix, the Thomas Algorithm (Tridiagonal Matrix Algorithm) is used, which originates from the Gaussian elimination method [18, 19].

III. METHODOLOGY

This section presents the formulation of the inverse problem for the flow process of tracers in river stretches using a

Bayesian approach to update the parameter of interest (longitudinal dispersion coefficient - E_l). The MCMC method used to solve the inverse problem proposed in this research work is presented, which in turn estimates the parameter E_l . It is worth noting that the methodology used in this research paper was based on the work of [15].

3.1 Bayesian approach

This section presents the Bayesian methodology that will be used to update the longitudinal dispersion coefficients E_l , taking into account the a priori information on the parameter of interest E_l and the known information about the observed sample.

Based on the work of [15], it is proposed to define the set of observed values of the tracer concentration in fluvial stretches (or reference values) as:

$$O(c_o) = \{c_o(\mathbf{x}_1, t_j); j = 1, \dots, N_t\}, \tag{4}$$

where \mathbf{x}_1 denotes the location of the collection point in the region Ω ; and N_t denotes the number of times the tracer concentration c_o is evaluated over time t_j , with $j = 1, \dots, N_t$ (see Fig. 2).

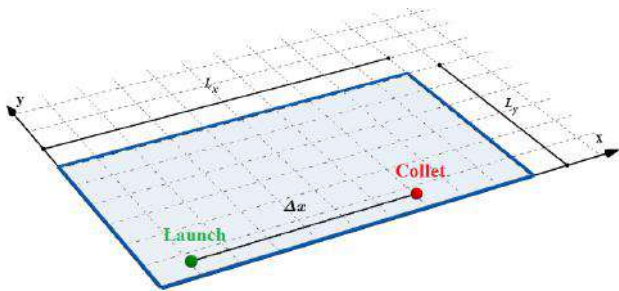


Fig. 2: Simplified model of the study region with launch and collection points.

An update of the information of the parameter of interest E_l is performed through the Bayes' theorem expressed by [15]:

$$P(E_l|O(c_o)) \propto P(O(c_o)|E_l)P(E_l), \tag{5}$$

where $P(E_l|O(c_o))$ is posterior distribution of the parameter of interest E_l ; and the o factor $P(O(c_o)|E_l)$ is the likelihood function, which represents the contribution of $O(c_o)$ on the parameter E_l and, in the case of this work, it is considered as a normal distribution expressed by [15]

$$P(O(c_o)|E_l) \propto \exp\left\{\frac{-\mathcal{E}}{2\sigma^2}\right\}, \tag{6}$$

where \mathcal{E} is the error defined by [15]:

$$\mathcal{E} = \sum_{j=1}^{N_t} [c_s(\mathbf{x}_1, t_j) - c_o(\mathbf{x}_1, t_j)]^2, \tag{7}$$

where, $c_s(\mathbf{x}_1, t_j)$ is the simulated concentration of the tracer at the collection point \mathbf{x}_1 for the instant of time t_j ; and σ^2 is the accuracy associated with concentration measurements $c_s(\mathbf{x}_1, t_j)$ and $c_o(\mathbf{x}_1, t_j)$.

As E_l will be proposed from a normal distribution with mean $\mu_p = 0$ and variance $\sigma_p^2 = 1$, then it is assumed that the prior distribution of the parameter of interest E_l is [15]:

$$P(E_l) = \exp\left\{\frac{-[E_l - \mu_p]^2}{2\sigma_p^2}\right\}. \tag{8}$$

3.2 Markov Chain Monte Carlo method

In the formulation of the inverse problem presented in Subsection 3.1, the Markov Chain Monte Carlo (MCMC) method is based on stochastic simulations, which has been shown to be an efficient technique for solving several complex problems [3, 4, 5, 6, 7, 10, 11, 12, 15, 20]. The MCMC method uses specific algorithms to generate ergodic Markov Chains whose stationary distribution is the posterior distribution $P(E_l|O(c_o))$.

In this work we consider the Metropolis-Hastings algorithm based on random walk to build the Markov Chains [15]:

$$\{E_l^{(k)}; k \in K\}, \tag{9}$$

which proposes a new candidate E_l given by:

$$E_l = E_l^{(k)} + (h_{rw}) * z, \tag{10}$$

where K is the set of non-negative integers; $E_l^{(k)}$ is the current state of the Markov Chain (or state of the Markov Chain in the instant k); h_{rw} is the parameter that determines the step size of the Markov Chain; and z has a Gaussian distribution $N(\mu_p, \sigma_p^2)$, with $\mu_p = 0$ and $\sigma_p^2 = 1$. The probability of acceptance of the new candidate E_l is given by [15]:

$$\alpha(E_l|E_l^{(k)}) = \begin{cases} \min\left(\frac{P(E_l|O(c_o))q(E_l^{(k)}|E_l)}{P(E_l^{(k)}|O(c_o))q(E_l|E_l^{(k)})}, 1\right), & A \\ 1, & B \end{cases} \tag{11}$$

where

$$A = P(E_l^{(k)}|O(c_o))q(E_l|E_l^{(k)}) > 0$$

and

$$B = \text{otherwise},$$

such that $E_l^{(k+1)} = E_l$ with probability $\alpha(E_l|E_l^{(k)})$ and $E_l^{(k+1)} = E_l^{(k)}$ with probability $1 - \alpha(E_l|E_l^{(k)})$. It is worth noting that the factor $q(*)$ is the instrumental probability distribution. For a better understanding of the MCMC method, Algorithm 1 is presented.

Algorithm 1: The MCMC method.

Step 1: Set $k = 0$ and specify an initial value for the longitudinal dispersion coefficient $E_l^{(0)}$, such that

$$P(E_l^{(0)} | O(c_0)) > 0.$$

Step 2: Generate a new candidate $E_l \sim q(E_l|E_l^{(k)})$, according (10).

Step 3: Solve the tracer flow problem modeled by Eq. (1) subject to conditions (2) - (3).

Step 4: Calculate the probability of acceptance of the new candidate E_l , according (11).

Step 5: Generate w from the uniform distribution in the interval $[0, 1]$, this is $w \sim U(0, 1)$.

Step 6: If $w \leq \alpha(E_l|E_l^{(k)})$, then

$$E_l^{(k+1)} = E_l,$$

otherwise

$$E_l^{(k+1)} = E_l^{(k)}.$$

Step 7: Increment $k = k + 1$, return to **Step 2** and continue the procedure until convergence is achieved.

IV. NUMERICAL RESULTS

4.1 Simulation parameters for observed values

For the construction of the set of observed values of the tracer concentration in fluvial stretches (or reference values), according to Eq. (4), the parameters considered the most adequate to the real problem are used [28]. Thus, a saline tracer (NaCl) was used, where the mean concentration of salinity (NaCl) in the natural river is determined at 37 mg/l. The launch point of the plotter is 0.7 m from the bank. At this point, the saline concentration became 2,551 mg/l at the time of release. The collection point was kept at the same distance from the river bank, however, carried out 50 meters downstream.

The domain Ω that represents the surface of the river, has dimensions L_x and L_y corresponding to 182 m and 42 m, respectively. This region is discretized with a mesh of 260 x 60 elements, resulting in a total of 15,600 volumes with a 0.7 m edge each. The simulation was parameterized with a maximum time of 352 seconds, and the time step used to solve Eq. (1) was equal to 2 seconds.

Finally, it is considered the speed of the river water u equal to 0.359 m/s; the transversal dispersion coefficient E_t equal to 0.008 m²/s; and the longitudinal dispersion coefficient E_l equal to 0.33 m²/s (reference value of the coefficient).

4.2 Results and discussions

This subsection is reserved to present the numerical results obtained with the Markov Chain Monte Carlo method for solving the Bayesian inverse problem. The values of the simulated concentration of the tracer $c_s(x_1, t_j)$ were obtained using the same parameters presented in Subsection 4.1, with the exception of the value adopted for the longitudinal dispersion coefficient.

Was specify 10.0 m²/s for initial value for the longitudinal dispersion coefficient $E_l^{(0)}$. For the parameter that determines the step size of the Markov Chain in Eq. (10) was used $h_{rw} = 0.01$. The value of the σ^2 in Eq. (6) was fixed at 0.25 for all simulations, and the tracer concentration $c_s(x_1, t_j)$ was evaluated at each two seconds of simulation.

The numerical results were obtained from a maximum of 10,000 proposals, with the objective of selecting 1,500 accepted samples of the longitudinal dispersion coefficient. The tracer concentration $c_s(x_1, t_j)$ was evaluated at each 2 seconds of simulation, with a maximum time of 352 seconds. It is observed that to reach the quantity of 1,500 accepted samples, 8,897 proposed samples needed only, thus resulting in an acceptance rate of 16.85%.

In Fig. 3 are presented the variations of the tracer concentration errors values for the 1,500 samples accepted, according to Eq. (7). Making a visual analysis of Fig. 3, it can be seen that the Markov Chain generated by the MCMC method converges to the stationary distribution of interest, which in this case it is the posterior distribution [15]. It is noticed that shortly after the 1,000 accepted samples, more precisely in the 1,184 sample, the curve reaches an stability zone. Thus, there is a set of 316 accepted samples of the longitudinal dispersion coefficient, after burn-in (1,184 accepted samples).

It can be observed a significant reduction in tracer concentration errors, reaching values below 5 measurement units. This can be seen in more detail in Fig. 4, which is presented the zoom of stability region of Fig. 3, this is, quantitative samples accepted from 1184 to 1500.

The reduced values of the simulated tracer concentration errors indicate that the values of the accepted longitudinal dispersion coefficients are close to the value of the reference coefficient used to generate the observed tracer concentration at the collection point x_1 at each instant of time t_j .

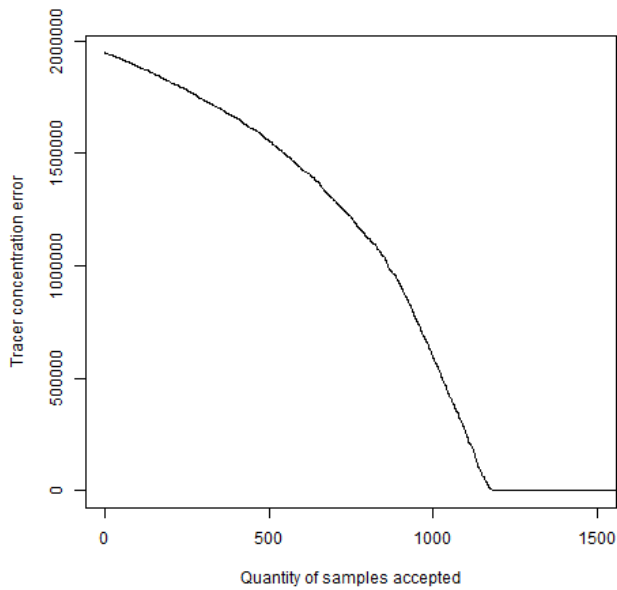


Fig. 3: Tracer concentration error versus quantity of samples accepted.

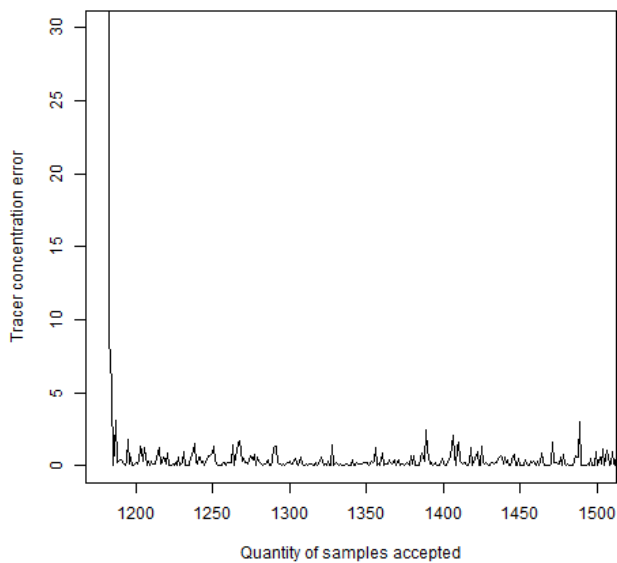


Fig. 4: Zoom of Fig. 3. Quantitative samples accepted from 1184 to 1500.

In Fig. 5 are presented the samples accepted of longitudinal dispersion coefficients E_l , through the MCMC method and Metropolis-Hastings algorithm based on random walk. In Fig. 6 are presented the zoom of stability region of Fig. 5, this is, quantitative samples accepted from 1184 to 1500.

Compared to the initial value for the longitudinal dispersion coefficient $E_l^{(0)}$, it is observed in Fig. 5 that the values of the accepted coefficients decrease considerably as the number of accepted samples increases, reaching values

close to the reference coefficient after a burn-in of 1184 accepted samples (see Fig. 6). In fact, as were mentioned earlier, this factor contributes to obtaining a reduced values of the simulated tracer concentration errors. Furthermore, it is noted in Fig. 6 that the MCMC method selects distinct longitudinal dispersion coefficients.

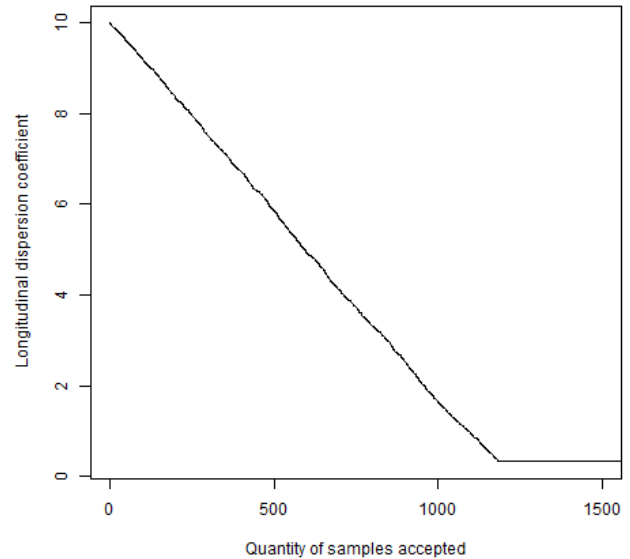


Fig. 5: Longitudinal dispersion coefficient versus quantity of samples accepted.

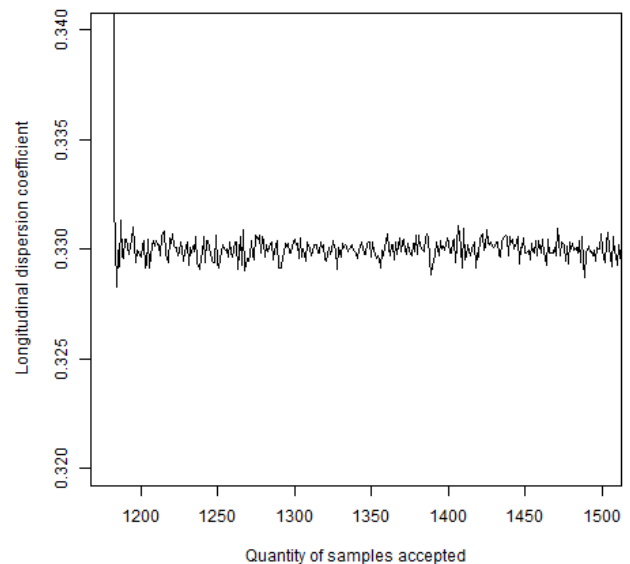


Fig. 6: Zoom of Fig. 5. Quantitative samples accepted from 1184 to 1500.

In Figs. (7) – (10) are presented the tracer concentration profiles at the x_1 position, which represents the location of the collection point in region Ω . In these figures, the solid red lines correspond to the tracer concentration values obtained with the reference longitudinal dispersion coefficient

$E_l = 0.33 \text{ m}^2/\text{s}$; the solid green lines correspond to the values of the tracer concentrations obtained with the initial longitudinal dispersion coefficient $E_l^{(0)} = 10 \text{ m}^2/\text{s}$; and the solid blue lines correspond to the mean values of tracer concentrations obtained for a limited set of accepted samples.

For a better analysis of the behavior of the tracer concentration profiles, the graphs with the respective mean profiles were divided into groups with the quantitative of 50 (see Fig. 8), 150 (see Fig. 9) and 250 (see Fig. 10) accepted samples of the longitudinal dispersion coefficient after the heating period, and also a group of with the quantitative of 50 samples accepted before the burn-in period (see Fig. 7). Thus, it becomes possible to better understand the mean results of tracer concentrations close to the reference values observed at the collection point x_1 .

Note that there is a significant difference between the tracer concentration profiles determined by the reference (solid red lines) and initial (solid green lines) coefficients. In fact, this is due to the large difference between the values of the reference and initial longitudinal dispersion coefficients.

It can be seen in Fig. 7 that the mean tracer concentration profile (solid lines in blue) behaves very similarly and close to the reference concentration values, even considering the mean of the last 50 samples before the burn-in period.

However, it is observed in Figs. 8 - 10 that the MCMC method was able to obtain better results than those presented in Fig. 7. In fact, this is because the average tracer concentration profiles (solid blue lines) corresponding to simulations performed using 50, 150 and 250 samples accepted of the dispersion coefficient after the burn-in period. It is noteworthy that at the end of the heating period, the tracer concentration error values are very small, compared to the errors obtained at the beginning of the Markov Chain generation, as already observed in Figs. 3 - 4. Thus, it can be seen that the tracer concentration profiles represented by the solid red lines occupy the same coordinates of the graph.

Therefore, based on the results presented, it is observed that the methodology used in this research work was efficient for the estimation of the longitudinal dispersion coefficient.

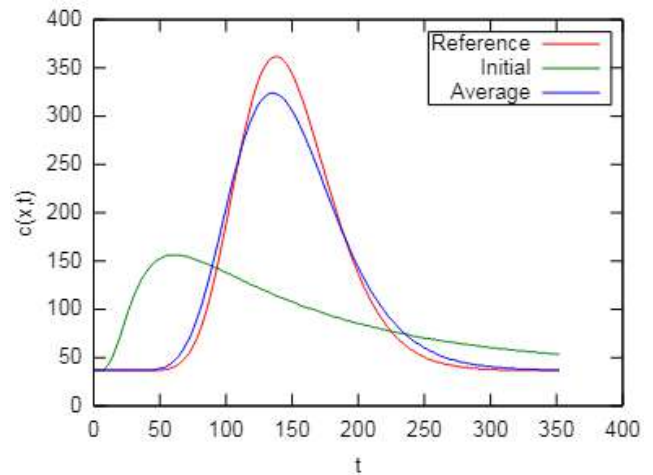


Fig. 7: Average of the last 50 samples before the burn-in period.

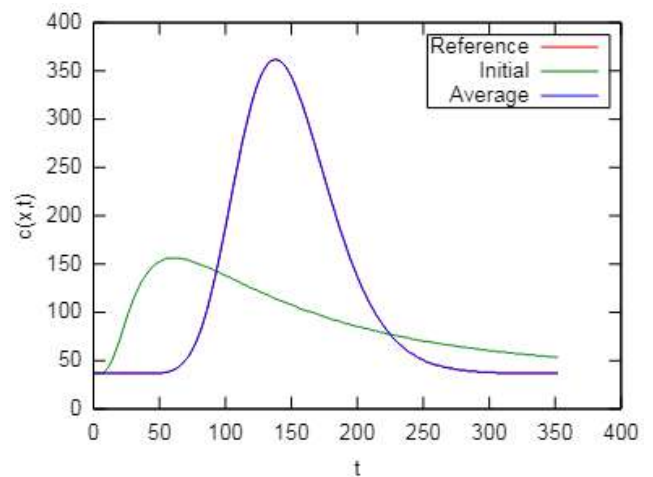


Fig. 8: Average of the first 50 samples after the burn-in period.

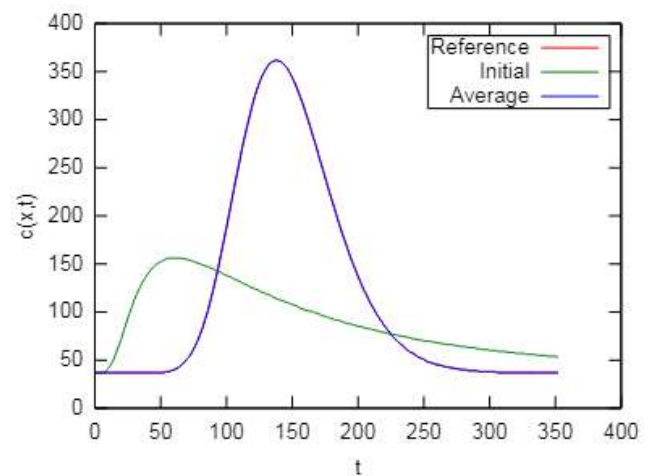


Fig. 9: Average of the first 150 samples after the burn-in period.

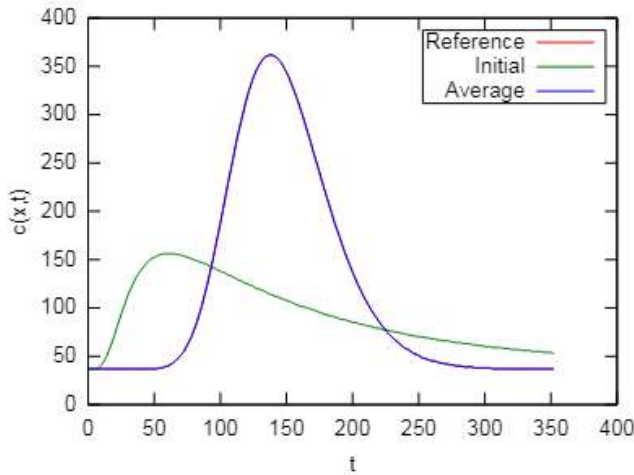


Fig. 10: Average of the first 250 samples after the burn-in period.

V. CONCLUSION

In this work, a statistical methodology was used to estimate the physical parameter longitudinal dispersion coefficient present in the tracer flow problem in natural rivers. This methodology consists of a Bayesian approach to formulate the inverse problem associated with the tracer transport problem, and an application of the Monte Carlo method via Markov Chains to solve the inverse problem formulated. Observing the numerical results obtained in this work, presented in Section IV, it can be stated that the MCMC method through the Metropolis-Hastings algorithm based on random walk generated a Markov Chain that converged to the equilibrium (or stationary) distribution, which in this case is the posterior distribution of interest. After the burn-in period, the accepted samples of the longitudinal dispersion coefficient were able to reduce the errors of the tracer concentration and, consequently, obtain better average simulated profiles of the tracer concentrations at the collection point. Thus, it can be said that the results achieved by the MCMC were quite expressive. This fact confirms the relevance of using statistical methodology to solve problems within the scope of behavioral prediction. The statistical tools used in this work were extremely efficient in estimating the values of the parameter of interest (longitudinal dispersion coefficient), which in turn can become a significant, respectable, useful and alternative resource for estimating parameters responsible for introducing uncertainties contained in the mathematical model that describes the physical process of tracer flow in natural rivers. However, it is also necessary that this methodology continues to be applied and tested in other types of problems, as well as the experimentation of new parameters and different formulations for the a priori distribution.

ACKNOWLEDGEMENTS

We thank God for completing this work, the families for their support and understanding, the Post-Graduation in Computational Modeling in Science and Technology of Fluminense Federal University (UFF) and Coordination for the Improvement of Higher Education Personnel (CAPES) for their financial support.

REFERENCES

- [1] Azevedo, J. S., Oliveira, S. P., and Lima, O. A. L. (2009). Métodos estocásticos para modelagem de escoamento estacionário e transiente em meios porosos. *Revista Brasileira de Geofísica*, vol. 27, n. 2, pp. 241-254.
- [2] Bussab, W. O. and Morettin, P. A. (2010). *Estatística básica*. 6th ed., Editora Saraiva.
- [3] Chrsitien, J. A. and Fox, C. (2005). Markov Chain Monte Carlo using an approximation. *Journal of Computational and Graphical Statistics*, vol. 14, n. 4, pp. 795-810.
- [4] Chen, Ming-Hui, Shao, Qi-Man, and Ibrahim, J. G. (2000). *Monte Carlo methods in Bayesian computation*. Springer (Springer Series in Statistics). 1st ed.
- [5] Douglas, C., Efendiev, Y., Ewing, R., Ginting, V., and Lazarov, R. (2006). Dynamic data drive simulations in stochastic environments. *Computing*, vol. 77, pp. 321-333.
- [6] Efendiev, Y., Datta-Gupta, A., Ginting, V., Ma, X., and Mallick, B. (2005). An efficient Two-Stage Markov Chain Monte Carlo method for dynamic data integration. *Water Resources Research*, vol. 41, n. 12.
- [7] Efendiev, Y., Hou, T., and Lou, W. (2006). Preconditioning Markov Chain Monte Carlo simulations using coarse-scale models. *SIAM J. Sci. Comput*, vol. 28, n. 2, pp. 776-803.
- [8] Freitas, L. C. G. and Oliveira, G. S. (org.). (2018). *Aplicações de química teórica no estudo de materiais: métodos in silico para nanomateriais*. São Carlos: EdUFSCar.
- [9] Gamerman, D. and Lopes, H. F. (2006). *Markov Chain Monte Carlo: stochastic simulation for Bayesian inference*. Texts in Statistical Science, 2nd ed.
- [10] Garcia, S., Lustosa, P. R. B., and Barros, N. R. (2011). Aplicabilidade do método de simulação de Monte Carlo na previsão dos custos de produção de companhias industriais: o caso da companhia Vale do Rio Doce. *Revista de Contabilidade e Organizações – FEA-RP/USP*, vol. 4, n. 10, pp. 152-173.
- [11] Ginting, V., Pereira, F., Presho, M., and Wo, S. (2011). Application of the two-stage Markov Chain Monte Carlo method for characterization of fractured reservoirs using a surrogate flow model. *Computational Geosciences*, v. 15, n. 4, pp. 691-707.
- [12] Hassan, A. E., Bekhit, H. M., and Chapman, J. B. (2009). Using Markov Chain Monte Carlo to quantify parameter uncertainty and its effect on predictions of a groundwater flow model. *Environmental Modelling & Software*, vol. 24, pp. 749-763.
- [13] Hastings, W. K. (1970). Monte Carlo Sampling methods using Markov Chains and their applications. *Biometrika*, n. 57, pp. 97-109.

- [14] Jesus, A. F. and Wendland, E. (2012). Solução numérica adaptativa da equação do transporte de contaminantes. 1st ed., Biblioteca24horas.
- [15] Jordem Pereira, T. and Amaral Souto, H. P. (2016). Utilização de modelos autoregressivos na quantificação de incertezas em problemas de transporte linear. *Tendências em Matemática Aplicada e Computacional*, vol. 17, n. 1, pp. 55–70.
- [16] Junior, A. P., et al.(2017). Modelo matemático para avaliação da qualidade ambiental: o caso dos núcleos Marabá Pioneira e Nova Marabá, Marabá – PA, *Revista Gestão & Sustentabilidade Ambiental*, vol. 6, n. 3, pp. 405-423.
- [17] Lourenço, N. A., et al. (2021). Uso do método de Monte Carlo para caracterização adicional de materiais para aplicação em blindagem de fótons. *Revista Brasileira de Física Médica*, v. 15.
- [18] Malalasekera, W. and Versteeg, H. K. (1995). An introduction to computational fluid dynamic: the finite volume method. Longman, London.
- [19] Maliska, C. R. (2004). Transferência de calor e mecânica dos fluidos computacional. 2nd ed, Rio de Janeiro: LTC.
- [20] Mondal, A., Efendiev, Y., Millick, A., and Datta-Gupta, A. (2010). Bayesian uncertainty quantification for flows in heterogeneous porous media using Reversible Jump Markov Chain Monte Carlo methods. *Advances in Water Resources*, vol. 33, n. 3, pp. 241–256.
- [21] Metropolis, N. and Ulam. S. (1949) The Monte Carlo method. *Journal of the American Statistical Association*, vol. 44, n. 247, 335-341.
- [22] Penereiro, J. C. and Ferreira, D. H. L. (2012). A modelagem matemática aplicada às questões ambientais: uma abordagem didática no estudo da precipitação pluviométrica e da vazão de rios. *Millenium*, n. 42, pp. 27-47.
- [23] Robert, C. P. and Casella, G. (2004). Monte Carlo Statistical Methods. Springer Texts in Statistics, 2nd ed.
- [24] Saito, C. H. (2019). Global waterpartnership e as ideias-chave em sua nova estratégia global 2020-2025. *Revista de Gestão de Água da América Latina*, vol. 16, 13th ed.
- [25] Seo, I. W. and Baek, K. O. (2004). Estimation of the longitudinal dispersion coefficient using the velocity profile in natural streams. *Journal of Hydraulic Engineering*, vol. 130, n. 3, p. 227-236.
- [26] Soares, P. A., Pinheiro, A., and Zucco, E. (2013). Determinação do coeficiente de dispersão longitudinal em rios. *Revista de Gestão de Água da América Latina*, vol. 10, n. 2, pp. 27–36.
- [27] Souza, M. P., Assis, C. A. S. C., and Cunha, D. M. (2021). Evaluation of the modulation transfer function for CsI imaging receptors in digital mamography using Monte Carlo simulations. *Revista Brasileira de Física Médica*, v 15.
- [28] Telles, W. R., et al. (2013). Simulação de uma pluma de contaminantes no Rio Macaé utilizando redes neurais artificiais. *Revista Brasileira de Recursos Hídricos*, vol. 18, pp. 165-174.
- [29] Tucci, C. E. M., Hespanhol, I., and Cordeiro Netto, O. (2001). *Gestão da Água no Brasil*. Brasília: UNESCO.
- [30] Unesco. WWAP. (2020). *Relatório Mundial das Nações Unidas sobre Desenvolvimento dos Recursos Hídricos 2020*.
- [31] Yoriyas, H. (2009). Método de Monte Carlo: princípios e aplicações em Física Médica. *Revista Brasileira de Física Médica*. vol. 3, n. 1, pp. 141-149.

Opening Area usage of Shear Wall Relating to Wall Area Used for Multistoried Building: A Review

Krishna Pal Singh

M. Tech. Scholar, School of Engineering & Information Technology, Sanskriti University, Mathura, India.

Received: 01 Oct 2021,

Received in revised form: 01 Nov 2021,

Accepted: 06 Nov 2021,

Available online: 14 Nov 2021

©2021 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/>)

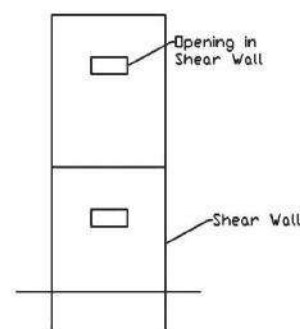
Keywords— Earthquake prone zone,
Multistoried building, Optimum opening, Re-
-Entrant corners, Shear wall

Abstract — In this present era of high-rise buildings and skyscrapers it is obligatory to work on overall shape, plan and structure of building. The building performance under seismic loading is a constraint of various factors comprises of geometry, location and the way of earthquake forces transferred to the ground. The affected zones of higher chances of occurrence of seismic effects with respect to other part of the country may leads to collapse of building under seismic load if they are not provided with and structural strengthening arrangement. However, safety has to be the main criteria when seismic hazard has taken into account in multistoried buildings. In the current study the solution for aforementioned problem is suggested by providing shear wall in a specified ratio with respect to wall area in plan irregularity which helps in resisting lateral load generated by seismic forces. This paper provides the review of research work previously presented by various researchers which shows the further research option.

I. INTRODUCTION

To make building more appealing various modifications in the shape, size and height etc. are proposed. This will make the building more appealing with respect to the other buildings but sometimes they becomes vulnerable toward various loading conditions which results in either creep or fissure or sometimes collapse for heavier unexpected loading came into effect. The multistoried buildings having number of stories higher than 15 to 20 stories, a simple rigid framed structure is not viable as this does not provides the lateral stiffness required by the system and leads to excessive deflection of the building. To make seismic proof buildings, the architectural features should be minimized up to the desirable limits. This problem is sorted either by increasing the size of members but this have its own limitation for or by making the structure comparatively more stable and resist deformation. Also to overcome this problem various structural elements or are added in frame which will reduce the undesirable and destructive situation. One of these are shear wall which is a vertical RCC member

located in place of normal wall as infill of desired width so as to bear and transfer the seismic effect to foundation and ground. But now a days shear walls are also face some constrains like opening for natural lightening, ventilation, entry or exit, etc. This will affect the strength of shear wall also.



Very Small Opening

Fig. 1: Multistoried Frame having very small opening of Shear wall relating to Wall Area Used

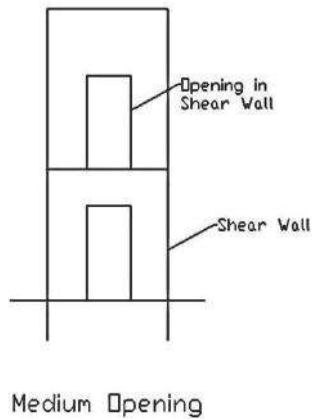


Fig. 2: Multistoried Frame having medium opening of Shear wall relating to Wall Area Used

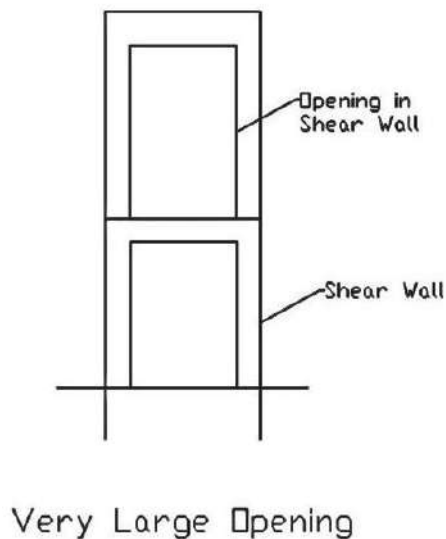


Fig. 3: Multistoried Frame having very large opening of Shear wall relating to Wall Area Used

II. CONCEPT OF OPENING PROVIDED IN SHEAR WALL

Cantilever shear walls always act as coupled shear walls consist of openings and have connected with coupling beams. Multistoried buildings may have openings in rows which is essential for doors, ventilations, openings and windows in both internal and external walls. As per architectural point of view, the opening has provided. This opening has to be decided within the limit to secure the structural resisting components by adverse seismic effects. Shear walls are especially important in high-rise buildings subject to lateral wind and seismic forces. Generally, shear walls are either plane or flanged in section, while core walls consist of channel sections.

III. REVIEW OF LITERATURE

The researchers presented the effect of opening in shear wall with variable size and shape in the various seismic parameters of the buildings. For analysis a fifteen storey building is chosen for study with variable location of shear wall with the size of opening. Various models are framed with variable location from internal to external shear wall and also core shear wall and in combination. Opening with rectangular and square shape is also analyzed for windows of different sizes and also doors of different sizes. The results of the study shows that column moment and axial force are reduced for both internal and external shear wall as compared to core type and core with internal type. Forces are predicted lesser by seismic coefficient method as compared to response spectrum method. Strength and rigidity of shear wall is decreases with opening extent (Ashok kankuntla, Prakarsg Sangave, Reshma Chavan).

Authors made an effort for seismic analysis with shear wall at center core and periphery of each side in the center of shear wall. Behavior of Multistorey building is analyzed for dynamic analysis by Etabs software. A forty storey building is taken for analysis with variable position of shear wall from center core to periphery of building with an opening size of 2m x 1.2m. The conclusions of the study are effects of displacement and drift are considerably lesser in case of outermost perimeter shear wall. Concentrations in stresses are increased by providing opening. Also performances are better in case of building with shear wall at the center core and at the center of periphery for the parameters storey drift and storey displacement also in this case base shear and stiffness is highest (Mahdi Hosseini, N. V. Ramana Rao).

Numerous studies are carried out on a static loading test of RC shear wall with openings carried out to check the variable number and layout of openings. The entire specimen has the same equivalent perimeter ration of openings that is 0.4. The specimens are designed to simulate the lower two storey of multistorey shear wall in multistorey building and scaled to one third of the prototype walls. The analyses are carried out with Finite element method and various models are compared against different constraints. The results of the study are the shear strength for RC shear wall with opening is within the safety limit, but its predictive accuracy is not so accurate. The axial deformation and stress distribution at the bottom of shear wall with openings were variable at columns, wing wall (Masoto Sakurai, Hiroshi Kuramoto, Tomoya Matsui, Tomofusa akita).

The aim of this study is to examine the effect of opening area to wall area ratio against various seismic parameters and yield resistance of the system. The

experimental study is done for multistorey building for various loading systems with various modes framed with opening of variable size and shape. The analyses were performed by ANSYS software and the non-linear static analysis known as hysteresis. The result of the study shows better performance by decreasing the area so that the system's final energy absorption is increased in cyclic and collateral hardness. Also by analyzing the surrender the decrease in opening area and the way in which succession begins enhance the system's performance and at some specific point stress concentrations are prevented (Peyman Ghaderi, Allaedin Behravesh).

The studies in the paper are carried out on a 30 storey building with regular square shaped structure having shear walls are placed at all four sides at the periphery. Two cases are taken for analysis under this in first case models are compared for with and without opening with variable size without incorporating the volume of shear wall and in the second case various models are compared with variable size of openings provided in the center of the shear wall by incorporating the volume of shear wall by increasing the boundary element dimensions. Analyses for various parameters are done by both response spectrum method and time history analysis method. The results of the study reveals that without considering the volume of shear wall and providing opening decreases the stiffness in lateral dimensions and so increases the lateral displacement and inter storey drift of the building. Also for second case as compared to first one the stiffness is increases (Ruchi Sharma, Jignesh A. Amin).

The work of the author in his study is to analyze the symmetric multistorey building with and without shear wall in a bare frame structure. Total 12 cases has taken for analysis and from that 10 cases are only for different types of shear wall location position and comparing all along with static seismic analysis. Shear wall has used in core of the building and periphery of the building. Figure 4 describes the best way to show how the seismic base shear of all the 12 frames behaves comparatively. It has been proved that the core location of the shear wall has been the best location for the stiffness requirement of the multistoried building that has been discussed in the paper for seismic Zone V (Sagar Jamle).

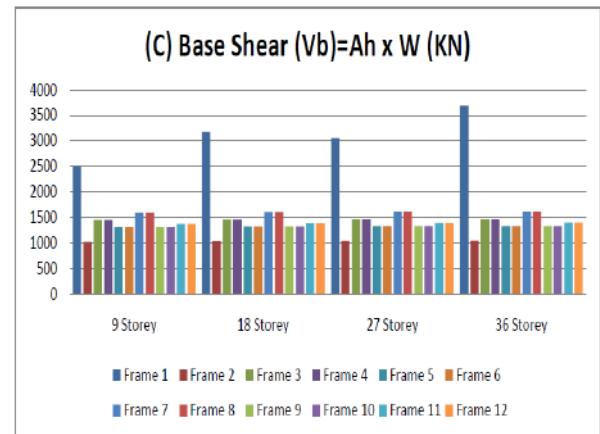


Fig. 4: Base Shear analysis

The aim of the researchers is to analyze the asymmetric shear wall system influenced by non-linear static behavior. The study is carried out for six models of 12 storied building with variable percentage of opening of shear wall with 10%, 20%, 30% and 40% opening. The study is carried out for the building located in North Karnataka zone III. Several seismic parameters are analyzed against various types of loading and constraints. The outcomes of the study shows that base shear for variable opening percentage is lesser as compared to model without any opening. Frequency is decreases with increase in opening but the time period is increases with increase in opening. Storey drift for models with opening in shear wall is higher as compared to the modes without any opening (Saleem Malik Yarnal, Sagar S Allagi, Prashant M Topalakatti, Arif Ahmed Mulla).

The author compared multistorey building with and without opening by non-linear methods. These methods are differ in terms of accuracy and transparency and are developed to rectify the limitations of linear methods without adding any complication to the working and analyzing procedure. Ten storied building is taken for analysis having shear wall provided in the center of periphery by SAP 2000 software. For analysis various models are framed with different opening percentage comprises of 0%, 14%, 25%, 33% & 42% at the center of the shear wall. The result of the study concludes that with the increase in percentage of opening displacement are also increases. Various seismic parameters like base shear and storey drift increases with the increases in percentage of opening. The results of capacity spectrum method shows capacity curve is intersected by demand curve at immediate occupation which leads to the stability of plastic hinges in the structure (Satpute S G, D B Kulkarni).

Author focuses the attention in studying the effect configuration and opening in shear wall system of the

building under seismic response. The model G + 10 storied taken during study with the objective is the building with different shaped opening and without opening comprises of rectangular and square shape and varied arrangement under reversed cyclic loadings. Various seismic parameters are analyzed for load combination applied as per IS 1893:2002. The analysis is performed by Etabs software. The results of the study shows that stiffness of the building is not depended on horizontal location of shear wall but depended on size of opening. This study also reveals that opening is very advantageous and useful (Shivangi Gupta, Rohit Rai, Smiriti Mishra).

The studies of the effect of opening in reinforced concrete shear wall are discussed by the author in this work. The objective this study is to frame a finite element model without shear wall and some finite models with reinforced coupled shear wall with opening for doors and window at centric and eccentric locations. Also an effort is made to optimize the thickness of coupling plate to achieve full wall capacity in reinforced concrete shear wall. The outcomes of the study are effect of opening is insignificant for opening area less than 20%. With the increase in opening area a non-linear variation is observed. There will be drastic increase for door opening in deformation variable from 15% to 25%. Eccentricity is insignificant while increasing for door opening more than 35% and window opening more than 30% (Sruthy K S, Dr. C Justine Jose).

The aim of the present study proves that the stiffness of the building influencing with the variation in percentage of opening area with respect to the wall area has been revealed. Study is carried out for two models of 6 and 12 stories with variable location of shear wall and size of openings. Openings are provided to accommodate doors and windows whose dimensions are initially fixed but are increased considerably at a rate of 14% to 35%. The results of the study shows that for opening provided in shear wall is less than 20% of shear wall area, since the main thing in terms of stiffness of shear wall system, size of the opening is major criteria. They concluded that when opening provided is beyond twenty percent, stiffness of the building is affected. Horizontal door opening location may not cause any considerable effect but the windows vertical locations will significantly affect the stiffness of the system (Vishal A Itware, Dr Uttam B. Kalwane).

IV. CONCLUSIONS

From the earlier review it was observed that several papers are presented in shear wall opening against various constraints such as location of shear wall, size and shape of the shear wall etc. In most of the papers presented major portions of work is done toward the seismic parameters

and are modeled for regular shaped building with rectangular plan only. Nowhere the analysis is done for opening in shear wall in Re - Entrant corners of the building along the height of building to accommodate the current population fit with appealing architecture and with safety.

1. A multistorey building with various irregular shapes comprises of "I" and "L" is taken for analysis with opening in shear wall system in all stories one by one at various locations within the stories to understand better the effect of opening ratio to wall area of the building and several seismic parameters in such case of high rise building. The analysis is done for Seismic zone III to observe the values of result parameters.
2. In this study various seismic parameters like nodal displacement, storey drift and modal participation factors are analyzed at various stories to examine the effective variation.
3. Some other deciding parameters like maximum of bending moment, shear force and axial force is needed to be analyzed for better optimization and conclusion for various cases.
4. Re – Entrant corner building condition is checked as per IS 1893 – 2016.

REFERENCES

- [1] Ashok kankuntla, Prakarsg Sangave, Reshma Chavan. 2016. Effects of Opening in Shear Wall. 13(1). ISSN: 2278-1684. 01-06.
- [2] Sagar Jamle, Dr. M.P. Verma, Vinay Dhakad, (2017), "Flat Slab Shear Wall Interaction for Multistoried Building under Seismic Forces", International Journal of Software & Hardware Research in Engineering (IJSHRE), ISSN: 2347-4890, Vol.-05, Issue-3, pp. 14-31.
- [3] Mahdi Hosseini, N. V. Ramana Rao. 2015. Earthquakes Analysis of High Rise Buildings with Shear Wall at the Center Core and Center of Each Side of the External Perimeter with Opening. 5(12). ISSN: 2319-7064. 59-71.
- [4] Masoto Sakurai, Hiroshi Kuramoto, Tomoya Matsui, Tomofusa akita. 2008. Seismic Performance of RC Shear Wall with Multi Openings. World Conference on Earthquake Engineering.
- [5] Sagar Jamle, Dr. M.P. Verma, Vinay Dhakad, (2017), "Flat Slab Shear Wall Interaction for Multistoried Building Analysis When Structure Length is greater than width under seismic Forces", International Journal of Software & Hardware Research in Engineering (IJSHRE) ISSN: 2347-4890 Vol.-05, Issue-3, pp. 32-53.
- [6] Peyman Ghaderi, Allaedin Behravesht. 2018. Survey of Influence of Opening Area to Wall Area Ratio on Stiffness Yielding Resistance of Concrete Shear Wall System. ISSN: 2575-8950. 5(5). 29-33.

- [7] Sagar Jamle and Roshan Patel, (2020), "Analysis and Design of Box Culvert- A Manual Approach in Structural Engineering", LAP LAMBERT Academic Publishing, Mauritius, ISBN: 978-620-0-78760-6.
- [8] Ruchi Sharma, Jignesh A. Amin. 2015. Effect of Openings in Shear Walls of 30-Storey Building. ISSN: 2170-127X. 44-55.
- [9] Sagar Jamle. 2017. Flat Slab Shear Wall Interaction for Multistoried Building under Seismic Forces. IJournals: International Journal of Software & Hardware Research in Engineering. ISSN-2347-4890. 5(3). 14-31.
- [10] Sagar Jamle, Kundan Meshram. 2019. Response Spectrum Analysis. Response Spectrum Analysis in Flat Slab Multistorey Building for Earthquake Zone IV. LAP Lambert Academic Publishing. ISBN: 987-620-0-32633-1. 1-177.
- [11] Saleem Malik Yarnal, Sagar S Allagi, Prashant M Topalakatti, Arif Ahmed Mulla. 2015. Non-Linear Analysis of Asymmetric Shear Wall with Openings. 4(8). ISSN Print: 2278-0181. 467-471.
- [12] Mohammad Bilal Rasheed, Sagar Jamle, (2020), "An Efficient Approach to Determine the Effects of Different Grades of Concrete in Outrigger and Wall Belt Supported System", International Journal for Research in Applied Science & Engineering Technology (IJRASET), ISSN: 2321 - 9653, vol. 8, no. 7, pp. 1833-1842.
- [13] Bhagwat Mahajan, Sagar Jamle, (2020), "Analytical Approach in Stability Enhancement Techniques by Altering Beam Members at Different Levels", International Journal of Advanced Engineering Research and Science (IJAERS), ISSN: 2349-6495(P) | 2456-1908(O), vol. 7, no. 6, pp. 301-308. <https://dx.doi.org/10.22161/ijaers.76.37>
- [14] Satpute S G, D B Kulkarni. 2013. Comparative Study of Reinforced Concrete Shear Wall Analysis in Multistoried Building with Openings by Non Linear Methods. 2(3). ISSN: 2319-6009. 183-193.
- [15] Shivangi Gupta, Rohit Rai, Smiriti Mishra. 2018. Analysis of Shear Wall with Opening. 5(3). ISSN: 2395-0056. 1024-1025.
- [16] Sruthy K S, Dr. C Justine Jose. 2017. Effects of Openings on Reinforced Concrete Coupled Shear Wall. 8(11). ISSN: 2229-5518. 42-51.
- [17] Zamran Khan, Sagar Jamle, (2020), " Optimization of Stability of Building based on Variation in Shear Wall & Concrete Grade Parameters: A Review", International Journal for Research in Applied Science & Engineering Technology (IJRASET), ISSN: 2321-9653, vol. 8, no. 9, pp. 444-450. <https://doi.org/10.22214/ijraset.2020.31489>
- [18] Vishal A Itware, Dr Uttam B. Kalwane. 2015. Effects of Openings in Shear Wall on Seismic Response of Structure. 5(7). ISSN: 2248-9622. 41-45.
- [19] Sagar Jamle, Nirmal Delmiya, Rahul Singh, (2020), "Efficient Use of UPV Meter: A Non Destructive Test of Concrete by Fragmentation Analysis", Journal of Xi'an University of Architecture & Technology, ISSN: 1006-7930, vol. 12, no. 4, pp. 3385-3394. <https://doi.org/10.37896/JXAT12.04/1078>

Epidemiological Profile of Prostate Cancer in Brazil

Gilmar Júnior Brito Santana¹, Ludianne Paz Lima da Silva², Juliana Azevedo da Paixão³,
Isleide da Silva Santos⁴

^{1,2}Graduated in Pharmacy, Unifacs, Brasil

³Department Health Sciences, Professor DNS I Unifacs Pharmaceutical Unifacs, Brasil

⁴Department Health Sciences, Pharmaceutical Unifacs, Brasil

Received: 12 Sept 2021,

Received in revised form: 25 Oct 2021,

Accepted: 05 Nov 2021,

Available online: 14 Nov 2021

©2021 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—*Prostatecancer, Incidence,
Mortality, Heterogeneity.*

Abstract—*Commonly initiated through a range of mutation sequences that occur throughout an individual's lifetime, the Prostate cancer (PC) is a pathophysiological disorder with diverse origin. In this work, we use the data about the incidence and mortality of PC available in a database from the Brazilian National Cancer Institute (INCA) that permitted the construction of graphs made using the Microsoft Office Excel to the analysis, so this study aimed to quantify the distribution of PC, analyzing its incidence at national, macro-regional, state and capital levels. Furthermore, monitoring mortality at the national and macro-regional levels, as well as its projection at the national level, and generating health indicators that can be useful in promoting public policies. PC has a high incidence in the Northeast and low in the North. The Southeast region presents a higher number of deaths, and the projection of the number of deaths motivated by PC tends to increase throughout Brazil until 2040. Prostate cancer is very heterogeneous across the country, with marked differences in the same geographic space. Thus, this study generated health indicators that can be useful for the promotion of preventive public policies and for budget reorganization, bringing the possibility of a more homogeneous, effective and efficient screening of prostate cancer.*

I. INTRODUCTION

Prostate cancer (PC) is a multifactorial disease that originates through a range of mutation sequences that occur throughout an individual's life. Chromosomal aberrations that originate prostate cancer are linked to the germline (hereditary 5%-10%, familial 15%-20%) and the somatic lineage that corresponds to sporadic cancer (70%-80)^{1,2}.

The accumulation of changes in the nucleotide sequences that make up DNA can lead to castration-resistant prostate cancer (CRPC) and distant metastasis, because DNA can be damaged by exogenous factors (ionizing radiation (IR), chemicals, ultraviolet radiation (UV)) and endogenous (reactive oxygen and nitrogen

species), in addition to spontaneous modifications. Thus, oncogenesis is activated when tumor suppressor genes mutate, causing malignant cells and even more aggressive prostatic tumors to appear³.

The inherited genes and their mutations that most confer an individual's susceptibility to developing prostate cancer are the following: AR (polyglutamate repetition), RNASEL (HPC1) (methylation), MTHFR (deletion), SRD5A2 (point mutations, amino acid exchange), MSR1 (point mutations, amino acid exchange), CYP17 (point mutations in the promoter sequence), BRCA1 (deletion), BRCA2 (deletion, promoter hypermethylation and protein truncation), ELAC2 (point mutations, amino acid exchange). Individuals who inherit the BRCA2 gene are five to seven times more likely to develop prostate cancer

and those who inherit the BRCA1 gene are more likely to develop more severe clinical conditions, including CRPC^{4,5}.

Spontaneously or randomly mutations corresponding among 70% to 80% of cases of prostate cancer. The main genes and their nucleotide changes that are involved in this process are the following: AR gene (point mutations, amplification and increased expression of splice variants), NKX3.1 (promoter hypermethylation), PTEN (deletion), GSTP-1 (promoter hypermethylation in CpG sequences) and CDKN1B (deletion). These changes occur over time, sometimes for decades. It is noteworthy that mutations in the GSTP-1 gene, often found in cancer patients, when expressed protects a prostate against free radicals. The PTEN gene is essential in proliferation, apoptosis and cell cycle regulation, changes in this gene are also common and it ends up affecting metastatic cancer⁵.

Main germline genes that are most involved in metastasis cases: ATM, ATR, BAP1, BARD, BRCA1, BRCA2, BRIP, CHEK2, FAM175A, GEN1, MLH1, MRE11A, MSH2, MSH6, NBN, PALB2, PMS2, RAD51C and RAD51D. Note that the patients with metastatic prostate cancer frequently present the genes BRCA1, BRCA2, ATM and CHEK2. Increased RGS2 is a suggestive prognosis for reduced survival in patients with CRPC. Due to this, the gene expression monitoring of RGS2 early in diagnosis can help to modulate therapeutic approaches for patients with CRPC^{6,7,8}.

Prostate cancer is the most diagnosed in 112 countries, incidence rates range from 6.3 to 83.4/100,000 men in all regions, with the highest rates in Northern and Western Europe, Caribbean, Australia/Nova Zealand, North America and South Africa and the lowest rates in Asia and North Africa. In 48 countries, PC ranks second as the leading cause of cancer death among men, countries in sub-Saharan Africa, the Caribbean, Central and South America (eg Ecuador, Chile and Venezuela), as well as Sweden. Advancing age, family history of the disease, genetic mutations such as those that occur in the BRCA1 and BRCA2 gene, and conditions such as Lynch syndrome are risk factors for prostate cancer^{9,10,11}.

Worldwide, about 19.3 million new cases of cancer were registered, with prostate cancer representing 7.3% of this total, which means 1.4 million of incidence^{11,12,13,14}.

According to the Brazilian National Cancer Institute (INCA), in 2020, 65,840 new cases of PC were registered in Brazil. The distribution of cases of prostatic cancer by regions of Brazil is as follows: Midwest with 5,350 (8.1%), Northeast with 20,570 (31.2%), North with 2,770 (4.2%), Southeast with 27,890 (42.4%) and South with 9,260 (14.1%). It is important to emphasize that prostate

cancer always appears in first place in all five (5) macro-regions of the country, compared to cancers that can affect humans.

One man in nine will be diagnosed with prostate cancer in Brazil throughout their lifetime, six (6) out of ten (10) diagnosed cases will be men over 65 years old, this denotes that age it really is a risk factor for prostate cancer. The mortality rate was 13.1%, with 15,983 deaths in Brazil in 2019^{15,16}.

Given the facts and data presented here, it is essential to develop studies with the aim of detailing the distribution of cases of prostate cancer in Brazil, as well as evaluating the behavior of prostate cancer at national, regional, state and capital levels. Thus, this study aimed to observe the distribution of prostate cancer, as well as its incidence, mortality and mortality projection at the national level, and generate health indicators that can be useful in promoting preventive public policies aimed at the area in question.

II. MATERIAL AND METHODS

A. STUDY LOCATION, DESIGN AND PERIOD

The present work is a quantitative, descriptive, retrospective and documentary study of non-probabilistic sampling among men affected by prostate cancer throughout the country. Data from 2000 to 2019 were collected from patients with a positive diagnosis for prostate cancer and who died in the South, Southeast, Northeast, Midwest and North regions, as well as the national mortality in order to analyze the mortality of PC and projecting mortality up to the year 2040. To analyze the national, regional, state and capital incidence, 2020 data from the male population and estimates of new cases of PC were collected.

B. STUDY POPULATION AND INCLUSION AND EXCLUSION CRITERIA

Men residing in the Federative Republic of Brazil who had a confirmed diagnosis for prostate cancer will be included in this series. Non-Brazilian men and women excluded.

C. DATA MANAGEMENT AND ANALYSIS

Graphs and tables created to perform the analysis of incidence and mortality, as well as for the projection of mortality done using Microsoft Office Excel program for dataprocessing.

This work used the population data, estimates of cases of PC and mortality collected through the website of the Brazilian National Cancer Institute (INCA) at <https://www.inca.gov.br/> and stored in the Microsoft Office Excel. The overall incidence was calculated by

dividing the estimate of PC's cases by the exposed population multiplied by 100,000 inhabitants.

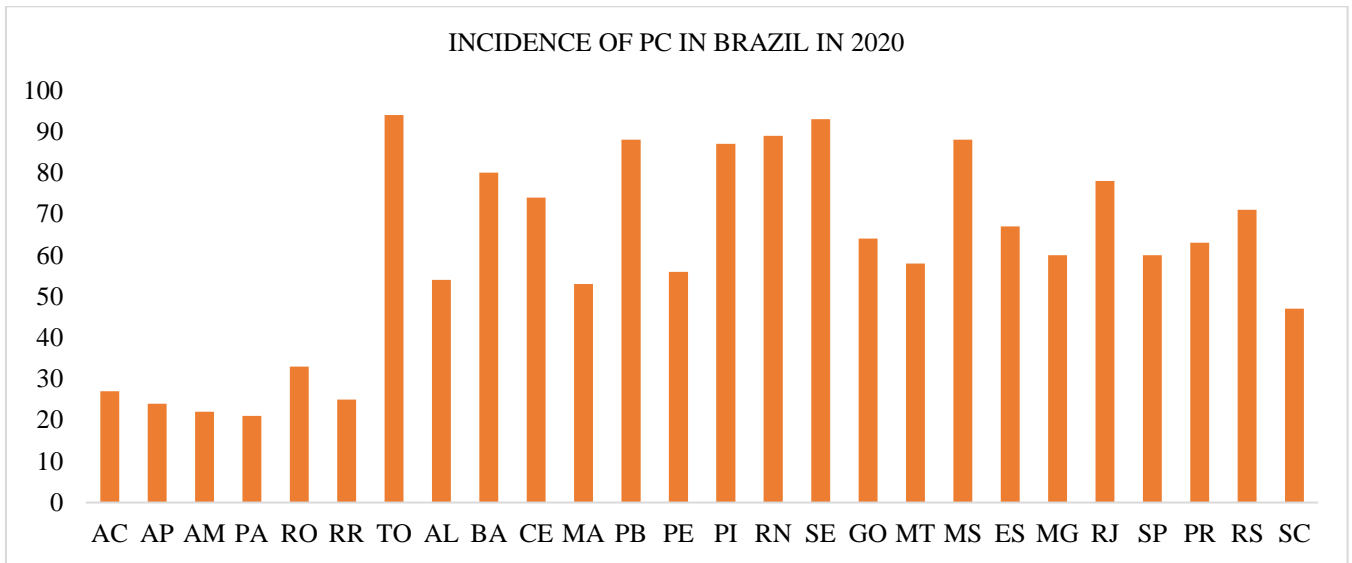
III. RESULTS AND DISCUSSION

According to the INCA¹⁵, the general incidence of Prostate Cancer (PC) in Brazil in 2020 was 29.2%, with approximately 65,840 men affected. Graph 1 shows a very high incidence in the state of Tocantins, with an average of 94 men with a positive diagnosis for PC for every 100,000, followed by Paraíba with 88 confirmed cases, Bahia with

80 and Ceará 74. There is an important heterogeneity in the distribution of PC, with the states of the Northeast region presenting a higher incidence.

A previous developed study¹⁷ demonstrated the behavior of PC in 185 countries; they suggested that the incidence of PC continues to increase in developed nations and with a clear growth in developing countries. According to the results expressed here, Brazil has been following this trend. Also in Graph 1, it is possible to see that the distribution of PC in Brazil is quite heterogeneous, with strong differences between the regions of the country.

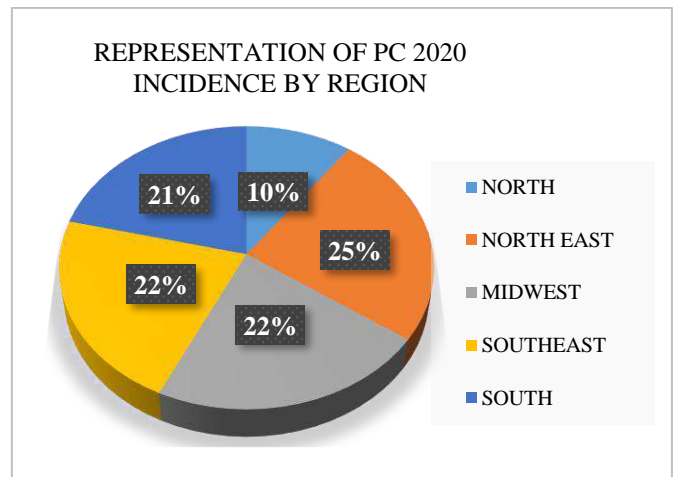
Graph 1: Overall incidence of PC in Brazil in 2020 per 100,000 inhabitants



From: BRAZIL, 2021,adapted.

On the representation of the overall incidence by region in percentage (Graph 2), it is possible to observe that the Northeast Region stands out for being the most affected by PC, with 25%, followed by the Midwest Region with 22% and the Southeast Region with 22% similar to the results found in a previous developed study¹⁸. In relation to the tendency presented in previous regions presented, the North Region with 10% of this total was an unexpected data. In this sense, this region is the one with the lowest incidence in the country. However, the data obtained may not be as reliable due to huge geographic and access barriers to healthcare. As a result, underreporting of data is suspected. Garnelo¹⁹, addresses the issue of access to health care in the North region, highlighting the lack of health professionals, access difficulties and budget limitations.

Graph 2: Representation of the incidence of PC 2020 by region

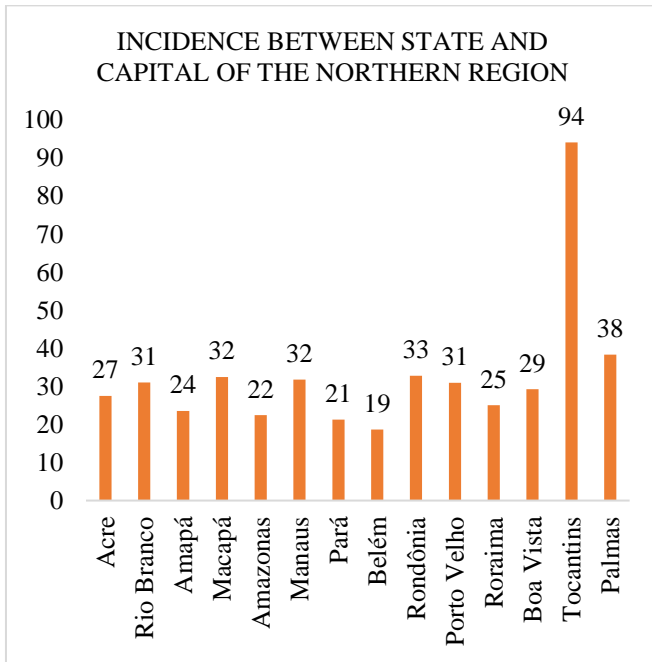


From: BRAZIL, 2021,adapted.

Graph 3 shows the behavior of prostate cancer between the states and their respective capitals in the North of the country. In general, there is a certain similarity between the incidences of PC. Tocantins has a divergent point to

observe, with an incidence of 94 men with PC for every 100,000, the capital of Tocantins, Palmas, has an incidence comparable to other capitals in the North region. A possible explanation is its proximity to the Northeast and Center-West regions, which have high incidence rates of PC. As evidenced, the North region has the lowest incidences of PC in the country; the study by Alcantara¹⁸ had identical results.

Graph 3: Comparison between the incidence of CaP between states and capitals in the Northern region of Brazil

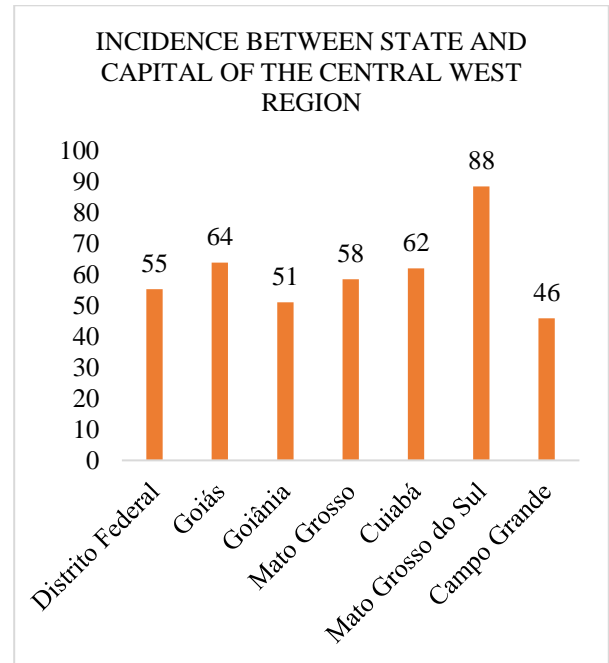


From: BRAZIL, 2021,adapted.

The comparison of the incidence of PC between states and capitals in the Midwest region, showed in Graph 4, highlighted a much higher incidence than in the North region. In addition, there is a very heterogeneous behavior among the states, the state of Mato Grosso do Norte has the highest incidence (88 cases for every 100,000 men) and the state of Mato Grosso do Sul has the lowest incidence (58 cases for each 10,000 men). Furthermore, there are differences between the states and their

respective capitals, denoting a very heterogeneous behavior of the PC in this region. In a previous study, Dutra²⁰ correlates this increase in the incidence of PC in the Midwest region with the sharp increase in the use of pesticide.

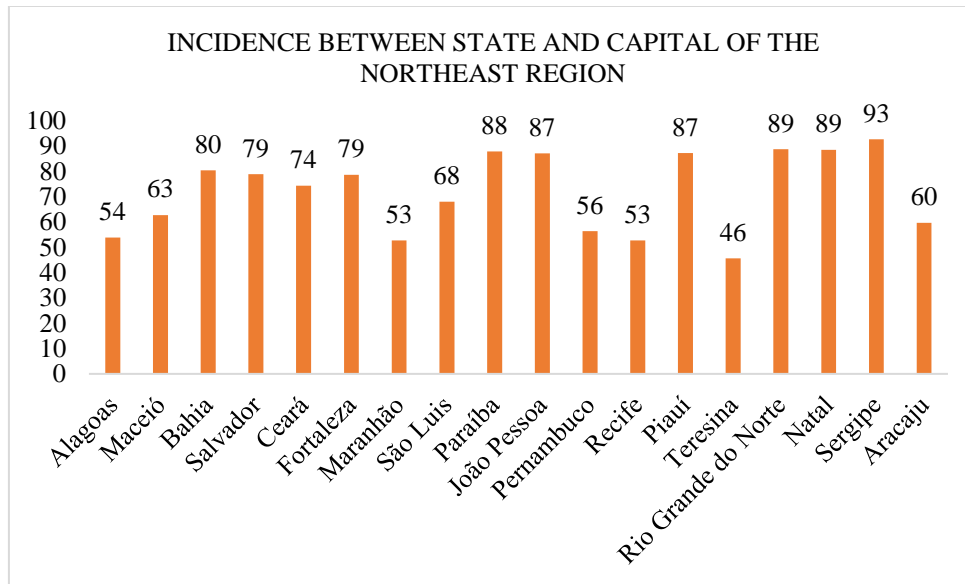
Graph 4: Comparison between the incidence of PC between states and capitals in the Midwest region of Brazil



From: BRAZIL, 2021,adapted.

Notably, there is a strong heterogeneity in the behavior of PC in this region (Graph 5). The Northeast has the highest incidences of PC in the country, a study developed²¹ revealed the epidemiological profile of men who are affected by prostate cancer in this region, with brown men being the most affected, aged between 60 and 69 years. Here, the state with the highest incidence was Sergipe, with (93 cases for every 100,000 thousand men), and the state with the least incidence was Maranhão, with (53 cases for every 100,000 thousand men). It is important to mention that there is a lot of difference regarding the behavior of PC in the Northeast; Alcantara¹⁸ had similar results to those mentioned here.

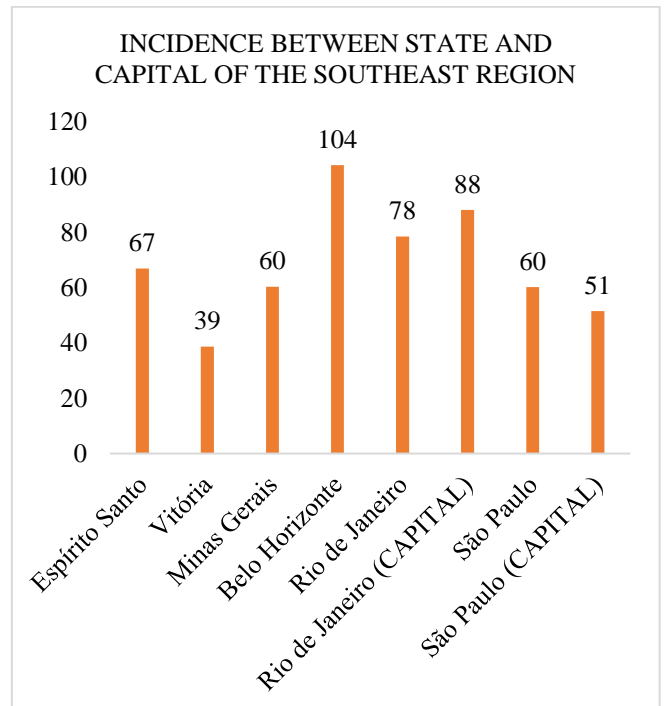
Graph 5: Comparison between the incidence of PC between states and capitals in the Northeast region of Brazil



From: BRAZIL, 2021,adapted.

Graph 6 shows the comparison of incidence between states and capitals in the Southeast region of the country. It is possible to observe a high incidence of PC and a strong heterogeneity between states and their capitals. It is important to mention that the Southeast region is the most developed in the country and the literature already correlates high rates of PCs incidence with a high level of socioeconomic development. The state of Rio de Janeiro has the highest incidence of PC, with 78 cases per 100,000 men, and the state of São Paulo and Minas Gerais have the lowest rates, with 60 cases per 100,000 men. A point to be noted is what happens in the capital of Minas Gerais, Belo Horizonte, which has the highest incidence of PC among all capitals in the region, with 104 cases for every 100,000 men, an average well above that of Brazil and one of the highest incidences of PC in the country, second only to Florianópolis. Sung¹¹ correlates that more developed regions have a higher incidence of PCs, as well as other types of neoplasms. Luizaga²² addresses in his studies the geographic disparities in the country and their impacts on access to health, which ends up implying different behaviors of pathologies, including PC.

Graph 6: Comparison between the incidence of PC between states and capitals in the Southeast region of Brazil

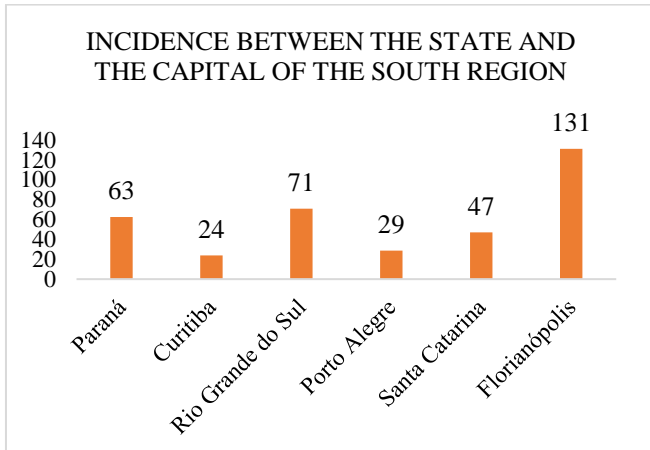


From: BRAZIL, 2021,adapted.

Graph 7 addresses the incidence of CaP between states and capitals in the southern region of the country. It is worth noting the heterogeneity of the incidence of PC between states and capitals in this region. Florianópolis has the highest incidence of PCs in the country, with an

incredible 131 cases per 100,000 men. The state of Rio Grande do Sul has the highest incidence, with 71 cases for every 100,000 men. Silva²³ observed in his studies a greater emergence of neoplasms associated with the intensive use of pesticides in the southern region of Brazil.

Graph 7: Comparison between the incidence of PC between states and capitals in the southern region of Brazil

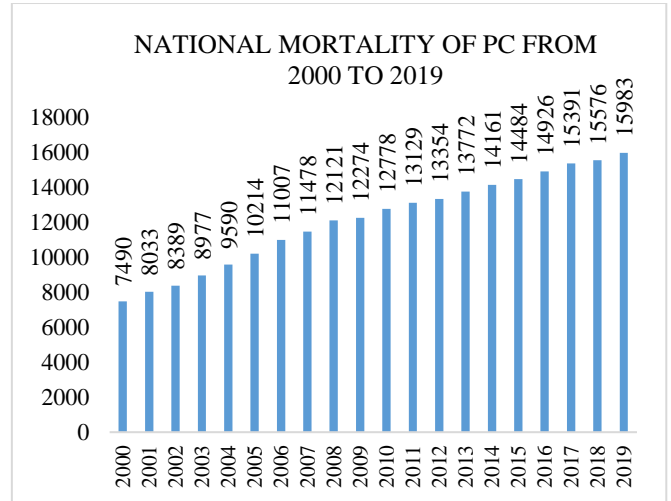


From: BRAZIL, 2021,adapted.

Related to the mortality of PCs at the national level showed in Graph 8 it is notorious that there is a significant increase in mortality from PC over the years, reaching a doubling over a period of 20 years. These data are in line with the increase in Brazilian life expectancy. Furthermore, with the population becoming increasingly gray it is very likely that the mortality of PC will continue

to grow. According to Alcantara¹⁸, the age group with the highest number of deaths from PC is 75 to 79 years old, and the lowest is between 40 to 44 years old, suggesting a correlation between age and death.

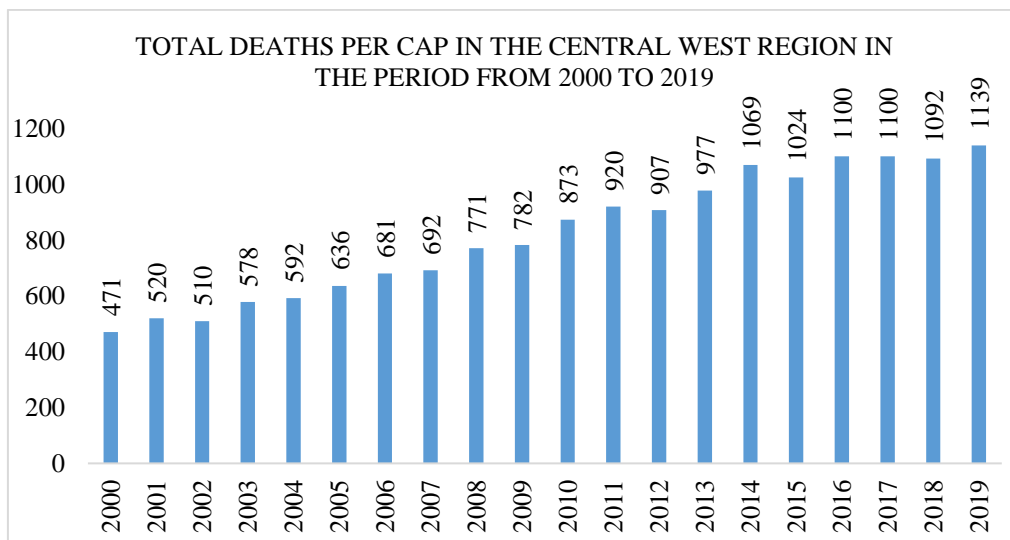
Graph 8: Comparison of PC mortality in Brazil between 2000 and 2019



From: BRAZIL, 2021,adapted.

Graph 9 quantifies the number of deaths from PCs in the Brazilian Midwest. It is possible to see a continued increase, with some variations over the years. In 20 years, this total number of deaths increased by about 242%. The age group of men who most die in the analyzed region follows that of Brazil, between 75 and 79 years. It is important to mention that when there is better health care decrease in the number of deaths from PC occurred¹⁸.

Graph 9: Comparison of PC mortality in the Midwest region of Brazil between 2000 and 2019



From: BRAZIL, 2021,adapted.

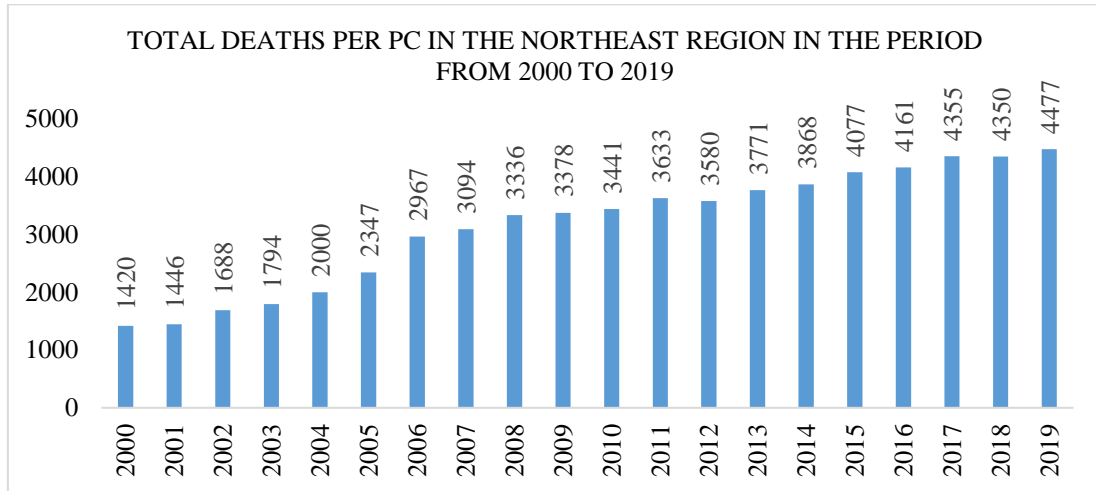
In Northeast Brazil, the total number of deaths from PC, Graph 10, a constant and growing increase in terms of

deaths is observed. A higher mortality from PC was observed in the age group over 80 years old in

Northeastern Brazil. Literature reports that the Northeast has the highest percentages of deaths from PCs in Brazil. It is suggested that this is due to a lack of access to health care, lack of budget, difficulties in diagnosis and early treatment^{24,25}. The data found by Vasconcelos²⁶ are similar

to the results presented here. In addition, in this region there is strong resistance to the digital rectal exam, a study reinforces the idea about its importance in the early diagnosis of PC²⁷.

Graph 10: Comparison of PC mortality in the Northeast region of Brazil between 2000 and 2019

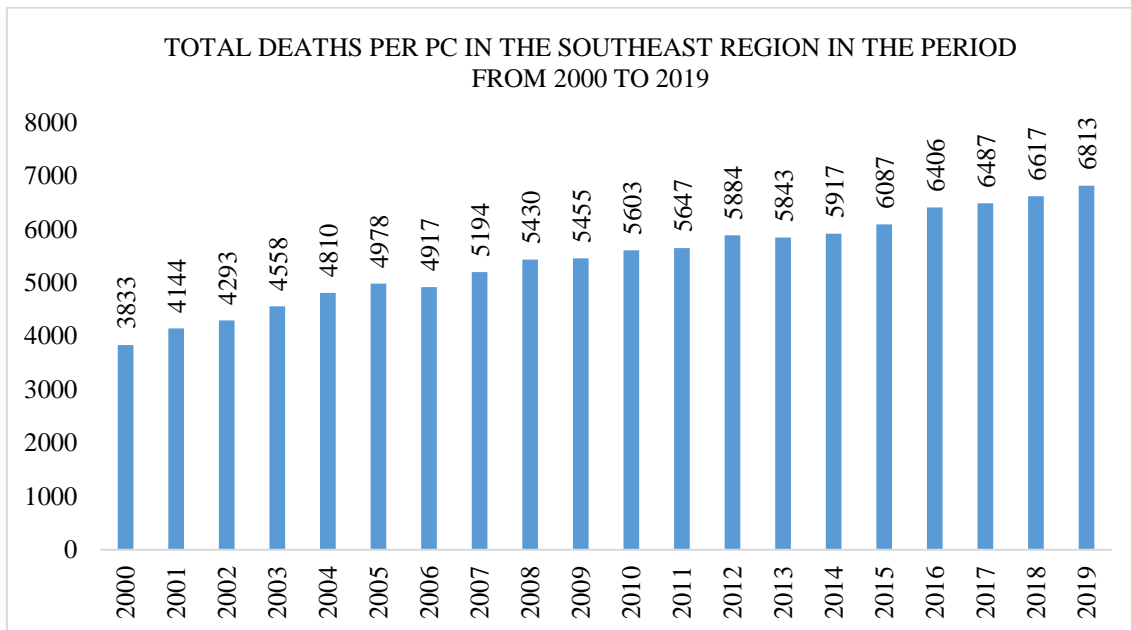


From: BRAZIL, 2021, adapted.

Graph 11 shows the number of deaths from PC in Southeastern Brazil. This region is the most economically developed in the country. As it has the largest population in the country, a higher number of deaths from PC is expected in the Southeast region, as observed in this result. Between 2000 and 2019, there was an increase in the

number of PC around 178%. Cesar²⁴ observed that the mortality rate in the Southeast region is between 1.88% and 2.04%, ranking fourth (4) in comparison with the macro-regions of Brazil. This number is expected to continue to grow due to increased life expectancy and the current mode of social behavior.

Graph 11: Comparison of PC mortality in the Southeast region of Brazil between 2000 and 2019



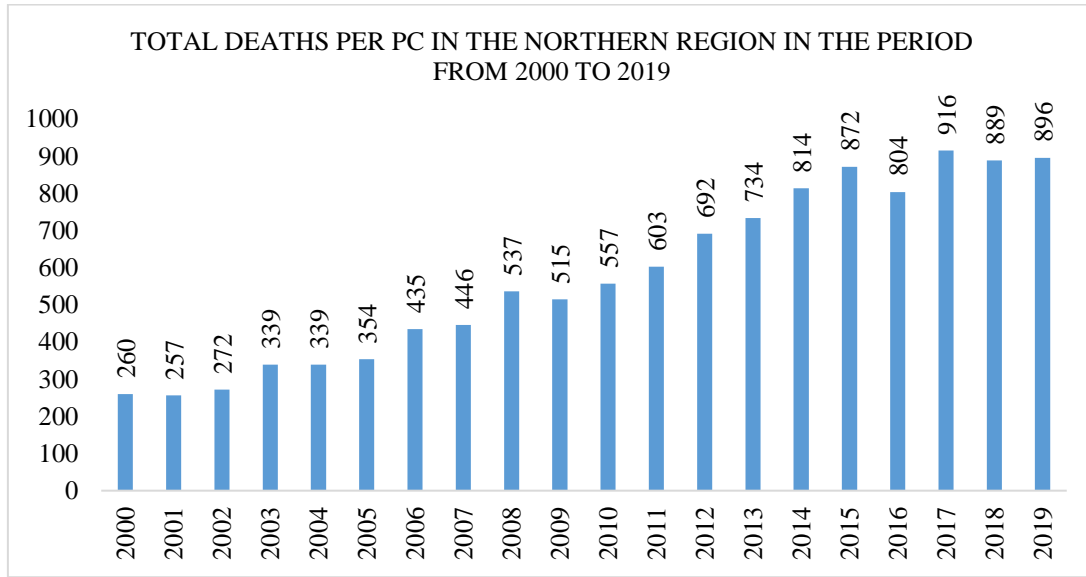
From: BRAZIL, 2021, adapted.

The number of deaths from PC in the northern region of the country is showed in Graph 12. According to Cesar²⁴, this region has the lowest mortality rate among the

other regions, ranging from 1.33% to 1.82%. It is possible to notice large variations in the arrangement of data over the years reported. Between the years observed (2000 to

2019), there was an increase of 344.6% in relation to the data in this region. deaths from PC. It is important to mention the reliability of

Graph 12: Comparison of PC mortality in Northern Brazil between 2000 and 2019

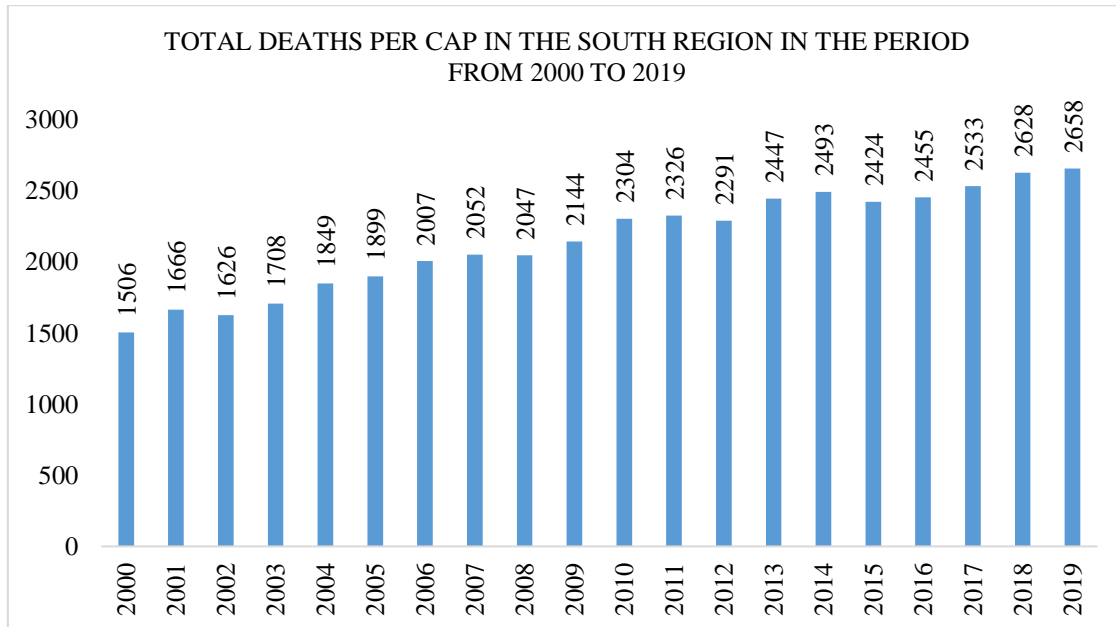


From: BRAZIL, 2021,adapted.

Graph 13 shows the total number of deaths from PC in the southern region of Brazil. According to Cesar²⁴, the South has the highest mortality rate from PCs in Brazil, ranging from 2.13% to 2.37%, this was also seen in all age groups analyzed, with emphasis on men from 80 years old.

A possible explanation for this is the intensive use of pesticides in monoculture areas²⁰.

Graph 13: Comparison of PC mortality in southern Brazil between 2000 and 2019



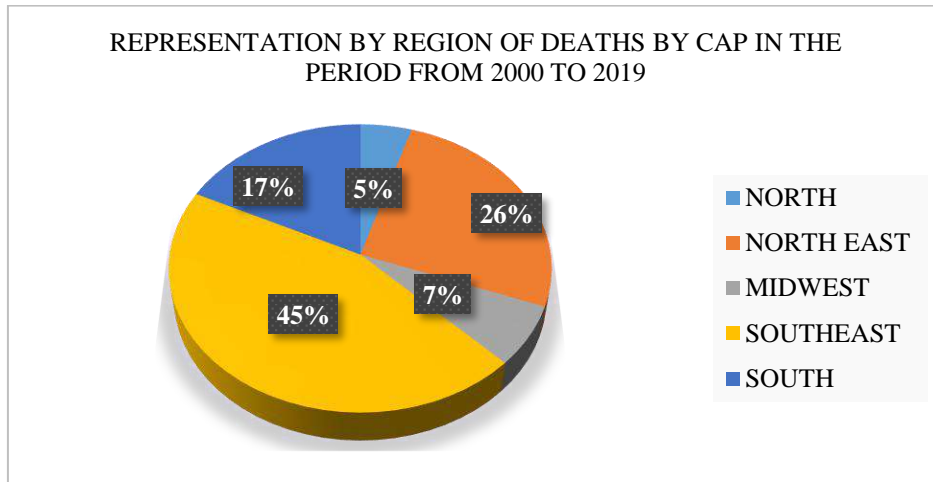
From: BRAZIL, 2021,adapted.

An overall representation, based on the total analysis of deaths, of the percentage of deaths from PCs between 2000 and 2019 in all regions of Brazil showed in Graph 14. The Southeast region is noteworthy, accounting for 45% of all

deaths from PC throughout Brazil. The North region has the lowest percentage, 5%. Previous studies^{24,28} found results similar to those analyzed in this present work. An important fact to report is that of all deaths recorded in

Brazil, between 2000 and 2019, 2% are deaths caused by prostate cancer.

Graph 14: Comparison of PC mortality in macro-regions of Brazil between 2000 and 2019

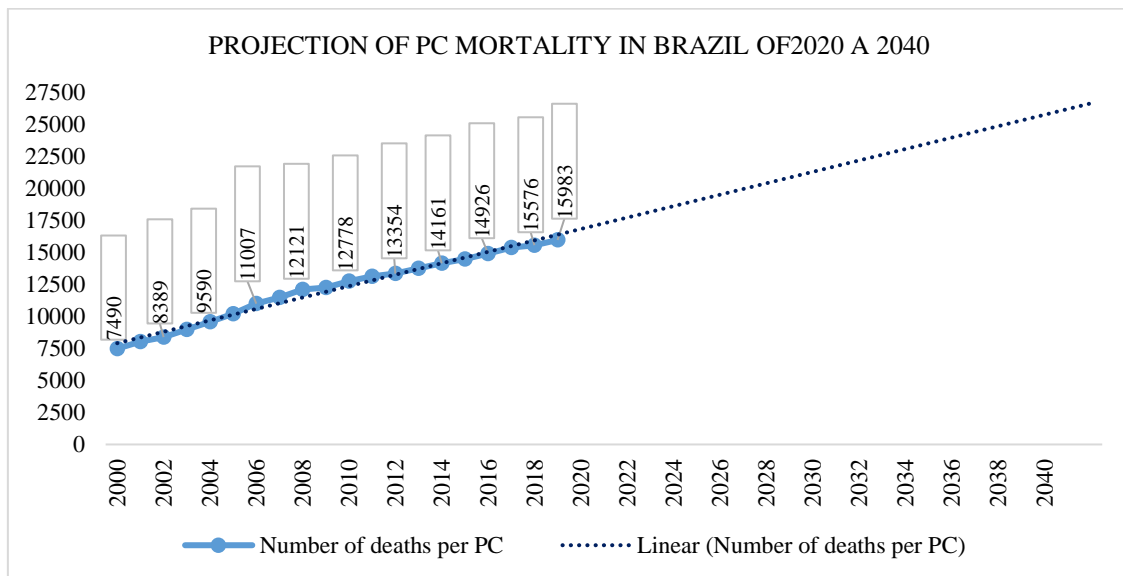


From: BRAZIL, 2021, adapted.

Graph 15 shows the real curve of mortality from PCs until 2020 and its projection until 2040. At the current rate, it there is an expectation that by 2040 Brazil will have around 26,000 deaths from PC across the country. Prostate cancer is a pathology closely related to the patient's age, so much so that its incidence is higher in men over 60 years of age and its mortality much more accentuated after 80 years of age, as mentioned above. Therefore, the results presented are worrisome. Furthermore, oncology services

are quite costly to public coffers, which further aggravates the problem presented. Another point to think about is that the regions of Brazil are very heterogeneous in terms of socioeconomic status; difficulties in accessing health care and tracking PCs are also common. In addition, in this work we analyzed the mortality in consequence of PC throughout the country and its respective macro-regions, over a 20-year period, and its projection until 2040.

Graph 15: Projection of PC mortality in Brazil until 2040



From: BRAZIL, 2021, adapted.

The process for the restoration of organic functions in patients with prostate cancer requires the use of several drugs, which can affect other vital functions of the body. To deal with all these pharmacotherapeutic processes, clinical management and observations on pharmacological conditions, the presence of a pharmacist who is part of the

health team that assists the cancer patient is essential. Thus, the pharmacist can act directly during the clinical management of the patient, contributing to the promotion of their health²⁹.

III. CONCLUSION

Prostate cancer (PC) is a very heterogeneous pathology that originates through changes in nucleotide sequences throughout an individual's life. In the study presented here, we found that PC is heterogeneous in the Brazilian territory in relation to its incidence and mortality, with very high numbers in some regions of the country, such as the Northeast and Southeast regions, in total discrepancy with the low indices presented by the North region. Overall, this suggests a different behavior of PC in different geographic regions.

Screening for PC through the measurement of PSA is an important tool to aid in the initial diagnosis of prostate cancer. Considering that the tracking campaigns popularly known as “Novembro Azul” are unequal in different geographic spaces in Brazil, as well as there are several budget limitations, which makes the diagnosis and notification of PC even more difficult. In a way, this represents the diverse socioeconomic inequalities that so afflict the nation.

It is expected that more investment in PC tracking campaigns, earlier detection and notification will occur. Thus, being able to guide the constituted government to better direct the public purse to the treatment units, aiming at a reduction in mortality. Another relevant fact about the treatment in question is genetic counseling, which consists of analyzing an individual's genetic set in order to search for genes that can trigger prostate cancer.

Prostatic cancer is a pathology closely related to advancing age, family predisposition and lifestyle. Therefore, educational campaigns and health education are essential so that, throughout life, the individual can be informed about the disease and take care of himself, in order to minimize the risks, especially if there are already cases in the family.

As far as we know, this is the first work that aims to analyze the general incidence of prostate cancer nationwide, comparing it between regions of Brazil and states vs capitals. In order to understand the behavior of PC, its mortality profile throughout the country and its projection until 2040 were drawn, which highlighted the need for greater attention to this pathophysiological disorder.

REFERENCES

[1] ZHONG, Zheng; YU, Jia; VIRSHUP, David M.; MADAN, Babita. **Wnts and the hallmarks of cancer. Cancer And Metastasis Reviews**, [S.L.], v. 39, n. 3, p. 5-20, 8 maio 2020. Springer Science and Business Media LLC. <http://dx.doi.org/10.1007/s10555-020-09887->

[2] YU, Yang; LIU, Jie; FENG, Nuan; SONG, Bo; ZHENG, Zeyu. **Combining sequence and Gene Ontology for protein module detection in the Weighted Network. Journal Of Theoretical Biology**, [S.L.], v. 412, p. 2-8, jan. 2017. Elsevier BV. <http://dx.doi.org/10.1016/j.jtbi.2016.10.010>.

[3] ZHANG, Wenhao; VAN GENT, Dik C.; INCROCCI, Luca; VAN WEERDEN, Wytse M.; NONNEKENS, Julie. **Role of the DNA damage response in prostate cancer formation, progression and treatment. Prostate Cancer And Prostatic Diseases**, [S.L.], v. 23, n. 1, p. 5-15, 13 jun. 2019. Springer Science and Business Media LLC. <http://dx.doi.org/10.1038/s41391-019-0153-2>.

[4] FRASER, Michael; ROUETTE, Alexandre. **Prostate Cancer Genomic Subtypes. Advances In Experimental Medicine And Biology**, [S.L.], p. 4-15, 2019. Springer International Publishing. http://dx.doi.org/10.1007/978-3-030-32656-2_5

[5] GANDHI, Jason; AFRIDI, Adil; VATSIA, Sohrab; JOSHI, Gargi; JOSHI, Gunjan; KAPLAN, Steven A.; SMITH, Noel L.; KHAN, Sardar Ali. **The molecular biology of prostate cancer: current understanding and clinical implications. Prostate Cancer And Prostatic Diseases**, [S.L.], v. 21, n. 1, p. 7-25, 27 dez. 2017. Springer Science and Business Media LLC. <http://dx.doi.org/10.1038/s41391-017-0023-8>.

[6] BRADY, Lauren; KRINER, Michelle; COLEMAN, Ilsa; MORRISSEY, Colm; ROUDIER, Martine; TRUE, Lawrence D.; GULATI, Roman; PLYMATE, Stephen R.;

[7] LINDER, Anna; LARSSON, Karin; WELÉN, Karin; DAMBER, Jan-Erik. **RGS2 is prognostic for development of castration resistance and cancer-specific survival in castration-resistant prostate cancer. The Prostate**, [S.L.], v. 80, n. 11, p. 5-11, 25 maio 2020. Wiley. <http://dx.doi.org/10.1002/pros.23994>.

[8] REBELLO, Richard J.; OING, Christoph; KNUDSEN, Karen E.; LOEB, Stacy; JOHNSON, David C.; REITER, Robert E.; GILLESSEN, Silke; KWAST, Theodorus van Der; BRISTOW, Robert G. **Prostate cancer. Nature Reviews Disease Primers**, [S.L.], v. 7, n. 1, p. 11-25, 4 fev. 2021. Springer Science and Business Media LLC. <http://dx.doi.org/10.1038/s41572-020-00243-0>

[9] BRAY, F. et al. **Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: a cancer journal for clinicians**, Hoboken, v. 68, n. 6, p. 394-424, Nov. 2018.

[10] PERNAR, C. et al. **The Epidemiology of Prostate Cancer**. Disponível em: <<http://perspectivesinmedicine.cshlp.org/content/8/12/a030361.full>> Acesso em: 20 de março de 2021.

[11] SUNG, H. et al. **Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin**. 2021 May;71(3):209-249. <https://doi.org/10.3322/caac.21660>

[12] FERLAY, J. et al. **Estimating the global cancer incidence and mortality in 2018: GLOBOCAN sources and methods.**

- International journal of cancer, New York, v. 144, n. 8, p. 1941- 1953, Apr. 2019
- [13] KHAZAEI, Z. et al. **Global câncer statistics 2018: Globocan estimates of incidence and mortality worldwide prostate cancers and their relationship with the human development index.** Disponível em: <Acesso em: 01 de abril de 2021.
- [14] RAWLA, Prashanth. **Epidemiology of Prostate Cancer.** World journal of oncology. 2019 Apr;10(2):63-89. <https://doi.org/10.14740/wjon1191>
- [15] INCA. **Estimativa 2020:** incidência de câncer no Brasil/Instituto Nacional de Câncer José Alencar Gomes da Silva. – Rio de Janeiro: INCA, 2019
- [16] OLIVEIRA, RAR. et al. **Rastreo do cancro da próstata no Brasil: experiência de um único centro do sistema público de saúde.** IntBraz J Urol. 2021; 47: 558-65.
- [17] BRAY, F. et al. **Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries.** CA: a cancer journal for clinicians, Hoboken, v. 68, n. 6, p. 394-424, Nov. 2018.
- [18] ALCANTARA, Stefanie de Sousa Antunes; MARTINELLI, PatriciaMerly; SOUSA, Luiz Vinicius de Alcantara; FONSECA, Fernando Luiz Affonso. **Epidemiological profile of prostate cancer mortality and access to hospital care in Brazilian regions - an ecological study.** Journal Of Human Growth And Development, [S.L.], v. 31, n. 2, p. 5-17, 3 ago. 2021. Faculdade de Filosofia e Ciências. <http://dx.doi.org/10.36311/jhgd.v31.12227>.
- [19] GARNELO, Luiza; LIMA, Juliana Gagno; ROCHA, Esron Soares Carvalho; HERKRATH, Fernando José. **Acesso e cobertura da Atenção Primária à Saúde para populações rurais e urbanas na região norte do Brasil.** Saúde em Debate, [S.L.], v. 42, n. 1, p. 5-15, set. 2018. FapUNIFESP (SciELO). <http://dx.doi.org/10.1590/0103-11042018s106>.
- [20] DUTRA, Lidiane Silva; FERREIRA, Aldo Pacheco; HORTA, Marco Aurélio Pereira; PALHARES, Paulo Roberto. **Uso de agrotóxicos e mortalidade por câncer em regiões de monoculturas.** Saúde em Debate, [S.L.], v. 44, n. 127, p. 5-6, dez. 2020. FapUNIFESP (SciELO). <http://dx.doi.org/10.1590/0103-1104202012706>.
- [21] ALBUQUERQUE, Lucas Vieira de; MORAES, João Victor Queiroz; BRITO, Lucas Andrade; BEZERRA, Samuel Sales; OLIVEIRA, Diego Menezes de. **Perfil epidemiológico dos pacientes internados por câncer de próstata na região nordeste do Brasil no período de 2011 a 2020.** Anais do I Congresso Nacional Multidisciplinar de Oncologia On-Line, [S.L.], p. 5-15, 27 jul. 2021. RevistaMultidisciplinaremSaúde. <http://dx.doi.org/10.51161/rem/s1563>.
- [22] LUIZAGA, Carolina Terra de Moraes; RIBEIRO, Karina Braga; FONSECA, Luiz Augusto Marcondes; ELUF NETO, José. **Tendências na mortalidade por câncer de próstata no estado de São Paulo, 2000 a 2015.** Revista de Saúde Pública, [S.L.], v. 54, p. 5-15, 28 out. 2020. Universidade de Sao Paulo, Agencia USP de Gestao da InformacaoAcademica (AGUIA). <http://dx.doi.org/10.11606/s1518-8787.2020054001948>.
- [23] SILVA, João Francisco Santos da et al. **Correlação entre produção agrícola, variáveis clínicas-demográficas e câncer de próstata: um estudo ecológico.** Ciência & Saúde Coletiva [online]. 2015, v. 20, n. 9, pp. 2805-2812. <https://doi.org/10.1590/1413-81232015209.00582015>
- [24] CESAR, LindcyMaticolli; FACCIN, Lucas Boa Sorte; MARTINEZ, MaianaGueretta; DOMINATO, Angélica Augusta Grigoli. **Câncer de mama e próstata no Brasil: análise epidemiológica / breastcancerandprostate in brazil.** Arquivos Médicos dos Hospitais e da Faculdade de Ciências Médicas da Santa Casa de São Paulo, [S.L.], v. 66, n. 1, p. 5-15, 24 maio 2021. FundacaoArnaldo Vieira de Carvalho. <http://dx.doi.org/10.26432/1809-3019.2021.66.011>.
- [25] FARIA, Lívia Silva de Paula; PEREIRA, Pedro Caldas; LUSTOSA, André Luis Morelli; ARAGÃO, Iapunira Catarina Sant'anna; ARAGÃO, Felipe Matheus Sant'anna; CUNHA, Marcos Guimarães de Souza. **PERFIL EPIDEMIOLÓGICO DO CÂNCER DE PRÓSTATA NO BRASIL: retrato de uma década.** Revista Uningá, [S.L.], v. 57, n. 4, p. 5-15, 23 dez. 2020. Editora UNINGA. <http://dx.doi.org/10.46311/2318-0579.57.4.076-084>.
- [26] VASCONCELOS, Vitor Lobão; SOARES, Ana Célia Goes Melo; PALMEIRA, Isabella Paiva; GUIMARÃES, Laís de Souza; MELO, Lívia Carvalho; SANTOS, Anne Karoline Tavares dos; PAIXÃO, Mariana Brito; SANTOS, Valéria Raquel Rabelo Trindade. **Temporal evolution of prostate cancer mortality trends in Sergipe and the Northeast region from 2008 to 2019.** Brazilian Journal Of Health Review, [S.L.], v. 4, n. 2, p. 5-15, 2021. Brazilian Journal of Health Review. <http://dx.doi.org/10.34119/bjhrv4n2-073>.
- [27] VASCONCELOS, Lidiane Assunção de; SOUSA, Carla Quaresma Durães de; LIMA, Gabrielle do Nascimento; SILVA, Ingrid Amanda Brito da; GOMES, NaellemJasminye Batista; SILVA, Samya Pureza da; BRAGA, Stephany Siqueira; OLIVEIRA, Beatriz Duarte de; NORTE, Raimunda Silvia Gatti; OLIVEIRA, Lauricéia Valente de. **The Importance of Rectal Touch Examination in the Prevention of Prostate Cancer and the Role of Nurses in Self-Care in Front of Ribeirinha Reality.** International Journal Of Advanced Engineering Research And Science, [S.L.], v. 7, n. 5, p. 5-9, 2020. AI Publications. <http://dx.doi.org/10.22161/ijaers.75.21>.
- [28] CONCEIÇÃO, Mara Beatriz Martins; BOING, Antonio Fernando; PERES, Karen Glazer. **Time trends in prostate cancer mortality according to major geographic regions of Brazil: an analysis of three decades.** Cadernos de Saúde Pública, [S.L.], v. 30, n. 3, p. 4-20, mar. 2014. FapUNIFESP (SciELO). <http://dx.doi.org/10.1590/0102-311x00005813>
- [29] SANTOS, Juliana Pereira; AZEVEDO, Regina Maria da Hora dos Santos; ARAUJO, Patrícia Lima; BENDICHO, Maria Teresita; XAVIER, Rosa Malena Fagundes. **Cuidadofarmacêuticoem UTI oncológica.** Brazilian Journal Of Health Review, [S.L.], v. 3, n. 3, p. 5-15, 2020. Brazilian Journal of Health Review. <http://dx.doi.org/10.34119/bjhrv3n3>

Breast cancer associated with pregnancy: Evidence for nursing care

Câncer de mama associado à gestação: Evidências para assistência de enfermagem

Anathaly Alves dos Santos Silva¹, Katiany Tamara Andrade Batista¹, Gleison Faria^{1*}, Alexandra Alves de Carvalho¹, Gilvan Salvador Junior¹, Cleovanio Oliveira da Silva¹, Raiane Kesia de Carvalho Pereira¹, Andressa de Jesus Lucio¹, Gean Carlos da Silva Saar¹, Francielly Maira Bordon², Cleverson de Oliveira Santos³

¹Nurse at the Faculty of Biomedical Sciences of Cacoal – FACIMED – RO, Brazil.

²Nurse at the São Lucas University Center of Ji-Paraná –RO, Brazil

³Bachelor's degree in nursing from the Institute of Higher Education of Cacoal – FANORTE – Cacoal – RO, Brazil.

*Corresponding author: gleisonfaria@hotmail.com

Received: 17 Sept 2021,

Received in revised form: 02 Nov 2021,

Accepted: 08 Nov 2021,

Available online: 15 Nov 2021

©2021 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— *Breast cancer; Gestation; Nursing care.*

Palavras-chaves — *Câncer de mama; Gestação; Assistência de enfermagem.*

Abstract— *Breast cancer, which normally affects women at a more advanced stage of life, is associated with women who delay pregnancy, and as it is probably the health problem that most affects women because of its incidence, taboos and fears, it is up to nursing professional establish actions aimed at providing humanized and effective care. The aim of the study is to understand the importance of nursing care for patients with breast cancer associated with pregnancy. the methodology was a descriptive study carried out from a literature review, based on: LILACS, BVS, SCIELO. Languages, Portuguese and Spanish were used as inclusion criteria for the period 2004-2016, 20 articles were selected for the construction of this work. There is a need to conduct studies aimed at this theme, supporting the decision-making of nursing professionals in the planning and implementation of interventions, promoting better care in the context of comprehensiveness, providing nursing care aimed at well-being physical, social and spiritual characteristics of the patient and her family members. It is concluded that the woman who is diagnosed with breast cancer during pregnancy undergoes great emotional suffering in relation to the treatment and prognosis and that the fact that the woman is pregnant does not inhibit the treatment and can select the best for the stage of pregnancy, studies have reinforced the importance of early diagnosis, which contributes to a better prognosis of women with breast cancer during pregnancy.*

Resumo— *O câncer de mama que normalmente atingia mulheres em fase mais avançada da vida, associa-se a mulheres que retardam a gravidez, e por ser provavelmente o problema de saúde que mais abala as mulheres*

por conta de sua incidência, tabus e medos, cabe ao profissional de enfermagem estabelecer ações que visem prestar uma assistência humanizada e eficaz. O objetivo do estudo é compreender a importância da assistência de enfermagem a paciente com câncer de mama associado à gestação. A metodologia foi um estudo descritivo realizado a partir de uma revisão bibliográfica, tendo como base: LILACS, BVS, SCIELO. Foram utilizados como critério de inclusão os idiomas, português e espanhol no período de 2004 a 2016, foram selecionados 20 artigos para a construção deste trabalho. Verifica-se a necessidade de condução de estudos direcionados a esse tema, subsidiando a tomada de decisão do profissional de enfermagem no planejamento e implementação de intervenções, promovendo um melhor do cuidado no contexto à integralidade, prestando assistência de enfermagem que vise o bem-estar físico, social e espiritual da paciente e seus familiares. Conclui-se que a mulher que recebe o diagnóstico de câncer de mama na gestação passa por um grande sofrimento emocional em relação ao tratamento e prognóstico e que o fato de a mulher estar gestante não inibe o tratamento podendo selecionar o melhor para o estágio da gestação, os estudos reforçaram a importância do diagnóstico precoce, o qual contribui para um melhor prognóstico de mulheres com câncer de mama na gravidez.

I. INTRODUCTION

This study supports nursing care for patients with breast cancer associated with pregnancy, aiming at the care of this patient in its entirety, describing the role of the nurse related to the emotional, physical, spiritual and social state, which seeks to respond to the problem by helping the professional in decision-making to provide assistance to these patients in their entirety (MINEO et al., 2013).

Thus, we propose this theme in view of: its scarcity in literature; the emotional, physical, social and spiritual process the pregnant woman goes through after diagnosis at a stage in which the woman becomes more sensitive due to hormonal changes and to relate nursing actions to minimize the suffering of patients with a cancer diagnosis breast during pregnancy, identifying the importance that nurses have for the healing process (BRASIL, 2016).

The feminist movement emerged in the 1970s and 1980s, with this women conquering a significant space in society, acquiring professional independence and autonomy in the formation of their families. With this transformation in the female history, there were changes in obstetrics, as breast cancer that normally affected women at a more advanced stage of life is associated with women who delay pregnancy, on the other hand, breast cancer affects older women younger, the reasons are still unknown, not knowing if this is due to female awareness, technological advances diagnosing cancer early or exposure to a carcinogen (MONTEIRO, et al 2013).

Pregnancy-associated breast cancer is a carcinoma diagnosed during pregnancy, lactation, or up to one year after delivery. This is a delicate situation, as it creates difficulty and anguish for the pregnant woman, family and health professionals, establishing a complex situation for its management, as maternal treatment, which must be immediate, despite care and well-being contradicts fetal is a key concern (MONTEIRO, MLD et al. 2013).

In this perspective, it is up to nursing to establish actions aimed at providing humanized and effective care, in order to the patient's psychological, social and spiritual physical well-being at all levels of care, implementing strategies for the prevention and early detection of breast cancer, especially in the gestational period.

The general objective is to understand the importance of nursing care for patients with breast cancer associated with pregnancy.

II. MATERIALS AND METHODS

This is a descriptive study, through a narrative review of the literature. Languages, Portuguese and Spanish were used as inclusion criteria for the period 2004-2016, 20 articles were selected for the construction of this work. Exclusion criteria were research published in congresses, blogs, forums or that did not meet the objectives or period of the study. To this end, 20 scientific articles were analyzed on the subject of publications between the years 2004 and 2016, based on: LILACS, BVS, SCIELO and Google Academico.

Articles that sought to explain the subject, which were in Portuguese, English and Spanish, were selected. The organization of this review took place between the months of December 2020 and May 2021, thus providing guidance for researchers in relation to the topic addressed, so that they can formulate hypotheses in an attempt to seek resolution of frequent problems related to the care provided in previous studies.

The present study did not need to be submitted for consideration by the Research Ethics Committee (CEP), as it is a study based on a literary review, all research data were analyzed and written in Microsoft Word®.

III. LITERATURE REVIEW

BREAST CANCER

The human body undergoes constant cell renewal. In the process of proliferation, the cell's genetic material changes. These changes can occur in a gene called a proto-oncogene (responsible for cell growth). When the proto-oncogene mutates, the (oncogene) starts to receive wrong instructions to carry out its activities, becoming defective cells, often very aggressive and uncontrollable. This change determines the formation of malignant tumors (INCA, 2016).

There are different types of cancer, and each type of cancer corresponds to a type of cell in the body. If cancer starts in epithelial tissues such as skin, breast or mucous membranes, it is called cancer. In connective tissues such as bone, muscle or cartilage, it is called a sarcoma. If untreated, metastasis (tumor lesions in other organs) can occur Death (MINEO., et al, 2013).

According to data from the National Cancer Institute (INCA), breast cancer is one of the main causes of death from cancer in women, accounting for about 25% of annual cases, with an estimated 57,960 new cases in 2016. The diagnosis Breast cancer can be a health problem that affects women at any stage of life and, due to its incidence, taboos and fears, it has a great impact on female psychology, sexual concepts, personal image and self. - Respect (Fernandez et al., 2011).

The breast is made up of fat, connective tissue and glandular epithelial tissue, which contains lobules and ducts. Breast cancer usually affects ducts, called ductal carcinoma, and can be in situ when it does not pass through the first cell layer of these ducts or always invade. Cancer that affects lobules is called lobular carcinoma, which is less common than ductal carcinoma, accounting for only 10% of cases. Inflammatory cancer is rarer and more aggressive, affecting the entire breast (GODINHO, 2012).

Invasive ductal carcinoma is so named because it invades adjacent tissues and accounts for 70% to 80% of cases. For this type of cancer, it is important to distinguish the histological types. There are eight variants of this type of cancer, medulla, papillary and colloid, only the papillary, glandular cystic and medullary types have a good prognosis (GODINHO, 2012).

There are several factors that can cause breast cancer, age, duration of ovarian activity, genetics, diet, alcohol and tobacco use, drugs (contraceptives, hormone replacement) and genetic alterations. The simple fact that the patient is a woman becomes a risk factor, as women have more breast tissue and are exposed to hormones, especially estrogen, which will cause the growth of breast cells at each menstrual cycle, contributing to a possible secretion of milk. but it is believed that through good nutrition, nutrition and physical activity, the risk of breast cancer can be reduced by up to 28% (PINHEIRO et al., 2013).

Breast cancer associated with pregnancy

Breast cancer associated with pregnancy is a carcinoma diagnosed during pregnancy, lactation or up to one year after childbirth, this fact is increasingly postponed by women to a more advanced stage of life, becoming more and more The association of breast cancer in pregnant women is frequent, representing 0.2% to 3.8% of cancers that affect pregnant women, second only to cervical cancer (GODINHO, 2012).

There is no difference between breast cancer in pregnant and non-pregnant women, but compared to non-pregnant women, the factors that can lead to late staging include: the rarity of the situation, the physiological changes of the breast, especially from the second month onwards, with circulating hormones (increased levels of estrogen, progesterone and prolactin, strong blood vessel formation, increased cell numbers, breast congestion, hypertrophy, and spontaneous papillary secretions may appear, affecting the physical examination. These factors are combined with the following facts: Mammography Photography is not a routine examination in prenatal care, and routine self-examination is not performed, which delays the detection of masses and puts the survival of women at risk (ALQUIMIM, et al. 2011).

Pregnancy-related breast cancer is identified between 17 and 25 weeks, but more than 50% of cases are only discovered after delivery, and invasive ductal carcinoma is most common in pregnant women. The three main factors that determine the risk of maternal death are: the histological type of tumor, the mother's age and the number of lymph nodes affected. In pregnant women with advanced cancer and younger than 33 years, the prognosis

is worse because, at this stage, women are not in the risk group and, therefore, are diagnosed late (GODINHO, 2012).

“The first report on this subject took place over a hundred years ago and showed a frustrating prognosis” (FERNANDES et al., 2011). It is believed that to obtain a good treatment effect, pregnancy should be interrupted, and this reality was changed to make mothers and babies healthy (GODINHO, 2012).

The treatment strategy for patients with pregnancy-related breast cancer should consider the type of tumor, stage, and period of pregnancy at the time of diagnosis. The method of treatment should be similar to that of non-pregnant patients with the same clinical stage. The goal is to prevent iatrogenic preterm birth without delaying the patient's treatment. Treatment may include hormonal therapy, chemotherapy, radiation therapy and other treatments. Most indicate surgery (FERREIRA and Spatz, 2014).

TREATMENT OF BREAST CANCER IN PREGNANCY

Hormone therapy is used for some hormone-sensitive malignancies; initially for breast cancer, then for other tumors such as thyroid and prostate (INCA, 2016).

The measurement of specific cell receptors for estrogen and progesterone is performed using tumor samples and, by establishing a clear relationship between the positivity of the receptor and the response to treatment, it brings new subsidies for hormonal therapy (INCA, 2016).

During pregnancy, this dose can be confusing because the level of hormone receptors in the cytoplasm of breast cancer cells is reduced, which ultimately leads to false negative results, because high levels of circulating estrogen in pregnant women can cause receptor translocation. in the nucleus and occupy the entire cytoplasm, matter, it is not known whether it will respond to hormonal manipulation (REZENDE, 2016).

According to Instituto Vencer o Câncer, the hormone therapy mechanism is based on two basic mechanisms, namely: inhibiting the production of hormones to prevent malignant cell division and blocking the binding of hormones to their receptors (called periphery blockade). In both cases, the rate of proliferation and induction of programmed cell death (apoptosis) will decrease.

According to the Barretos Cancer Hospital, hormone therapy, hot flashes, impotence, vaginal dryness, decreased libido, changes in blood lipid levels, weight gain and increased risk of blockage of leg veins (thrombosis).

Ovariectomy (removal of one or both ovaries) during pregnancy is a potentially risky behavior, as the ovaries are

responsible for the secretion of progesterone and estrogen, essential for pregnancy (REZENDE, 2016).

Pregnant women should avoid hormonal therapy during pregnancy, as breastfeeding needs to be suppressed due to a lack of understanding of the ongoing risks of hormonal stimulation (REZENDE, 2016).

Each stage of the tumor in surgery has its type and indications. It can be conservative, removing part of the breast, including fan resection (removal of a lump or part of the breast) and enlarged mastectomy (where the tumor is associated with a large number Resection, called marginal) and quadrantectomy (removal of about a quarter breast), removal of axillary lymph nodes or sentinel lymph nodes, or non-conservative (mastectomy) (FROSSARD, 2012).

Mastectomy is a surgical procedure designed to control tumor growth by mechanically removing all malignant cells present in cancer, so that these patients can survive, as it defines their stage, determines the risk of metastasis and eliminates the need for radiotherapy (MINEO, et al., 2013).

There are five types of mastectomy, simple or complete, including removal of the breast from the skin and complex papillary areola, mastectomy with one or two remaining pectoral muscles and accompanied by axillary lymphadenectomy (modified radical mastectomy); Mastectomy with removal of the pectoral muscle and axillary lymphadenectomy (radical), immediate reconstruction of the mastectomy and mastectomy with skin preservation (INCA, 2004).

The physical complications of mastectomy almost always consist of problems related to the surgical wound and the healing process, which can lead to flap necrosis, movement restriction, weakening of the strength of the affected arm and the most terrible lymphedema, which can be caused by vessels. lymphatics. Therefore, women must prevent these complications (FERREIRA and ALMEIDA, 2012).

Surgery is definitely the most suitable treatment for pregnancy-related breast cancer. Unlike radiation therapy, mastectomy during pregnancy does not cause fetal malformations. In the later stages of pregnancy, women undergoing mastectomy cannot breastfeed, even if the breast is reconstructed because the breast ducts have been removed (COSTA et al., 2006).

Mastectomy is seen by patients as a "mutilation" of the body, and many difficulties have been established, such as compromised high image, refusal to accept and social prejudice as a cause of embarrassment, which makes them biased against their own prejudice (ALVES et al., 2011).

Chemotherapy is the use of chemicals to treat tumor diseases. It is often used after mastectomy as a way to prevent the transfer of residual cells after tumor removal. Chemotherapy is a systemic treatment in which antitumor drugs can cause side effects in any tissue. For example: hematological toxicity, gastrointestinal toxicity, liver disease, cardiotoxicity, pulmonary toxicity, neurological complications, reproductive dysfunction, nephrotoxicity, metabolic changes, dermatological toxicity, systemic toxicity and allergic reactions, leading to the patient's experience in a worrying emotional state, because she has state emotionally shaken by the mastectomy and has to undergo long-term chemotherapy (ANDRADE & SILVA, 2007).

When the embryo and placenta form, chemotherapy can be given in the second or third trimester of pregnancy. Exposure of the fetus to this therapy can lead to low-incidence live births and does not appear to increase the risk of congenital malformations, but it may be related to intrauterine growth retardation and low birth weight. The most commonly used chemotherapy regimens during pregnancy are 5-fluorouracil (F), doxorubicin (A) or epirubicin (E) and cyclophosphamide (C) or doxorubicin and cyclophosphamide (AC) (MONTEIRO et al., 2014).

Some cells in the body divide more quickly and are more affected by the effects of drugs, including fetal cells in the organ-forming phase.

Cytostatics can cause malformations and mutations because (inhibition of cell growth or reproduction) they affect the placental fetus and chemotherapy should be avoided 3 to 4 weeks before delivery, as it is toxic to the bone marrow and can occur to the mother and the fetus in this condition can lead to neutropenia (low neutrophil content) and thrombocytopenia (low blood platelet content), thus increasing the chance of complications (SCHÜNEMANN et al., 2007).

Chemotherapy or lactation suppression should be avoided during breastfeeding, as several chemotherapeutics, such as cyclophosphamide (C) and doxorubicin, are found in breast milk, which can have serious consequences for the newborn (SCHÜNEMANN et al., 2007).

Radiotherapy is a method of destroying tumor cells by altering the genetic material, destroying the cells' ability to reproduce, high-energy ionizing radiation beams produced by linear accelerators or radioactive elements, in which pre-application of radiation dose calculated at any given time to treat benign, malignant lesions. Therefore, the tumor does not develop, it gives way in the medium term and, as it is a local treatment, it causes less damage to the surrounding normal cells (OLIVEIRA et al., 2016).

As a curative and palliative treatment, radiotherapy can improve the quality of life of patients. Common doubts cause anxiety and stress in advance, such as treatment period (lasting from one to seven weeks), course of treatment (lasting from two to thirty minutes), painless application, radiotherapy side effects, which can cause skin problems (dryness, itching), Blisters or scaling), depending on the tiredness of the application site, can cause diarrhea, nausea and vomiting, dry mouth, dysphagia, swelling, hair loss, sexual problems, urinary and bladder problems, direct effects can also occur due to 4 weeks and end of treatment 4 weeks The late effects that appear later reach 5 years as secondary cancers, such as fibrosis, genetic alterations and the development of other malignant tumors (OLIVEIRA et al., 2016).

Radiotherapy is a treatment, if possible, should be postponed until the postpartum period, as it can cause changes in the fetus at all stages of pregnancy; depending on the gestational age, the delivery for radiotherapy can be predicted, because before the implantation period (until conception) After the 9th day, the exposure to radiation can cause the death of the fetus. Exposure from the 15th to the 50th day after conception can cause fetal malformations, slow growth, microcephaly, eye diseases, changes in fetal behavior and cognition, and childhood cancer. As a treatment measure, abortion should not be considered during the treatment of breast cancer (COSTA et al., 2006).

It is noteworthy that patients with breast cancer using adjuvant therapy should use an intrauterine device (IUD), barrier methods or a combination of non-hormonal methods of contraception. It is recommended that women of childbearing age become pregnant after two years of studies with negative sentinel lymph nodes and three to five years after lymph node metastasis is found at autopsy, because more aggressive tumors may appear during this period and pregnancy will invade appropriate treatment (BASTOS and MONTEIRO, 2012).

In the case of breast-conserving surgery and radiation therapy, the milk production of the treated breast may be reduced. Some factors, such as the incision near the areola and nipple, the location of the tumor, the dose and the type of radiation, can alter the secretion of milk. However, breastfeeding in irradiated breasts is not recommended, as women can develop mastitis, in which case it will be a delicate process to occur (MONTEIRO et al., 2014).

EVIDENCE FOR NURSING CARE

Pregnancy is a period in which there is no health deviation in most of a woman's life, but it is characterized by complex changes, including changes in physiology, emotions and interpersonal relationships. Breast cancer

diagnosed during pregnancy, especially in young women who are in the reproductive period, starting a family and starting a career, is a delicate situation, as it can bring difficulties and pain for the pregnant woman, and the treatment makes it a cause. I mourn, for the lack of understanding of the disease, cessation of activities, side effects and major changes, a complex situation arises for its management, therefore requiring multidisciplinary medical care, especially the solution of nursing professionals aimed at minimizing it these painful actions of patients (GODINHO, 2012).

Regardless of the severity, when a woman is diagnosed with breast cancer, her identity is compromised, as breasts are related to happiness and life, impairing her social function, as breasts are considered a symbol of the female condition. This disease also brings taboos, fear, pain, insecurity and threats brought by the treatment, which contradicts the beginning of life and the "death penalty", and brings countless emotional and ethical conflicts to patients (COSTA et al., 2006).

Studies have shown that survival is the first concern for women and their families after a diagnosis of breast cancer. After the implementation of treatment and economic conditions, people began to worry about physical disfigurement and disfigurement caused by low self-esteem and decreased sexual desire and its impact on women's sexual life (SILVA, 2008).

The discussion triggered by this situation is that the disease should not stop only in the pathological aspect, it is necessary for the professional nurse to re-examine the patient's health/disease process as a whole, it is necessary to discuss with the client and his family based on general care of the patient, physical, social, mental and mental health (OLIVEIRA et al., 2010).

The nurse is a professional, spends more time with the patient and their family to help identify real and potential problems, and it can be seen from this that the nursing professional must seek technical-scientific knowledge to provide the patient with systematic care and humanized that meets their expectations and needs (MINEO et al., 2013).

From this perspective, nursing professionals determined their own concept of cancer and developed coping strategies, thus realizing adequate, human and effective care, reducing the pain of all participants, from primary care, cancer detection to the prognosis after the treatment (MINEO et al., 2013).

NURSING CARE FOR PREGNANT WOMEN WITH BREAST CANCER

Pregnancy-related breast cancer ended up causing public health problems and generating discussions about measures to diagnose breast cancer early. The National Breast Cancer Control Plan recommends early diagnosis and screening to reduce breast cancer. Between 25% and 30% of breast cancer mortality rates are in people between 50 and 69 years. Diagnosis made in the early stages of the disease has prognostic significance, with high cure rates, reduced mortality and high treatment costs (FROSSARD, 2012).

Therefore, the role of the nursing professional occurs in primary, secondary and hospital care. Nurses involved in female nursing need to implement educational actions for the prevention and early detection of breast cancer, especially during pregnancy, as an incentive to self-examination, based on the nursing process, in order to provide holistic, individualized and humanized care. Professionalism is very important, people understand the physical examination techniques, especially of the breasts, signs and symptoms, and any abnormality found, women must undergo imaging and histopathological exams (GODINHO, 2012).

In the pre- and postnatal period, nursing professionals perform clinical breast exams to detect abnormalities, assess symptoms reported by pregnant women and identify potentially palpable malignant lesions at an early stage, which is an excellent opportunity for health education.

According to the primary care cancer control booklet, nursing professionals have several roles in breast cancer control, including: according to the user's age group and clinical status, receiving users comprehensively, conducting consultations of nursing and clinical breast exams, according to local administrators. The plan or technical standard requires the detection, inspection and evaluation of signs and symptoms related to breast cancer, the requirements for assessment and collection of test results, and referral to the referral service for the diagnosis and/or treatment of breast cancer in accordance with the Palliative Care plan and clinical guidelines.

This approach should cover all aspects of pain (physical, mental and psychosocial) and seek cancer control, maintaining quality of life, ensuring that women have timely and comprehensive access to qualified actions and services, and are supervised by a team dedicated. Multidisciplinary team including nurses.

In terms of treatment, nurses can work in the area of chemotherapy and radiotherapy before and after surgery,

in order to inform patients about treatments such as mastectomy (mastectomy) and chemotherapy and their side effects, and help patients and their family members to understand the importance of treatment. Care for pregnant women with breast cancer must include dialogue, knowing how to listen, being safe and valuing the complaints and support of family members (MORENO, 2010).

In this case, we observed that the nurse went through all stages of nursing to pregnant women with cancer, from soon after the diagnosis of the disease, until reintegrating into the patient's daily life, promoting difficulties that can hinder the treatment, and the nurse should support and promote the adaptation of women to new situations, thus reducing the trauma of coping. Patients affected by this disease need to be guided by their families so that they have a clear understanding of the goals and consequences of treatment (MORENO, 2010).

This reality requires nurses' knowledge, principles, values, responsibilities and skills, who must set goals for the patient and their family and consider the individual's physical, emotional, social and spiritual well-being as a whole. Care for pregnant women with breast cancer must include dialogue, listening, security, attention to complaints and family support (STUMM, LEITE & MASCHIO, 2008).

To carry out nursing work, it is necessary to adopt a scientific method that enables nurses to apply the theoretical framework that guides and supports their actions in the nursing practice provided by a team of nurses, technicians and nursing assistants. It is based on the systematization of nursing, with the nurse being responsible for formulating, implementing and evaluating health plans, being a personal tool for nurses, allowing the use of standardized language to better communicate phenomena of interest to nursing practice (FROSSARD, 2012).

Caring for pregnant women with breast cancer requires the ability and responsibility of nursing professionals to understand the patient's problems and resolve them, and allow the necessary interventions to promote, protect, recover and restore the patient's health. provider. All settings, from homes and communities to emergency care institutions and rehabilitation centers, from diagnosis to post-mortem rehabilitation, and there is no difference, applicable to all fields. Developed in public or private institutions (GODINHO, 2012).

In the literature, we found a care plan based on a work tool that facilitates the execution of the care process, as it organizes knowledge and creates its own language to describe issues related to the patient and provide action recommendations. These tools are: NANDA (North

American Association of Nursing Diagnoses) and NIC (Classification of Nursing Interventions) that seek answers to the following questions: What care do nursing professionals provide to pregnant women diagnosed with breast cancer?

The solution to this problem provides support for nursing professionals, provides adequate care to pregnant women diagnosed with breast cancer and provides better conditions for the patient and her family to support themselves in the conditions experienced during treatment, rehabilitation and rehabilitation (OLIVEIRA. Et al. 2010).

IV. FINAL CONSIDERATIONS

It has been observed in the literature that the prognosis of breast cancer in young or non-pregnant pregnant women is poor because they are not at risk. There is evidence that pregnancy does not worsen the development of breast cancer. The poor prognosis is related to the late phase, emphasizing the importance of prevention.

In this case, the importance of nursing professionals at all levels of nursing was observed, not only providing physical assistance to women, but also assisting in the emotional and cultural care of women, thus seeking to reduce anxiety and provide greater safety and comfort, take a supportive role to help women adapt better to their new environment.

It is very important that nursing professionals implement comprehensive care for women with breast cancer during pregnancy and prepare these professionals for physical examinations, especially for prenatal and postpartum breast exams, including early detection of measures related to pregnancy related to breast cancer.

By synthesizing the knowledge generated in this review, it is necessary to carry out research on the subject to support the decision-making of nursing professionals in the planning and implementation of interventions, to promote better care in an integral context and to provide assistance in nursing. care In the physical, social and mental health of the patient and his family.

ACKNOWLEDGEMENTS

Thanks to the friends who contributed to the article.

REFERENCES

- [1] ALQUIMIM, Andreia Farias, et al. Diagnóstico de câncer de mama na gestação: há dificuldades adicionais?. FEMINA, 2011, vol 39, nº 5, pg 281-284.
- [2] ALVES, Pricilla Cândido, et al. Cuidados de enfermagem no pré-operatório e reabilitação de mastectomia: revisão

- narrativa da literatura. Rev. bras. enferm. vol.64 no.4 Brasília. 2011.
- [3] ANDRADE, Marceila, SILVA, Sueli Ruil. Administração de quimioterápicos: uma proposta de protocolo de enfermagem. Rev. bras. enferm. vol.60 no.3 Brasília May/June 2007
- [4] BASTOS, Fernando Artur Carvalho, MONTEIRO, Ivana Marvão. Câncer de mama e gestação: relato de caso. Rev. para. Med. 2012.
- [5] BRASIL. Ministério da Saúde. Instituto Nacional de Câncer. Estimativa 2016: incidência de câncer no Brasil / Instituto Nacional de Câncer. Rio de Janeiro: INCA, 2016. 4p.
- [6] CADERNO DE ATENÇÃO BÁSICA: Controle dos cânceres do colo do útero e da mama. Disponível em: http://bvsmms.saude.gov.br/bvs/publicacoes/controle_cancere_s_colo_uterio_2013.pdf. 02/10/2016.
- [7] CADERNO DE ATENÇÃO BÁSICA: Pré- Natal. Disponível em: http://bvsmms.saude.gov.br/bvs/publicacoes/cadernos_atencao_basica_32_prenatal.pdf 02/10/2016.
- [8] COSTA, Carmen Lúcia Resende, et al, Câncer de mama durante a gestação: revisão bibliográfica. HU rev, Juiz de Fora, v.32, n.4, p.109-114, 2006.
- [9] FERREIRA, Maria de Lourdes da Silva Marques, ALMEIDA, Sandra Regina Marques Acerra. Mastectomia: reabilitação no pós-operatório é essencial. 2012 Disponível em: http://www.moreirajr.com.br/revistas.asp?fase=r003&id_materia=111. Acesso em: 23/05/2016
- [10] FERREIRA, Luiz Rodrigo Guimarães, SPAUTZ, Cleverton César. Câncer de mama associado à gestação. FEMINA, 2014, vol 42, n° 4, pg 203-208.
- [11] FERNANDES, Ana Fátima Carvalho, et al, O prognóstico de câncer de mama na gravidez: evidências para o cuidado de enfermagem. Revista Latino-Americana de Enfermagem. São Paulo, 2011.
- [12] FROSSARD, Leonardo de Souza. Assistência de enfermagem ao paciente portador de câncer de mama: estudo de caso. Saúde e beleza, Rio de Janeiro, 2012.
- [13] GODINHO, Anne Allyucha. Câncer de mama associado à gravidez: Um olhar sociocultural. Disponível em: <https://www.lume.ufrgs.br/bitstream/handle/10183/55281/000856953.pdf?sequence=1> Porto Alegre, 2012.
- [14] HOSPITAL DE CÂNCER DE BARRETOS. Disponível em: www.hcancerbarretos.com.br/quimioterapia-2/33-paciente/opcoes-de-tratamento/quimioterapia/108-quimioterapia-e-os-efeitos-colaterais, acesso em: 23/03/2016.
- [15] INSTITUTO NACIONAL DE CÂNCER; Ministério da Saúde. Controle do Câncer de Mama: documento de consenso. Rio de Janeiro (Brasil): INCA; 2004.
- [16] INSTITUTO VENCER O CÂNCER. Disponível em: <http://vencerocancer.com.br/cancer/tratamento/hormonioterapia/>. Acesso em: 08/05/2016.
- [17] MINEO, Flávia Lúcia Venâncio. et al. Assistência de enfermagem no tratamento do câncer de mama. Revista Eletrônica Gestão & Saúde Vol.04, Nº. 02, Ano 2013 p.366-388.
- [18] MONTEIRO, Denise L. M. et al. Câncer de mama na gravidez: diagnóstico e tratamento. Revista HUPE, Rio de Janeiro, 2014, p 67-71.
- [19] MORENO, Marília Lopes. O papel do enfermeiro na abordagem ao câncer de mama na estratégia de saúde da família. Biblioteca Virtual Nescon. Uberaba, 2010
- [20] OLIVEIRA, Shérica Karanini Paz. et al. Sistematização da assistência de enfermagem às mulheres mastectomizadas. Cogitare Enferm. 2010, pg. 319-326.
- [21] OLIVEIRA, Ana Paula dos Santos. et al. Efeitos colaterais na radioterapia. Disponível em <http://aems.edu.br/iniciacao-cientifica/download/03a4d595f5.pdf> acesso em: 23/05/2016
- [22] PINHEIRO, Aline Barros, et al. Câncer de Mama em Mulheres Jovens: Análise de 12.689 Casos. Revista Brasileira de Cancerologia 2013; 59(3): 351-359
- [23] REZENDE, Jorge. Tratado de obstetrícia – câncer de mama na gravidez. Disponível em: <http://cmmc.med.br/publicacoes/tratado-de-obstetricia-cancer-de-mama-na-gravidez/> Acesso em: 08/05/2016.
- [24] SCHÜNEMANN, Eduardo Jr. et al. Radioterapia e quimioterapia na gestação. Revista Brasileira de Cancerologia. 2007, pg. 41-46.
- [25] SILVA, Lucia Cecilia. Câncer de mama e sofrimento psicológico: aspectos relacionados ao feminino. Psicologia em Estudo, Maringá, v. 13, n. 2, p. 231-237, 2008
- [26] STUMM, Eniva Milades Fernandes, LEITE, Marinês Tambara, MASCHIO, Gislaine. Vivências de uma equipe de enfermagem no cuidado a pacientes com câncer. Cogitare Enfermagem. Rio Grande do Sul, 2008.

Optimized Manufacturing Layout and Operational Balancing - A Case Study in an Electronic Line from the Industrial Pole of Manaus/AM, to increase productivity

Raimundo Wenderson da Silva Figueira, Fabiana Rocha Pinto

Department of Engineering, Faculdade Estácio do Amazonas, Brazil

Received: 10 Sept 2021,

Received in revised form: 28 Oct 2021,

Accepted: 08 Nov 2021,

Available online: 14 Nov 2021

©2021 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— *Layout, Factory, Processes
Optimization, Productivity, Flow.*

Abstract— *In the face of an extremely complicated phase for the national and international market, the factories are seeking ways to survive this turbulent moment for the economy, pursuing alternatives in order to make their processes more sustainable. So, in this way this can be possible to remain in the midst of increasingly difficult challenges and goals, it is understood the great importance of seeking the optimization of its manufacturing processes through their layouts in order to be economically stronger. Based on this, a case study was recommended to carry out an experiment, whose main objective is to optimize the layout as well as every part that makes up its production processes, proposing the unification of two production lines installed in the PIM (Manaus Industrial Pole) of the Electronics sector. With information of the production process through the collected data, was identified in the first layout the excesses in two production lines under study, which had the two identical processes in common, as well as the duplication of stations, tests and the unbalance of operational activities in oversized stream. The update of Takt time was also necessary given the opportunities found specifically in the packing area, with overproduction waste in certain stations. Searching for more productivity and improvements at a low cost, was determinate to choose the study to optimize the layout and improvements in the flow with a reduction in the operational cost through low-cost means. The entire experiment was accomplished with tools and programs in free versions available on the internet and already widely used in the industrial factory and environments, such as Sketchup, GBO (Operational Balance Chart) and Kinovea video editing program.*

I. INTRODUCTION

An optimization of the factory *layout* or its administration, typically remains under the responsibility of the Industrial Engineering area or the Process Engineering of the factory, seeking to obtain the autonomy to study and transform the current process by proposing new and more productive processes. The study of this process gives to the factory the flexibility to make decisions regarding the adaptation to

new technologies such as new machines or new production methods that take up less space than manual processes, replacing those that depends on more people or large occupation of the factory area. Each production process has its particularity, and having a detailed layout in your hands is knowing exactly what you can and cannot do, in other words, it means perhaps being one step ahead in a market that is always very competitive, making possible to

be ready for a quick and strategic change in the factory layout, with a short-term financial return and implementation of low-cost projects.

According to [1], the *layout* is the arrangement of men, machines and materials, which allows integrating the flow of materials and the handling of needed equipment, yield and movement, so that the storage takes place within the standard of economy and efficiency. Along these lines, the correct positioning of machines, inputs, products and equipment contribute to minimizing waste, both those related to movement, production such as stock and waiting [2].

The proper sizing of the *layout* provides to the organizations an efficient communication progress, between units, in which the company's available area makes the workflow more efficient [3]. This way, one of the major obstacles faced by industrial companies, regardless of the size of the factory, is the adaptation or redesign of the *layout* according to growth, in view of the need to produce new products or, in other words, to comply with the constant demand of the customer. Therefore, more and more the market demands that companies be ready to adapt their processes, enabling new ways to produce, optimizing their physical arrangement, and increasing their productivity.

Productivity is the real usage of all and any available resource, it is often confused exclusively with production and just to produce not always mean to have productivity, usually the productivity does not appear with a set of improvements which can make the productivity to be always and constantly in a production process if this process is controlled and mapped frequently. Thus, the elimination of downtime is an important action to obtain and to produce more with less cost, where the same hours lost during the production process can be transformed into productivity.

Regarding productivity, according to [4] time management is a contribution to personal life planning. Facing this competitive scenario in the industrial market, many factories focus on mapping and studying different ways in order to have in hands solutions that show the best usage of their industrial structure as a whole, as well as their machines, raw material, labor and its capital altogether. The choice of tool will depend on some factors, for example: type of *layout* intended, amount of information available or designer's preference [5]. The way the design of a physical arrangement or *layout* is designed directly reflects on the productivity of a production line installed in a factory that depends on various processes to be efficient in its output, considering all the points

described above and highlighted by its importance in designing a *layout* to become efficiently productive.

This study describes the transformation of a factory layout comparing its current and future process after improvements made through flow and balancing studies that led to a new process design, as a condition to prove the improvements made, pursuing more productivity and optimization in two lines of production through possible eliminated waste, followed by presentation and detailing with data and the result obtained with the help of specific literature on factory *layout* design and lean production, making possible to achieve the objective of this case study, in this way obtaining more productivity through optimized factory layout and balancing the operational process.

II. MATERIAL AND METHODS

As reference was used a company from the PIM (Industrial Pole of Manaus) in the Electronics sector for process mapping and *layout* design adopting 3D Sketchup software, version 2017 with a CAD (DWG) file, for the floor plan purpose, in which the area measured was described with characteristics of little space between operators, with stations operating in counter-flow making it difficult for the continuous process that should be working without interruptions.

For the job balancing the use of Lean GBO tool (Operational Balancing Chart), presents the optimization of the operational production process, proposing a new Takt in a shorter time than the current process, in which it had bottlenecks proving the unbalance of the activities. As an analysis, the illustration was made through the *Yamazumi graph* (a graph that shows the cycle time of each task), which in Japanese has the meaning of "stacking" the data. According with the process information, the Kinovea software was used for analysis through video, where the data is read in numbers. Considering that the tools used in this article are available in the industrial environment, or in other words, in the Production Engineering for the purpose of aiding in the study of processes with mapping or ergonomic evaluation for data collection, are an excellent support to the engineering engineer to the professional and the production in the industrial area.

Thus, this research is classified as descriptive [6] in detailing a specific production process and explanatory in identifying and understanding the cause and effects of a production process with quantitative data comparing before and after. This is a case study that reports the important benefits of an optimized factory layout, showing that the continuous study of the production process in greater detail makes it possible to produce more with

less. The data collection was carried out in a production area with two assembly lines containing 30 workstations each, with a total of 60 operators.

The entire production process was filmed stand-by-stand, the images are used for studies in the image editor program called *Kinovea*, a program of French origin proposed by Calmet in 2012, facilitating the chronoanalysis, recording of times and detailing of the assembly in angles, in such a way it was possible to carry out a detailed study at each workstation where the images generate data on the operational cycle of each operator (Figure 1).

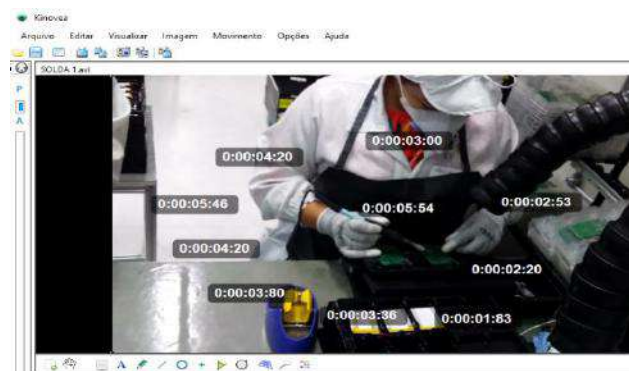


Fig.1. software *Kinovea* timing on video.

Subsequently, the data will be presented in a balancing graph for process optimization analysis. Each movement is registered and quantified forming operational cycles and based on their time averages that will feed the graphics which will represent this process. It is important to be aware of situations or movements that can break the sequence of the activity, this can occur in cyclical or no cyclical situations, which can be repetitive movements or with variation at the end of the activity. This video editor program called Kinovea, was an important tool used in data collecting for this experiment. Throughout, it is also possible to observe whether the operator is making adequate movements in carrying out the activities, whether the filming was well done, valuing the views during the video recording, and it is also necessary to identify whether the trained performer or operator is performing their activities according to the standards established through industrial engineering. It is possible for the operator to deviate from the standard method. In this video analysis model, it is possible to land the image or even slow down, zoom, so in this way details that would go unnoticed at normal speed can be identified. As well as inappropriate ergonomic movements that can cause discomfort to the operator and impact the time available to perform the activity or even each assembly cycle.

Before any filming in the process, it is important to guide the person who will be filming so as not to lose any detail of the editing process, everything is important.

Collecting data from the manufacturing area, the measurement was performed using a measuring tape and later all the measurement data were added to the free version drawing modeling software 3D *SketChup*, owned by Google, which is a program that offers numerous tools to transform the process in images, making possible to offer the future vision of a proposed *layout* and its possible impacts (Figure 2).

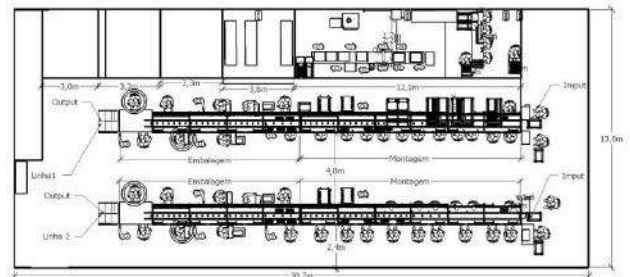


Fig.2. Construction of the current layout with the averages collected in the available area.

The figure 2 illustrates the measures added in the software this way generating the current *layout*, as main information a large area of 423.66m² was identified, but poorly distributed with two identical production lines capable of producing the same product models. The location of each process was measured in relation to the current *layout*, in the total space available, having as characteristics the distance between the two production lines measuring 4 meters between them, and 20 meters in length from beginning to the end, with side aisles measuring 2.4 meters illustrated via 2D drawing, enabling the study for new opportunities of improvement. With this software it was possible to design machines, assembly devices, its line structure and all the jobs evaluated in this experiment.

It is important to emphasize that since the identification of each object part of the production, from the detailing of each workstation, to the profile used on the treadmill, it was designed with this software called *SketChup*. An ally for engineering in 2D and 3D designs and helps in mapping any production process, whereas understanding the current process and proposing a future process is easier, considering that with more detail in the layout higher are the chances of transforming the process safely and have less risk of errors in project execution. With good planning it is possible to avoid unnecessary expenses with errors in the project. This way a 2D *layout* with a top view is born, in technical drawing designing the entire process and following rules through standards

established with the Brazilian Association of Technical Standards (ABNT), rich in metric details characterizing the input and output that represents the production flow of this production process described here for this experiment.

The 3D image generated by the Sketchup software simplifies the study of the entire production area visually, making it easier to see the entire process and develop solutions for a new flow in a future vision, based on the changes made for the development of the layout (Figure 3).

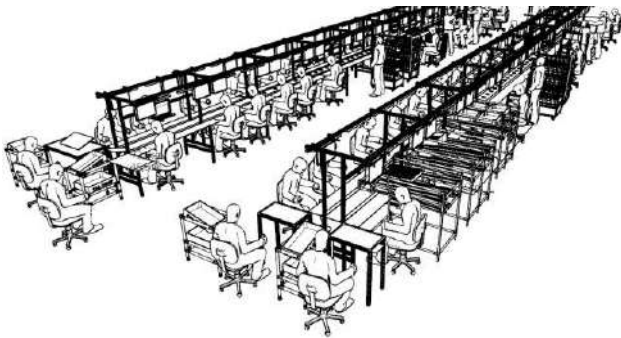


Fig.3. Current 3D layout with two production lines.

One of the main benefits of working with 3D layouts is the immediate identification of possible impacts on the movement of machines or workstations, which can bring negative results, impacting in productivity. The space available for each workstation with the exact dimensioning measurement is easily projected in this program, detailing everything, even all the material needed for assembly per workstation.

In 3D are also developed drawings of new devices that help in the assembly to facilitate the installation in a shorter time, they can be projected in the future state, enabling a dimensional analysis of how much space they will occupy in the future layout. These devices eliminate many manual processes that make assembly difficult. 3D drawing also facilitates understanding in management presentations where technical reading becomes an attachment to projected images, leaving lines in a superior 2D view, to three-dimensional images with rich details, facilitating the decision making regarding all changes made in the experiment involving the production process.

Then, in the development of the technical drawing, the main orthogonal views are projected as: A. Front; B. Higher; C. Side.

III. RESULTS AND DISCUSSIONS

Analyzing all the information on the production process of this factory located in the Industrial Pole of Manaus (PIM), considering the total area distributed to the two production lines with their layouts, plus the

chronoanalysis data obtained from the study of the workplaces, a proposal for a new layout and operational balance was reached.

The first step was to detail the process in the current layout, observing the entire manufacturing area described, this way, presenting more possibilities to produce more with less space.(Table 1).

Table 1. Improvement opportunities in the current state.

Opportunities for improvements in the current layout	
Layout / equipment	Assembly activities
Duplicate line layout	Out of the pattern
Duplication of posts	Very low uptime
Counter flow	
Super sizing	Duplication of activities
Excess material	No Golden Zone

The points raised were seen as opportunities for improvement with a low investment cost, since it was a process with characteristics of operational unbalance, disposal of materials beyond the reach of operators, without (Golden Zone), bottlenecks in the process, overproduction in stations, non-standard production processes in a specific layout with opportunity for improvement, dealing with two identical lines in their production processes. Then, raise the opportunities in operational balance analyzing the current state.

Taking into account that each line produced the same product model as the other, and that its machines and testing equipment had the same quantity in both lines, adding to the information obtained in the current GBO graph (Operational Balancing Graph) which the packing stations located at the end of the process are faster in their cycles activities, so they can deliver their respective assemblies in a shorter time than the initial part of the station line, showing the unbalance of activities in the same production line in layout format “I”.

For a better analysis, the production lines were divided into two parts: assembly and packaging. This way the process became clearer, where the use of design software for the visual of the current process became more evident and clearer.

As one of the first information obtained from the study, the chronoanalysis made evident in numbers that there were processes with greater production capacity, as well as the packaging that had many operators being part of this process, in the production line, which could be better distributed.(Table 2).

Table 2. Opportunities for improvement in the future state.

Proposed opportunities in the future state	
Layout / equipment	Assembly activities
Unified layout	Standardized work instruction
Unification of workstation posts	Operative balancing
Uninterrupted flow correction	Job optimisation
Layout optimization	Delete duplicate activity
Adequacy to material flow	Implement Golden Zone
Optimization of tests and equipment	Develop mounting devices

The opportunities highlighted in the study of the current layout resulted in the unification of the processes for their similarities supporting this proposal, eliminating the duplication of workstations that were repeated when the processes were analyzed together. Has been observed the opportunity to optimize the space available to produce, the arrangement of materials in the workstation resulted in the elimination of unnecessary movements with the application of the Golden Zone, which means the best arrangement of materials in the operator's gold zone. A better detailing in the work instruction avoided deviation from the established assembly standard. With the chronoanalysis and the balancing of activities, it was possible to optimize workstations. The development of devices that assist in production, streamline the process and ensure standardization of the assembly cycle, making the operating sequence more robust, without suffering sudden variations in the established takt, because without a well-detailed work instruction and with clearer information, it is difficult ensure standard production (Figure 4).

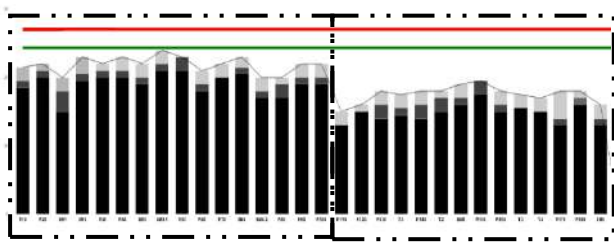


Fig.4. Current GBO Chart (Operational Balance Chart).

The GBO chart above was built using the times of activities collected by workplace that make up the information of the assembly process. The green parts are the activities that add value directly to the product, the activities in yellow are, for example, necessary movements in a manual process, in this way, they do not add value, but it is essential in this production model, and the activities in red color are unnecessary movements or activities that will make time available to produce more. These data prove the operational imbalance and the identification of the

production line process with the highest production capacity.

Evaluating the result above, there are two production lines that before the experiment used to produce individually at a takt of 12,8 seconds 281 pieces per hour, and had a shift capacity of 2.306 per shift with the quantity of 30 operators per production line.(Table 3).

Table 3. Results by production line.

Result per production line	
Before Experiment	After the experience
Takt time= 12,8	Takt time= 11,8
P/h=281	P/h=305
Capacity per shift: 2.306,25	Capacity per shift: 2.501,69
Number of operators: 30	Number of operators: 26

After the experiment, the takt was reduced to 11,8 seconds, managing to produce 281 pieces per hour and the shift capacity was now 2.500 pieces per shift. Proving that with the improvements made after the implementation of the new layout unifying the production lines, there was an increase of 24 pieces per hour, and 195 pieces per shift with 24 people, resulting in an increase in productivity of 8,46% with optimization of 8 operators in the future state.

The table 4 informs that the takt of 5,8s defined for the unified packing in the future state, has a production capacity of 620 pieces per hour, multiplying by 8,2 hours worked, the production capacity is 5.089 pieces per shift and the previous layout produced with the two lines with separate packings were only 4.612 pieces per shift, showing that the unification of identical processes can provide an optimization of operators through operational balancing and the elimination of duplicated processes, making it more productive and at the same time lean.(Table 4).

Table 4. Final result of the experimente, analysing the layoutvariables.

Result with the Packing Union of Production Lines		
Takt time= 5,8s		
P/h=620,6		
Capacity per shift: 5.089,6		
number of operators : 48		
products /hour	4.600	60 operators
products /hour	5.089	52 operators
Optimization of 8 operators		

With the optimized production flow, the result generated more productivity in a process that produced with more people in an optimized layout, making the area

available for other production processes. There was also a considerable gain with the reduction of people in this process (Figure 5).

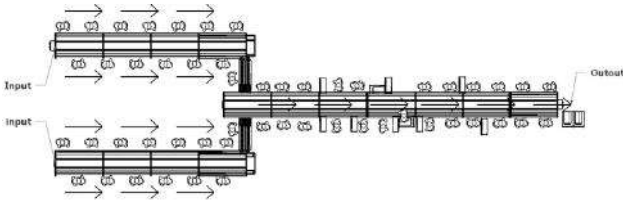


Fig.5. Future layout with Y-shaped production flow.

The Y layout was an option found for joining the lines only in the packing part, where the number of duplicated stations and tests made possible to streamline the assembly process by reducing takt and this way increasing production output and reducing labor at a area from 143 m² to 91.42 m² for the usage of small processes such as sub-assemblies that help the line with more manual processes area 143 m² to 91.42 m².

The process became a leaner and efficient without variations in productivity, before the unbalance of operational activities prevented production from maintaining constant numbers in the total daily productions, with improvements such as optimization in layout and in the productive operational process, this experiment proved to guarantee a better process through low-cost implementations proving that it is possible to produce more with less.

The choice of tool will depend on some factors, for example: type of layout intended, amount of available information or the designer's preference [5].

The measurement of possible gains in the study of the flow is one of the main objectives of this experiment, which results in an increase in productivity and, consequently, a reduction in labor costs. The profit can only be obtained by reducing costs [7].

Productivity is related to better or worse use of resources. It is the science of any business in an industry productivity and is directly linked to the production efficiency [8].

The current global scenario of crisis that companies are experiencing makes them study new proposals and re-read their production methods, their equipment and their global science in relation to their productivity [9].

IV. CONCLUSION

With the application of the layout tool as a condition for improving productivity and minimizing waste, several gains were analyzed such as: Lean production, producing

more with fewer people, reduction of production operational costs, producing only what is necessary and a layout making this way an available area for other production processes that can help in more productivity.

The main wastes observed were overprocessing, defects, unnecessary movement, waiting, counter-flow and operational unbalance, have been minimized in quantity after the improvements realized in the scenario where two production lines are drawn in the layout.

The layout, through the movement of the process, presented numerous improvements, regarding the reduction of overproduction and improvements in counter-flow. Mainly maximizing the company's productivity and reducing the expenses, such as labor, which did not add financial gains.

In this experiment it was only possible to obtain this result because both production lines under analysis are identical, in other words, they have duplicated processes. The unification of the final packaging processes of the production lines was the great point seen as an opportunity to transform the layout into a 'Y' format, a point where the optimization of operators was made possible, because the packing had oversized positions when evaluated in two processes that produced the same product and obtained the same production capacity. This was the main characteristic of this production process that enabled the entire transformation, obtaining the reduction of labor at a low cost in the experiment, thus proving an excellent result.

REFERENCES

- [1] BALLOU, Ronald. H. Logística empresarial: transportes, administração de materiais e distribuição física. São Paulo: Atlas, 2011.
- [2] NEUMANN, C.; SCALICE, R. K. Projeto de Fábrica e Layout. 1. ed. - Rio de Janeiro: Elsevier, 2015.
- [3] OLIVEIRA, D. P. R. Sistemas, organização e métodos: uma abordagem regencial. 20. ed. São Paulo: Atlas, 2011.
- [4] FLORES, G. T. Gestão do tempo como contribuição ao planejamento estratégico pessoal (Dissertação de mestrado, Universidade Federal de Santa Maria, Santa Maria), 2011.
- [5] NEUMANN, Clóvis; SCALICE, Régis Kovacs. Projeto de layout. In: _____. Projeto de fábrica e layout. Rio de Janeiro: Elsevier, 2015.
- [6] PRODANOV, C.C.; FREITAS, E.C.de. Metodologia do Trabalho Científico: Métodos e técnicas da pesquisa e do trabalho acadêmico.2.ed. Novo Hamburgo: Feevale, 277p. 2013.
- [7] BULHÕES, I. R.; PICCHI, F. A. Diretrizes para a implementação de fluxo contínuo em obras de edificações. Ambiente construído, 2011.
- [8] MOREIRA, Daniel Augusto Administração da Produção e Operações. 2. ed. rev. e ampl. - São Paulo: Cengage Learning, 2011.

- [9] ANTUNES, Junico; KLIPPEL, Altair Flamarion; SEIDEL, André; KLIPPEL, Marcelo Uma revolução na produtividade: a gestão lucrativa dos postos de trabalho – Porto Alegre: Bookman, 194 p., 2013.

Challenges of using Digital Technologies in the Context of Remote Learning for University Students with High Abilities or Giftedness

Thelma Helena Costa Chahini¹, Débora Thalita Santos Pereira²

Program in Culture and Society, Federal University of Maranhão, Brazil

Received: 25 Sept 2021,

Received in revised form: 03 Nov 2021,

Accepted: 10 Nov 2021,

Available online: 16 Nov 2021

©2021 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—College Students with High
Abilities/Super Gifted, Remote Learning,
Digital Technologies.

Abstract— The integration of two interdisciplinary areas - Education for Gifted and Digital Technologies - provided the questioning about how has been occurring the teaching-learning process of college students with high abilities or gifted in remote education. From this guiding question, it became evident the objective of identifying, from the perspective of the university student with high abilities, how this teaching process has occurred, and which digital technologies can enrich and streamline the curriculum of this student, in the context of remote teaching. To this end, we conducted an exploratory, descriptive research with a qualitative approach, whose development occurred through the participation of three college students with high abilities/super ability, enrolled in a higher education institution in the state of Maranhão. After analyzing the data, they showed a rich area for the development of studies and research, in view of the multiple potentialities of the use of digital technologies in the remote teaching of students with high abilities or over dotation. However, due to the lack of training, information and knowledge about the two areas, Gifted Education and Digital Technologies, the teaching-learning process of gifted students in Higher Education has been compromised in the context of remote teaching.

I. INTRODUCTION

Students with above average potential should be recognized, according to the Special Education Policy (Ministry of Education [MEC], 2008), by their high performance in intellectual, academic, leadership, psychomotricity and arts areas, in addition to great creativity, involvement with learning and accomplishment of tasks in the areas of interest.

Although they are highly intelligent, these students also have specific educational needs (cognitive, emotional and social) that cannot be disregarded. In view of this, specialized educational care for these students aims to supplement the areas of mastery and complement the areas

of difficulty, aiming to eliminate barriers that may obstruct education (Decree No. 7.611/2011).

In this sense, Siegle (2004) highlights the technological advances and their insertion in the field of education as "a ray of hope" for gifted educators and the bonus of the 21st century for the education of students with above average potential, in view of the numerous possibilities that these resources provide for curriculum enrichment of these students, when tuned to educational purposes and directed to the development of a new pedagogical practice that enables student autonomy.

Therefore, facing the current educational context - remote education -, its emergency character and all the difficulties inherent to this new pedagogical practice, the

current period gains relevance and becomes suitable for discussion about the teaching-learning of students with high abilities or giftedness in higher education.

It is within this context that the aim is to train a researcher of excellence, capable of investigating, acting critically and producing significant innovations for society. However, this researcher will only emerge if he is offered opportunities for the full development of his cognitive abilities through Inclusive Education.

Thus, the guiding question of this study is: How has the teaching-learning process of university students with high abilities or over gifted been carried out in the context of remote teaching? To this end, we aimed to know the perspectives of these students in relation to the operationalization of the teaching-learning process in the context of remote teaching, as well as the possibilities of using digital technologies, since these can streamline and enrich the teaching and curriculum of students with high abilities or gifted in the current learning modality.

Therefore, it was conducted an exploratory, descriptive research with qualitative approach, based on Gil (2002), from a bibliographic survey in the context of gifted education and the usability of digital technologies in the teaching-learning process. Three college students with high abilities or giftedness enrolled in an institution of Higher Education in São Luís/MA participated in this study. Data analysis, collected through open interviews, is based on Bardin (2016).

Thus, it is presented a research whose investigative bias does not end in this article, because the data explain an area still under development and that needs further studies and investigations, in order to meet the educational needs of gifted students, constantly invisibilized in the Brazilian educational system.

II. THE TEACHING-LEARNING PROCESS OF UNIVERSITY STUDENTS WITH HIGH ABILITIES OR GIFTEDNESS: possibilities of curricular enrichment from digital technologies

Gifted education is a field of interdisciplinary study in continuous construction, which focuses on two major issues: what constitutes high abilities and how to develop them in young people and adults. The evolution of this area, which is based on the field of education and psychology, has expanded the definition of what is understood today as high abilities or giftedness and how to enhance this ability through the appropriate teaching-learning process.

In this sense, Renzulli (2018) defines these learners as those who, when compared to their peers, demonstrate

exceptional performance or potential to develop superior performance in academic, creative, artistic, or leadership domains. That is, it is currently perceived, both the inclusion of learners with the potential already manifested and those who show only indications for the development of such potential.

Therefore, Virgolim (2019) in analogy to the growth of a plant, explains that the abilities of individuals with superior potential are perceived in three stages: latent, emerging and manifest, being the responsibility of the educational context to collaborate so that the superior potential receives conditions to be transformed into exceptional performance, respecting the peculiarities and heterogeneity of these students, meeting their specific needs and expanding the possibilities of manifestation of high abilities or over giftedness.

To this end, it is essential that giftedness is understood through the dynamic and continuous interaction of three characteristics: above-average intelligence (internal understanding and expression of a given cognitive ability), the level of motivation in performing the task in a specific area of interest and the creativity (degree of originality and flexibility) of ideas related to the area of interest of the gifted student.

Therefore, for inclusion to be real in the identification of students with higher potential, intelligence needs to be understood from the multiple perspective of Gardner (2010), in which an intelligent person has a dominant area and low/low cognitive performance in other areas of knowledge, a fact that does not exclude him/her from being identified as a gifted individual.

The other two factors highlighted by Renzulli (2018), creativity and motivation, also need to be considered with the same relevance of cognitive ability, because it is only from the confluence of these three characteristics that the superior potential is revealed in a person, at a certain time and under certain circumstances. In this sense, the continuous interaction of gifted behavior with internal and external factors to the individual, such as the environment and personality itself, stands out.

In view of this, students with high abilities or over giftedness, despite exceeding in cognitive potential, have specific educational, emotional and social needs that, if disregarded, will significantly affect the process of identification, development and manifestation of above average ability.

Therefore, they are considered target audience of Special Education, whose specialized educational care (AEE) should supplement the curriculum, providing conditions of access, participation and learning in regular education, ensuring the transversality of special education

actions, fostering the development of resources that eliminate teaching-learning barriers and ensuring the conditions for the continuity of studies in other levels, stages and types of education (MEC, 2008; Decree n. 7.611/2011).

That said, it is noteworthy that the inclusion of gifted students in the context of Higher Education has proved to be a challenge, since recent research highlights the insufficiency of studies in the area in this environment and the consequent difficulty in identifying these students. Without knowledge and identification, it is understood that the whole process of inclusion is compromised

In this context, Renzulli (2018) proposes a triadic model of enrichment in which the lesson maker student is transformed into a first-hand researcher or creator, whose activities and pedagogical interventions offer the overview of the areas of human knowledge, with a view to providing this student with the selection of his/her area of interest, providing challenges and conditions of engagement for the deepening of studies, research and training.

Therefore, according to Ribeiro and Galvão (2018), educational institutions are the locus par excellence of the development and expression of human potential and creativity. In this sense, Higher Education, by granting the student greater depth in teaching-learning and possibilities of extension of this process through oriented research, becomes the locus par excellence of training and development of the excellent researcher, whose advances generate intellectual, social and technological innovations necessary to meet the demands of contemporary society.

To this end, Siegle (2004), since the beginning of the XXI century, explains that educators of students with high abilities / gifted need to strive to systematize a curriculum with complexity and depth, whose structure organizes, analyzes, synthesizes and communicates large amounts of information. In this proposal, the researcher argues that technology is used effectively for this same purpose, specifically, the internet itself, which would then generate the necessary aid to practice and enrich the teaching-learning process of these students.

Siegle (2004) presents, then, the fusion of literacy and technology in the 21st century as a bonus for the education of gifted students, given that the Internet provides virtual learning environment that requires the application of a series of skills for the achievement of the pedagogical purpose. These skills are commonly cited as the purpose of gifted education.

In this way, the direct relationship between the goals of gifted students' education and the competences for learning with the help of digital technologies can be seen; for example, it should be noted that both fields aim at the

rapid processing of information; critical thinking, necessary in the selection amidst the infinity of information in the areas of knowledge; creative productivity, as technology has lowered the barriers that limited students from using authentic methodologies of professionals, contributing to the gifted student specializing without leaving home.

Thus, it is understood that the use of digital technologies in the teaching-learning process of students with high abilities or overdotating tends to enrich learning and curricula, in addition to generating significant and expansive possibilities to develop the excellent researcher, expanding their knowledge and enhancing their skills with dynamics and continuous interactivity (Santos & Boscaroli, 2021).

From this perspective, Pedro et al. (2011) proposes educational software as a pedagogical resource for curriculum enrichment for students with high abilities or over giftedness, provided that the quality of the digital resource is assessed, the teacher actually knows the software and performs a planning in which the educational purpose of the use of the digital resource is explicit for both the educator and the students, thus generating a new pedagogical practice.

With regard to the use of digital resources in the teaching-learning process of gifted students, Delpretto and Zardo (2010) emphasize that the goal of AEE is also to expand the student's access to technology resources, promote their participation in research practices and development of products and projects in the most diverse areas, such as arts, sports, science and others.

Thus, Santos (2019) argues that the use of digital technologies of information and communication in the teaching-learning process enables the sharing of information of interest to students, new ways to insert academic content and generates opportunities to develop criticality in the face of the information circulating in the various media, develop giftedness behavior in order to enhance and express creativity, which contributes to the increase of autonomy in the teaching-learning process.

According to recent research, digital technologies that can be adapted to different educational levels and learning styles in order to enrich the education of gifted learners (Depizzol & Pedro, 2018; Santos, 2019; Santos & Boscaroli, 2020; 2021) stand out, according to Table 1:

Table.1: Digital Technologies in the teaching-learning of gifted learners

DTIC	Pedagogical purpose	Potentiates
Power Point; Platforms like Powotoon and Canva; MindMeister; Windows Story Remix.	Construction of digital narratives (storytelling) and mind maps.	Encourages the development of critical and creative thinking, and linguistic, interpersonal and intrapersonal intelligence, with a view to sharing information.
Gamers: Minetest, Game Edito, LightBot.	Developing strategies for problem solving; developing a sense of leadership, social and emotional responsibility.	Creativity, productivity, logical-mathematical, spatial, linguistic, interpersonal and intrapersonal intelligence.
Arduino Platform	Construction of prototypes or robotic devices	Logical reasoning, hypothesis formulation, manual and aesthetic skills, collaborative and interdisciplinary work.
Software such as SOLFEGE 3.22.0; LMMS16; Musescore.	Auditory training, intervals, chords and theories, music production, music notation.	Musical intelligence mainly, but collaborates to strengthen logical-mathematical, interpersonal and intrapersonal intelligence.
Moodle Platforms, Tele-Mentoring or E-Mentoring, Ask an Expert.	Student engagement in the scientific field and mentorships in ODL.	All intelligences and skills in the most varied fields of human knowledge and the possibility to develop long-term scientific projects with specialized mentoring.
Adobe	Exploration of	Critical and creative

Photoshop; HyperStudio 4.0; Flash MX 2004; Podcasts.	digital image and video production	production for sharing ideas and interests.
Global Positioning System (GPS) and the Geographic Information System (GIS)	Route plotting, information gathering, determining locations, data pattern visualization, geographic concepts and spatial dimensions.	Spatial, bodily-kinesthetic intelligence, investigative skills.

With this said, it is emphasized that the current synchronous and asynchronous remote educational context requires the teacher a conscious and creative posture, able to visualize the possibilities of expansion and deepening of knowledge in order to create an attractive and challenging learning environment, whose goal is the formation of critical researchers, original and responsible for disseminating quality information.

Thus, the research cited, show that the production of multimedia resources, especially the production of videos, offer the student a space for dissemination of personal interests and critical space, as well as research in robotics, which provide an opportunity for interdisciplinary research space, rich in interpersonal relationships and influences from various areas.

The use of digital technologies in the teaching-learning process of gifted students enriches Higher Education with deeper knowledge, practicality, attractiveness, significant challenges, possibilities to create original products and develop criticality, with mentoring by experts from the most diverse areas, making the student an autonomous learner and able to expand his own potential.

III. METHOD

We developed research of exploratory, descriptive type, with qualitative approach (Gil, 2002). Initially, a bibliographic survey was conducted on the fields of research in the area of *gifted education* and *digital technologies*; subsequently, interviews were conducted with three students identified and with indications of higher potential, enrolled at the Federal University of

Maranhão/Brazil: identified in this study by: D1 (27 years, female, Degree in Theatre); D2 (19 years, male, Bachelor of Physical Education) and D3 (17 years, female, Interdisciplinary Bachelor of Science and Technology).

The interviews were conducted by sending a questionnaire via *Google forms*, containing six open questions about the teaching-learning process in the context of remote teaching, with questions about which digital technologies could be used in order to improve this type of teaching. The data obtained were analyzed through critical reading (BARDIN, 2016), highlighting the most relevant points, in order to answer the research problem and achieve the objectives of this study.

IV. RESULTS AND DISCUSSIONS

According to Bardin (2016), about the content analysis in open-ended questions answers, from a first floating reading of the material, intuitions or hypotheses and objectives about the data collected may arise. Next, there is the exploration of the material, the coding, classification and categorization, to then, there is the interpretation of what was collected.

In this sense, it was assumed from the first reading, problems related to the effectiveness of the teaching-learning process of gifted undergraduates in the context of remote teaching, so it was sought in the results of the interviews, data for the analysis of two categories: the development of the teaching-learning process in remote teaching of undergraduates with high abilities or giftedness and the usability of digital technologies during remote teaching, precisely which ones are being used and which ones could be inserted in this context.

Thus, when asked how the teaching-learning has occurred in the context of remote teaching, it is significant to point out that despite D2 highlighting "[...] it has been possible to take and acquire knowledge [...]". The participants emphasized that there are many failures in the communication teacher-student, because the process has become impersonal and inflexible, with minimal contact and little openness to discussions about the methodologies used by teachers.

A relevant fact is the criticism regarding the number of asynchronous classes, because the students showed preference and need for a more direct and open communication with the teacher in real time. Thus, it is understood that, although there is learning in the context of remote teaching, the most evident problem signaled by the students was that some teachers are replacing synchronous classes by recorded lessons and/or files to be studied only by the students, since these methodologies limit the

exchange of opinions and the possibility of students to ask questions in real time.

According to the students, the biggest difficulties they have been facing in remote teaching are the amount of materials for reading; little concentration in classes; difficulty in assimilating practical content, as well as lack of discussion with the faculty about the methodologies used in remote teaching, regarding the effectiveness of teaching methods in virtual classrooms, specifically for the educational needs of students with higher potential.

As for the facilities of remote teaching, unanimously, the students pointed out that they are: absence of expenses with transportation tickets and lunch; schedule flexibility. At this point, it is noteworthy that, even with the multiple possibilities of enrichment of the teaching-learning process in the virtual environment with the help of digital technologies, the facilities scored by students relate only to external factors and not in relation to the teaching itself. This allows us to infer that there is an absence of positive factors during the teaching-learning process to college students with high abilities.

In this sense, students highlighted the virtual classrooms, through the *Google Meet* platform, and the slides as digital technologies that are being used in remote teaching. However, there were some reservations, as pointed out by student D3: "I believe that the way *Google Meet* is used is not correct, because teachers seek to reproduce the face-to-face teaching within the remote [...]". The students also highlighted the side effects caused by the hours spent in front of the screen: headaches, eye strain and mental fatigue.

In other words, we confirm Santos and Boscaroli's (2021) defense that digital technologies do not enrich teaching by themselves, because it is the teacher's responsibility to define the educational goals and objectives that will be achieved through them. But this practice only happens if the educator knows and analyzes the function and potential of digital resources, as well as knowing how to handle them and, above all, planning the lesson in order to balance and ensure enrichment and learning.

When asked about how the teaching-learning process should occur in the remote context and what digital technologies could facilitate this process, D2 replied: "I believe that teachers should first be made aware of the issue of students with high abilities. Given this fact, it was found that the educational institution in question does not have a registration system or instruments of identification of these students, i.e., the three gifted students are not identified as such in the institution, researched, nor in their courses, which shows that if the student does not self-

declare with high abilities / gifted, there is no other way to identify it in the institution. This contention proves the invisibility of talents that could be polished and returned to society.

In the sequence, they also highlighted the need for content deepening, virtual learning spaces with more freedom for the act of learning itself, and to discuss with the teachers about how each of them learns best, with a view to meeting the needs of the high potential of each one, respecting their ways of learning and their specificities, in addition to exploring new methods and methodologies. In this sense, the speech of D3 stands out:

A teacher's teaching method is not the only one available, and therefore, each student's learning method is not unique either. By having other means of demonstrating their abilities and learning content, students with high abilities/super ability would achieve substantially more, since they are usually stuck in a method in which their abilities are hidden and paralyzed.

Thus, the students highlighted that the technologies used, such as digital platforms for virtual classes and slide materials are not sufficient for the proper development and enrichment of the classes from the perspective of a student with high abilities/super ability. Teachers do not use digital technologies properly and do not take advantage of all the possibilities that these technologies can offer. The students also reported that class time is not optimized effectively during the teaching-learning process.

In addition, they pointed out that a strategy to enrich the contents of the classes would be the use of multimedia resources, such as images and videos, which would be attractive, instigating for class discussions and would awaken the creativity of these students, in addition to critical thinking, because they would have the freedom to express themselves in different ways and question the expression of their peers.

It was verified in the answers of the students the appeal: to the freedom of learning; for space for discussion of teaching methodologies; for the deepening of content; the efficiency of methods and methodologies. Since the teaching-learning process in the context of remote teaching has proved to be deficient and insufficient to meet the specific educational needs of gifted students.

Such needs permeate the cognitive dimensions, since the participants expressed the individual demand for deepening the contents, lack of flexibility in the way of learning and expressing what was learned, in addition to diversity in the materials used as pedagogical resources and sent for individual studies asynchronously, and

didactic possibilities of viewing the practices that were suspended in view of the current teaching context.

The unmet needs also impact the emotional and social dimension of students, since it was scored the difficulty of concentration in class and communication with teachers, this characterized as minimal, limited and lack of interest on the part of teachers as the needs of gifted students, both for lack of knowledge and lack of empathy.

In general, it is considered that the teaching-learning process of university students with high abilities/super ability through the analysis of the data collection presented here, is insufficient for the development and training of these students, because there is a lack of pedagogical and attitudinal adaptations by the teachers, lack of knowledge and proper planning regarding the digital technologies that are being used and that could be used in remote teaching for curriculum enrichment of these students, in addition to lack of knowledge about high abilities/super ability, and the construction of an increasingly fragile relationship between teacher and student.

V. CONCLUDING REMARKS

As observed throughout the development of this research, students with high abilities or giftedness have an above-average cognitive potential in any of the areas of knowledge, alone or combined (MEC, 2008). And for the perception of these possible areas, it is necessary to understand that human intelligence is a multiple biopsychosocial construct, as established by Gardner (2010) in his theory of Multiple Intelligences.

But it is not only the above-average ability that needs to be observed, because the gifted behavior is manifested when the motivation and creativity act in confluence with the superior potential in the individual's area of interest (Renzulli, 2018). It is then the responsibility of the teacher to perceive these characteristics in the student's performance and relate them to the profile of the gifted learner such as their cognitive, emotional and social needs.

Once these students are not identified, the inclusion process is compromised, because without identification there is no way for the educational system to signal the specific demands of this audience that is also the target of Special Education. Without this specific care in the classroom and outside it, the higher potential succumbs to the accumulation of needs, facilitating risk situations for these individuals, such as academic dropout, social exclusion and the symbolic violence of invisibility.

In this sense, when reflecting on these students in Higher Education, invisibilized by the absence of identification, it is considered that it is commonplace in the

national territory the tradition of wasting talents that, in this space conducive to the formation of the excellent researcher, could contribute to intellectual, social and technological innovations so necessary to contemporary society.

Thus, we sought to identify how the teaching-learning process has been occurring in the context of remote teaching, according to the perspective of university students with high abilities/over giftedness, who have experienced, for over a year, this "new" pedagogical practice, synchronously and asynchronously.

In addition, considering the need for curriculum enrichment and dynamization of the teaching of this student, it was also aimed to know the possibilities of digital technologies in the insertion of education in this context, given the perception that these resources can be a bonus for the gifted education in all levels, stages and modes of education (Siegle, 2004).

In this aspect, according to the bibliographic survey, it is concluded: digital technologies can provide the development of skills that possibly would not awaken in non-digital practice, such as rapid processing of information, collective construction of digital narratives, development of gamers that contribute to the strengthening of creativity, criticality and interpersonal relationships (Santos & Boscaroli, 2020).

In addition to providing the expansion and enhancement of students' skills through opportunities for specialization in the field of research and innovation in investigative methods, virtual practices in platforms and software for professional use, long-term specialized mentoring, robotics projects, among others. However, this awakening only becomes possible if the educator has the knowledge and planning regarding the potential of these resources.

Thus, what was presented until then as a possibility of use, facing the new pedagogical context, remote learning, became an educational emergency for both teachers and students, who were inserted without preparation or previous experience to a new learning environment, full of possibilities, but that until today, are little noticed and considered, due to a major barrier: the lack of knowledge about digital technologies for education and the specific educational needs of students with high abilities/over giftedness.

Such considerations are highlighted from the analysis of the data collected, since it is highlighted the repetition of concepts such as flexibility, freedom, deepening of content and discussion/dialogue with teachers as the shortcomings of remote teaching offered in the context of

higher education for students with above-average potential.

The expression efficiency of the method was also widely used by students, with regard to a shortcoming that has harmed all the remote education: the choice of teaching methodologies does not meet the demands of gifted students and they are not offered an opportunity to discuss and dialogue about this situation with the teachers themselves, so that they can find new ways of learning.

It is not the virtual environment, but the way methodologies once used in face-to-face classroom were inserted in remote teaching without adaptations or considerations regarding the new educational environment and the specific demands of these students.

Thus, by the data analyzed, it is inferred that the deficiency in remote teaching for students with higher potential is generated by the absence of specific training for teaching adaptation to the new context of teaching, the absence of information and knowledge about the digital resources available and the possibilities of enrichment that digital technologies can offer learning, such as the absence of knowledge about high abilities or giftedness, the lack of pedagogical sensitivity regarding the understanding that these students were also taken out of their comfort zone for an environment that has deteriorated the teacher-student relationship, the failure in the identification of gifted university students, due to the absence of registration system and monitoring of these students.

That said, it can be concluded that the enrichment of the teaching-learning process of university students with high abilities or over gifted in the context of remote teaching will only occur when the teacher is actually trained to use digital technologies, in order to articulate technology and teaching and manage in the virtual classroom the digital resources, the student and the class itself.

To this end, the use of the technological resource must have a clear and explicit purpose for teachers and students, so that the use of digital technologies contributes to the formation of an innovative pedagogical practice, which seeks to expand the possibilities of curriculum enrichment, training of the excellent researcher and specific care of the educational needs of gifted students.

ACKNOWLEDGEMENTS

THCC is grateful to Coordination for the Improvement of Higher Education Personnel – acknowledges to CAPES (Finance code 001).

REFERENCES

- [1] Bardin, L. (2016). Content Analysis. Edições 70.
- [2] Decree n. 7.611, of November 17 (2011). Provides for special education, specialized educational care, and other provisions. http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2011/decreto/d7611.htm.
- [3] Delpretto, B.M.L., & Zardo, S.P.. (2010). Students with Abilities/Super ability in the Context of Inclusive Education. In B.M.L. Delpretto, F.A., Giffoni, & S.P. Zardo, Special education in the perspective of school inclusion: high abilities/Over Gifted (Vol. 10, pp. 19-24). Ministry of Education/SEESP.
- [4] Depizzol, F., Pedro, K.M. (2018). On the road to authorship: creation of educational games on Power Point by students with high abilities or over gifted. *Revista NEAD-UNESP*, 4(1), 2-20. <https://ojs.ead.unesp.br/index.php/nead/article/view/461>.
- [5] Gardner, H. (2010). The birth and spread of a meme. In H. Gardner, J-Q, Chen, & S. Moran. Multiple intelligences around the world (pp. 16-30). Artmed.
- [6] Gil, A.C. (2002). How to write a research project (4. ed.). Atlas.
- [7] Ministry of Education [MEC]. (2008). National Policy for Special Education from the Perspective of Inclusive Education. http://portal.mec.gov.br/index.php?option=com_docman&view=download&alias=16690-politica-nacional-de-educacao-especial-na-perspectiva-da-educacao-inclusiva-05122014&Itemid=30192.
- [8] Pedro, K.M., Paulino, C.E., & Chacon, M.C.M. (2011). Using educational software with high ability students. Universidade Estadual Paulista "Júlio de Mesquita Filho". <https://repositorio.unesp.br/bitstream/handle/11449/139916/ISSN2236-9708-2011-6896-6903.pdf?sequence=1>.
- [9] Renzulli, J. (2018). Re-examining the role of gifted education and gifted development for the 21st Century: a four-part theoretical approach. In A. Virgolim (Org.). High Abilities/Super ability: creative processes, affective and potential development (pp. 19-42). Juará.
- [10] Ribeiro, O.C., & Galvão, A.T.. (2018). Expertise, creativity and high abilities/super strength: a study in the search for boundaries. In A. Virgolim, (Org.), High Abilities/Super ability: creative processes, affective and potential development (pp. 113-139). Juará.
- [11] Santos, C. da L. dos, & Boscarioli, C. (2020, September 24-25). Investigating the use of digital technologies for extracurricular enrichment for high abilities/super ability. Proceedings of the 14th International Colloquium "Education and Contemporaneity". Federal University of São Cristovão. <https://ri.ufs.br/bitstream/riufs/13730/9/8>.
- [12] Santos, C. da L. dos, & Boscarioli, C. (2021). Digital technologies in the extracurricular enrichment of students with high abilities/super dotation. *International Journal Educon*, 2(1), 2-18. <https://grupoeducon.com/revista/index.php/revista/article/view/1538>.
- [13] Santos, C. da L. dos. (2019). High Abilities/Super ability in the Municipal Network of Foz do Iguacu/PR: an educational proposal with digital technologies [Master's dissertation]. Universidade Estadual do Oeste do Paraná. <http://tede.unioeste.br/handle/tede/4348>.
- [14] Siegle, D. (2004). The merging of literacy and technology in the 21st century: a bonus for gifted education. *Gifted Child Today*, 27(2), 32-35. <https://files.eric.ed.gov/fulltext/EJ682660.pdf>.
- [15] Virgolim, A.M.R.A. (2019). High Abilities/Super ability: an urgent pedagogical dialogue. *InterSaber*.

Normalization of Way Solepay Watershed in Mamala Village, Central Maluku Regency

Rudi Serang

Ambon State Polytechnic, Indonesia

Email: rudiserang65@gmail.com

Received: 08 Feb 2021,

Received in revised form: 03 Oct 2021,

Accepted: 06 Nov 2021,

Available online: 15 Nov 2021

©2021 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— Normalization, rainfall, river discharge, sedimentation rate

Abstract— Watershed is an area bounded by mountain ridges where rainwater that falls on the area will be accommodated by the mountain ridge and flowed through small rivers to the main river. The increase in population from year to year results in the need for land for shelter and clean water to be very important, thus requiring residents to tend to live on land located on hillside. The resulting impact on the surrounding environment is the reduction in green areas as water catchment areas in river basins, the threat of landslides and floods due to additional loads on the slopes. This study aims to overcome the accumulation of sedimentation which has resulted in water overflows along the Way Solepay watershed and to prevent sedimentation from occurring. The analysis method used in this research is rainfall analysis with the method of Log Percent III, Flood Planning Analysis, Watershed Erosion Analysis, and Sedimentation Analysis. The results of the analysis of this study show that there is a accumulation of sedimentation in the Way Solepay watershed on average every year of 3,599 m³ / day or 1,313,635 m³ / year and how to overcome this is by being transported regularly every year as much as 32,386 m³ / day or 11,954,078 m³ / yrs

I. INTRODUCTION

Climate change is a global phenomenon, experiencing an increase as a result of human activities such as the use of fossil fuels and changes in land use. One of the changes that occur in the global climate is the increasing frequency and incidence of extreme climates such as storms, floods and droughts.

The development of the population on Ambon Island is increasing from year to year, so that the problem of settlement is the main problem of the government in overcoming the existence of natural disasters such as floods that occur in rivers and settlements. Settlement

problems along the Way Solepay River Basin, Mamala Village. This must be considered by the local community and district government. From the results of observations at the research location, part of the Way Solepay watershed area has been damaged, water buffer land has been made into residential land which has resulted in flooding and landslides in the Way Solepay watershed area.

The limited handling of the Regency government and the awareness of the local community to expand the residential area in the Way Solepay watershed resulted in

flooding and landslides that brought sedimentation which could cause water overflowing in the river.

The condition of the Way Solepay river in Mamala Village along the watershed has been added to the construction of a 325 meter long retaining wall and a 2 meter high retaining wall, a watershed area = 9100 meters and a watershed width = 12.5 meters.

The way to overcome the sedimentation problem that occurs in the Way Solepay river is by periodically backfilling the Way Solepay watershed area. Therefore, the analysis of sedimentation transportation in the Way Solepay watershed needs special handling to overcome the water overflow that occurs in every rainy season on Ambon Island. Problems that occur in fact in the research area, the authors raise the title:

"Normalization of Way Solepay Watershed in Mamala Village, Central Maluku Regency".

II. LITERATURE REVIEW

2.1. General Purpose

Flood control is a relative term, because it is not economical to provide protection against the largest possible flood. Since the beginning of human civilization, floods are a natural occurrence that is well documented after describing a series of past floods. Hoye and Langbein (1955) concluded on a generally understood concept of flood control. Nature will let go of all the burdens it carries. Year-round floods cause immeasurable damage and terrible loss of life. Climatologists believe that the current flood rains are caused by a combination of meteorological and hydrological conditions that will only occur once in a million years. Reservoir,

2.2. Hydrology

Meteorology is part of a broader hydrological science, which includes observing the occurrence of water in the atmosphere and water on the ground and below the earth's surface. one of the hydrological cycle presentations as shown below

Rain usually occurs in many forms and can change shape during the process. The form of rain in the form of falling water droplets can be classified as drizzle or rain. Drizzle consists of rain with a grain size of <math><0.5\text{ mm}</math>. Larger raindrops are scattered on the air, droplets > 5 mm in diameter are generally unstable. Part of the rain will evaporate partially or completely before it reaches the ground surface. Rain on the ground can be captured by vegetation, infiltrating into the soil to evaporate or become surface runoff. Evaporation can come from the soil surface, free water surface, or from plant leaves through the process of transpiration. Some of the rain will

move on the ground as runoff, some will enter the soil used by plants, can become a deep supply of groundwater,

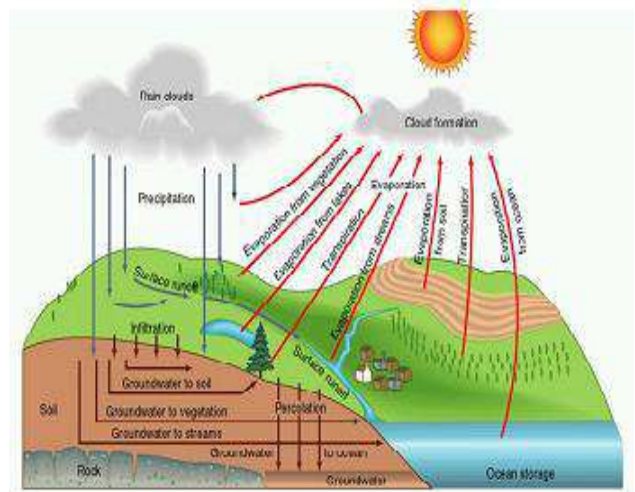


Fig.1: Hydrogen Cycle

(Source: Sandro Wellyanto Lubis 2009)

2.3. Surface Water Runoff

Runoff is the portion of rainfall that flows towards a channel, lake, river or sea as surface or underground flow. Runoff will only occur when the rate of rain exceeds the infiltration rate into the soil. Once the infiltration rate is met, water begins to fill in small or large creases in the soil surface. After the curve is filled, runoff begins. The water depth increases at the surface until it is sufficient to produce a runoff. So a rain in a short period of time may not produce runoff, while rain with the same incentive for a long time will produce runoff, in other words, rainwater that falls to the ground will flow to the ground if the soil infiltration capacity is less than the intensity of rain. The destructive force of water flowing on the ground is greater in proportion to the steeper and longer the slope. Plants that live above the ground will increase the ability of the soil to absorb water and reduce the destructive force of falling raindrops, the dispersion power and the carrying capacity of surface runoff. The rate and volume of runoff from an intermediate catchment area is updated by the distribution of rainfall in the area. The maximum runoff rate and volume play a role but heavy rainfall in a particular part of the catchment area can produce more runoff than moderate rainfall over the catchment. The amount of water that constitutes this layer is highly dependent on the amount of rainwater per unit time (intensity), soil condition (especially the slope), soil type, and the presence or absence of previous rain. Surface layers with a large number and speed often cause the removal or transport of land masses on a large scale as well. This is

what is often termed a flood. Floods overflow and cause soil particles called sedimentation.

2.4. Soil Structure

Soil structure is defined as the mutually binding arrangement of soil particles (Soil Survey Staff, 1975).

The slope can be component as shown in the following table:

Table 2: Slope Classification

Symbols	Slope Class	Land Shape
L ₀	0 - 3	Flat
L ₁	3 - 8	Slopes / waves
L ₂	8 - 15	Slightly sloping / wavy
L ₃	15 - 30	Sloping / hilly
L ₄	30-45	Somewhat cheating
L ₅	45 - 60	Steep
L ₆	> 65	Very steep

(Source: Asdak, 2002)

The soil primarily functions as a nesting medium providing most of the way for water flow to move to the surface. The effectiveness of the soil as a means of removing water depends largely on the size and resistance of the channel in the soil. The physical properties of the soil change the infiltration capacity and how large the particles can be separated and transported. Soil properties that explain how easily soil particles can be eroded are their separation and transportability. The properties that renew erosion include soil structure, texture, organic matter, and chemical and biological properties of soil.

2.5. Vegetation and Land Use

Vegetation is one part of the land system that provides benefits for the survival of creatures, especially humans. The existence of vegetation varies from place to place, because it is influenced by different land conditions. Vegetation plays an important role in maintaining soil sustainability because it can inhibit surface runoff and erosion, including: (1) interception of rain by plant canopy; (2) reduce surface runoff and water-destroying force; (3) the influence of roots and biological activities related to vegetative activities and their effect on structural stability and soil porosity; and (4) transpiration which results in reduced groundwater content. Thick ground cover vegetation such as grass or jungle will eliminate the influence of rain and topography on erosion.

Land use according to Aryad (1989; 2007) can be interpreted as any form of human intervention (intervention) on land in order to meet their daily needs. Land use is a dynamic process. Therefore, information on land use relatively quickly becomes out-of-date when compared with geomorphological and soil geological information. Land use can be grouped into two major groups, namely agricultural land use and non-agricultural land use.

2.6. Erosion

Erosion is the event of removing or transporting material in the form of a solution or suspension from the original site by running water (runoff flow), erosion is the loss or erosion of soil or parts of land in a place that are transported by water, wind to other places (Arsyad, 1989). Erosion is an important problem. The damage experienced to the soil where erosion occurs takes the form of a deterioration of the physical and chemical properties of the soil such as loss of nutrients and organic matter, poor infiltration, the ability of the soil to retain water, reduced stability of the soil structure which ultimately leads to worsening plant growth. . (Arsyad, 1989).

The classification of the level of soil damage by erosion according to (Arsyad, 1989) is presented in table 2.

Table 2: Classification of Soil Damage and Erosion Levels

Symbol	Erosion Rate	Information
E0	No erosion	Fixed soil layer
e1	Light	Less than 25% of the top layer is lost
e2	Moderate	25-27% of topsoil is lost
e3	It's a bit heavy	More than 75% of the topsoil up
e4	Weight	More than 25% of that layer is gone
e5	Very heavy	Same with trench erosion

(Source: Ashad, 1989)

2.7. Land Erosion Factors

Factors that influence the amount of erosion in a watershed include:

- Rain Erosion
- Soil sensitivity to rain

- Drought and slope length and tillage factors are closely related to soil cover or vegetation
- Rain Erosion (REI)
The amount of rain erosivity can be calculated based on the maximum rainfall data for each rainy day every month (from monthly rainfall data)
- Soil Erodibility (K)
The soil erodibility factor is closely related to the condition and physical soil.
- Slope (LS)
The slope factor can be calculated based on the empirical formula developed by Wischmeies, namely:
- For the slope (S) <20%, take:
 $LS = L_0 \cdot 0.5 \times (0.0138 + 0.00965 S + 0.00138 S^2) \dots$ (1)
- For a slope (S) > 20%, is taken;
 $LS_{0,6} \cdot 1,4 \dots$ (2)
Where :
Ls = slope factor
Lo = Length of flow over the ground
S = Slope
- Factors on Plant Types and Soil Processing (CP)
This CP factor has a huge effect on sediment production and the amount of erosion in an area. The size of the CP value can be adjusted based on soil processing activities and by planting certain types of plants on the land
- Erosion Rate
The estimated magnitude of the permissible erosion rate for a watershed is approached by the following formula (Achilil, 1982):
 $A = 4 + 1,226 (10 D - K - 2) \dots$ (3)
Where :
A = Permissible rate of erosion (tonnes / ha)
K = soil erodibility factor
D = depth of soil layer, (m)

Table 3: Classification of Erosion Hazards

Erosion rate tonnes / ha / year	Classification
0.0 - 12.5	Very small
12.5 - 17.5	Small
17.5 - 25.0	Medium
25.0 - 30.0	Weight
> 30.0	Very Heavy

(Source: Ashad, 1989)

2.8. Stream erosion

In the analysis of river channel erosion, the grain stability of the river bed and the volume of sediment transport will be reviewed.

In a gloomy river channel, in general, sediment transport, seen from the way it moves, can be divided into two, namely;

- Suspended load where the sediment particles move floating in the water and carried along with the flow
- Bed load, which moves the particles not far from the river bed and moves, shifts, rolls and jumps individually.

If there is a change in the river either artificially or naturally, the riverbed will change accordingly. Over time an adequate relationship will re-form between the hydraulic properties of the irrigation and the sediment that flows downward and eventually a stable channel will be formed.

Therefore, in making a review / planning of a river, the transverse reservoir must be selected not only based on the flood discharge but also taking into account the condition of the river repair work.

The stable condition of the channel means the condition where along the channel there is no streak and deposition. This means that the amount of sediment flowing in each cross section of the river must be kept stable.

2.9. Analysis of Rainfall Intensity` Bq1awsv bnm

To determine the intensity of rainfall, it is analyzed using the Log Pesen III method with the formula:

$$\sum \frac{\text{LogXi}}{n}$$

Where :

n = Return period in this case n = 10 years

Xi = Average daily rain during observation (mm)

2.10. Calculation of the Flood Plan

Design flood is a large discharge of annual flow caused by rain with a certain ulan period.

Flood plans are different from the largest floods. The largest flood can occur at any time, while the planned flood is expected to occur once for a certain period of time, to calculate the planned flood discharge the following methods can be used:

Flood discharge calculation using the Der Weduwen Method:

Formula: $Q = \alpha \cdot \beta \cdot q_n \cdot A \dots$ (4)

Where :

- Q = Discharge (m³ / s)
- α = Flow coefficient (run off coefficient)
- β = Reduction coefficient
- qn = Maximum rain (mm)
- A = Area of flow

1. The run off coefficient is the ratio between run off and rain:

$$\alpha = 1 - 4,1 / (\beta \text{ qn} + 7) \dots\dots\dots (5)$$

2. Concentration time (t)

$$t = 0.25. L. A^{-0,126}. I^{-0,26} \dots\dots\dots (6)$$

Where :

- t = Concentration time (hours)
- L = Length of river (km)
- I = Slope of 0.001
- A = Area of watershed (km²)

3. Reduction coefficient (β)

This figure is used to get the average rainfall from the maximum rainfall.

$$\beta = \frac{120 + \frac{t+1}{t+9} A}{120 + A} \dots\dots\dots (7)$$

Where :

- β = Reduction coefficient
- t = Concentration time
- A = Area of the watershed

2.11. River Discharge Analysis

This analysis is carried out to determine the river discharge that occurs in the Way Solepay watershed using the following formula:

River water layer discharge (DLAS) uses the general equation DLSA (Chow), namely;

$$Q = V. A \dots\dots\dots (8)$$

Where :

- Q = River flow rate (m³ / sec)
- V = River water layer velocity (m / sec)
- A = Wet cross-sectional area of river water layer (m³)

2.12. Analysis of Average Sediment Discharge

To calculate the annual average sediment discharge, the planned annual return discharge is used as follows:

$$Q = a * \beta * g * A \dots\dots\dots (9)$$

Where :

- Q = Return flood discharge (m³ / sec)
- A = Area of flow area (Km²)
- S = slope of the river bed
- t = Concentric timebreast milk (hour)
- β = Reduction coefficient
- g = The calculated rain intensity (m³/ km² / sec)

2.13. Sedimentation Rate

Sedimentation rate prediction is done using the equation:

$$Q_s = Q. S \dots\dots\dots (10)$$

Where :

- Q_s = River water sediment discharge (gram / second)
- Q = River flow rate (m³ / sec)
- C_s = Weight of filter paper (mg)
- V = Sediment concentration (mg / liter)

2.14. Sedimentation Transport

Many methods for estimating the capacity for sediment loading have been developed, which are based on hydraulic shear rate, flow velocity and sediment properties.

$$V = P * Q \dots\dots\dots (11)$$

Where :

- V = volume of sedimentation (m³)
- P = length of river (m)
- Q = amount of sedimentation (m²)

The process of erosion between grooves is used in several computer models to estimate erosion, including CREAMS (Kniel, 1980).

III. METHODOLOGY

3.1. Location and Time

The location or object of this research analysis was taken based on the map of Ambon island, Central Maluku Regency, with the problem of sedimentation transportation planning that occurred in the Way Solepay River, Mamala Village in the last 10 years (2008 - 2017) of the rainfall data at the Ambon Pattimura Airport Meteorological Station.

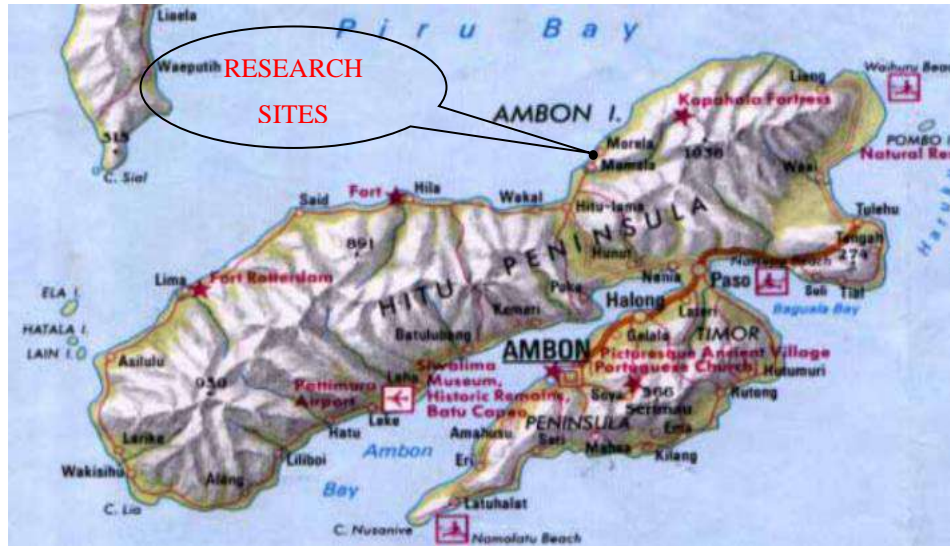


Fig.2: Research Location

3.2. Writing Technique

In general, the analysis techniques of this research are as follows:

1. Data collection
2. Rainfall analysis using Log Percent III method
3. Planned Flood Analysis
4. Watershed Erosion Analysis
5. Sedimentation Analysis

3.3. Materials and Tools

The materials needed in carrying out this analysis are a permit and data, both in the form of analysis data and planning data from the object being analyzed, and so on. Meanwhile, the tools used are digital cameras, heavy equipment to support the implementation, meters and other supporting tools.

3.4. Analysis Variable

The analysis variables required in the analysis of sedimentation transport on the Way Solepay River are specified as follows:

1. Map of the Way Solepay River
2. Map of research locations

3.5. Data Collection Technique

In conducting sedimentation transport analysis, data collection steps are very important, all of which are a schematic or description of the analysis process being carried out. The data collection stages from the sedimentation transport analysis are as follows:

1. Preparation phase
2. Data collection stage
3. Problem formulation stage
4. Problem analysis stage
5. Implementation of activities

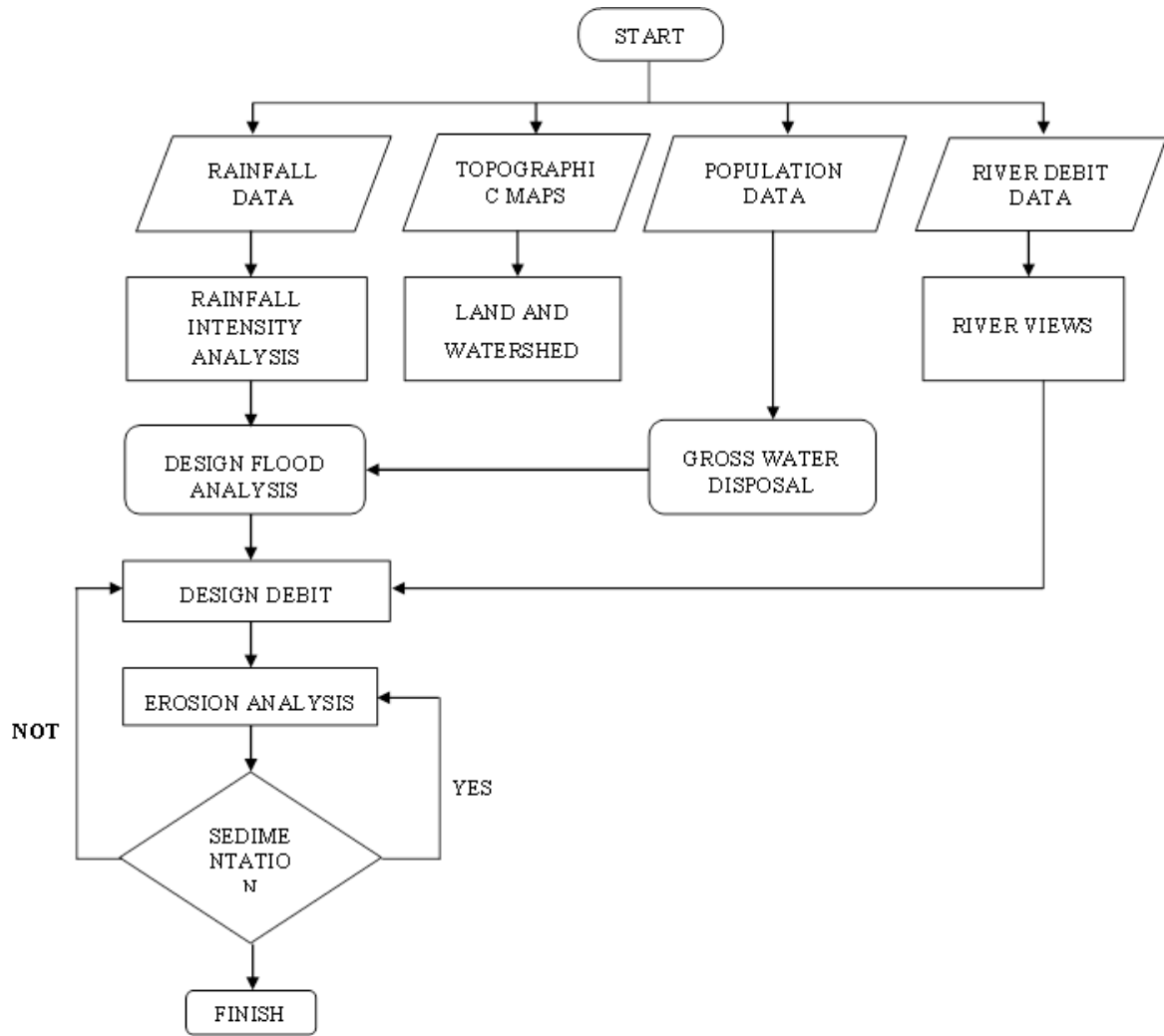


Fig.3: Flowchart Research

IV. ANALYSIS AND DISCUSSION

4.1. The Mechanism of Erosion

So erosion can occur at least with one step, namely dispersion by granules or runoff water. The erosion stages include:

1. Raindrops collide with the ground;
2. Splash the ground by raindrops with soil.
3. Destruction of a lump of soil by raindrops.
4. Transport of splashed particles / soil mass dispersed by runoff during rain.

To find out the relationship between erosion and hydrology, we must study the effects of land and vegetation management in upstream and downstream watersheds, including their effects on erosion, water quality, flooding and climate in the upstream and downstream areas. And the influencing factors in this calculation are rain erosivity, slope slope, soil sensitivity to erosion, and river length, and soil management factors which are closely related to land cover or vegetation.

4.2. Hydrological Data Analysis

To find out the amount of erosion that has occurred in the Way Solepay watershed, it is necessary to know the planned flood discharge that will be used to calculate the amount of erosion that occurs in the Way Solepay watershed.

The accuracy of the results of hydrological analysis to determine the magnitude of the planned flood depends on the amount of data available, the length of observation and the data used to analyze it.

The more data available and the length of time for the observation, the more accurate the results will be, as will the selection of the right method, because the formulas used are empirical formulas.

Rainfall data required is maximum daily rainfall data with a minimum number of observations in the last 10 years from 2008 - 2017. Rainfall data for this analysis is taken from the Pattimura - Ambon Meteorological Station.

4.3. Rainfall Calculation

Rainfall calculation analysis, selected the Pattimura Airport Meteorological Station Observation Post - Ambon.

Table 4: Maximum Daily Rainfall Data in Way Solepay Watershed 2008 - 2017

No.	Observation Year	Rainfall (mm)
1	2003	305.16
2	2004	372.17
3	2005	429.09
4	2006	261.31
5	2007	378.66
6	2008	405.25
7	2009	416.34
8	2010	397.05
9	2011	216.76
10	2012	323.00

(Source: Pattimura-Ambon Airport Meteorological Station)

a) Calculation of Algebraic Average Rainfall

$$R = \frac{1}{n} (R^1 + R^2 + R \dots R^n) \dots \dots \dots (12)$$

Table 5: Rainfall Recapitulation

Year	R	R - Rr	(R - Rr) ²	(R - Rr) ³
2003	94.47	-184.35	-33984.92	-6265.12
2004	135.65	-143.17	-20497.64	-2934648.34
2005	237.82	-41	-1681	-68921
2006	262.05	-16.77	-281.23	-4716.27
2007	284.66	5.84	34.10	199.17
2008	476.31	197.49	39002.3	7356848.77
2009	167.32	-111.5	-12432.25	-1386195.87
2010	325.68	46.86	2195.84	102897.98
2011	384.17	105.35	11098.62	1169239.88
2012	420.09	141.27	19957,21	2819355.46
Σ	2788.29		3411.03	7047794.66

(Source: Analysis Results)

b) Calculation of Standard Deviation, Coefficient of Variation and Coefficient of Skewness

1. Σ Year (n) = 10

2. On average, Rr

$$Rr = \sum \frac{Ri}{n}$$

$$= \frac{2788,29}{10}$$

$$= 278,82$$

3. Standard Deviation, Std

$$Std = \sqrt{\frac{\sum_{i=1}^n (R - Rr)^2}{n - 1}}$$

$$= \sqrt{\frac{3411,03}{9}}$$

$$= 19,46$$

4. Coefficient of Variation, Cv

$$Cv = \frac{Std}{Rr}$$

$$= \frac{19,46}{278,82}$$

$$= 0,06$$

5. Skewness Coefficient, Cs

$$Cs = \frac{n \sum (R - r)^3}{(n - 1)(n - 2)(Std)^3}$$

$$= \frac{10 \times 7047794,66}{(9)(8)(19,46)^3}$$

$$= 132.82$$

4.4. Calculation of the Flood Plan

Design flood is a large discharge of annual flow caused by rain with a certain ulan period.

Flood plans are different from the largest floods. The largest flood can occur at any time, while the planned flood is expected to occur once for a certain period of time, to calculate the planned flood discharge the Log Percent III method can be used:

➤ Planning flood discharge calculation:

Formula: Q = α .β .qn .A

Where :

- Q = Discharge (m³ / s)
- α = Flow coefficient (run off coefficient)
- β = Reduction coefficient
- qn = Maximum rain (mm)
- A = Area of flow

1) Calculation of the length of rain (hours)

t = 0.25. L. A -0,126. I-0.26

Where :

- T = concentration time (hours)
- L = length of river (km)
- I = slope 0.01
- A = Area of watershed (km²)

t = 0.25. L. A -0,126. I-0.26

$$= 0.25. 9.10. 0.0216 -0.126. 0.01 -0.26$$

$$= 12 \text{ hours}$$

2) Redux Coefficient (β)

This figure is used to get the average rainfall from the maximum rainfall.

$$\beta = \frac{120 + \frac{t+1}{t+9} A}{120 + A}$$

Where :

- β = Reduction coefficient
- t = Concentration time (hours)
- A = Area of watershed (km^2)

$$\beta = \frac{120 + \frac{12+1}{12+9} 0,0216}{120 + 0,0216} = 1.02$$

3) Calculation of rainfall area ($\text{m}^3 / \text{sec} / \text{km}^2$) with return period

$$qn = \frac{Rn}{240} + \frac{67,65}{t+1,45}$$

Where :

- Rn = daily maximum rainfall
(mm / day) with a return period of (n)
years. = 278.8 mm / day
- t = time (hours)

$$qn = 6.2 \text{ m}^3 / \text{s} / \text{km}^2 \frac{278,8}{240} + \frac{67,65}{12+1,45}$$

4) The run off coefficient is the ratio between run off and rain:

$$\alpha = 1 - 4,1 / (\beta qn + 7)$$

Where :

- B = reduction coefficient
- qn = area of rainfall ($\text{m}^3 / \text{sec} / \text{km}^2$)

$$\alpha = 1 - 4,1 / (1.02 \cdot 6.2 + 7) = 0.7$$

5) Flood discharge calculation

$$Q = \alpha \cdot \beta \cdot qn \cdot A$$

Where :

- Q = Discharge (m^3 / s)
- A = flow coefficient = 0.7
- B = reduction coefficient = 1.02
- qn = Maximum rain (mm)
= $6.2 \text{ m}^3 / \text{s} / \text{km}^2$
- A = Area of flow = 0.0216 km^2

$$Q = \alpha \cdot \beta \cdot qn \cdot A = 0.7 \cdot 1.02 \cdot 6.2 \cdot 0.0216 = 0.0956 \text{ m}^2 / \text{sec}$$

4.5. Slope (L_s)

As an example of calculating the slope of the slope, DAS Way was chosen Solepay

Known :

$$\text{River length, } L = 9.10 \text{ km}$$

$$\text{Watershed area} = 0,0216 \text{ km}^2$$

$$\text{Drainage Density, } d = \frac{L}{A}$$

$$= 9,10 / 0.0216 = 421.29 \text{ km}^2$$

4.6. Calculation of potential and actual land erosion in the Way Solepay watershed

From the data it is known:

1. For land slopes of 0 - 3%, value of $K = 0.120$
2. For land slopes of 3 - 8%, value of $K = 0.120$
3. For land slopes of 8 - 15%, value of $K = 0.260$
4. For land slopes of 15 - 40%, value of $K = 0.230$
5. For land slopes >40%, value of $K = 0.210$

4.7. Calculation of Average Slope

(for average slope $S = 4\%$)

$$D = 1,35 \cdot d + 0,26 \cdot S + 2,80$$

$$= 1,35 \cdot 421.29 + 0,26 \cdot 4 + 2,80$$

$$= 572,581$$

$$L_o = \frac{1}{2 \cdot D}$$

$$= \frac{1}{2 \cdot 572,581} = 285.79 \text{ m}$$

$$L_s = L_o^{0.5} (0.0138 + 0.00965 \cdot S + 0.00138 \cdot S^2)$$

$$= 285,790.5 (0.0138 + 0.00965 \cdot 4 + 0.00138 \cdot 4^2)$$

$$= 1.259$$

(for the average slope $S = 11.50\%$)

$$D = 1,35 \cdot d + 0,26 \cdot S + 2,80$$

$$= 1,35 \cdot 421.29 + 0,26 \cdot 11.50 + 2.80$$

$$= 574,531$$

$$L_o = \frac{1}{2 \cdot D}$$

$$= \frac{1}{2 \cdot 574,531} = 287,265 \text{ m}$$

$$L_s = L_o^{0.5} (0.0138 + 0.00965 \cdot S + 0.00138 \cdot S^2)$$

$$= 287.2650.5 (0.0138 + 0.00965 \cdot 11.50 +$$

$$0.00138 \cdot 11.50^2)$$

$$= 5,211\%$$

(for average slope $S = 20\%$)

$$D = 1,35 \cdot d + 0,26 \cdot S + 2,80$$

$$= 1,35 \cdot 421.29 + 0,26 \cdot 20 + 2.80 = 576,741$$

$$L_o = \frac{1}{2 \cdot D}$$

$$= \frac{1}{2 \cdot 576,741} = 288,370 \text{ m}$$

$$Ls = 14,283\% \left(\frac{Lo}{22,1}\right)^{0,6} \left(\frac{20}{9}\right)^{1,4}$$

(for average slope S = 35%)

$$D = 1,35 \cdot d + 0,26 \cdot S + 2,80$$

$$= 1,35 \cdot 421,29 + 0,26 \cdot 30 + 2,80 = 579,341$$

$$Lo = \frac{1}{2 \cdot D}$$

$$= \frac{1}{2 \cdot 579,341} = 289,670 \text{ m}$$

$$Ls = 31,351\% \left(\frac{Lo}{22,1}\right)^{0,6} \left(\frac{35}{9}\right)^{1,4}$$

(for average slope S = 40%)

$$D = 1,35 \cdot d + 0,26 \cdot S + 2,80$$

$$= 1,35 \cdot 421,29 + 0,26 \cdot 40 + 2,80 = 581,941$$

$$Lo = \frac{1}{2 \cdot D}$$

$$= \frac{1}{2 \cdot 581,941} = 290,970 \text{ m}$$

$$Ls = 37,898\% \left(\frac{Lo}{22,1}\right)^{0,6} \left(\frac{40}{9}\right)^{1,4}$$

Thus:

1. For land slope 0 - 30%

Formula: $A = 4 + 1.226 (10 D - K - 2)$

$$A = 4 + 1.266 (10 \cdot 572,581 - 0.120 - 2)$$

$$= 7250,191 \text{ tons / ha / year}$$

2. For land slope 3 - 8%

$$A = 4 + 1.266 (10 \cdot 574,531 - 0.120 - 2)$$

$$= 7274,878 \text{ tonnes / ha / year}$$

3. For land slope 8 - 15%

$$A = 4 + 1.266 (10 \cdot 576,541 - 0.260 - 2)$$

$$= 7300,147 \text{ tons / ha / year}$$

4. For land slope 15 - 40%

$$A = 4 + 1,266 (10 \cdot 579,341 - 0,230 - 2)$$

$$= 7335,633 \text{ tonnes / ha / year}$$

5. For slopes > 40%

$$A = 4 + 1.266 (10 \cdot 581,941 - 0.210 - 2)$$

$$= 7368,575 \text{ ton / ha / year}$$

The average allowable erosion rate for the Way Solepay watershed area is:

So the formula that I derive is:

$$\overline{Ar} = \frac{1A + 2A + 3A + 4A + 5A}{5}$$

$$\overline{Ar} = \frac{7250,191 + 7274,878 + 7300,147 + 7335,633 + 7368,575}{5}$$

$$= 7305,884 \text{ tons / ha / year}$$

Table 6. Calculation of Slope Slope (Ls)

No	Long River	Large DAS	Drainage Density (d)	Slope Land%	Slope is average	D	Lo (m)	Ls
	DAS WAY Solepay							
	9,10	0.0216	421.29	0 - 3	4.00	572,581	285.79	1,259
	9,10	0.0216	421.29	3 - 8	11.50	574,531	287,265	5,211
	9,10	0.0216	421.29	8 - 15	20.00	576,741	288,370	14,283
	9,10	0.0216	421.29	15 - 40	35.00	579,341	289,670	31,351
	9,10	0.0216	421.29	> 40	40.00	581,941	290,970	37,898

(Source: Analysis Results)

Table 7. Calculation of Erosion Rate

DAS name	Slope Land (%)	Thickness Humus (D)(M)	Erodibility (K)	Erosion Rate (A) Ton / ha / yr	A Average (Ton / Ha / Year)
Way Solepay	0 - 3	3.00	0.120	7250,191	7,305,884
	3 - 8	3.00	0.120	7274,878	
	8 - 15	3.00	0.260	7300,147	
	15 - 40	3.00	0.230	7335,633	
	> 40	3.00	0.210	7368,575	

(Source: Analysis Results)

The calculation of erosion can be seen in Table 7. Based on the calculation results, it can be seen that the erosion rate in the Way watershed Solepay, is classified as very heavy so it needs immediate handling.

4.8. Annual Average Sediment Discharge Calculation

To calculate the annual average sediment discharge, the planned annual return time discharge using the DER WIDUWEN method is as follows:

$$Q = \alpha * \beta * q * A$$

Where :

$$A = \text{Flow area (km}^2\text{)} = 0.0216 \text{ km}^2$$

$$t = \text{Concentration time (hours)} = 4.65 \text{ hours}$$

$$\beta = \text{The reduction coefficient} = 1.26$$

$$q = \text{The calculated rain intensity (m}^3\text{ / km}^2\text{ / sec)} = 314,130 \text{ m}^3\text{ / km}^2\text{ / second}$$

$$\alpha = \text{Flow coefficient} = 0.421$$

Thus, the annual average sediment discharge can be calculated as follows:

$$Q = 0.421 * 1.26 * 314,130 * 0.0216 \\ = 3,559 \text{ m}^3\text{ / day}$$

$$Q \text{ year} = 365 * 3,559 = 1,313,635 \text{ m}^3\text{ / year}$$

4.9. Sedimentation Transport

$$\text{River length} = 9100 \text{ m}$$

$$\text{Lots of sedimentation} = 3,599 \text{ m}^3\text{ / day}$$

$$= 1,313,635 \text{ m}^3\text{ / yr}$$

$$\text{Sedimentation Transport (V)} = P * Q$$

$$\text{Sedimentation transport / day} = 9100 \text{ m} * 3.559 \text{ m}^3\text{ / day} \\ = 32,386 \text{ m}^3\text{ / hr}$$

$$\text{Sedimentation transport / yr} = 9100 \text{ m} * 1,313,635 \text{ m}^3\text{ / yr}$$

$$= 11,954,078 \text{ m}^3\text{ / yr}$$

V. CONCLUSIONS AND SUGGESTION

5.1. Conclusion

Based on the results of calculations and analysis, the following conclusions can be drawn:

- 5.1.1. The accumulation of sedimentation that occurs in the Way Solepay watershed is an average of 3,599 m³ / day or 1,313,635 m³ / year.
- 5.1.2. How to handle it sedimentation namely being transported out of the Way Solepay watershed regularly every year as many as 32,386 m³ / day or 11,954,078 m³ / yr

5.2. Suggestion

This research has several suggestions as follows:

- 5.2.1. For the Mamala Village Government to be able to participate and work together to maintain environmental sustainability by replanting shade trees, providing formative counseling so that the community around the watershed realizes their responsibility to maintain and protect the existing forest from damage.
- 5.2.2. For people who live around the watershed, they must maintain and preserve a clean culture by not throwing garbage into the river.

REFERENCES

- [1] Arsyad, 1989. S Soil and Water Conservation. Faculty of Agriculture, Agricultural Institute: Bogor
- [2] Bennet, HH, 1939. Soil Conservation, Mc.Graw-Hill, New York.

- [3] Choy Asdak, MSc, PhD, 2002. Hydrology and Watershed Management, Gajah Mada.
- [4] Ministry of Public Works Standard SK SMI – 18–1989 – F, 1989. Flood Discharge Calculation Method. LPMB Foundation: Bandung.
- [5] Ministry of Public Works, Directorate of Irrigation I, 1986. Handbook of Irrigation Planning, Bandung: cv. GalangPersada.
- [6] Hoye and Langbein (1955)
- [7] Rahim.SE 2002. Soil Erosion Control in the Framework of Environmental Conservation, Bandung: Earth Literacy.
- [8] Vanoni, V, A. 1975. Sedimentatioan Engineering, New York.

The use of myofascial release in fibromyalgia: scope analysis

O uso da liberação miofascial na fibromialgia: análise de escopo

Karina Pangrácio de Oliveira^{1*}, Lais Akemi Chianca Kagawa¹, Anselmo Cordeiro de Souza², Claudia Kumpel³, Poliani de Oliveira Lima³, Abrahão Augusto Joviniano Quadros³.

¹Graduanda em Fisioterapia pelo Centro Universitário Adventista de São Paulo, São Paulo - SP, Brasil.

²Mestre em Promoção da Saúde pelo Centro Universitário Adventista de São Paulo, São Paulo - SP, Brasil.

³ Professor Doutor, docente no Centro Universitário Adventista de São Paulo, São Paulo - SP, Brasil.

* Autor correspondente: karina_pangracao1@hotmail.com

Received: 20 Sept 2021,

Received in revised form: 01 Nov 2021,

Accepted: 08 Nov 2021,

Available online: 16 Nov 2021

©2021 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—*Fibromyalgia, Myofascial release, Therapeutics.*

Palavras-chave— *Fibromialgia, Liberação miofascial, Terapêutica.*

Abstract— *Objective: This study aimed to map the available contributions on the use of myofascial release as an auxiliary therapeutic strategy in fibromyalgia. Methods: It is a scoping review (scope review) of the indexed and non-indexed scientific literature (gray area), in the SciELO (Scientific Electronic Library Online) databases; LILACS (Latin American and Caribbean Literature in Health Sciences); PubMed; PEDro (Physiotherapy Evidence Database); and in the “gray area of literature” through the search engine Google Scholar, by the combination of keywords “myofascial release” AND “fibromyalgia”, without restrictions on year of publication, language, or any other restriction. Results: The corpus totaled eight articles, predominantly occurring at PubMed, outlined in clinical trials, carried out in Spain, diagnosed with fibromyalgia according to the criteria of Wolfe et al. (1990), with an outcome related to “quality of life” and “pain”. Conclusion: It is concluded that, in general, the studies available on myofascial release as an auxiliary therapeutic strategy in fibromyalgia indicate positive results for the various outcomes investigated, although there are few studies on the theme, explaining a significant gap in the national and international academic-scientific context.*

Resumo— *Objetivo: Este estudo objetivou mapear as contribuições disponíveis sobre o uso da liberação miofascial como estratégia terapêutica auxiliar na fibromialgia. Métodos: Trata-se de uma scoping review (revisão de escopo) da literatura científica indexada e não indexada (área cinza) nas bases SciELO (Scientific Electronic Library Online), LILACS (Literatura Latino-Americana e do Caribe em Ciências da Saúde), PubMed e PEDro (Physiotherapy Evidence Database) e na “área cinzenta da literatura” por meio do buscador Google Scholar, pela*

combinação de palavras-chave “myofascial release” AND “fibromyalgia”, sem restrições de ano de publicação, idioma, ou qualquer outra restrição. Resultados: O corpus totalizou oito artigos, prevalentemente com ocorrência na PubMed, com delineamento de ensaios clínicos realizados na Espanha, com diagnóstico da fibromialgia pelos critérios de Wolfe et al. (1990), com desfecho relacionado à “qualidade de vida” e à “dor”. Conclusão: Conclui-se que, em geral, os trabalhos disponíveis sobre liberação miofascial como estratégia terapêutica auxiliar na fibromialgia indicam resultados positivos para os vários desfechos investigados, ainda que sejam poucos os estudos acerca da temática, explicitando lacuna expressiva no contexto acadêmico-científico nacional e internacional.

I. INTRODUÇÃO

A síndrome da fibromialgia (SFM) é um distúrbio crônico neurobiológico de afetação funcional musculoesquelética e do tecido conjuntivo, comum em qualquer idade e sexo, prevalente na meia-idade e em mulheres, de etiopatogenia multifatorial complexa indefinida, de difícil diagnóstico e clinicamente subestimada (Ceko, Bushnell, & Gracely, 2012; Clauw, 2014; Häuser, 2015; Häuser, Sarzi-Putini, & Fitzcharles, 2019; Marques, Santos, Berssaneti, Matsutani, & Yuan, 2017; Schmidt-Wilcke & Clauw, 2011).

Como a SFM é um distúrbio polissintomático com diversas manifestações, é comum o atraso no diagnóstico, além de testes excessivos e tratamento inadequado, convertendo-se em substancial ônus social e econômico para indivíduos, famílias e sistema de saúde (Ghavidel-Parsa, Bidari, Maafi, & Ghalebarghi, 2015). Apesar de o impacto e os custos serem de difícil avaliação, o ônus é comparável a doenças crônicas como diabetes e hipertensão (Ghavidel-Parsa et al., 2015; Skaer & Kwong, 2016). Algumas estimativas na Europa e Estados Unidos apresentam custo direto médio anual por paciente de 2.274 a 13.000 dólares, dependendo da gravidade dos sintomas e da rota de cálculo dos custos, além de vários indiretos, por vezes “ocultos” (Ghavidel-Parsa et al., 2015; Lacasse, Bourgault, & Choinièri, 2016; Skaer & Kwong, 2016).

A literatura científica apresenta valores de prevalência de SFM entre 0,2 e 6,6% (população em geral), entre 2,4 e 6,8% (mulheres), entre 0,7 e 11,4% (áreas urbanas), entre 0,1 e 5,2% (áreas rurais) e entre 0,6 e 15% (populações especiais). A heterogeneidade em diferentes países pode se dever a questões metodológicas ou a diversos fatores, tais como variação climática e distintos grupos étnicos (Heidari, Afshare, & Moosazadeh, 2017; Marques et al., 2017). A prevalência entre as mulheres é 8 a 9 vezes maior do que em homens e aumenta com a idade (Heidari et al., 2017).

Destaca-se que, segundo Yuan, Matsutani, e Marques (2015), a liberação miofascial melhora a fadiga, a rigidez e a qualidade de sono das pessoas afetadas pela SFM. Assim, o programa massagem-miofascial pode ser considerado uma terapia alternativa e complementar com potencial para promover melhorias transitórias nos sintomas desses pacientes (Castro-Sánchez, Matarán-Peñarrocha, Arroyo-Morales et al., 2011).

A técnica de liberação miofascial consiste em um conjunto de terapias manuais e ou instrumentais (Ajimsha, Al-Mudahka, & Al-Madzhar, 2015) que objetivam reduzir tensão miofascial, auxiliar no ganho da extensibilidade tecidual, prevenir e tratar dor miofascial pós exercício. No entanto, os diversos materiais (instrumentos) e tipos metodológicos desenvolvidos com a liberação miofascial possuem diferentes indicações e raciocínio para tomada de decisão (Oliveira & Mendonça, 2016).

A liberação miofascial está baseada na liberação da fásia muscular, a qual se faz presente em grande escala no corpo humano. Ela é composta pelas bainhas ao redor de nervos e vasos, as quais evoluem órgãos torácicos e abdominopélvicos, formando o peritônio e a pleura, e também é responsável por promover a união do osso com osso, músculo a osso, além de formar as bandas tendíneas (Lindenfeld, Schmitt, Hendy, Mangine, & Noyes, 1994; Woods, Hawkins, Hulse, & Hodson, 2002).

As fásias estão presentes em todas as direções e sentido, tornando-se assim uma matriz tridimensional contínua; correspondem a uma rede conectiva única que mantém todos os músculos no lugar e interligados. Destaca-se que o sistema facial é formado após o desenvolvimento embrionário, e recobre os músculos de conexões por todo o corpo no interior de faixas de fásias integradas e funcionais (Myers, 2020).

O sistema de fásia tem múltiplas funções no organismo humano, e a principal e mais importante é a manutenção e estabilização da postura ereta do corpo humano. Sua outra atuação é na proteção do atrito entre os

grupos musculares (Huijing, 2009). A transmissão de tensão no sistema musculoesquelético ocorre da seguinte forma: desde o endomísio, passando pelo perimísio e o sarcômero, junção miotendinosa, tendões e suas inserções ósseas, indo até a formação de parte do sistema de estabilização estática articular (cápsulas, ligamentos e retináculos), incluindo as expansões aponeuróticas. Quaisquer disfunções do sistema musculoesquelético e/ ou visceral podem levar a uma desordem dessas fâscias e aponeurose, interferindo assim na perfeita funcionalidade dos sistemas (Schleip & Muller, 2013).

Destaca-se que são escassas as investigações sobre o uso da liberação miofascial na fibromialgia por profissionais atuantes nas ciências do movimento (Pereira et al., 2020). Logo, a fim de subsidiar uma prática baseada nas evidências disponíveis, o objetivo da presente pesquisa foi mapear as contribuições disponíveis na base empírica da literatura a esse respeito.

II. MÉTODOS

Trata-se de uma *scoping review* (revisão de escopo) da literatura científica indexada e não indexada (área cinza). Nessa perspectiva, utilizou-se o modelo metodológico proposto por estudiosos do Instituto Joanna Briggs (Peters et al., 2017). Adaptada aos nossos propósitos, a estrutura dessa revisão consiste em seis etapas consecutivas: 1) identificação da questão e objetivo de pesquisa; 2) identificação de estudos relevantes que viabilizassem a amplitude e abrangência dos propósitos da revisão; 3) seleção de estudo, conforme os critérios predefinidos; 4) mapeamento de dados; 5) sumarização dos resultados por meio de uma análise temática qualitativa em relação ao objetivo e à pergunta; e 6) apresentação dos resultados.

Na primeira fase para elaboração da pergunta norteadora da pesquisa, utilizou-se a proposta PCC (Araujo, 2020), acrônimo para os três componentes integrantes da proposta a seguir explicitada: “P” – população (quem compõe e quais as características da população a ser pesquisada?); “C” – conceito (qual a questão central a ser examinada?); e “C” – contexto (que detalhes específicos, ou fatores culturais, ou localização

geográfica, ou questões de gênero, ou questões raciais etc. estão relacionados à população?). Esse esforço resultou na seguinte questão: quais estudos disponíveis da base empírica da literatura sobre o uso da liberação miofascial na fibromialgia?

Na segunda fase, consideraram-se as bases de dados de interesse na indexação de periódicos das Ciências da Saúde e, em específico, nas áreas da Fisioterapia e Educação Física, a saber, *Scientific Electronic Library Online*(SciELO), Literatura Latino-Americana e do Caribe em Ciências da Saúde(LILACS), PubMed, *Physiotherapy Evidence Database* (PEDro). Foi feita busca na nominada “área cinzenta da literatura” por meio do buscador *Google Scholar* (páginas em português)(Mugnaini & Sales, 2011) .

A busca realizou-se *online* entre setembro e outubro de 2020. Para definição das palavras-chave, levaram-se em conta termos utilizados correntemente em outras publicações científicas, dado que nem todos os termos de interesse nessa revisão estavam indexados entre os termos controlados dos Descritores em Ciências da Saúde (DeCS) e *Medical Subject Headings* (MeSH). Assim, foi eleita a combinação em inglês “*myofascial release*” AND “*fibromyalgia*”.

Na terceira etapa, como critérios de seleção entre os artigos resultantes das ocorrências, a única premissa foi serem artigos científicos, sem restrições de ano de publicação, idioma ou qualquer outra. A pré-seleção pela análise do título e resumo nas bases de dados foi realizada nas 69 ocorrências resultantes da pesquisa ampla. A análise ocorreu de modo independente por três pesquisadores e teve como parâmetro a seleção dos artigos que respondessem à questão norteadora. Depois de discutidas as divergências, excluíram-se, com consenso, os artigos que não respondiam à problemática-tema; oito artigos originais foram identificados e permaneceram para compor esta revisão.

Para melhor visualização, explicita-se percurso de coleta de dados via fluxograma segundo modelo *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA) (Tricco et al., 2018), como apresentado na Figura 1.

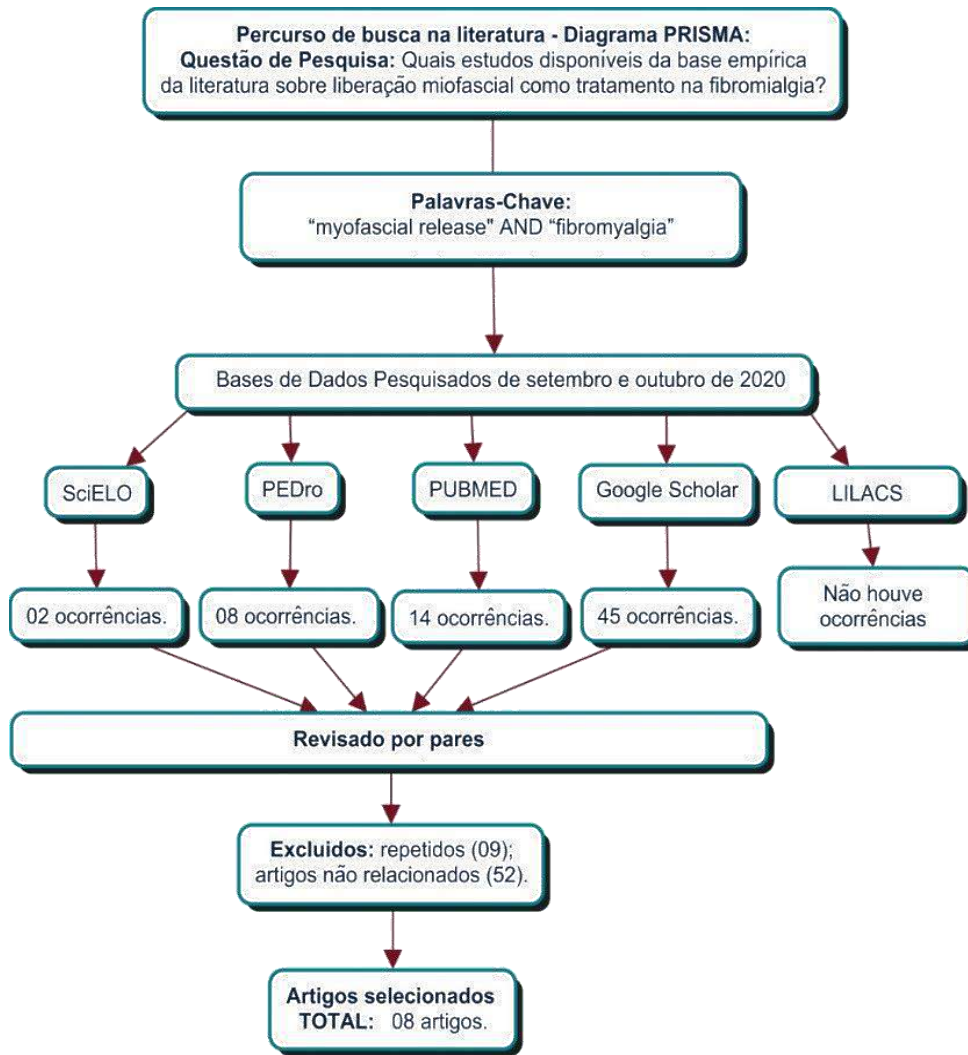


Fig.1: Fluxograma de busca nas bases de dados

Fonte:elaborada pelos autores.

III. RESULTADOS

A quarta fase consistiu no mapeamento dos dados e foi mediada pela categorização via leitura completa dos artigos selecionados. Foi feita a tabulação em uma planilha do programa *Excel*, empregando-se questões de interesse (identificação, ano, país, objetivos, principais achados, critérios diagnósticos, revista científica e características metodológicas). Para melhor apresentação dos resultados, optou-se por considerar as seguintes variáveis dos artigos selecionados (Quadro 1): título, autores, país de origem, periódico/ano, delineamento/objetivo, variáveis estudadas, conforme se explicita nas principais informações dos artigos que compõem esta revisão.

Quadro 1. Caracterização e mapeamento da revisão do conhecimento

Título	Autores	Método	País de origem	Critério	Objetivo	Principal achado (contribuição ou resultado)
Benefits of a self-myofascial release program on health-related quality of life in people with fibromyalgia: a randomized controlled trial	Ceca, Elvira, Guzmán, & Pablos (2017)	Ensaio clínico	Espanha	Wolfe <i>et al.</i> (1990, 2010)	Descobrir os benefícios da aplicação de um programa de autoliberação miofascial na qualidade de vida relacionada à saúde em pessoas com SFM	A aplicação de um programa de autoliberação miofascial pode melhorar a qualidade de vida relacionada à saúde de pessoas com SFM, desde que prática regular e estruturada seja realizada
Eficácia de um programa de condicionamento miofascial na dor, depressão, ansiedade e qualidade do sono em pessoas com fibromialgia	Ceca, Pablos, Elvira, López-Hernández, & Ortega (2020)	Ensaio clínico	Espanha	Wolfe <i>et al.</i> (1990, 2010)	Determinar a eficácia da aplicação de um programa de autocondicionamento miofascial na dor, depressão, ansiedade e qualidade do sono em pessoas com SFM	Participar de um programa de autocondicionamento miofascial regularmente e sob o controle de um profissional de educação física e esporte pode afetar pacientes com SFM de forma positiva tanto física quanto psicologicamente
Effects of myofascial release techniques on pain, physical function, and postural stability in patients with fibromyalgia: a randomized controlled trial	Castro-Sánchez, Matarán-Peñarrocha, Arroyo-Morales <i>et al.</i> (2011)	Ensaio clínico	Espanha	Wolfe <i>et al.</i> (1990)	Determinar o efeito das técnicas de liberação miofascial nos sintomas de dor, estabilidade postural e função física em pacientes com SFM	Os resultados sugerem que as técnicas de liberação miofascial podem ser uma terapia complementar para os sintomas da dor, função física e gravidade clínica, mas não melhoram a estabilidade postural em pacientes SFM
Benefits of massage-myofascial release therapy on pain, anxiety, quality of sleep, depression, and quality of life in patients with fibromyalgia	Castro-Sánchez, Matarán-Peñarrocha, Granero-Molina <i>et al.</i> (2011)	Ensaio clínico	Espanha	Wolfe <i>et al.</i> (1990)	Determinar se a terapia de liberação miofascial de massagem pode melhorar a dor, ansiedade, qualidade do sono, depressão e qualidade de vida em pacientes com SFM	As técnicas de liberação miofascial melhoraram a dor e a qualidade de vida em pacientes com fibromialgia

Quadro 1. Caracterização e mapeamento da revisão do conhecimento (continuação....)

Título	Autores	Método	País de origem	Critério	Objetivo	Principal achado (contribuição ou resultado)
A pilot study of myofascial release therapy compared to Swedish massage in fibromyalgia	Liptan, Mist, Wright, Arzt, & Jones (2013)	Quase experimental	Estados Unidos	Wolfe <i>et al.</i> (1990)	Comparar a massagem sueca diretamente com a liberação miofascial	Tanto a massagem sueca quanto a liberação miofascial foram consideradas seguras, toleráveis e aceitáveis por pacientes com SFM, ainda que a liberação miofascial possa resultar em maiores reduções nos sintomas da SFM comparada com a massagem sueca padrão
Improvement in clinical outcomes after dryneedling versus myofascial release on painpressure thresholds, quality of life, fatigue, painintensity, quality of sleep, anxiety, and depressionin patients with fibromyalgia syndrome	Castro-Sánchez <i>et al.</i> (2019)	Ensaio clínico	Espanha	Wolfe <i>et al.</i> (2010)	Comparar a eficácia do agulhamento seco com a liberação miofascial em pontos desencadeadores de dor miofascial nos músculos cervicais, qualidade de vida, impacto dos sintomas de dor, qualidade do sono, ansiedade, depressão e fadiga em pacientes com síndrome de fibromialgia	A terapia com agulhas secas mostrou melhoras maiores em comparação com a de liberação miofascial para os limiares de pressão de dor, os componentes da qualidade de vida do papel físico, dor corporal, vitalidade e função social, bem como o impacto total dos sintomas de SFM, qualidade do sono, estado e ansiedade-traço, ansiedade-depressão hospitalar, intensidade geral da dor e fadiga
Efeitos do método Rolfing® de integraçãoestrutural e da acupuntura na fibromialgia	Stall, Hosomi, Faelli, Pai, Teixeira, & Marchiori (2015)	Quase experimental (pré e pós-intervenção)	Brasil	Wolfe <i>et al.</i> (1990)	Verificar a eficácia do método Rolfing® de integração estrutural, da acupuntura e da combinação das duas técnicas no alívio dador, nos estados de ansiedade e depressão e na melhora da qualidade de vida dos fibromiálgicos	As duas técnicas foram benéficas tanto individual quanto associadamente durante os três meses de acompanhamento

Quadro 1. Caracterização e mapeamento da revisão do conhecimento (continuação....)

Título	Autores	Método	País de origem	Critério	Objetivo	Principal achado (contribuição ou resultado)
Síndrome fibromiálgica tratada com o método Rolfing® de integração estrutural	Stall & Teixeira (2014)	Quase experimental (pré e pós-intervenção)	Brasil	Wolfe <i>et al.</i> (1990)	Verificar a eficácia do método Rolfing® no tratamento de pacientes fibromiálgicos no alívio da dor e nos estados de ansiedade e de depressão	Os pacientes tratados apresentaram melhora que se correlacionou com a intervenção do método Rolfing®

Fonte: elaborado pelos autores.

Em relação ao ano de publicação, houve predomínio de 2011, com dois artigos (25%), e 2013, 2014, 2015, 2017, 2019 e 2020, com um estudo cada (12,5%). Quanto ao país de origem, a amostra se apresentou pouco diversificada, gerando uma amostra concentrada no continente europeu e americano, com prevalência de publicações de amostras da população da Espanha, com cinco estudos (62,5%), seguida pelo Brasil, com duas investigações (25%), e Estados Unidos da América, com um estudo (12,5%).

Em relação ao delineamento, houve maior proporção de ensaios clínicos randomizados (62,5%), seguido de estudos de efetividade quase experimental com avaliação pré e pós-intervenção (37,5%). No que diz respeito ao critério do diagnóstico da fibromialgia utilizado, seis estudos (75%) utilizaram os critérios indicados por Wolfe *et al.* (1990), e dois, de Wolfe *et al.* (1990, 2010). Quanto aos autores, houve estudos conduzidos por fisioterapeutas, profissionais de educação física ou ambos (em estudos com autores de várias formações na área da saúde), conforme esperado.

Três modalidades foram relatadas: “liberação miofascial” (como terapia manual ou massagem), “autoliberação ou condicionamento miofascial” e “método Rolfing”. Sobre os desfechos, foi prevalente a investigação da eficácia no uso da liberação miofascial em acometidos por SFM para “qualidade de vida” e “dor”. De modo geral, os trabalhos disponíveis atribuem a liberação miofascial como uma estratégia complementar de impacto positivo na saúde física e psicológica.

IV. DISCUSSÃO

O principal objetivo da presente pesquisa foi mapear as contribuições disponíveis sobre liberação miofascial como tratamento na fibromialgia. Entre os resultados mais

significativos, é possível destacar que houve perfil de publicações prevalentemente com ocorrência na PubMed, com delineamento de ensaios clínicos, realizados na Espanha, com diagnóstico da fibromialgia pelos critérios de Wolfe *et al.* (1990), com desfecho relacionado à “qualidade de vida” e à “dor”. De modo geral, os estudos disponíveis atribuem a liberação miofascial como uma estratégia de impacto positivo na saúde física e psicológica.

Sublinha-se que a SFM, anteriormente conceituada como um transtorno discreto (“afetado” ou “não afetado”), passou a ser percebida como um desfecho *continuum* (Clauw & Ueda, 2017; Wolfe, 2015). Por volta de 76 a 100% dos indivíduos reclamam de fadiga comparecente em geral ao despertar e com frequência sua intensidade aumenta após esforço físico e contingentemente pode tornar-se tão acentuada a ponto de atividades aparentemente leves intensificarem a dor e o cansaço (Wolfe & Cathey, 1985; Yunus, Masi, Calabro, Miller, & Feigenbaum, 1981).

Análises recentes indicam que a SFM pode ocorrer espontaneamente por efeito cumulativo de estresse físico, psicológico e emocional que se dá ao longo da vida (Kwiatek, 2017). Koca, Acet, Tanrikut, e Talu (2016) enfatizam que nenhum tratamento está disponível para a cura dos sintomas, porém há propostas para o controle destes e o reparo da função por múltiplos tratamentos (medicamentosos e não medicamentosos). Terapias manuais são uma forma não medicamentosa de intervenção que promove o relaxamento e alívio de dor, favorecendo melhor qualidade de vida dos indivíduos com fibromialgia (Pereira *et al.*, 2020; Takiguchi, Fukuwara, Sauer, Assumpção, & Marques, 2008).

Na presente revisão foi evidenciado que existem poucos estudos disponíveis sobre a temática liberação

miofascial na literatura científica. O mesmo ocorre com outras revisões da literatura que estudaram a temática relacionada a diferentes desfechos (LAIMI, et al., 2018; Pereira et al., 2020; Yuan et al., 2015).

De modo geral, no presente estudo os estudos disponíveis atribuem a liberação miofascial como uma estratégia válida de impacto positivo na saúde física e psicológica. De modo semelhante, Yuan et al. (2015) sustentam haver evidências moderadas de que a liberação miofascial é benéfica para os sintomas da fibromialgia. Diferentemente, Laimi, et al. (2018) afirmam em sua revisão que as evidências atuais sobre a terapia de liberação miofascial não são suficientes para justificar esse tratamento na dor musculoesquelética crônica, incluindo até mesmo a SFM. Atribuímos essas diferenças a questões metodológicas usadas nos estudos.

A Liga Europeia Contra o Reumatismo (EULAR), em uma de suas revisões de recomendações, sugere para o manejo da fibromialgia o emprego de uma abordagem graduada com a finalidade de aperfeiçoar qualidade de vida do indivíduo. Tal abordagem se fundamenta em avaliação psicossocial abrangente, centralizar os atributos não farmacológicos, consentir com a disponibilidade, custo, possíveis efeitos negativos e preferências de cada pessoa (Macfarlane et al., 2016). Entre outros tratamentos não farmacológicos com diversificados elementos (educacionais, psicológicas e exercícios), são considerados efetivos na diminuição de dor e fadiga em acometidos pela SFM (Macfarlane et al., 2016), além do fato de que a elaboração do trabalho realizado em equipe multidisciplinar proporciona uma ampliação e motivação.

Vale destacar ainda que a liberação miofascial é uma terapia manual / massagem que pode incluir liberação do ponto gatilho miofascial que visa à restauração da função muscular, tratando "pontos gatilhos" musculares, ou seja, "nós" hiperirritáveis dentro de faixas tensas de músculos esqueléticos (Mauntel, Clark, & Padua, 2014). Implementação ou não da liberação do ponto gatilho miofascial na presente revisão de modo geral foi inespecífica.

A presente revisão se limitou a mapear a literatura disponível sobre o uso da liberação miofascial, incluindo técnicas de liberação direta (usa dedos, cotovelos ou ferramentas do terapeuta, aplicando pressão sustentada (90-120 segundos) de poucos quilogramas), indireta (alonga o complexo miofascial por uma carga menor e maior duração) e liberação automiofascial (usa vários tipos de massageadores de rolos e fornece ferramentas para quem sofre de dor). Tal panorama da evidência disponível do ponto de vista clínico é potencialmente promissor no uso da liberação miofascial como estratégia auxiliar na

terapia do paciente acometido pela fibromialgia, associado à cinesioterapia e a terapias complementares.

V. CONSIDERAÇÕES FINAIS

De modo geral, os estudos atribuem a liberação miofascial como uma estratégia auxiliar de impacto positivo na saúde física e psicológica, com prevalência em desfechos voltados à "qualidade de vida" e à "dor". Porém, são escassos os estudos na literatura científica nacional e internacional, e as conclusões dos trabalhos disponíveis ainda são limitadas e inespecíficas, com notáveis lacunas clínicas e científicas que corroborem a consolidação do uso da liberação miofascial em suas variadas técnicas e formatos como estratégia auxiliar na terapêutica do paciente acometido pela fibromialgia. Do ponto de vista clínico, seu uso é potencialmente promissor, associada a outras técnicas de treino funcional e cinesioterapia.

REFERÊNCIAS

- [1] Ajimsha, M. S., Al-Mudahka, N. R., & Al-Madzhaz, J. A. (2015). Effectiveness of myofascial release: systematic review of randomized controlled trials. *Journal of Bodywork and Movement Therapies*, 19(1), 102-112.
- [2] Araujo, W. C. O. (2020). Recuperação da informação em saúde: construção, modelos e estratégias. *ConCi: Convivências em Ciências da Informação*, 3(2), 100-134.
- [3] Castro-Sánchez, A. M., López, H. G., Sánchez, M. F., Marmol, J. M. P., Aguilar-Ferrández, M. E., Suárez, A. L., & Matarán-Peñarrocha, G. A. (2019). Improvement in clinical outcomes after dry needling versus myofascial release on pain pressure thresholds, quality of life, fatigue, pain intensity, quality of sleep, anxiety, and depression in patients with fibromyalgia syndrome. *Disability and Rehabilitation*, 41(19), 2235-2246.
- [4] Castro-Sánchez, A. M., Matarán-Peñarrocha, G. A., Arroyo-Morales, M., Saavedra-Hernández, M., Fernández-Sola, C., & Moreno-Lorenzo, C. (2011). Effects of myofascial release techniques on pain, physical function, and postural stability in patients with fibromyalgia: a randomized controlled trial. *Clinical Rehabilitation*, 25(9), 800-813.
- [5] Castro-Sánchez, A. M., Matarán-Peñarrocha, G. A., Granero-Molina, J., Aguilera-Manrique, G., Quesada-Rubio, J. M., & Moreno-Lorenzo, C. (2011). Benefits of massage-myofascial release therapy on pain, anxiety, quality of sleep, depression, and quality of life in patients with fibromyalgia. *Evidence-Based Complementary and Alternative Medicine*, 2011:561753. doi: 10.1155/2011/561753
- [6] Ceko, M., Bushnell, M. C., & Gracely, R. H. (2012). Neurobiology underlying fibromyalgia symptoms. *Pain Research and Treatment*, 2012:585419. doi: 10.1155/2012/585419

- [7] Ceca, D., Pablos, A., Elvira, L., López-Hernández, L., & Ortega, A. L. (2020). Effectiveness of a self-myofascial conditioning programme on pain, depression, anxiety and sleep quality in people with Fibromyalgia. *Cuadernos de Psicología del Deporte*, 20(1), 147-165.
- [8] Ceca, D., Elvira, L., Guzmán, J. F., & Pablos, A. (2017). Benefits of a self-myofascial release program on health-related quality of life in people with fibromyalgia: a randomized controlled trial. *The Journal of Sports Medicine and Physical Fitness*, 57(7-8), 993-1002.
- [9] Clauw, D. J. (2014). Fibromyalgia: a clinical review. *JAMA*, 311(15), 1547-1555.
- [10] Clauw, D. J., & Ueda, H. (2017). Summary of the fibromyalgia research symposium 2016 in Nagasaki. *Pain Reports*, 2(1), e582. doi: 10.1097/PR9.0000000000000582
- [11] Ghavidel-Parsa, B., Bidari, A., Maafi, A. A., & Ghaleboghi, B. (2015). The iceberg nature of fibromyalgia burden: the clinical and economic aspects. *The Korean Journal of Pain*, 28(3), 169-176.
- [12] Häuser, W., Ablin, J., Fitzcharles, M.-A., Littlejohn, G., Luciano, J. V., Usui, C., & Walitt, B. (2015). Fibromyalgia. *Nature review. Disease primers*, 1(15022). doi: 10.1038/nrdp.2015.22.
- [13] Häuser, W., Sarzi-Putini, P., & Fitzcharles, M.-A. (2019). Fibromyalgia syndrome: under-, over- and misdiagnosis. *Clinical and Experimental Rheumatology*, 37(Suppl. 116), 90-97.
- [14] Heidari, F., Afshare, M., & Moosazadeh, M. (2017). Prevalence of fibromyalgia in general population and patients, a systematic review and meta-analysis. *Rheumatology International*, 37(9), 1527-1539.
- [15] Huijing, P. A. (2009). Epimuscular myofascial force transmission: a historical review and implications for new research. International Society of Biomechanics Muybridge Award Lecture, Taipei, 2007. *Journal of Biomechanics*, 42(1), 9-21.
- [16] Koca, T. T., Acet, G. K., Tanrikut, E., & Talu, B. (2016). Evaluation of sleep disorder and its effect on sexual dysfunction in patients with Fibromyalgia syndrome. *Turkish Journal of Obstetrics and Gynecology*, 13(4), 167-171.
- [17] Kwiatek, R. (2017). Treatment of fibromyalgia. *Australian Prescriber*, 40(5), 179-183.
- [18] Lacasse, A., Bourgault, P., & Choinière, M. (2016). Fibromyalgia-related costs and loss of productivity: a substantial societal burden. *BMC Musculoskeletal Disorders*, 17(1), 168. doi: 10.1186/s12891-016-1027-6
- [19] Laimi, K., Makila, A., Bärlund, E., Katajapuu, N., Oksanen, A., Seikkula, V., ... Saltychev, M. (2018). Effectiveness of myofascial release in treatment of chronic musculoskeletal pain: a systematic review. *Clinical Rehabilitation*, 32(4), 440-450.
- [20] Lindenfeld, T. N., Schmitt, D. J., Hendy, M. P., Mangine, R. E., & Noyes, F. R. (1994). Incidence of injury in indoor soccer. *The American Journal of Sports Medicine*, 22(3), 364-371.
- [21] Liptan, G., Mist, S., Wright, C., Arzt, A., & Jones, K. D. (2013). A pilot study of myofascial release therapy compared to Swedish massage in Fibromyalgia. *Journal of Bodywork and Movement Therapies*, 17(3), 365-370.
- [22] Macfarlane, G. J., Kronisch, C., Dean, L. E., Atzeni, F., Häuser, W., Fluß, E., ... Jones, G. T. (2017). EULAR revised recommendations for the management of fibromyalgia. *Annals of the Rheumatic Diseases*, 76(2), 318-328.
- [23] Marques, A. P., Santos, A. S. E., Berssaneti, A. A., Matsutani, L. A., & Yuan, S. L. K. (2017). Prevalence of fibromyalgia: literature review update. *Revista Brasileira de Reumatologia*, 57(4), 356-363.
- [24] Mauntel, T. C., Clark, M. A., & Padua, D. (2014). Effectiveness of myofascial release therapies on physical performance measurements: A systematic review. *Athletic Training and Sports Health Care*, 6(4), 189-196.
- [25] Mugnaini, R., & Sales, D. P. (2011). Mapeamento do uso de índices de citação e indicadores bibliométricos na avaliação da produção científica brasileira. In *Anais do Encontro Nacional de Pesquisa em Ciência da Informação*. (p. 2361-2372). Brasília: Thesaurus.
- [26] Myers, T. W. (2020). *Anatomy Trains E-Book: Myofascial Meridians for Manual Therapists and Movement Professionals*. London: Elsevier Health Sciences.
- [27] Oliveira, R., & Mendonça, L. (2016). *Liberação miofascial*. Santo André: Sociedade Nacional de Fisioterapia Esportiva.
- [28] Pereira, A. W. B., Lopes, A. B. A., Amora, T. R. M., Viegas, I. F., Sousa, A. P. S., Uchôa, M. C. G., & Sousa, A. A. (2020). Liberação automiofascial no tratamento da fibromialgia: revisão de literatura sistemática. *Brazilian Journal of Health Review*, 3(2), 3158-3165.
- [29] Peters, M. D. J. et al. (2017). Scoping reviews. In Aromataris E., Munn Z., editores. *Joanna Briggs Institute Reviewer's Manual*. Austrália: The Joanna Briggs Institute.
- [30] Schleip, R., & Müller, D. G. (2013). Training principles for fascial connective tissues: scientific foundation and suggested practical applications. *Journal of Bodywork and Movement Therapies*, 17(1), 103-115.
- [31] Schmidt-Wilcke, T., & Clauw, D. J. (2011). Fibromyalgia: from pathophysiology to therapy. *Nature reviews. Rheumatology*, 7(9), 518-527.
- [32] Skaer, T. L., & Kwong, W. J. (2017). Illness perceptions and burden of disease in fibromyalgia. *Expert Review of Pharmacoeconomics & Outcomes Research*, 17(1), 9-15.
- [33] Stall, P., Hosomi, J. K., Faelli, C. Y. P., Pai, H. J., Teixeira, M. J., & Marchiori, P. E. (2015). Efeitos do método Rolfing® de integração estrutural e da acupuntura na fibromialgia. *Revista Dor*, 16(2), 96-101.
- [34] Stall, P., & Teixeira, M. J. (2014). Síndrome fibromiálgica tratada com o método Rolfing® de integração estrutural. *Revista Dor*, 15(4), 248-252.
- [35] Takiguchi, R. S., Fukuwara, V. S., Sauer, J. F., Assumpção, A., & Marques, A. P. (2008). Effect of acupuncture on pain, sleep and quality of life improvement in fibromyalgia patients: preliminary study. *Fisioterapia e Pesquisa*, 15(3), 280-284.
- [36] Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., ... Straus, S. E. (2018).

- PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Annals of Internal Medicine*, 169(7), 467-473.
- [37] Wolfe, F., & Cathey, M. A. (1985). The epidemiology of tender points: a prospective study of 1520 patients. *The Journal of Rheumatology*, 12(6), 1164-1168.
- [38] Wolfe, F., Clauw, D. J., Fitzcharles, M.-A., Gendenberg, D. L., Katz, R. S., Mease, P., ... Yunus, M. B. (2010). The American College of Rheumatology preliminary diagnostic criteria for fibromyalgia and measurement of symptom severity. *Arthritis Care & Research (Hoboken)*, 62(5), 600-610.
- [39] Wolfe, F., Smythe, H. A., Yunus, M. B., Bennett, R. M., Bombardier, C., Goldenberg, D. L., ... Clark, P. (1990). The American College of Rheumatology criteria for the classification of fibromyalgia: report of the multicenter criteria committee. *Arthritis Rheumatology*, 33, 160-172.
- [40] Woods, C., Hawkins, R., Hulse, M., & Hodson, A. (2002). The Football Association Medical Research Programme: an audit of injuries in professional football – analysis of preseason injuries. *British Journal of Sports Medicine*, 36(6), 436-441.
- [41] Yuan, S. L. K., Matsutani, L. A., & Marques, A. P. (2015). Effectiveness of different styles of massage therapy in fibromyalgia: a systematic review and meta-analysis. *Manual Therapy*, 20(2), 257-264.
- [42] Yunus, M., Masi, A. T., Calabro, J. J., Miller, K. A., & Feigenbaum, S. L. (1981). Primary fibromyalgia (fibrositis). *Seminars Arthritis Rheumatology*, 11(1), 151-171.

Fixed orthodontic technique without bracket: an alternative to conventional orthodontic treatments

Ewelyn Caroline Ribeiro Corrêa¹, Brienna Almeida Costa¹, Amanda Araújo Freitas¹, Rebeca Luzia Solarte Barbosa¹, Rodrigo Marocchio Pavane², Mário Jorge Souza Ferreira Filho¹.

¹Centro Universitário do Norte – UNINORTE, Manaus/AM – Brasil

²Centro de Ensino e Pesquisa em Reabilitação Oral – CEPROEDUCAR, Manaus/Amazonas - Brasil

Received: 15 Sept 2021,

Received in revised form: 01 Nov 2021,

Accepted: 09 Nov 2021,

Available online: 15 Nov 2021

©2021 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—Orthodontic Appliance Design,
Dental Esthetics, Orthodontic Appliances,
Fixed, Dental Esthetic.

Abstract—The search for orthodontic treatment goes far beyond the correction of mismatches in the teeth, prevention of occlusal problems or functional benefits, the patient also associates orthodontic treatment with the aesthetic benefit, which becomes a motivator in choosing which appliance model to use during your treatment. Therefore, this article presented the difference between fixed and removable orthodontic techniques, analyzing their pros and cons, established by scientific basis so that the reader understands and determines which technique to use for each patient. During the literature review, it was noted that aesthetics and comfort are determining factors in choosing the type of orthodontic appliance to be used in the treatment, and fixed orthodontics without brackets is capable of meeting this need. Over the years, 3D technology was introduced, making it possible to perform a virtual set-up, giving the professional a precise preview of the necessary movements. Fixed orthodontics without brackets was improved in Brazil by Guaracy Fonseca and Ney Tavares, with the emergence of the 3D-BOT - Bracketless Orthodontics Treatment (three-dimensional orthodontic treatment without brackets) technique, which stood out for being one of the best alternatives in orthodontic treatment in which refers to aesthetics, as it idealizes highly relevant advantages, such as aesthetically invisible and comfortable, it does not impair diction and does not make cleaning difficult, in addition to the low cost and treatment completion in less time.

I. INTRODUCTION

Dentistry is an area that has presented several innovations over the years, and when it comes to orthodontics, there are a multitude of new treatments, which in turn are even more effective and not always aesthetic and comfortable. The customer who seeks to solve their problem does not always want to give up the result just for the aesthetic part. Over the years, the famous

orthodontic appliances have evolved, with the patient's comfort in mind (MARINIELLO; COZZOLINO, 2008).

There are several treatment models offered, such as: conventional buccal and lingual orthodontics, aligners and others. Although conventional vestibular orthodontics offers satisfactory final results, there are many injuries caused to the oral mucosa if the treatment is continued for a long period. On the other hand, lingual orthodontics with the use of brackets is uncomfortable, making hygiene,

phonetics and tongue space difficult, which is one of the main muscles responsible for chewing and swallowing. Aligners, in turn, are not fully aesthetic, due to attachments and because they depend almost completely on the patient's cooperation (FONSECA et al., 2019).

Based on this new perspective, fixed orthodontics without brackets has emerged as one of the best options in aesthetic orthodontic treatment. Macchi and Nunzio (2000) was the first to use the technique, which initially took the name of active fixed containment, indicated for the correction of diastemas, small crowding and dental rotations. A technique that consists of using nickel-titanium wires, fixed on the lingual surface of the teeth, with fluid resin.

Mussili (2008) demonstrated a 7 to 10 year study where he followed the procedures and realized that the restraints are capable of generating minimal movement in post-orthodontic treatment. However, Guaracy and Ney Tavares (2019) developed in Brazil the 3D-BOT (Bracketless Orthodontics Treatment), it receives this name for being able to perform the movements of the 3 planes of the oral cavity.

Although the technique requires a longer service time, greater training of the orthodontist and the need for posterior occlusal lifting, it continues to be one of the best treatment options, taking into account its low cost, ease of cleaning, ability to complete the treatment in less time and keeping faithful to the esthetics (TAVARES et al., 2019).

In view of this, it is the objective of this work to demonstrate, through a literature review, a possible alternative to conventional orthodontic treatments.

II. LITERATURE REVIEW

Smiling is one of the ways to express emotions, having an aesthetically pleasing and harmonious smile facilitates communication, self-image security and a feeling of physical and psychological emotional well-being. Malocclusion or an aesthetic misalignment can lead to decreased self-confidence (SHARMA et al., 2017).

Orthodontic treatment becomes an option for malocclusion correction, but the patient, when seeking treatment, ponders the choice of the appropriate device in terms of function and aesthetics. The market has a wide variety, being the conventional with brackets (metallic, porcelain, ceramic and polycarbonates) to aligners, although the latter presents itself as an aesthetic device, it is not effective, due to the attachments and completely depend on collaboration of the patient (FONSECA et al., 2019).

According to Couto and Abreu (2020), it is clear that orthodontic appliances have an effect on the appearance of patients and, for this reason, orthodontic evolution in recent years has been accompanied by an increase in aesthetic search and with the objective of create a dental occlusion that meets functional standards. This stimulated the generation of orthodontic devices that meet the demand of these patients. The use of conventional orthodontic appliances, consisting of bands, brackets, wires and ligatures, is associated with a general impairment of facial appearance.

Among the models offered on the market, such as conventional buccal and lingual orthodontics with the use of brackets, offer satisfactory results that have been the gold standard for decades, they have better torque control during anterior retraction (MÁRTHA et al., 2013).

Lingual orthodontics presents itself as an aesthetic technique, but with low acceptance by patients, as there are reports of maladaptation, swallowing problems, difficulty in cleaning, phonation alteration and reduction of the lingual space. During the initial research, it is clear that the orthodontist must have great skill in performing the technique, as there is difficulty when bonding the brackets, due to limited visualization (KAIRALLA et al., 2010). The use of the device when not followed up correctly brings negative consequences to the patient's gingival health, brackets facilitate the accumulation of plaque and etiological factors can cause gingivitis and consequently progress to a periodontal problem (MADARIAGA et al., 2020).

Aesthetic aligners are different from traditional models, it is a set of removable transparent plates with the objective of gradually moving the teeth and one of the benefits for the patient is visual, since the aligner is practically imperceptible. Aligners, like any orthodontic technique, have their limitations, as in the treatment of malocclusions that require premolar extractions and require patient cooperation, as their use requires discipline. In this technique, it is not possible to measure the activation levels, since during the treatment there is tooth movement, which will possibly generate intense pain, and because it is a removable aligner, the patient can remove the appliance and not have a satisfactory tooth alignment (VIEIRA et al., 2013).

Based on the premise that limitations and difficulties were found in existing orthodontic devices, the fixed orthodontic technique without brackets was developed. Macchi and Nunzio (2000) designed the first active fixed retainer that has been used since 1996, thinking of patients who had relapsed orthodontic treatments, making a new intervention necessary. The device was well accepted by

the patients, being easy to apply, using a Nickel-Titanium (Ni-Ti) wire, bonded by light-curing fluid composite resin, fixed by the lingual or palate surface to the dental elements to be moved. The construction of the device is simple and inexpensive, having been perfected over the years by the authors to achieve more complex malocclusion resolutions.

Mussili (2008) conducted a study of 7 to 10 years, where he realized that fixed retainers without brackets are able to generate minimal movement in post-orthodontic treatment, noted that the cases in which it was worked, there was a significant result in a period of 4 to 5 months. With the correct preactivation, it is possible to achieve good results such as: diastema closure, arc alignment resolution, tip and torque control.

Tavares and Fonseca (2019) presented the 3D technique – Bracketless Orthodontic Treatment (three-dimensional orthodontic treatment without brackets), which consists of moving the dental element in the transverse direction, rotating on its axis, in the coronal plane, instructing and extruding it and in the sagittal plane, taking it from buccal to lingual or palate, that is, it can work with a device in all three planes. In this technique, an intraoral scan with 3D technology is performed, with images of the superior, inferior and occlusal arches. The images are included in orthodontic software, to carry out the Set Up (movement of the teeth to the desired position). When performing this movement, it is possible to accurately determine both the final shape desired for the arches and define how much incisor protrusion is necessary. The final perimeter of the arc pre-established in Set Up, helps in defining the arc. The wire is glued in the occlusal of the posterior teeth and lingual of the anterior ones, being necessary to make the posterior occlusal lifting in the last occlusal teeth, the lifting works by releasing the contact of the other teeth, which facilitates the leveling of the arches and transversal corrections and individual rotation.

The 3D-BOT does not use brackets, the fluid resin is what keeps the wire fixed to the teeth, Fonseca (2019) also reports that, to be well executed, the technique needs a good helper to make the resin light curing, because the wire must be exactly well-aligned with the Sputnik instrumentation to drive the drawing generated by the 3D technology. It allows the application of aesthetic buttons via the buccal or the lingual to facilitate auxiliary mechanics with intermaxillary elastics and rotations via binary, and for slippage it is necessary to wax the wire.

The technique has some negative points, such as: patients who have a tendency to anterior open bite, where the tongue is interposed between the teeth and can favor

the appearance or aggravate the anterior open bite; need for posterior occlusal lifting and must be performed by a more experienced professional (TAVARES et al., 2019).

Therefore, the fixed orthodontic technique without brackets idealizes several advantages, such as: aesthetically invisible and comfortable; doesn't get in the way of diction; does not make cleaning difficult; being a self-ligating technique, it allows sliding, if necessary. It has decisive protrusion/lingualization control by determining the wires used in the prototype, regardless of the patient's cooperation and to determine the diagram to be chosen, the final models are already printed, so that the orthodontist can make the initial and final comparison of the treatment. With this, it establishes an early construction of arches, minimizing chair time, which creates a bond of trust between the patient and the orthodontist. Due to the 3D technology, the fixed technique without brackets makes a virtual Set Up, giving the professional an accurate preview of the necessary movements and is not limited to the treatment of antero-inferior recurrences. Thus, it became a fast, efficient and effective technique (FONSECA et al., 2019).

III. DISCUSSION

Through the smile we can express a multitude of feelings, Sharma (2017) says that malocclusion affects the individual's self-esteem and confidence, and from this point onwards, the search for aesthetic orthodontic treatment begins. The fixed orthodontic technique without brackets was developed considering the aesthetic standard required by the population since the 1990s.

Among the most popular aesthetic devices, lingual orthodontics and aligners are offered in dental offices, Kairalla (2010) reports on lingual orthodontics with brackets, a technique that can meet the aesthetic needs of the discreet and invisible patient. Vieira (2013) says that with the use of three-dimensional computational technology, it is possible to make invisible aligners, making them more aesthetic and comfortable than the lingual ones with brackets. Mussili (2008) portrays that fixed orthodontics without brackets is a simple technique, with Nickel-Titanium wires bonded to the lingual face of the elements with fluid resin, capable of leveling teeth in cases of relapse, or in more clinical cases. complicated, being much more aesthetic than those mentioned above.

As for the limitations and difficulties found, (KAIRALLA et al., 2010) mentions that the use of lingual appliances with brackets causes discomfort and can cause injuries to the patient's tongue, speech difficulty, limited vision of the dentist when placing the brackets on the lingual surface and a longer working time. The Aligner

also has its limitations, such as preventing biomechanical control by the professional during orthodontic consultations, even though careful planning was carried out in computerized virtual models. The device still generates a self-cost for the patient, without guarantees of a someone's treatment (VIEIRA et al., 2013). Fixed orthodontics without brackets is not as efficient in cases of patients who have a tendency to the previous open bite, where the tongue is interposed between the teeth and can favor the appearance or worsen the previous open bite (TAVARES et al., 2019).

Fixed orthodontics without brackets, being a simple and low-cost device, brings someone's results in cases completed in less time, Mussili (2008) reports that teeth leveling can be done in relapse cases, and also in more complicated clinical cases. , as in patients who have never undergone orthodontic treatments and are much more esthetic than those mentioned above.

Fixed orthodontics without brackets initially emerged as retainers, authors such as Macchi and Nunzio (2000) talk about active fixed retainers, which have the purpose of being a retreatment for a recurrence of orthodontic treatments, with long years of study and improvements, Mussili (2008)) with his 9-year study, asked questions to know how effective the technique would be, and concluded that despite some limitations that are smaller compared to aligners and much more comfortable compared to lingual orthodontics. In the technique reported by Mussili, named Bracketless Fixed Orthodontics (fixed orthodontics without brackets), all the biomechanical principles of Burstone and Melsen are applied, which makes it reliable.

These retainers, as they were initially called undergoing an evolution, where some authors reported that it could be more than a device for post-orthodontic treatment, Mariniello and Cozzolino (2012) portray that it is an innovative technique, its placement on the lingual surface of the teeth makes it more comfortable and so it is one of the choices of patients. Guaracy (2019) and Tavares (2019) offered technological innovations through three-dimensional planning, which provides the patient with a virtual Set-Up, providing them with a vision of the final result, receiving the name of 3D-BOT (Bracketless orthodontic treatment).

IV. FIGURES



Fig. 1: Before and after the 3D BOT treatment

Fonte: Fonseca Jr GL, Tavares N, Cavalcante GRG, Fonseca CH. Técnica ortodôntica fixa sem bráquetes, com Tecnologia Tridimensional "3D-BOT".

V. CONCLUSION

It is concluded that there are numerous devices capable of performing an effective orthodontic treatment, but fixed orthodontics without brackets is a technique that has brought changes to the orthodontic market, offering a service of efficiency, quality and low cost, being able to meet the needs esthetic, as they are fixed to the lingual surface of the dental elements and without the use of brackets, providing comfort, without interfering with hygiene and still completing in less time.

REFERENCES

- [1]. COUTO, B. L. B.; ABREU, L. G. Comparação entre alinhadores ortodônticos e pares de aparelhos ortodônticos fixos convencionais: uma revisão sistemática e meta-análise. *Arq Odontol, Belo Horizonte*, v. 56 n. 1, p 1-30, set. 2020.
- [2]. FONSECA, Jr. GL.; TAVARES, N.; CAVALCANTE, GRG.; Fonseca, CH. Técnica ortodôntica fixa sem bráquetes, com Tecnologia Tridimensional "3D-BOT". *Sci. Pract.*, v. 12, n. 46, p 22-30, 2019.

- [3]. KAIRALLA, S. A.; KAIRALLA, R. A.; MIRANDA, S. L.; PARANHOS, L. R. Ortodontia lingual: um aparelho “invisível”. *Rev Bras Cir Craniomaxilofac.*, São Paulo, v.13, n.1, p 40-3, mar. 2010.
- [4]. MACCHI, AMD.; NUNZIO, CDDS. Fixed active retainer for minor anterior tooth movement. *Journal of Clinical Orthodontics.*, v. 34, n. 1, p 48-49, 2000.
- [5]. MADARIAGA, A. C.; BUCCI, R.; RONGO, R.; SIMEON, V.; D’ANTO, V.; VALLETTA, R. Impact of Fixed Orthodontic Appliance and Clear Aligners on the Periodontal Health: A Prospective Clinical Study, *Dent J.*, Basel, v.4, n.1, p 1-8, jan. 2020.
- [6]. MARINELLO, A.; COZZOLINO, F. Lingual active retainers to achieve teeth levelling in orthodontics: case series. *International dentistry sa.*, v.10, n. 5, p 24-29, 2008.
- [7]. MARTHA, K.; MEZEI, T.; JANOSI, K. A histological analysis of gingival condition associated with orthodontic treatment. *Rom J Morphol Embryol.*, v.54, n.3, p 823-827, nov. 2013.
- [8]. MUSSILI, M. The bracketless fixed orthodontics: nine years of clinical experimentation. *Prog Orthod.*, Salerno, v. 9 n. 1, p 72-91, 2008.
- [9]. SHARMA, A.; MATHUR, A.; BATRA, M.; MAKKAR, D. K.; AGGARWAL, V. P.; GOYAL, N.; KAUR, P. Avaliação objetiva e subjetiva da necessidade de tratamento ortodôntico do adolescente e seu impacto sobre a autoestima. *Rev Paul Pediatr.*, São Paulo, v. 35, n.1, p 86-91, mar. 2017.
- [10]. TAVARES, N; FONSECA, Jr. GL.; CAVALCANTE, GRG.; SOUTO, TNS.; PATO, BJM.; RAMACCIATO, JC. 3D-BOT – uma nova alternativa para tratamentos estéticos, confortáveis e previsíveis – relato de casos. *Orthod. Sci. Pract.*, v. 12, n.47, p 47-59, 2019.
- [11]. VIEIRA, G. M.; FRANCO, E. J.; GUIMARÃES, C. H. Alinhadores invisíveis: indicações, limitações biomecânicas e a problemática da mensuração das forças aplicadas. *Rev Clin Ortod Dental Press.*, Maringa, v. 12, n.1, p 94-104, 2013

Landscape of Family Farming in the Municipality of Naviraí-MS

Samuel Carvalho de Aragão¹, Márcio Teixeira Oliveira², Viviane Lima Catelan Moreira³, Renno de Abreu Araújo⁴, Matheus Bornelli de Castro¹, Daniel Zimmermann Mesquita¹, Fabio Yoshimi Wada¹, Priscila Gonzales Figueiredo¹, Bruno Toribio de Lima Xavier¹, André Carvalho Baida¹, Cristiano Moreira Oliveira³, Michely Cinquini Freire da Silva¹, Jorge Granja de Oliveira Junior³, Anderson Sanita⁵, Suellen Moreira de Oliveira², Ricardo Augusto Lins do Nascimento⁶

¹Federal Institute of Education, Science and Technology of Mato Grosso do Sul – IFMS campus Naviraí-MS, Brazil.

²Federal Institute of Education, Science and Technology of Mato Grosso do Sul – IFMS campus Três Lagoas-MS, Brazil.

³State Agency for Animal and Plant Sanitary Defense – IAGRO, Campo Grande-MS, Brazil.

⁴Federal Institute of Education, Science and Technology of Pará – IFPA campus Paragominas-PA, Brazil.

⁵Secretary of Professional and Technological Education - SETEC/MEC, Brasília-DF, Brazil.

⁶Federal Institute of Education, Science and Technology of Mato Grosso do Sul – IFMS campus Dourados-MS, Brazil.

Corresponding author

Email : samuel.aragao@ifms.edu.br

Received: 12 Sept 2021,

Received in revised form: 01 Nov 2021,

Accepted: 10 Nov 2021,

Available online: 18 Nov 2021

©2021 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 — *Family farming, Naviraí - MS. Agricultural production. Public policy.*

Abstract — *The municipality of Naviraí - MS doesn't differ in terms of land quality from the then new state of Mato Grosso do Sul created in 1977. However, the process of formation of the municipality began in the 1930's. The municipality of Naviraí and region is an agricultural production hub, with a prominent position in grain production, with the crops of corn, soybeans, cassava and sugar cane, in addition to agricultural production developed by family farming that meet the local market and public policies such as the Food Acquisition Program – PPA and the National School Feeding Program – PNAE. Thus, this work aimed to provide an overview of family agricultural production and public policies available to farmers in the municipality of Naviraí - MS. It was identified that the municipality has a great diversification in production and that it has been one of the protagonists in family agricultural production, with emphasis on horticulture being one of the largest producers in the state. This role is a reflection of the concern of Municipal, State and Federal Public Management in developing policies that foster local development, however, the minimal access of farmers to rural credit policies such as PRONAF was identified, soon it becomes necessary more publicity and technical support for greater reach of PRONAF, raising family farming in Naviraí - MS to even higher levels.*

I. INTRODUCTION

Responsible for meeting the population's food needs, family farming is one of the oldest activities in the world, that in addition to producing food, moves the economy, brings social, environmental and cultural impacts. This activity over the years has been synonymous with the diversification of food production, in addition to contributing to local and regional development, the fixation of man in the countryside having more sustainable agricultural practices, enabling greater safety and quality in the food supply, contributes to the preservation of the genetic heritage of cultures, preservation of traditional knowledge, among many characteristics that elevate the importance of Brazilian family farming.

Despite its high relevance to society, this family activity is experiencing serious difficulties in aspects related to the low level of education, access to credit, technologies, tools, aspects related to management, obstacles in the sale of products and problems related to infrastructure. The sustainability of family farming depends on public policies of the three entities of the Federation (Federal, State and Municipal) that will assist rural producers, since the State is responsible for ensuring the perpetuity of activities that contribute to local development, regional and national.

Therefore, it is essential for efficient public policies to be created to understand the reality of this activity both in social, economic, environmental and cultural aspects, as well as in the main cultures of the productive matrix of family farming. Once these aspects are known, public policies will meet the main needs and needs of these farmers who play a very important role in society.

Mato Grosso do Sul is one of the main states in agricultural production in Brazil, in this state the municipality of Naviraí - MS is located in the southern region, which has been a reference municipality in regional development in the Microregion of Iguatemi. Therefore, this study aimed to provide an overview of family agricultural production and public policies available to farmers in the municipality of Naviraí - MS.

a) The Mato Grosso do Sul state

Due to the great debate that has been taking place for decades among the population of Mato Grosso, political, economic, cultural issues, among others, where the discontent and anxiety of the Mato Grosso people was already clear and notorious, so that the federal government would carry out the division of the state, with the main objective of making the governability of the then large state viable [1].

This entire movement culminated with the creation of the state of Mato Grosso do Sul, through the publication of Complementary Law n° 31, October 11, 1977, and the implementation of the state in 1979. At the time, the state after being implemented was made up of 55 municipalities, with 453.000 inhabitants in the urban area and 547.000 in the rural area, with an area of 350.549 square kilometers with Dr. Harry Amorim Costa as its first governor [1] [2].

And over 44 years old, another 24 cities were created, totaling 79 in 2021, with an estimated population of 2.8 million people [3]. The main base of the economy is agribusiness, but it also stands out worldwide for its natural beauty [2].

In the division of states, Mato Grosso do Sul kept all the research structure existing at the time, which was in the south of Mato Grosso [2] [4]. The then created state of Mato Grosso do Sul is located in the central west region of Brazil, bordering the following countries Paraguay and Bolivia (1103 km) and with the following Brazilian states: Mato Grosso, Goiás, Minas Gerais, Paraná and São Paulo [2].

A Term of Adjustment was signed on February 8, 1979, which had the objective of establishing an administrative coexistence, seeking to streamline economic development activities through assistance between the parties aiming at the transfer of the existing patrimony and documentary collection that was already owned to the territory of Mato Grosso do Sul [5].

After 44 years of implementation in the state of Mato Grosso do Sul, the then young Brazilian state, became one of the largest grain producing states in the country, having the 5th largest cattle herd, with national prominence in the raising of pigs, poultry, fish, in the production of honey, cellulose, ethanol, among other agribusiness activities [2] [3].

b) The municipality of Naviraí

The municipality of Naviraí - MS does not differ in terms of land quality from the then new state of Mato Grosso do Sul created in 1977. However, the process of formation of the municipality began in the 30s. President Getúlio Vargas, aware of the potential of the lands in the Midwest region in which they were mostly unproductive implemented a process of development and colonization of the State. What would later be called Naviraí happened after the national context of the March to the West, which was a national policy that began in the 1930's, during the government of President Getúlio Vargas, in the period known as the Estado Novo. In this context, in 1937, the project began, which had as its central premise to promote economic integration and encourage the settlement of areas

in the Brazilian Midwest, which were underexplored and presented great opportunities for progress [6].

Therefore, the municipality of Naviraí was created as a result of a policy of occupation and private colonization promoted by the Federal Government in the early 1950's. These policies sought regional integration and development, bringing development to various locations and regions of the country. Such measures brought important transformations that allowed the process of land occupation, land tenure reorganization and local production based on agricultural activity, which was one of the main sources of economic gains over the years [7] [8].

The beginning of its foundation occurred in 1952 by Ariosto Riva and other companions, creating in this region the Colônia Vera Cruz Mato Grosso Ltda. resulting from the acquisition of two plots corresponding to a total area of 18.997 hectares. Later in 1963 the headquarters was called the "golden city" of the Southern Cone. The name of the municipality comes from an indigenous word that named a river in the locality. According to indigenous tradition, the words VIRÃ (purple/purple), Í (suffix for small), ÌVIRAÍ (small bush), NA (impregnate), I (river, stream) can mean either "small river impregnated with purple bushes", or "river impregnated with small purple trees" [9][10].

In 1958, through State Law No. 1195, of December 22, 1958, Naviraí was named as the district of Caarapó. A few years later, in 1963, the district was emancipated, elevating it to the status of a municipality through the 1944 State Law of November 11, 1963, which dismembered the lands of Caarapó [7] [11].

Naviraí is located in the south of the state of Mato Grosso do Sul, located 345 km from Campo Grande, capital of the state, has an estimated population according to the IBGE of 55.689 people, the municipality has a territorial dimension of 3.189 km² and an HDI (Human Development Index) of 0.7 . The municipality is located in a strategic region where important highways cross the locality. BR 163 is one of the main transport and connection corridors to other regions, MS 487 connects the region and the State of Paraná, and MS 141 connects the region to BR 267, connecting to some cities in the Eastern Region. In addition, there is river transport with the support of 3 ports, located on the Paraná River in the Southern Cone region [3][12].

According to the Secretary of State for the Environment and Economic Development – SEMADE, the municipality of Naviraí is located in a region known as Cone-Sul, formed by 8 municipalities: Eldorado, Iguatemi,

Itaquiraí, Japorã, Mundo Novo, Naviraí, Sete Quedas and Tacuru. This region is based on agricultural production, with a prominent position in grain production for the municipalities of Naviraí and Itaquiraí, with corn, soy and sugarcane crops, in addition to agricultural production developed by family farming. Among these municipalities, the most notorious economic hub is the municipality of Naviraí. In addition to the predominance of agriculture, the municipality has been showing growth in other segments such as industry and agribusiness, mainly in the food sector, in the processing of meat, grains, cassava, milk, sugar and alcohol, among other foods, with the verticalization of production [2].

Studies carried out by Pereira et al. (2017) [13] reinforce that of the 16 municipalities that make up the Microregion of Iguatemi in the state of Mato Grosso do Sul, where agricultural activity is one of the most important, Naviraí is the most prominent. Due to its population that is larger than other cities, achieving significant growth over the years, and the GDP that is above average. These factors have made the municipality a hub of the micro-region and can take the lead in the search for the region's development.

c) Family Farming in the municipality of Naviraí

According to Federal Law 11.326/2006 [14], anyone who practices activities in rural areas is considered as a family farmer, simultaneously meeting the following requirements:

"I - does not hold, for any reason, an area greater than 4 (four) fiscal modules; II - predominantly use labor from the family itself in the economic activities of its establishment or enterprise; III - have a minimum percentage of family income originating from economic activities of your establishment or enterprise, as defined by the Executive Branch and IV - run your establishment or enterprise with your family" [14].

According to Landau et al. (2012) [15] a fiscal module in the municipality of Naviraí corresponds to 45 hectares, thus a family farmer in this municipality is considered to be one who holds up to 180 ha. IBGE data (2017) [16] show the land distribution profile according to the size of the properties. According to Table 1, it is observed that, on average, up to 42.79% of establishments are in this range. However, it cannot be affirmed that this percentage corresponds exclusively to the lands where family farming is developed.

Table 1: Land structure in the municipality of Naviraí - MS

Municipality	Total Area Group	Total	2017	
			Family Farming – no	Family Farming – yes
			Total	Total
	Total	442	253	189
Naviraí (MS)	More than 0 to less than 0.1 ha	6	3	3
	From 0.1 to less than 0.2 ha	4	3	1
	From 0.2 to less than 0.5 ha	4	2	2
	From 0.5 to less than 1 ha	6	2	4
	From 1 to less than 2 ha	17	6	11
	From 2 to less than 3 ha	5	-	5
	From 3 to less than 4 ha	12	6	6
	From 4 to less than 5 ha	7	2	5
	From 5 to less than 10 ha	26	10	16
	From 10 to less than 20 ha	87	14	73
	From 20 to less than 50 ha	50	16	34
	From 50 to less than 100 ha	21	10	11
	From 100 to less than 200 ha	28	12	16
	From 200 to less than 500 ha	54	54	-
	From 500 to less than 1,000 ha	34	34	-
	From 1.000 to less than 2.500 ha	51	51	-
	From 2.500 to less than 10.000 ha	25	25	-
10.000 ha and more	3	3	-	
Producer without area	2	-	2	

Source: Prepared by the authors based on data from the Agricultural Census – IBGE (2017)[16].

In Naviraí there are two areas that house most of the family farmers, they are: the Juncal Settlement and the Green Area. Created on August 31, 2001, with an area of 24.531.67 hectares, the Juncal Settlement was created peacefully through a settlement project (PA) with capacity for 114 families [17].

The green area is located on Rodovia MS 141 – Km 03, with a total area of 42 hectares. The area is known as Distrito Verde, as it is an agricultural community, with projects financed by the federal, state, municipal and other institutions. The District has 34 families, 46 men and 35 women. The District's agriculture is based on the production of vegetables, fruits, vegetables and honey [18].

These two producing regions of the municipality have the support of organizations that work with the aim of strengthening the production processes and especially of

marketing and production management, they are the Women's Association of Settlement Juncal (Amaju), Navieraiense Association Terra e Paz (Antep) , Naviraí Family Farmers Cooperative (COAF-NV) and Juncal Settlement Producers Cooperative (Coopaju).

The analysis carried out by Silva and Ferreira (2019) [18] at COAF-NAV, founded in 2012, and working with producers in the District of Verde, showed that the number of members tends to grow annually, they are mostly male. over 35 years old. In the Verde District, the production consists of vegetables, fruits and honey, among which vegetables stand out the cabbage, parsley, watercress, mango, pineapple and lemon. Most of this production is sold in Naviraí, with 52% destined for schools and hospitals; 35% to markets and fairs 13% is distributed in neighboring cities.

Amaju is the Juncal Settlement Women's Association, made up of 18 women beneficiaries of the National Agrarian Reform Plan - PNRA. It was created in 2007 to initially commercialize sweets and semi country chicken. Currently the association is a member of COOPAJU. Currently, the association has seven women aged between 50 and 59 years [19].

II. PUBLIC POLICIES DEVELOPED IN THE AGRICULTURE OF NAVIRAÍ – MS

a) PRONAF as the first public policy to encourage and strengthen Brazilian family farming

Over the centuries, family farming has always been on the sidelines of public policies in the three spheres of the State, making this noble Brazilian activity unattended [20]. One of the factors that allowed this context is due to the fact that policies developed for rural areas since the colonial period benefit more employer agriculture [21] [22].

However, this context began to improve after the promulgation of the Federal Constitution in 1988, when several social movements and organizations called for policies to promote family farming. Therefore, in 1995, the National Family Agriculture Program (PRONAF) was created, which was later implemented by Presidential Decree N°. 1,946 in 1996 [23] [24]. Pimentel and Claudino (2020) [25] reinforce that the debates around public policies that benefit family farming gained more strength after the promulgation of the Federal Constitution.

Sousa and Niederle (2021) [26] point out that until the 1990s there was no specific national public policy to assist family farming. Therefore, PRONAF was the first public policy aimed at this segment [27]. The Program was created with the objective of encouraging the development of family farming, through the provision of financing for the production, acquisition of equipment and infrastructure in rural establishments with special interest rates [20] [28].

In addition, the authors add that the Program's premise is to provide the economic development of the farmer, as well as his permanence in the field. On the other hand, PRONAF proposes to socially strengthen family farming, in order to promote rural development, with increased productivity, improve the quality of life of these farmers, in addition to inserting them in the market [29].

Among several criteria defined in different PRONAF modalities and subprograms, one of the main ones for accessing rural credit is to qualify as a family farmer, as defined in Law 11.326, of July 24, 2006. This law defines the guidelines for the formulation of public policies for

family farming, in addition to defining the criteria and characteristics that delimit the family farmer [14].

PRONAF has four existing financing modalities, being used for funding, marketing, investment, industrialization or integration of quotas by beneficiaries in agricultural production cooperatives. Each modality has its criteria, credit limits, terms and interest rates depending on the financing purpose. Rates vary from 3% to 4.6% per year, with payment terms and advantages [30] [20] [31].

Within each modality there are subprograms destined for several beneficiaries, being the credit lines: Pronaf costing, more food, microcredit, agroindustry, FGPP - RES. 4801, Art. 1, agroindustry (investment), agrarian reform, semiarid, quota shares, women, forest, agroecology and youth. While PRONAF subsidizes the development of family farming through financing, the National School Feeding Program (PNAE) and the Food Acquisition Program (PAA) act as supporting factors in expanding the insertion of family farming products in the market [21] [47].

b) Public policies for the inclusion of family farming products in the market: National School Feeding Program (PNAE) and the Food Acquisition Program (PAA)

On June 16, 2009, the federal government published Federal Law 11,947, which amended Federal Law 8913 of July 12, 1994, providing measures and providing for the provision of school meals and the Direct Money Program at School to basic education students, changing all previous laws [32].

Among all the deliberations contained in Federal Law 11,947, in addition to the states transferring to municipalities the responsibilities of feeding students enrolled in basic education, an article published in the Law at the time came as a great challenge to be met in thousands of municipalities in Brazil regarding the acquisition of foodstuffs [32].

Article 14 of Federal Law 11,947 of June 16, 2009, determines that of the total financial resources transferred by FNDE, under the PNAE, at least 30% (thirty percent) must be used in the acquisition of foodstuffs directly from agriculture family and rural family entrepreneurs or their organizations, prioritizing agrarian reform settlements, traditional indigenous communities and quilombola communities [32].

As Federal Law 11.947 entered into force from the date of its publication, in Brazil several municipalities, mainly in the North, Northeast and Midwest regions, had difficulties in complying with the legislation a priori, since small producers were not yet organized in associations or

cooperatives, as well as, as a small individual producer prepared to issue invoices and logistics for the delivery of products, a situation that in many cases took up to 5 years to adapt to the new legislation [33].

Although the Midwest region had the most difficulties in adapting to the PNAE, the state of Mato Grosso do Sul was the first to adapt to the new legislation, and among the most prominent municipalities in the state, the municipality of Naviraí over the years it has been standing out, as it has through public policies introduced in family farming that has allowed it to reach rates much higher than what is determined by legislation, which means that basic education students have quality food [33].

c) Food Acquisition Program – PAA

Within the logic of decentralized management, the theme of food and nutrition security gained space on the Brazilian political agenda with the creation, in 1993, of the National Council for Food and Nutritional Security (CONSEA), under the Presidency of Itamar Franco (1992-1994). A set of actions was aimed at family farmers, with a double objective: to increase their income and to increase the supply of agricultural products for food. As for the first objective, it is important to consider that most families in conditions of misery and poverty in Brazil are family farmers [35].

The Family Farming Food Acquisition Program – PAA was created from an articulation of the National Council for Food and Nutritional Security – CONSEA with the Federal Government, being constituted as a structuring action in the context of the Zero Hunger proposal. Established by article 19 of Law 10.696/2003, the PAA is developed with resources from the Ministries of Social Development and Fight against Hunger - MDS and Agrarian Development - MDA. The PAA guidelines are defined by a Management Group, coordinated by the Ministries of Social Development and Fight against Hunger and composed of five other Ministries: Finance; Budget Planning and Management; Agriculture, Livestock and Supply, represented by the National Supply Company - CONAB; Agrarian Development and Education, represented by the National Education Development Fund – FNDE.

The PAA aims to provide food insecure populations with access to food and social and economic inclusion in the countryside, through the strengthening of family farming [35].

According to data provided by the Ministry of Social Development, the first PAA food purchases were made in 2003 from agrarian reform settlers at the Itamaraty Farm in Mato Grosso do Sul. Since then, the PAA has made important advances in terms of ensuring access to food,

promoting food and nutritional security for the population and supporting family farming [35].

Since its inception, the PAA modalities were managed directly by CONAB, or executed by states and municipalities with agreements with the Federal Government. As of Resolution No. 50 of September 26, 2012, the Institutional Purchase modality started to work through Public Tenders, in line with the functioning of the National School Feeding Program (PNAE). In 2013, the old agreements were exchanged for a Term of Adhesion by the states and municipalities which were interested in participating in the PAA. A new management was formed, where producers received payment according to the delivery of the products in a Banco do Brasil account, exclusive to the PAA [35].

In the Institutional Purchase modality, the PAA is one of the integrants of actions related to school feeding in the states and municipalities. However, there is no obligation to participate in the Program and its execution depends on a budget allocation established annually and on the interest of eligible institutions. Anyway, this PAA modality, in the old format of Food Acquisition to Serve School Feeding, started the association between family farming and school feeding, later expanded with Law nº 11.947/2009 [32] that regulates the Program National School Feeding (PNAE). Article 14 of this Law provides that:

“Of the total financial resources transferred by the FNDE, within the scope of the PNAE, at least 30% (thirty percent) must be used in the acquisition of foodstuffs directly from family farming and rural family entrepreneurs or their organizations, prioritizing settlements of agrarian reform, traditional indigenous communities and quilombola communities [32]”.

Although there are difficulties, participation in the PNAE opens up for the agrarian reform settlers the possibility of greater insertion and direct participation in the local economy, in addition to contributing to the maintenance of traditional eating habits.

The purchase of products from family farmers is carried out through Public Calls, which establish, in advance, a price list. These should not be greater than those practiced in wholesale and retail food, so as not to burden public purchases in relation to conventional bidding for products for school meals. At the same time, the reduction of marketing links through direct and local purchase can enable family farmers to receive values above those found in their traditional sales channels [36].

The PAA and the PNAE have suffered and are being criticized, it is clear that their existence is recognized and

they strengthen family farming as a food producer, it fosters the Brazilian economy by integrating other sectors of society.

d) Municipal public policies developed in family farming in Naviraí – MS

Since the 1990s, there had been an area of 20 alqueires in Naviraí purchased by the municipality with the aim of building an agricultural school. This area was located at a distance of approximately 7 km from the city center. However, the school project did not evolve and this area was donated to the federal government to build a prison in 2001. The prison area occupied 3 alqueires, with the other 17 alqueires in a situation of abandonment. In view of this situation, in 2005, AGRAER rural extensionists, represented mainly by Agronomist Ronaldo Botelho, decided to start work with the competent bodies to reintegrate the area that the prison did not use for the municipality again. And with the possession of this area, the Green District Project began in Naviraí.

The Green District project was designed to primarily serve those farmers in the “Feira do Produtor Rural”, who were mostly tenants and did not own the land where they were producing. In this way, the total area of the Green District, which is approximately 43.4 hectares, was divided into 34 properties of 1.2 hectares for each family, already containing a 32 m² house, a semi artesian well and a community water reservoir. The only thing the project recipients would pay for would be the construction of the house.

In addition to the farmers who already had experience in the production of vegetables, some people who had no direct connection with agriculture were also awarded an area in Distrito Verde. The biggest challenge was to provide conditions so that these people could produce satisfactorily so that they could sustain themselves and evolve both in the technical part and in the economic and social parts.

According to the project's mentor, Agronomist Ronaldo Botelho, the main objective of Distrito Verde was to create opportunities for access to land, food responsibility, price balance, income, the generation of new jobs, the reduction of the circulation of produce on the roads and supplies.

At first, there was a certain fear among farmers about moving to a location close to a federal prison. However, after the awareness work carried out with the people about the opportunity and also about the safety of the place, many interested people started to appear. Subsequently, people were selected through interviews and questionnaires carried out by AGRAER technicians.

After the initial period of implementation, there were some difficulties regarding technical, economic and relationship issues among some farmers. One of the difficulties presented was the impossibility of accessing rural credit at first, due to the fact that the producer would only have the title deed after the settlement of the 32 m² house with the Housing Agency of Mato Grosso do Sul (AGEHAB).

One of the most outstanding characteristics of family farming is the diversification of production, which allows farmers to produce and generate income during the twelve months of the year. In addition to the economic, social, environmental and cultural benefits of this activity, it is the result of this construct, production, which makes it possible to generate income and provide a better quality of life for producers. One of the main channels most used in Brazilian municipalities for the sale of products from family farming is open markets [37].

As it is considered an easy-access, less bureaucratic and more viable marketing channel, farmers choose this channel due to its ease. Therefore, in Naviraí, many rural producers sell their products at Feira da Lua, Feira do Mercado Municipal and in strategic places in the city where family farmers park their vehicles and sell their products. While another portion sells its products through middlemen, restaurants, bakeries, supermarkets, PNAE, PAA, among others.

The Municipality of Naviraí - MS, through the Economic Development Management, has all the equipment and agricultural implements necessary to serve family farmers in the municipality. In the rural settlement, a green district like any other family farmer in the municipality, which greatly favors the entire production system of family farming in the municipality.

As this is an activity carried out in the countryside, it is essential to maintain the local roads that connect farmers, suppliers and other agents in the production chain, allowing for the logistics of products and inputs from the field to the city. According to the Municipality of Naviraí, the municipality has 900 km of side roads in its territorial area that provide access to various rural properties, being important channels to transport agricultural production from the countryside to the urban environment, allowing access.

e) Rural Extension, Technical Assistance and Agricultural Research - AGRAER.

The Agrarian Development and Rural Extension Agency - AGRAER, an entity of the state executive, co-responsible for the promotion of rural development, linked to the State Secretariat for the Environment, Economic Development, Production and Family Agriculture

(SEMAGRO), acts in the definition of provision policies of services and coordination of the implementation in the activities of Technical Assistance, Rural Extension, Agricultural Research, Cartography, Land Regularization and Supply and other services related to the development and improvement of agriculture and livestock, aimed at rural producers, their families and organizations (Individuals and Legal Entities) with priority given to family farmers, namely, traditional farmers, settlers, indigenous people, quilombolas, fishermen and aquaculturists [38].

It is among the institutions authorized to issue the Pronaf Aptitude Statement. The Declaration of Aptitude (DAP) to the National Program for Strengthening Family Agriculture (Pronaf) functions as the identity of the family farmer. It is what allows agricultural families access to different public policies, such as: financing (Pronaf), agrarian reform credits (Federal Government settlements), rural housing program, product certifications (seals), professional training courses (Pronatec), food sales in schools (school lunches), hospitals and military institutions, among others. "DAP is the gateway for family farmers to public policies to encourage production and income generation. Currently, it is estimated more than 5.1 million active DAP's throughout Brazil. In Mato Grosso do Sul, 18.153 family farmers are in possession of the document, while 67 associations or cooperatives make use of the Legal DAP [39].

f) Inspection, Inspection, Health Education and Agricultural Control - IAGRO.

The State Agency for Animal and Plant Sanitary Defense of the State of Mato Grosso do Sul - IAGRO, was created by Decree-Law n° 9, of January 1, 1979. Linked to the State Secretariat for Production of Agrarian Development, Industry, of Trade and Tourism [40].

IAGRO, through the delegation of the Ministry of Agriculture, Livestock and Supply, carries out the actions of the Animal and Plant Sanitary Programs that aim to: implement public education, health, inspection and inspection policies to promote, maintain and restore animal health and plant, the quality of its products and by-products through health protection, control, inspection and inspection of products and by-products of agricultural origin, inspection of agricultural inputs and biosafety activities, to ensure human health. Fulfill and enforce the operational obligations delegated by the Executive Branch, dealt with in the legislation regarding the protection of animal and plant health and the control and inspection of agricultural products, goods and services, processes and technologies achieved by the agricultural health care system [41].

It provides technical and administrative support to the Municipal Animal Health Councils [42] and the Municipal Council for Sustainable Rural Development [43].

Mato Grosso do Sul's ARTE Seal will enable handcrafted products of animal origin to be marketed throughout Brazil. Obtaining the ARTE Seal is a certificate that the production is in compliance with good agricultural practices and the products are in compliance with good manufacturing practices and enable them to increase income, add value to production and expand markets [44].

III. OBJECTIVE

The objective this paper was make an overview of family farming production and public policies available to farmers in the municipality of Naviraí - MS

IV. METHODOLOGY

a) Research Outline

This work was carried out through a bibliographical survey on family farming in the municipality of Naviraí MS. Data were collected from public agencies that provide assistance to family farmers in the city, as well as from publications on the topic discussed, classifying it as qualitative research [45].

b) Characteristics of family farming in Naviraí MS

As already mentioned, the profile of family farming (Table 2) in Naviraí MS is similar to that of the entire state of Mato Grosso do Sul and Brazil. Producers with complete elementary education level, families where father, mother and a large percentage of their children work in the cultivation of the land, live on rural properties with water, electricity and, in many cases, even connectivity.

They cultivate and market their products and live on a family income between 2 and 3 minimum wages. In most cases, they sell their products without the presence of the middleman, at open fairs, commerce and or even sell their products from the property and buyers will look for the products at the property.

As it is a municipality where the vast majority of properties are not available, a long distance to the center of the municipality facilitates the commercialization process, and also because the connectivity allows for better communication with the buyer, factors that have helped in daily activities of the family farmer.

Data were collected from the Municipality of Naviraí, on the Juncal settlement and also on the Verde District,

two poles of great importance for family farming in the municipality. As well as the last agricultural census in Brazil, which was in 2017.

V. RESULTS AND DISCUSSION

The land ownership structure in the municipality of Naviraí - MS is mostly concentrated in large land properties. This fact becomes evident since in 2017 of the 442 rural establishments in the municipality, only 189 (42.8%) were family farming, while 253 (57.2%) were not family farming according to the criteria defined by law . As illustrated in the data in the table 1 below.

Table 2 - Number of rural establishments in Mato Grosso do Sul and in the municipality of Naviraí - MS

	Family farming	%	No family farming	%	Total
Mato Grosso do Sul	43.223	60,7%	27.941	39,3%	71.164
Naviraí	189	42,8%	253	57,2%	442

Source: Prepared by the authors based on data from the Agricultural Census – IBGE (2017).

What differs from some Brazilian states as mentioned by Araújo et al. (2021) [46], in the state of Pará, family farmers represent 85% of the total number of rural establishments. In the state of Paraná, according to data from the 2017 Agricultural Census, 228.888 properties (75%) are family farming establishments. Most of the farmers who run the rural family farming establishments in Naviraí - MS are in the age group of 55 to less than 75 years of age reaching 99 farmers (52.4%) while 18.5% are 45 years old or younger. of 55 years old, 12.2% are between 35 and under 45 years old, as the percentages are allocated in the class of 25 to less than 35 years old with 5.8% and 75 years old above with 11.1% [16].

Therefore, it is clear that most of the family farmers who run the establishment are middle-aged above. Of these 189 farmers, 175 (92.5%) know how to read and

write while 14 do not, in relation to education only 24 (12.6%) have completed elementary school, in relation to high school 37 (19.5%) have this training in some modality being EJA, high school technician, former scientific, classical or regular high school education, only 27 (14.2%) have higher education (undergraduate) and only 1 has a master's degree, so that the others have incomplete primary education and have never attended school. This reality is in complete contrast to the other 236 establishments that are run by farmers who are not part of family farming, in which the level of education is well above that of family farmers, a fact which is observed that 109 (46.1%) of the farmers have some college degree, 57 (24.1%) have high school and 27 (11.4%) have primary education, while the other parcels are incomplete primary and a very small percentage never attended school.

Table 3 - People employed in rural establishments in Brazil, Midwest Region, Mato Grosso do Sul and in the municipality of Naviraí - MS in 2017

	Family farming	%	No family farming	%	Total number of establishments	%
Brazil	10.115.559	67,0%	4.989.566	33,0%	15.105.125	100%
Midwest	557.149	46,8%	632.678	53,2%	1.189.827	100%
Mato Grosso do Sul	102.323	40,1%	152.648	59,9%	254.971	100%
Naviraí - MS	497	20,5%	1.929	79,5%	2.426	100%

Source: Prepared by the authors based on data from the Agricultural Census – IBGE (2017).

According to Table 2, from a total of 2,426 people employed in rural establishments in the municipality of Naviraí - MS, 497 people (20.5%) are employed in family

farm establishments and 1929 workers (79.5%) do not qualify as not family farmers.

In relation to people employed in the rural countryside in Brazil, 67% of the rural workforce is allocated to family

farming, in the Midwest this reality is different with only 47% of the workforce coming from family farming. The state of Mato Grosso is a reflection of the Midwest region with 40% of the workforce in family farming agricultural establishments. In the municipality of Naviraí, the reality of the labor employed in the countryside is totally different, with only 20.5% of the labor originating from family farming [16]. However, it is noteworthy that it is observed in the municipality of Naviraí - MS that there are numerous small productions of horticultural products produced in urban areas and on the outskirts of the city these products are marketed as if they were from family farming, but from urban production.

Within this scenario experienced in the municipality of Naviraí, it contrasts with the reality experienced in Brazil, in the Midwest region and in the state of Mato Grosso do Sul, where the cultivation of sugarcane, eucalyptus and commercial agriculture are activities developed on a large scale in the State and in the municipality where the large agribusiness workforce in the municipality is employed. And that it has large agribusinesses that employ thousands of residents.

It is a reality that most family farmers have difficulties in accessing equipment, technologies, tools, aspects related to management, marketing, lack of technical assistance, insufficiency of financial resources, among other factors that limit their performance in the field [20]. Knowing that with respect to connectivity, more than 70% of properties

have access to the internet and/or other means of communication, preserved back roads and access to education. In 2017, according to data from the Census of Agriculture of the 189 rural family farming establishments, only 65 received some type of technical guidance carried out by the Government (federal, state and municipal), owned and by cooperatives. Of these, 44 (67%) were carried out by federation entities, while 124 rural establishments did not receive any type of technical guidance [16].

In 2019, the municipality carried out a number of 1.112 repeated visits to rural properties. In 2020, this number decreased, with 895 technical visits being carried out. It is noteworthy that since March 2020 the country has been facing many adversities in all operational aspects due to the sanitary issues of COVID-19, which impacted and will still cause serious damage to family farming.

According to IBGE municipal agriculture data (2019) [45], the main crops exploited in the municipality are listed in table 4. Among the crops, it is known that beans, cassava and watermelon stand out among family producers. Although these species figure with relevance among this class of farmers, the absence of official data on the origin of production does not allow for a precise diagnosis.

Table 4- Species cultivated in the municipality of Naviraí, according to the municipal agricultural survey - IBGE 2019.

State Position*	culture	Planted area (ha)	Harvested area (ha)	Quantity produced (ton.)	Average production yield (kg/ha)	Production Value (Thousand Reais)
20°	total	167.860	167.860	R\$ 458.579,00
18°	oat grain	150	150	150	1.000	R\$ 53,00
23°	sugar cane	14.323	14.323	1.080.051	75.407	R\$ 84.957,00
49°	beans	72	72	154	2.139	R\$ 327,00
8°	manioc	2.265	2.265	45.300	20.000	R\$ 14.838,00
5°	watermelon	120	120	2.400	20.000	R\$ 1.440,00
16°	corn grain	60.000	60.000	252.000	4.200	R\$ 112.203,00
15°	soybean grain	90.000	90.000	225.000	2.500	R\$ 243.675,00
12°	sorghum	260	260	1.040	4.000	R\$ 416,00
10°	wheat	670	670	804	1.200	R\$ 670,00

* Position in relation to the planted area

Source: Prepared based on data from the Municipal Agriculture Survey (PAM) – IBGE (2019).

The productive matrix of family farming is well diversified in the municipality of Naviraí - MS, with a very representative production compared to other municipalities in the state of Mato Grosso do Sul in terms of horticulture. One of those responsible for this expressive production

together with other farmers is the Green District, whose production is based on vegetables, greens and legumes [18]. The table below provides a retrospective of the main crops produced by family farming in Naviraí according to the 2017 Agricultural Census.

Table 5- Main crops produced by family farming in Naviraí - MS and its position in family farming in the State and in total production in 2017

	Culture	Total Production (in tons) Naviraí - MS	Family Farming Production (in tons) Naviraí - MS	% Produced by Family Farming in relation to Total	Position of Naviraí - MS in family farming production	Overall Total Production (in tons) of Mato Grosso do Sul	Production (in tons) of Family Farming in Mato Grosso do Sul	% produced by Family Farming in relation to the Total	Position of Naviraí - MS in the State's total production
Horticulture	Lettuce	280	275	98,21%	5°	8.228	5.536	67,28%	5°
	Almeirão	67	66	98,51%	3°	1.033	861	83,35%	5°
	Broccoli	2	2	100,00%	9°	175	106	60,57%	19°
	Scallion	52	51	98,08%	4°	1.278	821	64,24%	6°
	Carrot	3	3	100,00%	8°	362	248	68,51%	14°
	Coriander	19	19	100,00%	5°	475	397	83,58%	7°
	Green cabbage	26	24	92,31%	7°	1.425	1.021	71,65%	15°
	Bell pepper	1	1	100,00%	10°	443	336	75,85%	23°
	Okra	7	6	85,71%	13°	1.382	1.303	94,28%	24°
	Arugula	57	56	98,25%	3°	1.114	724	64,99%	4°
Parsley	58	57	98,28%	2°	647	535	82,69%	2°	
Temporary cultures	Pumpkin, pumpkin, Jerimum	4	3	75,0%	35°	3.432	2.724	79,4%	52°
	Cassava (cassava, cassava)	45.747	4.004	8,8%	11°	403.080	174.276	43,2%	3°
	watermelon	1	1	100,0%	25°	28.953	7.418	25,6%	79°
	Corn	304.772	101	0,0%	50°	9.232.573	367.225	4,0%	15°
	Soy	275.104	924	0,3%	40°	8.064.607	284.188	3,5%	19
	Forages for cutting	39	39	100,0%	1°	27.448	1.228	4,5%	7°

Table 5 does not contain data on permanent crops because the 2017 Agricultural Census does not present data on this type of crop in family farming [16]. Regarding the production of family farming horticulture in Naviraí - MS, the municipality occupies a prominent position in all

its products in relation to 79 municipalities in the state of Mato Grosso do Sul, with emphasis on the production of parsley, arugula, almeirão, chives and lettuce. And in other products, the one with the lowest production is the okra occupying the twenty-fourth position [16].

Observing the temporary crops, it is worth mentioning the forage crop for cutting and the production of cassava. Where the forages for cutting are destined to feed milk cows and the production of cassava destined for industrialization in starch factories, which is culturally this production in the municipality.

In addition to family farming producing for their own subsistence, part of the production is destined for sale. One of the most used channels for the sale of products from family farming is the municipal market and open markets. Known as the Municipal Market of Naviraí, it is the place where several farmers sell their products. According to Pereira et al. (2018) [13], the municipal market enables integration and social interaction, integration because it allows farmers to exhibit and market their products in a shared space, making contact with the final consumer more accessible. On the other hand, it guarantees the interaction between farmers and consumers in a single space, strengthening and valuing local culture.

Programs such as PNAE and PAA have the objective of inserting family farming products into the market, ensuring the sale of family farmers' products, bringing development to producers. In the study by Teixeira, (2020) [51] it was identified that the PNAE causes positive impacts for the Brazilian rural entrepreneur, such as: increased income, promotion of social inclusion, improvement in quality of life and ease of access to the market. The graph 1 below shows the financial values and number of contracts for the PRONAF, PNAE and PAA programs in the years 2019 (Table 5) and 2020 (Table 6).

Graph 1: Values in Reais of the Programs: PRONAF, PNAE and PAA in 2019 and 2020 in the municipality of Naviraí - MS

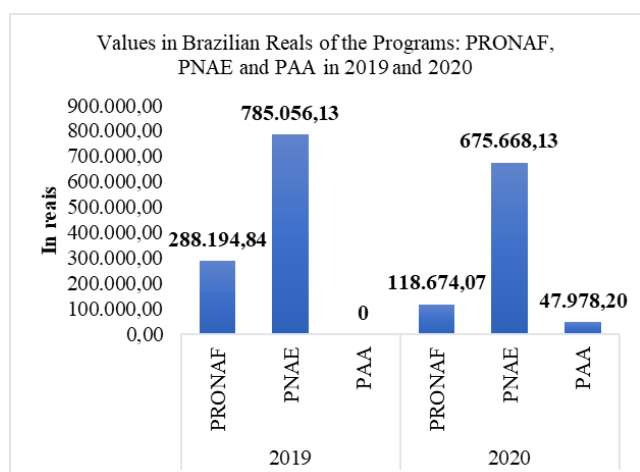


Table 6: Contracts completed in 2019 by type

	2019		
	PRONAF	PNAE	PAA
No. of Contracts	9	38	0

Table 7: Contracts completed in 2020 by type

	2020		
	PRONAF	PNAE	PAA
No. of Contracts	5	49	6

Of the 79 municipalities in the state of Mato Grosso do Sul, the municipality of Naviraí occupied in 2019 the 73rd position in terms of funds received from PRONAF. In 2020, this scenario worsened, given that the pandemic caused by the SARS-CoV-2 virus (COVID-19) took the municipality to the last position in the ranking [47], we cannot mention COVID-19 as the major cause of reduction in PRONAF contracts, since according to public data from the Brazilian Central Bank, in 2019 only 9 PRONAF contracts were executed, which placed the municipality in 73rd position as mentioned above. This shows that the small producer is not having access to this public policy that is so important in the production process for Brazilian food, only 4.76% of family farming establishments had access to PRONAF considering that there was no repetition of contracts in the same property.

PRONAF is an important program of the Federal Government with the objective of strengthening family agriculture, through it the farmer manages to alleviate some adversities in the countryside with the concession of rural credit. Therefore, there is a positive impact with the permanence of man in the countryside; the increase in productive capacity; acquisition of equipment, supplies and technologies; improvement in the infrastructure of the properties; improvement in the lives of farmers; among many other benefits that contribute to rural development [46] [28] [31].

On the other hand, the PNAE had a significant financial volume both in the total value of contracts and in the number of contracts carried out in 2019 and 2020. Although there was a small decrease of about 14% in the value of total contracts, however there was an increase in the number of contracts, increasing from 38 contracts in 2019 to 49 in 2020, enabling greater participation of farmers. As for the PAA, there were no contracts in 2019,

but in 2020, 6 contracts were executed in the amount of BRL 49.978.20.

VI. CONCLUSION

When researching production data from family farming in Naviraí MS, we realized that the municipality invests a lot in family farming, a great example of this is the Juncal settlement and the green district where family farmers have technical assistance, support of agricultural implements at their disposal, health and education, with this support, the production of horticulture and temporary crops has reached prominent positions in production in relation to the 79 municipalities of Mato Grosso do Sul, an example of which is the production of parsley, almeirão, chives and cassava, which are among the first in the state production.

The study identified that although farmers in Naviraí do not have more significant support and insertion in rural credit provided by PRONAF in order to encourage and strengthen their activities, however, although there are these difficulties faced by this class of rural workers, even so, some farmers manage to market their products in programs such as the PNAE, which are acquired for school lunches. This fact demonstrates that farmers have overcome the difficulties faced and managed to guarantee the marketing, income and sustenance from their products from the family, even if there is a deficiency of public policies that encourage, strengthen and develop this activity in the County. However, greater support, incentives and subsidies are essential for this class that is so in need of welfare actions, responsible for supplying a considerable part of the domestic market.

REFERENCES

- [1] Barcelos, J. (2015). Mato Grosso do Sul - 1978/1979 - Utopia x Realidade. Editora Simplíssimo Livros.
- [2] SEMAD. (2015). Estudo da Dimensão Territorial do Estado de MS: Regiões de Planejamento. Retrieved July 6, 2021, from http://www.semagro.ms.gov.br/wp-content/uploads/2017/06/estudo_dimensao_territorial_2015.pdf
- [3] IBGE. (2021). Município de Naviraí 2020. Retrieved May 26, 2021, from <https://www.ibge.gov.br/cidades-e-estados/ms/navirai.html>
- [4] Costa Junior, E. M. A. e. a. (1983). A pecuária de corte na economia Sul matogrossense. Embrapa.
- [5] MATO GROSSO DO SUL. (1979). Lei de criação do Mato Grosso do Sul. TJMS. Retrieved July 13, 2021, from https://www.tjms.jus.br/legislacao/public/pdf-legislacoes/decreto-lei_n_9.pdf
- [6] Gonçalves, D. L. (2015). A colonizadora Vera Cruz Mato Grosso Limitada e a formação de Naviraí [Doctoral dissertation, Universidade Federal da Grande Dourados].
- [7] Rodrigues, W. O. P., & Dornelas, T. M. (2018). Formação territorial e dinâmica produtiva do município de Naviraí-MS. Encontro Internacional de Gestão, Desenvolvimento e Inovação (EIGEDIN).
- [8] Zacarias, G. C., & Pereira, J. A. (2018). território e desenvolvimento local: estudo sobre a constituição do município de Naviraí-MS como pólo urbano regional. Encontro Internacional de Gestão, Desenvolvimento e Inovação (EIGEDIN).
- [9] Bem, A. (2018). A mulher no espaço rural de Naviraí-MS: êxodo ou permanência. Revista Pantaneira, 17, 8-16.
- [10] Almeida, R. M. R. (2018). Bibliotecas escolares: história e cultura escolar em Naviraí – MS (1986-2010) [Master's thesis, Universidade Estadual de Maringá].
- [11] Zacarias Santos, J. F. (2019). A dinâmica de mobilizações dos Guarani e Kaiowa no estado de Mato Grosso do Sul: uma etno-história da luta pela terra na Comunidade Indígena Kurupi de Santiago Kue [Doctoral dissertation, Universidade Federal da Grande Dourados].
- [12] Silva, W. G., & Aguillera, F. F. (2019). Dinâmica e articulação econômica do município de Naviraí-MS no contexto da geografia regional sul-mato-grossense. Geografares, (29), 54-70.
- [13] Pereira, C. H. et. al. (2018). Análise SWOT e visão baseada em recursos como suporte à formulação do planejamento estratégico: um estudo no mercado municipal de Naviraí-MS. Revista Eletrônica Gestão e Serviços, 9(1), 2232-2249.
- [14] BRASIL. (2006). Lei Federal 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. Retrieved March 16, 2021, from http://www.planalto.gov.br/ccivil_03/Atos2004-2006/2006/Lei/L11326.htm.
- [15] Landau, E. C., Cruz, R. K., Pimenta, F. M., & Guimarães, D. P. (2012). Variação Geográfica do Tamanho dos Módulos Fiscais no Brasil. Retrieved May 24, 2021, from <https://aiba.org.br/wp-content/uploads/2013/11/variacao-Geografica-do-Tamanho-dos-Modulos-Fiscais-no-Brasil-Embrapa.pdf>
- [16] IBGE. (2017). Censo Agropecuário 2017 resultados definitivos. Retrieved February 2, 2021, from <https://sidra.ibge.gov.br/pesquisa/censo-agropecuario/censo-agropecuario-2017>
- [17] INCRA. (2017). Incra nos Estados - Informações gerais sobre os assentamentos da Reforma Agrária. Retrieved April 27, 2021, from <https://painel.incra.gov.br/sistemas/index.php>
- [18] Silva, H. H., & Ferreira, A. d. S. (2019). O cooperativismo e a agricultura familiar no Distrito Verde, Naviraí/MS. Encontro Internacional de Gestão, Desenvolvimento e Inovação (EIGEDIN).
- [19] MAPA. Vitríni da agricultura familiar. Disponível em: <https://sistemas.agricultura.gov.br/vitrine/ produtor/09336636000183/index.html>. Acesso em: 23 jun.2021.

- [20] Castro, C. N. d., Resende, G. M., & Pires, M. J. D. S. (2014). Avaliação dos impactos regionais do Programa Nacional da Agricultura Familiar (PRONAF). Instituto de Pesquisa Econômica Aplicada – IPEA.
- [21] Reifschneider, F. J. B. e. a. (2010). Novos ângulos da história da agricultura no Brasil. Embrapa Informação Tecnológica.
- [22] Beltrame, G., & Ravanello, F. d. S. (2015). Benefícios socioeconômicos ocasionados pelo PRONAF para o desenvolvimento da agricultura familiar. 4º Fórum Internacional Ecoinovar, Santa Maria.
- [23] Fossá, J. L. e. a. (2020). Acesso e Distribuição do Pronaf entre Agricultores Familiares no Estado de Santa Catarina. *Desenvolvimento em Questão*, 18(53), 222-244.
- [24] Grisa, C., Wesz Junior, V. J., & Buchweitz, V. D. (2014). Revisitando o Pronaf: velhos questionamentos, novas interpretações. *Revista de Economia e Sociologia Rural*, (52), 323-346.
- [25] Pimentel, W., & Claudino, L. S. D. (2020). Políticas públicas para agricultura familiar: avaliação do acesso ao PRONAF entre feirantes de uma associação de agricultores em Abaetetuba, Pará. *DESAFIOS - Revista Interdisciplinar da Universidade Federal do Tocantins*, 7(3), 294-303.
- [26] Souza, D. N., & Niederle, P. A. (2021). Pronaf e inclusão produtiva dos agricultores familiares: estudo de caso no Estado do Tocantins. *Revista Grifos*, 30(51), 378-397.
- [27] Lima, A. F., & Iwata, B. F. (2019). Agriculturas e agricultura familiar no Brasil: uma revisão de literatura. *Retratos de Assentamentos*, 22(1), 50-68.
- [28] Sena, A. S., & Barbosa, K. L. (2017). Agricultura familiar e políticas públicas de desenvolvimento rural: um estudo do Programa Nacional de Fortalecimento da Agricultura Familiar no município de Capanema, nordeste paraense, Amazônia Oriental [Dissertation, Universidade Federal Rural da Amazônia].
- [29] Pessôa, E. C. S. (2007). Agricultura familiar no Nordeste Paraense: um estudo de caso do PRONAF na comunidade Santa Ana-PA, Itabocal, Mãe do Rio (PA) [Master's dissertation, Universidade Federal do Pará].
- [30] BRASIL. (2020). Boletim mensal sobre os subsídios da União – Programa Nacional de Fortalecimento da Agricultura Familiar (15). Secretaria de Avaliação, Planejamento, Energia e Loteria. https://www.gov.br/economia/pt-br/centrais-de-conteudo/publicacoes/boletins/boletim-subsidios/arquivos/2020/pronaf_boletim_subsidiios.pdf/@download/file/pronaf_boletim_subsidiios.pdf
- [31] Malysz, P. A., & Chies, C. (2012). A importância do Pronaf na permanência do agricultor familiar no campo. XXI Encontro Nacional de Geografia Agrária. Territórios em disputa: Os desafios da geografia agrária nas contradições do desenvolvimento brasileiro, Uberlândia.
- [32] BRASIL. (2009). Lei Federal 11.947 - Programa Nacional de Alimentação Escolar PNAE (11947). Diário Oficial da União. http://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2009/Lei/L11947.htm
- [33] Machado, P. M. O. e. a. (2018). Compra de alimentos da agricultura familiar pelo Programa Nacional de Alimentação Escolar PNAE: Estudo transversal com o universo de municípios brasileiros. <https://www.scielo.org/article/csc/2018.v23n12/4153-4164/pt/>.
- [34] Silva, M. C. (2018). Compra de alimentos da agricultura familiar pelo Programa Nacional de Alimentação Escolar PNAE: Estudo transversal com o universo de municípios brasileiros. <https://www.scielo.org/article/csc/2018.v23n12/4153-4164/pt/>.
- [35] BRASIL. (2003). Ministério do Desenvolvimento Social. Programa de Aquisição de Alimentos – PAA.
- [36] Baccarin, J. G. (2011). Agricultura familiar e alimentação escolar sob a vigência da Lei 11.947/2009: adequação das chamadas públicas e disponibilidade de produtos no estado de São Paulo em 2011. Congresso da Sociedade Brasileira de Economia, Administração e Sociologia Rural, Vitória.
- [37] Carvalho, F. F., & Grossi, S. F. (2019). A importância das feiras livres e seus impactos na agricultura familiar. *Revista Interface Tecnológica*, 16(2), 226-234.
- [38] AGRAERA. (2021). Agência de Desenvolvimento Agrário e Extensão Rural - Carta de serviços. <https://www.cartasdeservicos.ms.gov.br/category/semagro/agraer/>.
- [39] AGRAERb. (2021). Agência de Desenvolvimento Agrário e Extensão Rural - Declaração de Aptidão (DAP). <http://www.agraer.ms.gov.br>.
- [40] IAGRO. (2021). Agência de Defesa Sanitária Animal e Vegetal - Apresentação da IAGRO. Retrieved July 8, 2021, from <https://www.iagro.ms.gov.br/apresentacao/>
- [41] MATO GROSSO DO SUL. (2020). Decreto Nº 15.519, DE 14 de outubro de 2020. Reorganiza a estrutura básica da Agência Estadual de Defesa Sanitária Animal e Vegetal (IAGRO), e dá outras providências. Diário Oficial.
- [42] IAGRO. (2003). Resolução CESA/IAGRO – Nº 002/2003 de 18 de Agosto de 2003. Aprova o Regimento Interno dos Conselhos Municipais de saúde Animal, do estado de Mato Grosso do Sul, de que trata a lei nº 1.953, de 09 de abril de 1999 e dá outras providências. Diário Oficial. http://www3.servicos.ms.gov.br/iagro_ged/pdf/473_GED.pdf
- [43] CMDR. (2021). Conselho Municipal de Desenvolvimento Rural. Retrieved September 4, 2021, from <https://navirai.ms.gov.br/noticia/navirai-empossa-novo-conselho-municipal-de-desenvolvimento-rural>.
- [44] DIPOA. (2020). Cartilha sobre a concessão do selo ARTE no Estado de Mato Grosso do Sul - IAGRO. Retrieved September 26, 2021, from <https://www.iagro.ms.gov.br/wp-content/uploads/2020/12/Cartilha-Concessao-Selo-Arte-2.pdf>.
- [45] IBGE. (2019). Instituto Brasileiro de Geografia e Estatística. Produção agrícola municipal 2019. Retrieved June 20, 2021, from <https://www.ibge.gov.br/estatisticas/economicas/agricultura-e-pecuaria/9117-producao-agricola-municipal-culturas-temporarias-e-permanentes.html?=&t=resultados>.
- [46] Araújo, R. d. A. e. a. (2021). Rural Credit in Family Agriculture: An analysis of the distribution of PRONAF

resources in Pará from 2016 to 2020. International Journal of Advanced Engineering Research and Science (IJAERS), 8(9), 125-137.

- [47] BCB. (2021). Matriz de dados de Crédito Rural - Contratações.
<https://www.bcb.gov.br/estabilidadefinanceira/micrrural>
- [48] Grisa, C., & Schneider, S. (2019). Três gerações de políticas públicas para a agricultura familiar e formas de interação entre sociedade e estado no Brasil. Revista de Economia e Sociologia Rural, 52(1), 125-146.
- [49] Teixeira, D. M. (2020). Impactos do PNAE para o empreendedor familiar rural brasileiro. Revista Livre de Sustentabilidade e Empreendedorismo, 5, 109-132.

Multidisciplinary treatment in cases of dental agenesis - literature review

Almir Angelo Ximenes da Silva¹, Lucielen dos Santos Sousa¹, Natalia Campos Bahia¹, Rebeca Luzia Solarte Barbosa¹, Rodrigo Marocchio Pavane², Mário Jorge Souza Ferreira Filho¹

¹Centro Universitário do Norte – UNINORTE, Manaus/AM – Brasil

²Centro de Ensino e Pesquisa em Reabilitação Oral – CEPROEDUCAR, Manaus/Amazonas - Brasil

Received: 22 Sept 2021,

Received in revised form: 06 Nov 2021,

Accepted: 12 Nov 2021,

Available online: 18 Nov 2021

©2021 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—Anodontia, dental implantation, orthodontic appliances, quality of life.

Abstract—Tooth agenesis is the absence of one or more teeth in both deciduous and permanent dentition. This anomaly occurs during intrauterine life and is usually associated with other developmental anomalies. It is one of the most common anomalies in human beings, affecting about 25% of the population, with higher prevalence in females. The aim of this study was to perform a literature review on the multidisciplinary treatment between orthodontics and implant dentistry in cases of tooth agenesis. The affected patients require orthodontic treatment prior to implant installation because, in addition to aesthetic dissatisfaction, they also present with functional complications such as Class II and III malocclusions. This approach is still not widely used and studies are scarce, but it is the best when the goal is to restore aesthetics and function to the patient. An effective orthodontic treatment performed before installing an implant is of utmost importance to achieve good results at the end of treatment. The immediate load implants are the most indicated for these cases because they have several benefits and the number of surgical interventions is only one.

I. INTRODUCTION

Dental agenesis is one of the most common anomalies in human beings, affecting about 25% of the population, with a higher prevalence in females. Ethnicity is related to the predominance of agenesis, with black patients being less affected and Asian patients being more affected. It is an anomaly arising from disturbances during the stages of odontogenesis, it is usually present during permanent dentition. Its etiology is multifactorial and may involve genetic, environmental, radiation, and the main one is heredity (BARBOSA et al., 2016; E SILVA et al., 2018; SIRIANNI et al., 2019).

This anomaly can be classified as hypodontia, oligodontia and anodontia, according to the amount of

dental elements involved. Hypodontia affects 0-6 dental elements except third molars, oligodontia affects more than 6 dental elements except third molars and anodontia is the absence of all dental elements. Hypodontia is the most common alteration and even though it is not a public health problem, this alteration can cause some problems such as speech disorders and chewing difficulties, and can also cause aesthetic problems and harm the individual's self-esteem (BARBOSA et al., 2016; SIRIANNI et al., 2019).

The diagnosis can be made through clinical and radiographic examinations, it is extremely important that this diagnosis is made as soon as possible, in order to receive the proper treatment. Patients affected by this

anomaly present complications in their masticatory and phonetic conditions, malocclusions, and compromised esthetics (BARBOSA et al., 2016).

Orthodontic treatment is one of the options for patients with this condition and who are still in the growth phase, another dental element is used to correct the absence and after this movement, to have a more favored esthetics, it is necessary to make a contour with composite resin in moved element to look more like missing tooth element. However, the best treatment option, considering functional and aesthetic factors, is that of a multidisciplinary approach, involving orthodontics to maintain space, align and level the dentition, and implantology (RÉDUA, R.B; RÉDUA, P.C., 2018).

The installation of implants with immediate loading has been presented as an excellent option for rehabilitation of patients with no dental elements, they demonstrate great satisfaction with the procedure during and after surgery. The success rate of this technique is high if all surgery protocols are followed, and the main one is primary stability, as it is involved with the implant osseointegration process. And among the main benefits, we can mention: less time to complete the treatment, possibility of applying load in a few days, recovery of esthetics and functionality in a way that the biomechanics of the implant is not harmed (ASSIS et al., 2019; MONEZI et al., 2019).

Oral rehabilitation through implants was facilitated through pre-surgical planning, thus having excellent results and predictability of treatments with immediate loading implants, returning with the aesthetics and functionality of the patients' dental elements in addition to providing psychological well-being and safety for professionals who will perform the treatment (MENEZES et al., 2020).

In this paper we will present a literature review on dental agenesis, its causes and possible forms of treatment, aiming at a multidisciplinary treatment that restores function and aesthetics to patients, articles published from 2016 to 2020 were used.

II. LITERATURE REVIEW

Dental agenesis is the absence of one or more dental elements in both primary and permanent dentition. This anomaly occurs in intrauterine life when there is a change in normality and is constantly associated with other developmental anomalies, such as microdontia (SILVA et al., 2018; SIRIANNI et al., 2019). Dental agenesis can generate several problems for the patient, such as malocclusion, periodontal problems and problems in the

temporomandibular joint, thus being very important for orthodontics and pediatric dentistry. patient self-esteem (SILVA et al., 2018; SIRIANNI et al., 2019; SANTOS et al., 2017).

This change from normality is classified according to the number of dental elements that did not develop, being hypodontia, oligodontia and anodontia. Hypodontia is the absence of 1 to 6 dental elements, patients who have hypodontia differ in skeletal features, a common feature in these patients that occurs because of an absence of neighboring dental elements or because of a shortage of space for the eruption of the teeth. dental elements is the ectopic location of adjacent dental elements (BARBOSA et al., 2016; RÉDUA et al., 2018).

Dental agenesis refers to a genetic syndrome that causes mutations in genes MSX1, AXIN2 and especially in PAX9, as it acts in the formation of the mesenchyme during odontogenesis. These genes are responsible for the development, shape and position of dental elements, so if any disorder or mutation affects any of them during the initial phase of the element's development, it may result in deformation or even loss of the element. Recently, in some studies it was verified that the mutation in the LRP6 gene also involves tooth agenesis (FAUZI et al., 2019; SILVA et al., 2018).

Tooth agenesis can affect both primary and permanent dentition, however, it is more often diagnosed during permanent dentition. In primary dentition, it is more unilateral, and in permanent dentition its greatest prevalence is bilaterally when it involves the upper lateral incisors, whereas in other dental groups it is more unilateral (AL-ANI et al., 2017). The dental elements most affected by this anomaly are the third molars, followed by the lower second premolar, upper lateral incisor and upper second premolar (MORENO et al., 2019).

The hereditary factor is considered the greatest determinant of hypodontia, yet a study was carried out in order to investigate some possible risk factors for causing hypodontia, in this study it was found that consuming 10 or more cigarettes a day during pregnancy causes greater chances of a child developing hypodontia (AL-ANI et al., 2017; SILVA et al., 2018). Hypodontia can cause several problems, both functional, such as decreased chewing ability, open bite and malocclusion, as well as aesthetic problems, which can cause psychological disorders to the patient. multidisciplinary (RÉDUA et al., 2018; SILVA et al., 2018).

The treatment of patients with hypodontia is flexible according to the severity, in many cases a multidisciplinary approach is necessary, however the use

of removable partial dentures has its weaknesses, as the results can be unsatisfactory. The multidisciplinary approach between orthodontics and implantology is very effective in the treatment of hypodontics, with an adequate use of orthodontic treatment may be able to reduce the loss of bone tissue, and this treatment also brings root parallelism, thus facilitating the surgery of placement of dental implants, the strategy of orthodontic treatment is the preservation of bone tissue and keratinized mucosa, the use of space retainers is essential so that the place for placement of dental implants is reserved for patients who have been treated with the use of implants dental procedures showed very satisfactory results, with the return of functionality and favorable aesthetics (ATTIA et al., 2019; REDUA et al., 2018).

Patients affected by tooth agenesis need orthodontic treatment prior to implant placement because, in addition to dissatisfaction with esthetics, they present impairment in the functional part, such as Class II and III malocclusions (BORALI et al., 2018). Orthodontic treatment is also extremely important to maintain the space for the installation of the definitive implant, because through some studies it was possible to observe that the implant must present a distance of 1.5 to 2.0 mm from the adjacent teeth to avoid complications such as: root damage and peri-implant bone loss (REDUA et al., 2018; SASAKI et al., 2018).

The planning of orthodontic treatment needs to be very well prepared and in conjunction with the installation of implants that will take place later, since it has been proven in research that patients who undergo treatment with fixed braces for a very long time or poorly planned have bone loss significant due to the movement of dental elements (JAGER et al., 2017). This bone loss can negatively interfere in the osseointegration process, the key to dental implant success, and this can be considered a risk factor for it (ALGHAMDI, H.S; JANSEN, J.A., 2020).

A multidisciplinary approach in these cases of tooth agenesis is necessary from the beginning to the end of the treatment in order to have a satisfactory result in esthetics for the patient and a stable occlusion for the installation of implants (AOKI et al., 2018). Having a stable occlusion is one of the criteria for indicating immediate loading implants, as it is believed that this factor, together with: healthy periodontium, bone quality, absence of parafunctional habits, good hygiene, systemic condition of the patient and others, are closely related. linked to the implant success rate (MONEZI et al., 2019).

III. DISCUSSION

Sasaki et al. (2018), mention that without performing an orthodontic treatment prior to implant placement, in cases of agenesis, it is not possible to guarantee that the mesiodistal space will be adequate to receive it. After all, the deciduous dental elements have quite different sizes from the permanent ones, which are usually affected by agenesis. Likewise, Al-Ani et al. (2017) report that treatment in orthodontics should be carried out in early adolescence, which is when most of the growth has already taken place and the other dental elements in development are erupting.

In the study by Hong et al. (2017), it was observed that over the last 30 years the use of dental implants for the rehabilitation of patients who have lost dental elements congenitally or not, has grown a lot, becoming popular due to its high success rate and few complications. Yildiz et al., (2018) add that the immediate load implant has been quite indicated, especially for anterior regions of the maxilla and mandible, because in addition to reducing surgical interventions, it also reduces bone loss in the peri-implant crest, resulting in a good soft tissue healing and positively contributing to esthetics.

According to Assis et al. (2019), the installation of dental implants with immediate loading has become an excellent alternative to replace missing dental elements, meeting the expectations of patients immediately in terms of aesthetic issues. For Buser et al. (2017), it is mentioned that there are still cases in which the installation of implants needs to be postponed, for reasons of the patient: not being at the appropriate age to receive the implants, pregnant or for work reasons; and for local factors: bone lesions, root cysts and inadequate bone volume to receive an immediate loading implant.

Assis et al. (2019) also describe that the immediate loading technique is contraindicated in cases where the patient has a diagnosis of bruxism, changes in bone metabolism, uncontrolled diabetes and habits such as smoking, as these factors are capable of interfering with the primary stability of the implant. It is enhanced by Gupta et al. (2017) that the essential requirement for the successful installation of a dental implant with immediate load is primary stability, because during the osseointegration process it will be gradually replaced by biological stability.

Thus, Tettamanti et al. (2017) identified that the success of this technique depends not only on bone quantity, but also on bone quality and on the type of occlusal load that this implant will receive. The rehabilitation of one or more missing dental elements

using this technique proves to be reliable and effective, offering comfort, esthetics and function to the patient.

IV. CONCLUSION

Multidisciplinary treatment for cases of tooth agenesis has not been widely used and there is a scarcity of studies on the subject, but it can be concluded that it is the best technique aimed at the patient's aesthetics and function. Thus, an effective orthodontic treatment performed before the installation of an implant is extremely important to obtain good results at the end of the treatment. Immediate load implants are the most indicated for these cases because they have several benefits and the number of surgical interventions is only one.

REFERENCES

- [1] AL-ANI, A.H. et al. Maternal Smoking during Pregnancy Is Associated with Offspring Hypodontia. *J. Dent Res.*, [S.L], v. 96, n. 9, p. 1014-1019, may. 2017.
- [2] AL-ANI, A.H.; ANTOUN, J.S.; THOMSON, W.M.; MERRIMAN, T.R.; FERALLA, M. Hypodontia: An Update on Its Etiology, Classification, and Clinical Management. *BioMed Research International*, 2017. Available in: <http://dx.doi.org/10.1155/2017/9378325>. Acesso em 18 de mai. de 2020.
- [3] AOKI, N.; ISE, K.; INOUE, A.; KOSUGI, Y.; KOYAMA, C.; LIDA, M.; BABA, J.; IWAI, T.; MITSUDO, K. Multidisciplinary approach for treatment of a dentigerous cyst – marsupialization, orthodontic treatment, and implant placement: a case report. *Journal of Medical Case Reports*, [S.L], v.12, n.305, p.1-7, oct.2018.
- [4] ASSIS, L. C.; ARAUJO, M. O.; PINHEIRO, J. C.; MORAIS, E. F. et al. Uso de carga imediata em Implantodontia: Revisão dos conceitos atuais. *Revista da AcBo*, [S, L], v.8, n.3, p.82-87, set.2019.
- [5] ATTIA, S., SCHAAF, H.; EL KHASSAWNA, T.; MALHAN, D.; MAUSBACH, K.; HOWALDT, H.P.; STRECKBEIN, P. Oral Rehabilitation of Hypodontia Patients Using an Endosseous Dental Implant: Functional and Aesthetic Results. *J Clin Med.*, [S.L], v. 15, n. 8, oct. 2019.
- [6] BARBOSA, D. F. M.; CRUZ, C. M.; CREPALDI, M. V.; OLIVEIRA, B. L. S. Agenesias Múltiplas, Planejamento e Hereditariedade. *Revista FAIPE*, Cuiabá, v.6, n. 2, p. 14-27, jul./ dez.2016.
- [7] BORALI, R.; MENEZES, C.C.; VENEZIAN, G.C.; VEDOVELOO, S.A.S.; DEGAN, V.V. Association between agenesis and root morphology of anterior teeth. *Revista de Odontologia da UNESP* [online], 2019. Available from: <https://doi.org/10.1590/1807-2577.09119>. Acesso em: 18 de mai. de 2021.
- [8] FAUZI, N.H.; ARDINI, Y.D.; ZAINUDDIN, Z.; LESTARI, W. A review on non-syndromic tooth agenesis associated with PAX9 mutations. *Japanese Dental Science Review*, [S.L], v.54, n.1, p. 30-36, fev.2018.
- [9] GUPTA, G.; GUPTA, D.K.; GUPTA, N.; RANA, K.S. Immediate Placement, Immediate Loading of Single Implant in Fresh Extraction Socket. *Contemporary Clinical Dentistry*, [S.L], v.10, n.2. p. 389-393, april-jun.2019.
- [10] HONG, D.G.K.; OH, J.H. Recent advances in dental implants. *Maxillofacial Plastic and Reconstructive Surgery*, [S.L], v.39, n.33, p. 1-10, dec.2017.
- [11] MENEZES, F. R. D. D.; Da SILVA, A. B. P., BRIGIDO, A. J. Técnica de planejamento reverso de prótese fixa sobre implantes dentários: Relato de caso. *Revista da ACBO*, [S.L], v.9, n.1, p. 13-19, jan. 2020.
- [12] MONEZI, L. L. L.; MATOS, E. M. C.; CORRÊA, R. C. M.; CAVALCANTE, T. C. Implantes imediatos: Uma revisão de literatura. *Revista Eletrônica Acervo Saúde / Electronic Journal Collection Health*, [S.L], v.30, n.30, p. 1-6, aug.2019.
- [13] MORENO, M.T.; DÍAZ, A.; GONZÁLEZ, A.; MANRÍQUEZ, S.G.; TORO- IBACACHE, V. *Int. J. Morphol.*, [S.L], v.34, n.4, p. 1382-1386, 2019.
- [14] REDUA, R. B.; REDUA, P. C. Hypodontia of mandibular incisors: considerations on the orthodontic treatment. *Dental Press J. Orthod.*, Maringá, v. 23, n. 4, p. 79-87, aug. 2018.
- [15] SANTOS, M.R.; SILVA, M.M. Reabilitação protética em paciente portadora de agenesia dentária: Relato de caso. *Revista da ACBO*, [S.L], v.7, n.1, p.36-41, jan.2018.
- [16] SASAKI, H.; HIRANO, T.; NOMOTO, S.; NISHII, Y.; YAJIMA, Y. Dental implant treatment with computer-assisted surgery for bilateral agenesis of maxillary lateral incisors: A case report. *Bull Tokyo Dent Coll*, [S.L], v.59, n.1, p. 43-51, mar.2018.
- [17] SILVA, M. F.; BASBUS, J. A. C.; VALLADÃO, A. S. N.; PECORACO, P. V. B.; MAIA, M. P. C. Ausências Dentárias Atípicas – Série de Casos. *Revista Saber Digital*, [S.L], v. 11, n. 1, p. 95 - 108, jun.2018.
- [18] SIRIANNI, L. O.; GONÇALVES, A. L. C. Avaliação da prevalência de agenesia de segundos pré-molares dos pacientes do curso de Odontologia do Centro Universitário da Serra Gaúcha. *Journal of Oral Investigations*, Passo Fundo, v. 8, n. 2, p. 7-18, jul.-dez. 2019.
- [19] TETTAMANTI, L.; ANDRISANI, C.; ANDREASI, M.B.; VINCI, R.; SILVESTRE. Immediate loading implants: review of the critical aspects. *Oral & implantology*, Rome, v.10, n.2, p.129-139, sep.2017.
- [20] YILDIZ, P.; ZORTUK, M.; KILIÇ, E.; DINCEL, M.; ALBAYRAK, H. Esthetic Outcomes after Immediate and Late Implant Loading for a Single Missing Tooth in the Anterior Maxilla. *Nigerian Journal of Clinical Practice*, [S.L], v.21, n.9, p. 1164-1170, sep.2018.

Móveis Rudnick`s Successful History: Leadership and Commitment

Miguel Nenevé¹, Mário Nenevê², Celiana Hertz Varela³, Aloysio Dos Santos Bahiense Junior⁴

¹Professor at UNIR and ;Faculdade Católica de Rondonia, PhD in Literature. Email: nenevemi@gmail.com

²Professor at UNIVILLE, PhD in Business Administration and Tourism. Email: mneneve@uol.br

³ Trainee fellowship student at UNIVILLE. Email: celiana.hortz@hotmail.com

⁴ Lecturer at UNIVILLE, MSC, E-mail: alobahiense@yahoo.com.br

Received: 19 Sept 2021,

Received in revised form: 03 Nov 2021,

Accepted: 11 Nov 2021,

Available online: 20 Nov 2021

©2021 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— Administration, Authentic
Leadership, Authentic Organization, Rudnick
S.A., Organizational Atmosphere.

Abstract— History has been neglected lately in the world and ins some countries such as Brazil one feels the strong impact on this negligence. It is not uncommon to see people trusting more in fake news spread through WhatsApp than in History based on serious research. The fact is that some people neglect History because they think history deals with the past mainly. In this work we want to argue that history does matter and it is very important to pay attention to History in order to understand the present too. We propose to study the history of a successful company in Southern Brazil: Móveis Rudnick SA from São Bento do Sul, SC,. We suggest that this corporation is a good example of a good organizational climate, leadership and commitment. Surely this depends on good management, that is, a form of interaction between leaders and subordinates, between directors managers and workers. Moreover, this fact greatly influences on the result of the organizational environment and a consequent profitability. We also discuss the characteristics of the company`s leaders, claiming that these characteristics converge into authentic leadership contributing to form an authentic organization. Finally we argue that Móveis Rudnick is an organization in which authentic leaders are those who value interaction and transparency leading to an authentic organization.

I. INTRODUCTION

In a time when History is much neglected, when people prefer quick communication received through WhatsApp , when we are invaded by fake news , we want to argue that studying history, investigating the past is really necessary. History can teach us the best way to look at events and facts either good or bad ones. Besides it can help us avoid falling into the same traps that people or corporations did. Therefore, History is not only about the past, but about the present and the future. In this work we claim that studying the history of a successful company may be a way of helping people and entrepreneurial in general who are when starting

their own business. We propose to explore the history of a successful company. We believe that , often, just by having studied the histories of companies and the way they have faced work and commitment one can access the strategies and principles that made them successful. History in this sense may help encourage people in their new business. In this sense, we argue that by studying individuals and companies that are in a position you or your corporation want to be in in the future, can be a great motivation. By identifying a successful company in a country, province or city and studying it may help people not only from business but from other areas to learn about administration,

leadership, commitment and other factors. In addition to this, the process of researching how a company has unfolded and grown in a community may help us to understand the community we live in, the people who live in, and give us more knowledge on the whole context of administration, as well as authentic leadership, commitment and awareness of the need to adaptation. In this work, we are going to focus on a company located in Southern Brazil, in the city of Sao Bento do Sul.

II. MOVEIS RUDNICK – THE START

MÓVEIS RUDNICK S/A. is a nationally recognized industrial company in the furniture sector in São Bento do Sul – Santa Catarina, Southern Brazil. where descendants of German immigrants settled in 1873. In 1938 Mr. Leopoldo Edmundo Rudnick, started a woodwork factory, or rather, a small joinery which later became a factory. in a small shed located on Estrada Dona Francisca, in the interior of the municipality. The groups of immigrants who arrived in the city of São Bento do Sul worked with wood in their original land and this was an important motivation to continue their activities in Santa Catarina. In 1946 the small joinery (woodwork) moved to the Oxford district, where one of the company's production units is now located. Thus, in 1959 the “Industria de Móveis Rudnick was founded having Mr. Leopoldo Rudnick as the patriarch of the organization. The patriarch Mr. Rudnick cultivated values, strongly linked to his family, to the Lutheran Church and appreciated discipline and commitment. There was a “Rudnick bulletin which contextualized itself within the modus operandi of other furniture factories. It should be noted that, at the time, the reference in furniture production in the region was Móveis Cimo, whose headquarters were in Rio Negrinho, 15 miles from São Bento do Sul.

The micro-region of São Bento do Sul, located in the northern plateau of Santa Catarina (near Paraná) encompasses the municipalities of São Bento do Sul, Rio Negrinho and Campo Alegre. The forest in the region, in the period of the first German immigrants, had a great biodiversity, and the most common species found were ‘araucaria pine’, mate, imbuia, cinnamon tree, among other species of timber wood.

The combination of the existence of abundant raw material and artisans with the trade in wood and mate, responsible for generating income and accumulating regional capital, enabled the development of furniture production. The carpentry production system at the beginning of the 20th century was artisanal, little industrialized, and the product met the demands of the buyers, whose market was regional. With the increase in the flow of immigrants, the sale of

products grew, with a corresponding improvement in the quality of the products.

In the late 1950s, producers began to offer furniture made by the factories. In the 1960s, the furniture industry was consolidated in the municipalities of São Bento do Sul, Rio Negrinho and Campo Alegre, giving rise to the furniture pole, structured by the large availability of raw material (especially imbuia), by the supply of qualified labor and by its own financial resources, when the company started to sell its products in the cities of Rio de Janeiro, São Paulo and Curitiba.

It is important to emphasize, for the context of our work, that in the 1960s the Brazilian government encouraged reforestation of imported trees, which caused a strong impact on the region, as companies cleaned areas of natural wood to introduce the planting of imported pine. The first large company to settle in the city was Battistella which used to work with pine wood. The industries that were here previously, such as the extinct Móveis Cimo worked with native wood. (TERNES,

In the 60s, Rudnick company received subsidized financing and started implementation of actions to expand its industrial park. At that time, the motivation to produce furniture was the market which demanded it. Thus, most of the industries in São Bento do Sul focused on the organization and commitment of the companies, and applied all the forces in a production, with a qualified workforce that differentiated it from other regions of the country.

During the 1970s, taking advantage of the high growth of the Brazilian economy, the furniture sector experienced a strong expansion of demand in the domestic market, with the incorporation of the North and Northeast regions of Brazil as consumers of products from the São Bento do Sul hub.

III. FURNITURE INDUSTRY IN THE STATE OF SANTA CATARINA

From 1970 onwards, the organization started to import machines, thus beginning a new period, with more technology, better quality standards and an advanced commercial policy. For example, modern machines were imported from Germany in 1974, which brought the advantage of producing on a larger scale and with a laminated finish, with high gloss, differentiated from other industries in the region. It should be noted that Rudnick was the first buyer of the Agglomerate, whose industry at the time Placas do Paraná was pioneered in Curitiba.

Thus, in the 1970s, when the expansion of demand was notable, Rudnick stood out for its innovation in the

production of straight-line (modern) furniture. Contrary to the companies in the region, which, given the specialized workforce, operated with colonial furniture.

Rudnick in the face of the favorable market had an upward growth in the 1970s, becoming known in the market. Its customers were retail stores, and it operated through its own sellers and representatives throughout Brazil. It basically operated with bedroom furniture.

Another strategy, in the company's innovative era, was the acquisition of companies. When its industrial park was fully consolidated, in 1977, it bought another company in the same sector that operated with shelves from Móveis Alpes, but its production line remained with the same products, but with central administration by Móveis Rudnick.

As Rudnick had a high cash flow, its investments became operating companies with an already cooled market. At the end of the 1970's, with the abrupt reduction of the imbuia wood and with the entry of new production technologies, most furniture producing companies started to use reforested (imported) Pinus, destined for the domestic market. This phase changed the production process, which used to be more artisanal, to a straighter line, using more modern equipment, influenced by Government incentives for the acquisition of equipment. A striking fact was that, without the appropriate technology, companies started to produce furniture in Pinus for the national market, which distorted the concept of furniture made from this plant species. The quality of the furniture was a factor that, until today, a great part of the consumers of previous generations, abhor Pinus furniture.

In the 1980s, the Brazilian economy went through a period of uncertainty, with the financing crisis with a strong reduction in purchasing power in general. According to ABIMÓVEL (2003), in the case of the furniture center of São Bento do Sul, the 1980s marked a new and decisive phase in the development of the furniture industry in the region, characterized by the retraction of the domestic market, by the change in raw material (consolidation pine) and by the search for the international market.

Rudnick, in a matrix model, centralized the media activities and started to produce in decentralized way, acting in each manufacturing unit with a focus on a particular product, at the time a competitive advantage, which later on, harmed it, due to isolated activities, sometimes, with the same type of machinery.

With operations throughout the Brazilian market, as well as in the export sector, with pool tables and a very positive cash flow, the company started a phase of prominence in the Brazilian furniture market. And under the influence of inflation, it was able to evolve, taking advantage of it by

having a positive cash flow and taking advantage of suppliers.

In 1994, during the government of Itamar Franco, Brazilian currency was changed with the "Plano Real" in order to stop the inflation which was very high. This fact required new modes of operating which was successfully done by the leaders of the company.

In 2001, the company constituted the Board of Directors in which family members were transferred to it. Currently, the Rudnick Group is managed exclusively by an executive board and family members make up the organization's Board of Directors. In addition, the company has around 600 employees, an administrative headquarters, two manufacturing units and a distribution center that, together, add up to approximately 50 thousand square meters of built-up area.

Today the company has a segmented focus and manages to print more strategic actions. And it survived in the face of adversity because it had reserves built up at the time of its growth, without which, to straighten up again, it would certainly suffer setbacks.

The permanence and sustainability of the Rudnick company is based on values, as mentioned above, which it values to conserve over time. The company is integrated into the community and has always collaborated to the society, e.g., by giving land to Univille - University in São Bento do Sul and other social institutions. During its trajectory, countless professionals have passed by, important leaders who helped the company to take important steps towards their professional advancement. Important here is to have a brief discussion on the issue of leadership.

IV. MOVEIS AND THE ISSUE OF LEADERSHIP

Leadership has been studied for a long time, which is proven by the varied interpretations of this concept. While some theorists were concerned with studying what a leader is, others chose to dedicate themselves to understanding what they do, and how their work interferes with other functions around them, outlining the different styles and forms of leadership. When it comes to organizational leadership, the importance and attention must be understood, as this is a fundamental link for the success of associations, since it has its own goals and objectives, hence the dependence of companies on their leadership to achieve the success and, where a healthy climate prevails, in which the team members feel committed and integrate happily into the work environment, there are authentic leaders in "Authentizotic Organizations" (Kets de Vries, 2001). The theory of authentic leadership is a recent approach, and crosses an abundant range of studies and approaches, but in general all

of them improved that authenticity takes as a starting point that leaders, through their self-awareness, self-acceptance, self-knowledge, faith, actions and services, have authentic relationships with their followers and associates, supported by transparency, trust, integrity and high moral standards (Avolio & Gardner, 2005). Thus, in this investigation, the objective is to understand if MÓVEIS Rudnick S.A.'s leadership is authentic, and promoter of an authentic organization.

Every company seeks good results and qualified people in their management and leadership. A leader is someone capable of leading a team to any challenge and result, for that it is necessary to know how to live with people, have self-confidence and believe in the company itself. A good leadership is able to obtain results through the interaction between the leader and his followers, as an environment with a sense of belonging and personal importance must be created. A leader must, mainly, understand the needs of his team, having the ability to visualize how personal events can interfere in the organizational day-to-day. Authentic leadership comes to transform a group of people into a team. This vision of leadership comes from the various business and world crises, more specifically from business scandals in the world, where business leaders were in disrepute with the world market and with the population. Authentic leadership gained a definition by Walumbwa et al (2008, p. 84) recently: A leader behavior pattern that builds on and promotes psychological capabilities and a positive ethical climate to foster greater self-awareness, an internalized moral perspective, processing of balanced information and relational transparency by leaders who work with followers, promoting positive self-development.

A leader must be authentic in order to be able to develop himself, the company in which he works together with his subordinates. Sparrowe (2005, p. 420) quotes Shakespeare in his famous book Hamlet, where a character Polonius talks about being who you really are. Avolio et al. (2004, p. 802) define authentic leaders as "[...] people who have achieved high levels of authenticity, who know who they are, what they believe in and value, and who act based on these values and beliefs while interacting transparently with others". Esper (2015, p. 5-6) brings that authentic leadership is a normative theory, which proposes how the leader should be and act, based on the principles of positive psychology and positive organizational behavior. Thus, it is understood that authentic leadership is nothing more than a leader's behavior. A positive behavior, based on ethics and morals.

1. INTERNAL ATMOSPHERE FOR AN AUTHENTIC COMPANY

All organizations have an internal atmosphere which favors the health of employees and the development of the

company. Currently, because of many reasons, we live in a world of stress, and this occurs within companies, creating a psychologically unstable environment. Souto and Rego (2003) point out that the stress that predominates in most organizations has devastating effects for both companies and individuals. Thus, authentic organizations arise, as a way to help workers, allowing them to maintain a balance between professional, personal and family life. Rego (2004, p. 2) brings the meaning of authenticity. "Authentizotic" is a neologism derived from the conjugation of the Greek terms *authentikos* and *zotikos*. The first means that the organization is authentic, trustworthy and the second means that it is vital to people's lives, giving them meaning to life. Authentizotic organizations are known, according to Rego (2004, p.3) as "a good workplace", a place where employees trust the people they work for and feel proud of what they do and enjoy working with others. An authentic organization is a place that helps its employees to have a balance between personal, family and work life. Thus, for Souto and Rego (2004, p. 5) the concept of authentizotic organization is inspired by this model, intending to highlight the relevance of the psychological well-being of individuals for the functioning of organizations.

2. OUR RESEARCH ON MÓVEIS RUDNICK, AN AUTHENTIC ORGANIZATION

In order to develop our research on the company we used quantitative research, with questionnaires that had already been theoretically validated, covering leaders and followers of MÓVEIS Rudnick. The data collected from the company sought to ascertain through statistical methods the profile of the existing leadership in the organization and, if confirmed as authentic, what its influence on the organizational climate is, to confirm whether it is an organization theoretically called "organizational authentication". It is noteworthy that before applying the questionnaires, it is expected to know the researched company, organizational aspects, departments, sectors and command fluency were identified, in addition, the scientific questionnaires exclusively addressed Authentic Leadership (WALUMBWA, 2008) and Authentic Organizations (REGO and SOUTO, 2004). The collection sought to include all intermediate leaders, below the leader who runs the company, also contemplating those led, at random in a number that statistically represented a sample considered valid, by measuring the total number of workers.

The criteria for the inclusion of participants with regard to outlook, obeyed that he has a designation of manager, unit, department or sector; in relation to intermediate leaders, it followed the profile that the respondent is an intermediate leader, with a hierarchy below managers, supervisors in a department or unit of the company, regardless of any other

qualification. The others led were chosen from among MÓveis Rudnick's employees, who carry out work activities, without command, in the manufacturing or administrative sectors; they were chosen through the easy access to the sectors, negotiated with the company's directors, during the day shift, without observing any other requirement, that is, at random. The first questionnaire applied deals with authentic leadership and includes 16 questions, sixteen factors that seek to assess the main characteristics attributed to authentic leadership (self-awareness, relational transparency, internalized moral perspective and balanced processing), while the second questionnaire has 21 questions, relating to Authentizotic associations, through measurement according to a structure proposed by Rego and Souto (2004), focused on the cultural perception of the organization. The questionnaires were answered with marking, using the Likert scale (RENSIS LIKERT, 1932) with five positions in the range between 1 and 5, with affirmations, where: 5 - always; 4 - almost always; 3 - from time to time; 2 - rarely; and 1 - never. In possession of the collected data, through the Likert scale of the applied statements, it was possible to analyze the existence of an authentic leadership in the organization and how the organizational climate is perceived by the approached collaborators. The results obtained with the help of 58 employees (various levels of leadership) are presented below. For better exposure of readers, the graphs will bring all the calculated percentages, to gauge the existence or not of Authentic Leadership, as well as, in terms of authentic organizational climate.

V. SOME RESULTS

Among the responses to our questionnaire, the vast majority marked the maximum score 5 representing the statement "always" and score 4 representing the statement "almost always", see: According to the averages in the table above, the minimum average reached was is 3.29, a sufficient number to confirm that the researched organization has attitudes based on factors such as self-awareness and ethics, in addition to having transparent relationships that generate motivation and commitment from the organization's components (GARDNER et al, 2011). True leadership has ideas with a strong sense of value, has ethical positions and its performance goes beyond expectations, as a result the organization becomes healthier, the environment becomes beneficial to employees who in turn wear the organization's shirt with much more determination. This judgment had already been declared by Bass in 1985 in his work "Leadership and Performance Beyond Expectations", in which the author states that the ethical vision of the organization is a preconceived vision of true leadership.

Authentic leadership emphasizes the establishment of an honest relationship of the leader with the follower, guided by transparency in labor relations, in order to cultivate a relationship of mutual trust; this means that the hierarchy cannot be the cause of problems in organizations, after all, in the production chain, everyone has great value, besides the final objective does not materialize if each one does not comply with what they are willing to do. Engagement is based on a relationship of trust that presupposes access to the information you need and decent and rewarding working conditions (ESPER & CUNHA, 2015).

Other answers to our questionnaires indicate that MÓveis Rudnick is an authentic, that is, a company where its employees feel integrated, are part of a general purpose and, therefore, committed to it, making the company part of their individual purpose. The confirmation of this assumption about authentic organizations at MÓveis Rudnick is clear, since the numbers indicated in the table above mean that the organization offers a good organizational climate. Healthy practices in an organizational environment are bricks for a more positive performance in it, after all organizations that do not put healthy actions into practice and that treat employees only as numbers, become disreputable companies and may face problems including filling out its staff. It was noticed through the data obtained and the graphs above, that both converge to confirm authentic leaders and an authentic organization. Both tables present significant averages in the researched statements, amply evidencing the authentic leadership and the authentic environment found in the analyzed company.

VI. FINAL CONSIDERATIONS

This work is not completed. Further investigations on the history of the company will be developed. However we would like to emphasize that a study on company and leadership cannot neglect the history of the company. An Authentizotic company as MÓveis Rudnick S/A could not be complete without a brief history of its foundation, and of its founder, Mr. Leopoldo Rudnick. How the company developed itself, facing several challenges it is also important to be investigated. History does matter when we study a company. We live in an important moment when some fake news seem to be stronger than the study of history and we, as students and scholars must start to show resistance towards this situation.

Moreover, trough the results obtained from our study it was possible to perceiver that the history of MÓveis Rudnick corporation revealed important moments when a true leadership was necessary. The company nowadays, following the steps of the founder reveals to be an organization in which authentic leaders are present, leaders

who value interaction and transparency. In this way, the company promotes positive characteristics to their followers and provide feedback that fuels composition of a healthy and functional organizational environment. In further work, we will proceed our study aiming at a deeper knowledge of the company, by listening to more people involved in the company since its beginning.

REFERENCES

- [1] AVOLIO, B. J.; GARDNER, W. L.; WALUMBWA, F. O. (2005, p 387-406) Authentic leadership development: Emergent trends and future directions. *Authentic leadership theory and practice: Origins, effects, and development.*
- [2] AVOLIO, B. J.; GARDNER, W. L. (2005) . 16, n. 3, p. 315-338.). *Authentic leadership development: getting to the root of positive forms of leadership.* *Leadership quarterly*, Amsterdam..
- [3] BARON, L., & PARENT, É.(, 22(1), 37-53. 2015.) *Developing authentic leadership within a training context: Three phenomena supporting the individual development process.* *Journal of Leadership & Organizational Studies*
- [4] BASS, B. M. (1985) *Leadership and Performance.* New York: Free Press,
- [5] BERGAMINI, C. W (19894. *Liderança administração do sentido.* 1ª. ed. São Paulo: Atlas,
- [6] BHINDI, N.; DUGNAN, P. (1997) *Leadership for a new century: Authenticity, intentionality, spirituality and sensibility.* *Educational Management e Administration*, v. 5, n. 1..
- [7] BRIEF, A. P.; WEISS, H. M. (2002) *Organizational behavior: Affect in the workplace.* *Annual Review of Psychology*, v. 53, p. 279-307..
- [8] BUNKER, K. A. (1997). *The power of vulnerability in contemporary leadership.* *Consulting Psychology Journal: Practice and Research*..
- [9] DE GEUS, A. (1997a) *The living company.* *Harvard Business Review*, v. 75, n. 2, p. 51-59, 1.
- [10] DEN DULK, L.; VAN DOORNE-HUISKES, A.; SCHIPPERS, J(1999. *Organizações “amigas da família”:* uma comparação internacional. *Sociologia – problemas e Práticas*, n. 29, p. 31-50. ESPER, A. J.
- [11] F.; CUNHA, C. J. C. A (2015). *Liderança autêntica: uma revisão integrativa.* *NAVUS - Revista de Gestão e Tecnologia*, v. 5, n. 2, p. 60-72, abr./un..
- [12] GARDNER, W. L., COGLISER, C. C., DAVIS, K. M., DICKENS, M. P. (2011). *Authentic leadership: A review of the literature and research agenda.* *The Leadership Quarterly*, 22(6), 1120-1145.
- [13] GEORGE, B., SIMS, P., MCLEAN, A. N., & MAYER, D. (2007). *Discovering your authentic leadership.* *Harvard Business Review*, 129-138.
- [14] GIMENES, A. M., DEL CIEL, S. R. M., COSTA, A. K. G., OLIVEIRA, A. M. (2020) *O papel dos líderes nas organizações.* *Instituto de Ensino Superior de Londrina/INESUL.* P. 1-15.
- [15] KARLOF, B (2009). *Conceitos básicos de administração: um guia conciso.* Rio de Janeiro: Rocco,
- [16] KETS DE VRIES, M.F.R. *Creating authentizotic organizations: Well-functioning individuals in vibrant companies.* *HumanRelations*, 54,101-111. 2001.
- [17] LIMA DE, D. V. P., MARTINS, T. N., NAVARRO, S. B., TRINDADE, F. M., SILVA, T. F., PERRI, R. A. *O papel do líder dentro das organizações.* *Faculdade de Ciências Jurídicas e Gerenciais/ ACEG.* P. 1-7, 2013.
- [18] LYUBOVNIKOVA, J., LEGOOD, A., TURNER, N., MAMAKOUKA, A. (2015) *How authentic leadership influences team performance: The mediating role of team reflexivity.* *Journal of Business Ethics* published online (May), 1-12..
- [19] NONAKA, I., VON KROGH, G., VOELPEL, S (, 27(8), 1179-1208.2006.). *Organizational knowledge creation theory: evolutionary paths and future advances.* *Organization Studies*
- [20] REGO, A.(2004.) *Organizações autentizóticas: Desenvolvimento e validação de um instrumento de medida.* *Estudos de Gestão*,
- [21] STOGDILL, R. M. (2004), *Handbook of leadership*, N. Y., MacMillan/ Free Press,
- [22] VERGARA, S. C.; BRANCO, P. D.(2001) *Empresa humanizada: a organização necessária e possível.* *Revista de Administração de Empresas*, v. 41, n. 2, p. 21-30, .
- [23] VILAÇA, I. (2012). *Espiritualidade Organizacional e Capital Psicológico: O papel da Liderança Autêntica.* *Tese de Doutorado em Psicologia*, Universidade de Extremadura, Badajoz, Espanha).
- [24] WALUMBWA, F. O., AVOLIO, B. J., GARDNER, W. L., WERNISIGN, T. S., PETERSON, S. J.(2008) *Authentic leadership: Development and validation of a theory-based measure?* *Journal of Management*, 34 (1), 89-126.

Ceramic Laminates in Conoid Teeth: An integrative Literature Review

Sandy Dias Moraes¹, Robson dos Santos Paiva Filho², Hayssa Cunha da Silva³, Ítalo Augusto da Costa Lacerda⁴

^{1,2,3}Undergraduate student of the Dentistry course at Centro Universitário do Norte – Ser Educacional.

⁴Teacher and advisor of the Dentistry Course at Centro Universitário do Norte – Ser Educacional.

Received: 18 Sept 2021,

Received in revised form: 05 Nov 2021,

Accepted: 15 Nov 2021,

Available online: 22 Nov 2021

©2021 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— Ceramic Laminates, Conoid
Teeth, homogeneity.**

Abstract — *The treatment of conoid teeth represents a challenge for the dental team, as few elements are available in most cases, making it difficult to obtain an aesthetic that advocates anatomical and color homogeneity among the elements involved. Conoid teeth are changes in the size and shape of natural teeth. These changes have an aesthetic effect on the patient's smile, as the affected teeth are smaller than normal and have a sharpened incisal surface. Based on the content presented, the following issue is raised: Why ceramic laminates can be indicated for use in conoid teeth? Thus, the aim of the study is to carry out an integrative literature review of ceramic veneers in conoid teeth. The methodology used was a literature review, with searches in databases following the criteria of articles published in the period from 2015 to 2021. When ceramic laminates are considered, different restorative approaches have been proposed, depending on the facet thickness and color of the remaining tooth structure. It is concluded that Ceramic veneers are a well-established treatment method for the conservative esthetic restoration of malformed teeth, such as conoids.*

I. INTRODUCTION

Currently, cosmetic needs are of fundamental importance for a large part of society. Among the available aesthetic restorative materials, professionals have options ranging from composite resins to ceramics. For a long time, the material of choice for cosmetic and conservative procedures was composite resin, however, its organic matrix degrades and absorbs water; therefore, the material needs constant maintenance and polishing to prolong its useful life (ABRANTES et al., 2019; MENEZES et al., 2015).

Porcelain greatly imitates the natural structure of dental elements and is an excellent option to avoid the various deficiencies of composite resin. When done well according to a precise clinical protocol, porcelain restorations have a

long clinical life. The material has several important characteristics, including physicochemical stability, excellent biological compatibility, sufficient resistance to compression and abrasion, excellent reproduction of the optical properties of the tooth structure, adherence to cement and dental substrates, and color stability (GUGELMIN et al., 2020; UZÊDA et al., 2020).

The idea behind minimally invasive cosmetic dentistry is that the clinician should choose the most conservative method possible, avoiding unnecessary wear and tear on the tooth structure, while restoring the patient's function and appearance. The development of minimally invasive dentistry was only possible thanks to technological advances in ceramic systems and the development of the adhesive cementation technique. Initially, dentists

cemented 0.5 mm thick laminated veneers onto an unprepared tooth surface. The material used was feldspathic ceramic, which has good clinical and laboratory sensitivity, especially in minimal thicknesses. However, gum inflammation was observed over time after cementation due to the overcontour created by these restorations. Therefore, dentists chose to limit dental preparations to the space needed for these restorations, in order to develop the original emergence profile of the teeth (ESPÍNDOLA-CASTRO et al., 2020).

The improvement of current ceramic systems, especially pressed ceramics reinforced with lithium disilicate, brought back the idea of unprepared laminates. Although these veneers reach thicknesses similar to those of feldspathic ceramics, lithium disilicate ceramics allow restorations up to 0.2 mm in thickness with greater clinical and laboratory ease. Due to their better mechanical properties, these restorations can be made, finished, tested and cemented more safely (SILAMI et al., 2016; ABRANTES et al., 2019).

The growing demand for esthetic restorations by patients and physicians, together with improvements in adhesive materials, composite resins and dental porcelains have provided the possibility of conservative and long-lasting esthetic treatments. Due to the natural appearance they provide with ceramic veneers, they are often the restoration of choice for anterior teeth. The use of ceramic laminates and composite resins has evolved into a predictable treatment method in terms of longevity, periodontal status and patient satisfaction (ESPÍNDOLA-CASTRO et al., 2020).

Ceramic laminates are a predictable option for creating a successful restorative treatment while preserving tooth structure throughout. In the case of conservative preparations, it is essential that there are two tools available during the diagnostic phases and part preparation procedures: diagnostic waxing and acrylic resin. If there is no need to mask the color, a minimal reduction in tooth structure allows the laminate radiolucency to give a natural appearance. Furthermore, an ultra-conservative preparation preserves the enamel available for bonding, thus increasing the prognosis for long-term bonding success (UZÊDA et al., 2020).

The main advantage of ceramic laminates is their aesthetics, in addition to less plaque accumulation when compared to composite resin and greater clinical longevity. In current longitudinal studies, ceramic veneers had a success rate above 90% after 10 years, when ceramic restorations were bonded using the adhesive technique. Dental preparation must preserve the enamel as much as possible, as when the ceramic veneer is cemented onto

teeth prepared in dentin, success rates can drop to around 60%. Ceramic laminates have the advantage of greater clinical longevity compared to other techniques, in addition to providing reinforcement to the tooth structure (VENÂNCIO et al., 2015).

The disadvantages of ceramic laminates are the possibility of dentin sensitivity and difficulty in repairing in case of fracture. The construction of ceramic laminates exhibited a complex execution both in the clinical and laboratory stages (SILAMI et al., 2016).

It is always a great challenge to add color, shape, surface texture and individual characteristics in a restricted space, generating high costs. Irreversibility is also a disadvantage, because once installed, future correction is very limited. A ceramic laminate can only be removed with use and replaced by a crown (ESPÍNDOLA-CASTRO et al., 2020).

After understanding the ceramic laminates, it is essential to conceptualize conoid teeth. Classified as an anomaly of tooth size and shape, the conoid tooth is generally characterized by a smaller than normal size and a sharp tip that replaces the nearly flat surface characteristic of the incisal edge of the maxillary lateral incisors. This anomaly manifests itself more frequently, affecting about 1% of the population, and it is more common in females. It can also be associated with cases of agenesis or be part of the characteristic signs of a syndrome (OLIVEIRA et al., 2021).

This anomaly translates into aesthetic discomfort for the patient, as the appearance of these teeth is far from normal standards. The most common treatment modalities include direct or indirect composite resin restorations, with anterior treatment being preferred. However, this scenario was transformed due to the widest possible use of ceramics in order to obtain a more predictable and durable treatment result (SILVEIRA et al., 2017; VERONEZI et al., 2017).

Conoid teeth naturally present an ideal configuration to indicate the use of ceramic laminates for aesthetic restorative treatment as it is a procedure that only needs a light wear, in order to give resistance to the piece. This is currently a gold procedure due to the need for minimally invasive procedures and the material has excellent properties, such as piece longevity, biocompatibility, appearance similar to teeth, in addition to good color stability (ESPÍNDOLA-CASTRO et al., 2020).

Based on the content presented, the following issue is raised: Why ceramic laminates can be indicated for use in conoid teeth? Thus, the aim of the study is to carry out an literature review of ceramic veneers in conoid teeth.

II. LITERATURE REVISION

2.1 Conoid teeth

Dental anomalies occur between the sixth and eighth week of intrauterine life, since at this stage the conversion of embryonic structures such as the dental sac, dental papilla and dental organ is performed, which in the histodifferentiation process will give rise to the formation of enamel, dentin and cement (LOBATO et al., 2019; OLIVEIRA; MIGUEL; MAGALHÃES, 2021).

Dental anomalies are defined as congenital malformations of dental tissues that occur as a result of changes that affect the natural process of odontogenesis, in which several genes intervene that regulate the process, if altered it can cause damage to the primary, permanent or both dentition, causing delay in the change from deciduous to permanent dentition and, sometimes, lack of development of the jaws; in addition to affecting characteristics such as number, size, shape, structure and color of some or all teeth (LOBATO et al., 2019; REIS et al., 2016; SANTOS et al., 2015).

Microdontia is a dental variation that is distinguished by a reduction in the mesiodistal and cervico-incisal diameter (by coronary alteration or level of the gingival margins) of the dental crown, which is why they are considered small teeth with adequate anatomy. It can occur in a generalized way or in a single tooth, with the upper lateral incisor being the one that most frequently presents changes in size and shape (SILVA et al., 2016).

Tapered teeth were described by Dr. Grahnén as those teeth in which the mediobuccal incisal width (incisal width) of the ring is less than the cervical width (the width of the area close to the gum line). It is an anomaly in the shape of the teeth, as they present an abnormal shape, and the affected tooth has a conical appearance. Conoid teeth have a prevalence of 0.6 to 9.9%. About 55 people are affected by cone-shaped upper lateral teeth, with women more prone than men (LOBATO et al., 2019; REIS et al., 2016).

Proportional microdonism is usually associated with dwarfism due to hypofunction of the pituitary gland. Small teeth in normal or large jaws may be due to cross-inheritance. Regression or atavism may be the cause of the rudimentary development of individual teeth, which take the cone or haplodon shape of the reptile or fish dentition. This abnormality is often inherited and occurs especially in the weaker teeth, the upper second incisors (SILVEIRA et al., 2015).

This anomaly can generate a lack or excess of space, unfavoring the arch length, not only involving aesthetics, but also impairing occlusion, since the tooth could adopt an incorrect position. Its etiology is related to hereditary,

environmental, genetic and epigenetic factors. A possible method to diagnose microdontia of the upper lateral incisor when it is smaller, equal to or up to 0.7 mm wider than the mandibular lateral incisor, the result would be an excess of lower dental material in relation to the upper one (AGUIRRE et al., 2015).

Microdontia in any tooth can cause changes in the sagittal dimensions of the arch and these can be treated through restorative procedures to preserve esthetics and occlusion, taking into account a multidisciplinary diagnosis that includes evaluation for periodontics, orthodontics, rehabilitation and endodontics. Therefore, it is necessary to consider several factors, both aesthetic, functional, social and cultural (SILVA et al., 2016).

Patients with conical teeth can be successfully treated. Dentistry today offers several treatment options depending on the patient's expectations and the clinician's experience. Current dentistry offers several types of treatments for this anomaly, improving the esthetic zone and, of course, the smile: crowns, dental restorations or ceramic laminates, the focus of this work.

2.2 Ceramic laminates

Ceramic veneers (LC), which are chosen to provide excellent esthetics, are a well-established treatment method for the conservative esthetic restoration of malformed, discolored, misaligned, traumatized, fractured and worn anterior teeth. The recommended surface preparation within the enamel and adhesive cementation facilitate restoration with minimal loss of healthy tooth structure (ABRANTES et al., 2019).

The use of LCs with minimal preparation and no preparation can achieve the desired aesthetic result in a conservative manner. Initially, LCs were fabricated from stacked feldspathic porcelain and used in an "unprepared" manner 0.5–0.7 mm thick. While not removing healthy tooth structure was admirable, it often provided less-than-desirable results. The laminates often looked bulky and the soft tissue showed signs of irritation. It is important to remember that the ultimate goal of any dental treatment is to restore health and function, as well as esthetics, using the most conservative treatment method available (ESPÍNDOLA-CASTRO et al., 2020).

Recent marketing efforts by dental manufacturers and labs, aimed at dentists and consumers, have advocated "unprepared" laminates as a tooth structure preservation option that is aesthetically equivalent to or better than laminates that require preparation. The desired final position, shade and shape of the restoration should be the main determinants of the level of reduction. There are many significant advantages in preserving tooth structure, including lack of need for anesthesia, lack of post-

operative sensitivity, enamel bonding, minimal bending stress, longer lasting restorations, potential reversal, and higher levels of treatment acceptance between the patients. Patients with small or lingually positioned teeth should be considered ideal candidates for techniques that involve no or minimal preparation (ABRANTES et al., 2019; MONTENEGRO; SILVA; PINTO, 2015).

As LCs continued to evolve, a minimally invasive approach was used to provide a more esthetic and biologically compatible restoration. A minimum preparation of 0.5 mm was used to allow the placement of laminates, to be able to adequately mask unsightly areas and/or change the color, in addition to providing the minimum resistance necessary for the manufacture and delivery of the LC. Dental preparations for CLs require 3% to 30% of the tooth structure by weight and a quarter to half the amount of tooth reduction of conventional full coverage crowns (ESPÍNDOLA-CASTRO et al., 2020).

2.2.1 Incisal Preparation

Different designs of dental preparations have been described such as the fringed incisal edge, the 0.5–1 mm incisal bevel, the intra-enamel (or window) and the overlapping incisal edge preparations. There are different reports on whether the incisal edge should be included in the preparation for LCs. Castelnuovo et al. in 2000 they reported that the elimination of the palatal chamfer for VCs with incisal butt joints resulted in stronger restorations and simplified tooth preparation. They also suggested that the faciopalatal path of insertion allowed for easier seating of multiple facets and eliminated the risk of fracture of thin, unsupported palatal ceramic protrusions (GUGELMIN et al., 2020).

The current trend when teeth are prepared for LCs is to include the incisal edge by chamfering or through overlapping. A silicone index is more useful than a depth gauge drill when preparing the palatal surface and reducing the incisal edge, with a depth gauge drill having limited application in this situation (GUGELMIN et al., 2020; TOMASELLI et al., 2019).

2.2.2 Lip preparation

There are several methods to achieve the required reduction with preparation: freehand, use of depth cuts / grooves (the use of depth cutters or grooves and dimples has been recommended to control tooth preparation as the use of standardized objects allows accurate judgment of depth), and use of silicone or temporary mass index (the use of silicone index derived from wax-up allows visualization of the reduction needed to achieve the shape and contours of the pre-planned shape and length of the final facets) (OLIVEIRA JÚNIOR et al., 2019).

2.2.3 Interproximal Extension

There is no conclusive evidence on what is the best way to prepare the interproximal area of a tooth for an LC. Options range from virtually no preparation to a preparation just before interproximal contact to a slight opening of the interproximal contact. Breaking the contact (sometimes called “slice preparation”) may be necessary to clean the contact in certain situations, such as changing the shape or position of teeth and in the case of multiple facets. With the additional interproximal space, this allows freedom to adjust the contours and position of the teeth (MONTENEGRO; SILVA; PINTO, 2015; SILAMI et al., 2016).

2.2.4 Cervical margin

The desired position for the finish line of the varnish is just within the limits of the gingival sulcus. There is no reason to hide the interface subgingivally unless a drastic color change is desired. The finish line configuration must be chamfered. From a laboratory standpoint, it is extremely beneficial for the dentist to place at least one light bevel finish line so the ceramist clearly knows where to build the porcelain. In tetracycline-stained cases, it is desirable to go further subgingivally to mask the dark coloration in the cervical region. In this situation, it may also be necessary to remove some more of the tooth structure. Conventional diamond burs leave a macroscopically rough surface on the enamel. Additional tooth preparation using a small particle size diamond drill or a multiflute tungsten carbide finish drill will smooth the surface of the preparation and can be used to refine the finishing margin (OLIVEIRA JÚNIOR et al., 2019).

The success of the LC technique involves paying close attention to detail for the following: case planning, conservative preparation (to save enamel) of teeth, proper ceramic selection, proper selection of cementation materials and methods, proper finishing and polishing of restorations, and adequate planning for the continued maintenance of restorations (ABRANTES et al., 2019).

2.2.5 Material Selection

To improve the esthetics of anterior teeth through laminated veneers, two types of materials are indicated for their translucency and potential to be used in small thicknesses: sintered feldspathic porcelain and pressable ceramic, which can also be milled using a computer-aided manufacturing technique (OLIVEIRA et al., 2021).

Type I patients are candidates for conventional ceramics, while type II patients require high-strength ceramics. Type IB patients require simple esthetic veneers, although in this case the substrate teeth present color changes. Therefore, regardless of the need for shape

modifications, the ceramic material selected must be able to hide the color of the underlying substrate. In these cases, both porcelain and cement must have varying degrees of opacity to hide color changes. In type II patients, high-strength feldspar or alumina ceramics and oxide ceramics are indicated (GUGELMIN et al., 2020).

2.2.6 Cementation

There are many systems that have water-soluble, color corrected try-in gels; optimum viscosity levels; and color stable resin cements, opaque and color modifiers. Once properly cemented, LCs become an integral part of the tooth structure and share part of the applied load stresses during the chewing cycle. For cementation of LCs, a light-curing cementitious composite is preferred. In the case of ceramics with a thickness greater than 0.7 mm, the light-curing composite resins from not reach their maximum hardness. In these situations, dual polymerization cementation composite is advisable (ABRANTES et al., 2019).

The success of the porcelain veneer is determined by the strength and durability of the bond formed between the three different components of the veneer complex: the tooth surface, the porcelain veneer, and the cement composite. Magnification may be preferred for cementation procedures. Laminates should be evaluated in the laboratory model for proper seating and marginal fit. Rubber dam is essential for the lower teeth to isolate the lip and tongue and control moisture (OLIVEIRA JÚNIOR et al., 2020).

2.2.7 Clinical studies

The success rate of LCs was evaluated and shown a range from 18 months to 20 years; the success rate reported in these studies ranges between 75% and 100%. Fracture, microleakage and detachment are types of failure observed in LCs (ABRANTES et al., 2019).

The preparation of teeth greatly influences the durability and color of the ceramic restoration, as the dental preparation will determine the internal surface contour and thickness of the ceramic material. The laminate requires a minimum of 0.2 mm to (ideally) 0.3 mm thick for each shade change. Ceramic translucency also plays an important role in light penetration (TOMASELLI et al., 2019).

Patients with bruxism or tooth-to-foreign body contact may not be ideal candidates for veneers. In cases of minor incisal wear due to bruxism, it is often possible to restore the incisal length using LCs. It is very important to evaluate the occlusal scheme and control the occlusal forces before attempting any LC treatment. In these cases, an occlusal protection is indicated to help prevent

postoperative ceramic fractures (ABRANTES et al., 2019; ESPÍNDOLA-CASTRO et al., 2020).

The adhesion complex between porcelain, cementitious composite and enamel is considered a great advantage of porcelain veneers. It has been reported that the bond strength of this complex is about 63 MPa, while the bond between the composite and enamel is about 31 MPa and between the composite and porcelain alone is 33 MPa (MONTENEGRO; SILVA; PINTO, 2015; SILAMI et al., 2016).

III. MATERIALS AND METHODS

Literature review, with a qualitative approach, whose data collection was carried out from April to October 2021. A search and selection of articles related to the topic was carried out, in which the search criteria taken into account were: scientific articles from journals or electronic databases such as PubMed and Scielo, using the keywords “microdentics”, “conoid teeth” and “ceramic laminates”, which should meet the publication requirement in the last 05 years. Fifteen articles that met the criteria of this review were selected.

IV. RESULTS AND DISCUSSION

When performing the first search, a total of 271 articles were found in the databases. Afterwards, when the titles of these articles were read, 186 were selected. When reading the abstracts, only 102 articles remained and, finally, by adopting the inclusion criteria, only 15 articles comprised the present literature review. work, as illustrated in Figure 1.

When ceramic laminates are considered, different restorative approaches have been proposed, depending on the thickness of the veneer and the color of the remaining tooth structure. In the case of improving esthetics by changing the shape and texture of the teeth without severe discoloration, thinner veneers may be indicated. After being informed about the advantages and disadvantages of each restorative option (GUGELMIN et al., 2020; MONTENEGRO; SILVA; PINTO, 2015; SILAMI et al., 2016).

One of the most common materials used to make laminates is feldspathic porcelain. The main component of feldspathic porcelain is feldspar; a naturally occurring glass that contains silicon oxide, aluminum oxide, potassium oxide and sodium oxide. Feldspathic porcelain has many advantages; the material is very thin so it can be almost translucent, resulting in a natural looking restoration. Furthermore, it requires minimal dental preparation. Therefore, the enamel can be preserved.

Furthermore, it is possible to etch feldspathic porcelain with hydrofluoric acid, which gives a great bond strength to the remaining enamel (ABRANTES et al., 2019; ESPÍNDOLA-CASTRO et al., 2020; TOMASELLI et al., 2019).

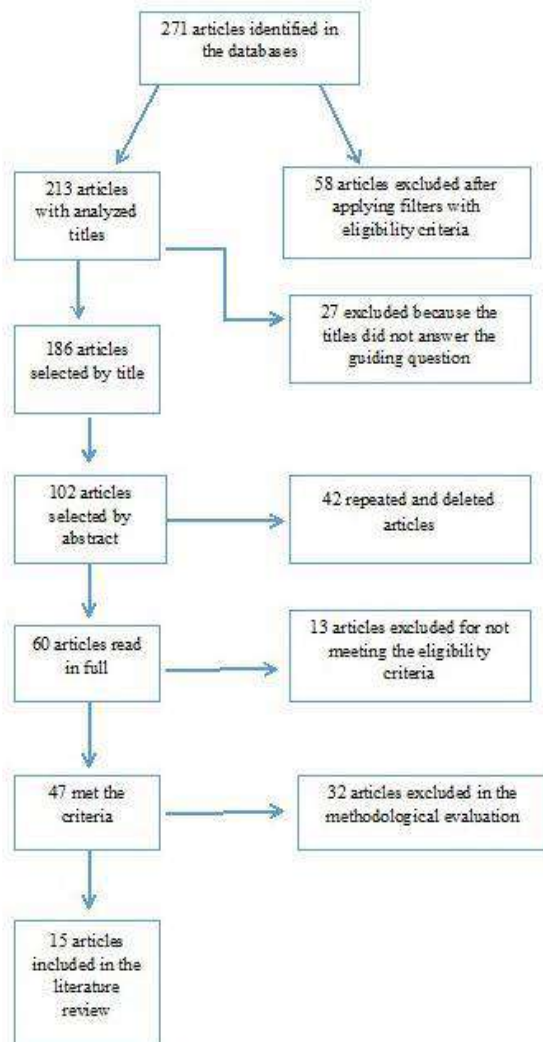


Fig.1: Selection of studies for the review.

Source: The authors themselves, 2021.

Feldspathic porcelain has some disadvantages. The manufacture of feldspathic porcelain can be done by two methods: the refractory matrix technique and the platinum sheet technique (ESPÍNDOLA-CASTRO et al., 2020). These methods are sensitive to the technique and the varnish manufactured requires good care before bonding (OLIVEIRA JÚNIOR et al., 2020). Also, masking discolored teeth can be difficult because porcelain is so thin. In addition, it has been reported that acid etching of the internal surface of the porcelain can cause microcracks that can lead to a decrease in the flexural strength of the porcelain and, eventually, fracture the laminate

(GUGELMIN et al., 2020; MONTENEGRO; SILVA; PINTO, 2015 ; SILAMI et al., 2016).

The in vitro study by Espíndola-Castro et al. (2020) suggests that extracted teeth that are restored with porcelain veneers have regained their original strength. Meanwhile, Oliveira et al. (2021) and Oliveira Júnior et al. (2020) point out that this may explain the low failure rate (0 - 5%) in clinical studies due to detachment of the porcelain laminate, especially when there is a lack of parafunctional habits.

Respectively, some authors have reported that when porcelain veneers are bonded to composites instead of enamel, porcelain veneers tend to have a higher failure rate (ABRANTES et al., 2019; GUGELMIN et al., 2020; TOMASELLI et al., 2019).

Many studies have investigated the longevity of porcelain veneers. Beier et al. (2017) reported in a retrospective clinical study a survival rate of 94.4% after five years and 93.5% after ten years; they found that the main reason for failure is a ceramic fracture. A randomized clinical trial by Layton and Walton (2016) showed similar results, with a survival rate of 96% after ten years and 91% after 20 years. In addition, Smales and Etemadi (2018) reported a 95% survival rate for porcelain veneers over 7 years. It is essential to emphasize that these studies and others (Abrantes et al., 2019; Gugelmin et al., 2020; Oliveira et al., 2021) that reported a high survival rate of porcelain veneers had a rigorous evaluation of the remnant enamel and systems stickers. As a result, careful and conservative preparation and optimal isolation during cementation are necessary to ensure predictable results.

There are other studies that report a lower survival rate for porcelain veneers. A retrospective study of 2,563 laminates in 1,177 patients by Burke and Lucarotti (2019) reported a survival rate of 53% at 10 years. The material type of the laminates was not reported. In addition, the study evaluated facets made by the general dental service and, therefore, it is possible that tooth preparations did not meet specialist level criteria. Another retrospective study was carried out by Shaini et al. (2017) reported a survival rate of 47% at 7 years. The laminates were made by graduate students and staff members at the University of Birmingham, UK. The study reported that over 90% of veneers were placed on unprepared teeth, which may be a reason for the high failure rate, as it is suggested that the bond to aprismatic enamel is much weaker than prepared enamel.

In addition to the optical characteristic similar to the tooth structure, glass-ceramic materials have good adhesion characteristics to the tooth structure. This increase in retention is mainly related to the use of

hydrofluoric acid to condition their internal surfaces, associated with the use of silane bonding agents (TOMASELLI et al., 2019). Furthermore, when dental preparation is restricted to enamel, a better and more reliable bond can be obtained (OLIVEIRA et al., 2021; OLIVEIRA JÚNIOR et al., 2020)

Many studies used a light-curing resin-based cement. This type of cement is an appropriate choice for cementing indirect facets in terms of bond strength and increased working time. The use of light-curing materials for the cementation of veneers, however, is based on the idea that light could easily pass through the indirect restoration due to its translucency and reduced thickness. A concern related to light transmittance through ceramic materials and its influence on the degree of cement conversion and mechanical properties should be raised (ABRANTES et al., 2019; GUGELMIN et al., 2020; OLIVEIRA et al., 2021; TOMASELLI et al., 2019).

It should be noted that even when dual resin cements are employed, light activation plays an important role in the degree of conversion of the material. (Oliveira et al., 2021) Another aspect to be considered when cementing laminates with materials that depend on the light transmission capacity through the ceramic is that not all light curing devices are equal and that different curing properties can be achieved for the same curing unit if used with a fiber optic or polymer light guide tip (GUGELMIN et al., 2020; MONTENEGRO; SILVA; PINTO, 2015; SILAMI et al., 2016).

Impaired vision of malformed teeth, such as conoid laterals or microdontia, can be successfully improved by porcelain or ceramic restorations. A precise and interdisciplinary diagnostic approach is recommended to obtain aesthetic, conservative, predictable and lasting results in the maxillary anterior dentition (ABRANTES et al., 2019; GUGELMIN et al., 2020; TOMASELLI et al., 2019). In this sense, Silami et al. (2016), showed in their studies that diagnostic additive waxing, aesthetic elongation of the clinical crown, direct acrylic mock-up, cementation procedures, direct restorations with composite resin used for the aesthetic rehabilitation of a patient with conoid lateral incisors, and a unsatisfactory Class IV restorations in the central incisor were presented and, as an alternative, ceramic veneers, ensuring their practicality and duration, unlike other techniques already used in the study patient.

Corroborating the previous notes, Abrantes et al. (2019) mention that ceramic laminates are one of the most used cosmetic dentistry services in the market. Many dentists use laminates as a solution for certain forms of microdontia, especially conoid teeth. As much dental

preparation is not required before placing the veneers, the already small tooth does not need to be further compacted or shrunk. Ceramic, a strong, high-quality material, helps make the new tooth natural while making the teeth more durable.

Gugelmin et al. (2020) and Oliveira et al. (2021) reinforce that porcelain materials have great biocompatibility and, concomitantly, can maintain favorable dental esthetics and patient satisfaction. These studies, with evaluation times ranging from 5 to 20 years, support that therapy with ceramic veneers in conoid teeth has a favorable clinical performance.

Lobato et al. (2019) suggested that the success of the ceramic veneer technique on conoid teeth involves paying close attention to detail for the following: case planning, conservative preparation (to save enamel) of teeth, proper selection of ceramics, proper selection of materials and methods adequate cementation, finishing and polishing of restorations, and adequate planning for ongoing maintenance.

V. CONCLUSION

Given the above, the following conclusions can be drawn:

- The minimally invasive aesthetic dentistry professional should choose the most conservative method possible, avoiding unnecessary wear and tear on the tooth structure;
- Conoid teeth are changes in size and shape of natural teeth. These changes have an aesthetic effect on the patient's smile, as the affected teeth are smaller than normal and have a sharpened incisal surface;
- Ceramic laminates are a well-established treatment method for the conservative aesthetic restoration of malformed teeth, such as conoids;
- Ceramic laminates on conoid teeth, when made according to the proper indications and a precise clinical protocol, offer excellent longevity and appearance.

REFERENCES

- [1] ABRANTES, P. et al. Restabelecimento da estética do sorriso com laminados cerâmicos: relato de caso. **Revista Ciência Plural**. v. 5, n. 3, p. 120-131, 2019.
- [2] ESPÍNDOLA-CASTRO, L. et al. Reabilitação estética do sorriso com laminados cerâmicos: caso clínico. **Research, Society and Development**, v. 9, n. 12, p. 1-17, 2020.
- [3] GUGELMIN, B. et al. Color Stability of Ceramic Veneers Luted With Resin Cements and Pre-Heated Composites: 12 Months Follow-Up. **Brazilian Dental Journal**. v. 31, n. 1, p. 69-77, 2020.

- [4] LOBATO, M. et al. Reanatomização de dente conóide com resina composta por meio de técnica de aplicação simplificada. **Revista Naval de Odontologia**. v. 46, n. 1, p. 31-36, 2019.
- [5] MENEZES, M. et al. Reabilitação estética do sorriso com laminados cerâmicos: Relato de caso clínico. **Rev Odontol Bras Central**. v. 24, n. 68, p. 37-43, 2015.
- [6] MONTENEGRO, G.; SILVA, W.; PINTO, T. Laminados cerâmicos: simplificando a cimentação. **Full Dent. Sci**. v. 6, n. 24, p. 439-445, 2015.
- [7] OLIVEIRA, B.; MIGUEL, J.; MAGALHÃES, A. Restauração estética de dentes conóides associada ao recontorno gengival em paciente jovem: relato de caso. **Rev Odontol Bras Central**. v. 30, n. 89, p. 64-82, 2021.
- [8] OLIVEIRA JÚNIOR, O. et al. Influence of Pre-Curing Different Adhesives on the Color Stability of Cemented Thin Ceramic Veneers. **Brazilian Dental Journal**. v. 30, n. 3, p. 259-265, 2019.
- [9] REIS, E. et al. Reanatomização estética de incisivo lateral conóide unilateral com resina composta na técnica direta-relato de caso clínico. **Anais da Jornada Odontológica de Anápolis – JOA**, 2019.
- [10] SANTOS, J. et al. **Otimização estética de incisivos laterais conóides através do uso de compósitos diretos**. (2015). Disponível em: <http://sdibrasilblog.com.br/wp-content/uploads/2019/05/Caso-Pola-Dra.-Cla%CC%81udia-Machado.pdf>. Acesso em: 20 abr. 2021.
- [11] SILAMI, F. et al. Influence of Different Types of Resin Luting Agents on Color Stability of Ceramic Laminate Veneers Subjected to Accelerated Artificial Aging. **Brazilian Dental Journal**. v. 27, n. 1, p. 95-100, 2016.
- [12] SILVA, A. et al. Incisivo lateral conóide. 15 f. **Trabalho de Conclusão de Curso** (Odontologia). Curso de Odontologia da FACS/UNIVALE, 2016.
- [13] SILVEIRA, D. et al. Reanatomização de incisivo lateral conoide em odontopediatria: relato de caso. **Revista Intercâmbio**. v. 8, n. 1, p. 231-342, 2017.
- [14] TOMASELLI, L. et al. Influence of Pre-Heating Regular Resin Composites and Flowable Composites on Luting Ceramic Veneers with Different Thicknesses. **Brazilian Dental Journal**. v. 30, n. 5, p. 459-466, 2019.
- [15] VERONEZI, M. et al. Remodelação estética de dentes conóides: tratamento multidisciplinar. **Revista Digital da Academia Paraense de Odontologia**. v.1, n.1, p.35-41, 2017.

Short Commercialization Circuits: Contributions and challenges for the strengthening of Family Farming

Elson de Oliveira¹, Stefania Evangelista dos Santos Barros², Mauricio Oliveira da Silva Sugai³, Denes Dantas Vieira⁴, Hélder Ribeiro Freitas⁵, José Raimundo Cordeiro Neto⁶

^{1,2,3}Doctoral student at the Postgraduate Program in Agroecology and Territorial Development at the Federal University of Vale do São Francisco (PPGADT/UNIVASF), Brazil. Email: elsonagro@yahoo.com.br.

^{4,5,6}Professor of the Postgraduate Program in Agroecology and Territorial Development at the Federal University of Vale do São Francisco (PPGADT/UNIVASF), Brazil.

Received: 22 Sept 2021,

Received in revised form: 09 Nov 2021,

Accepted: 14 Nov 2021,

Available online: 22 Nov 2021

©2021 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— *Short sales circuits, Family farming, Markets, Food and nutrition security, agroecology.*

Abstract— *Short circuits of commercialization (CCC), especially open markets, government purchases and networks of producers and consumers, have the potential to strengthen Family Agriculture, especially those that produce following the guidelines of alternative agriculture. In this sense, this paper analyzes the contributions and challenges of these types of marketing that provides more direct relationships between producer and consumer, in addition to reciprocity, bonds of trust, food and nutrition security and qualifies social agents in accessing public policies. The objective was to analyze the contributions and challenges of the CCCs for the strengthening of Family Agriculture in Brazil and in the world. The methodology approached was the bibliographical research, about the CCC and its fundamental bases. Having as object of study the modalities of CCC: open fairs, producer and consumer networks and government purchases. The main topics were: (i) short circuits and their potential as a marketing strategy for family farming; (ii) food and nutrition security in the context of short commercialization circuits; and (iii) short sales circuits in the world; initiatives, challenges and similarities. It is possible to state that the CCCs are distributed in several countries around the world, maintaining similarities in terms of challenges and organizations. The CCCs have been strengthening Family Agriculture with access to markets, but it is deficient in public policies. The CCCs, in addition to contributions to income generation, enable the establishment of improvements in food and nutrition security, strengthen organizational processes and promote development in different ways beyond economic growth.*

I. INTRODUCTION

THE Family Agriculture has as its characterization and primordial element for its structuring the use of family labor, even if it hires temporary employees at certain moments of agricultural production. Added to the use of small areas for production, which

leads to diversification, replacement of inorganic inputs by organic and use in many cases of native seeds.

Historically, Family Farming has had major obstacles in its production processes, including the difficulty of accessing land and inputs. After production, they face difficulties in accessing efficient markets and in absorbing the productive surplus, especially for those who

carry out differentiated production such as organic and agroecological ones. In addition, its production reveals different outlet possibilities – it can present as its destination self-consumption, barter, producer fairs, agribusiness, sale to government markets or even fair trade (SAMBUICHI et. al., 2019).

For Pierri and Valente (2015), the commercialization of Family Farming, especially in Brazil, is consolidated in four channels; (i) sale of raw material for agribusiness, for the production of processed or ultra-processed products; (ii) sales to companies that distribute food; (iii) sales to institutional markets (government purchases), mainly the Food Purchase Program (PPA)¹ and the National School Feeding Program (PNAE)² and (iv) direct sales to the consumer. The last two are included in the short commercial circuits (CCC).

Therefore, this work will address the short circuits of commercialization (CCC) of Family Farming, especially families that produce following the guidelines of agroecology, organic production, agroecological transition and other ecologically-based productions. Having as object of study and examples the modalities of CCC that they are; open markets, producer and consumer networks and government procurement. As an understanding of CCC, we will approach the one defined by Guzzatti, Sampaio and Turnes (2014) who understand that the commercialization occurs through more direct relations between producer and consumer, not necessarily in a direct way, but can be indirect since there is only one intermediary between the consumer and producer poles.

It aimed to analyze the contributions and challenges of short commercialization circuits for the strengthening of Family Farming in Brazil and in the world. As a methodological process, a bibliographical research was carried out, on the subject of short commercialization circuits, considering its fundamental bases.

For this, the work is divided into 6 topics: (i) Introduction; (ii) short circuits and their potential as a marketing strategy for Family Farming; (iii) food and nutrition security in the context of short commercialization

¹The PAA is an initiative with a focus on fighting hunger, it aims to purchase foodstuffs from Family Farming and with subsequent distribution in nursing homes, schools, day care centers, hospitals, etc. It is governed by the art. 19 of Law No. 10696, of July 2, 2003, within the scope of the Zero Hunger Program, and Decree No. 7775, of July 4, 2012. (SAMBUICHI, 2020).

²The PNAE is a public policy linked to school meals. With Law No. 11,947, of June 16, 2009, it was recommended that at least 30% of the transfer from the National Education Development Fund (FNDE) be invested in the purchase of Family Farming products (PEIXINHO, 2013).

circuits; (iv) short sales circuits in the world: initiatives, challenges and similarities; (v) final remarks, and (vi) references.

II. SHORT CIRCUITS AND THEIR POTENTIALITIES AS A MARKETING STRATEGY FOR FAMILY AGRICULTURE

The CCCs are strictly linked to the process of changing the concept of food and its nutritional quality, mainly by more informed and demanding consumers. This process also influences producers who need to enter demanding markets in terms of quality and origin (SCHNEIDER E FERRARI, 2015).

The search for the quality of food to be consumed permeates the establishment of relationships that determine the space in which it was produced, trust and, as a result, consumers value traditions and develop a rapprochement between producers and consumers (GOODMAN, DUPUIS AND GOODMAN, 2012). In other words, CCCs offer everything that the conventional system cannot demonstrate to its customers (SONNINO; MARSDEN, 2006).

Considering that the CCCs have at their base the elimination of intermediaries in their mercantile processes through direct sales, this new concept allows for "respatialization and resocialization" between producers and consumers, that is, producers offer qualified products with price control sales and in return the consumer has access to healthy and nutritionally rich food (SCHNEIDER E FERRARI, 2015).

According to Schneider (2016), the marketing of products from family farming is favored when the farmer interacts directly with their markets, through CCC, with the possibility of linking between farmer and final consumer, with a focus on relationships of trust, reciprocity and fair market; thus differentiating from large traditional markets.

The potential of the insertion of Family Farming in CCC adds in its process benefits that can be: (i) Social, favoring the consumer-producer relationship, with bonds of trust, reciprocity and autonomy; (ii) Economic, with insertion in markets and improvements in sales at fair prices; (iii) Environmental; with less negative impacts on the environment, as they develop cleaner production processes to ensure product quality; (iv) Preservation of traditional systems of family farmers and (v) Health; with access to healthy food (CORREIA et al. 2012).

The CCCs, in addition to gains in the commercialization processes, enable other values to be exchanged between consumers and producers, such as

bonds of trust and cooperation, thus favoring reciprocity between all involved (SCARABELOT and SCHNEIDER, 2012). For Pierri and Valente (2015), even the presence of the middleman/intermediary positively helps in the commercialization of production, as in several production chains the producer prioritizes production and "outsources" the part of commercialization to other social actors, including in this understanding, representative organizations, such as associations and cooperatives of family farmers themselves.

We can consider that the CCCs are divided into three main dimensions; (i) economic dimension, with advances in processes that obtain fair payment for products; (ii) space dimension, with a reduction in the

producer-end consumer relationship; (iii) sociological dimension, with greater interaction and construction of consolidated social values (SCHNEIDER AND FERRARI, 2015).

Still characterizing the short commercialization circuits as potentiating significant advances for Family Agriculture, we can consider it in three types; (a) direct sales, establishing proximity between the two poles, and creating bonds of trust and cooperation; (b) extended sales, the producer's trademarks and characteristics are worked on and can be sold in spaces far from the production; (c) regional sales, the products are directed to the region where the producers are located (MARSDEN, BANKS E BRISTOW, 2000). As shown below.

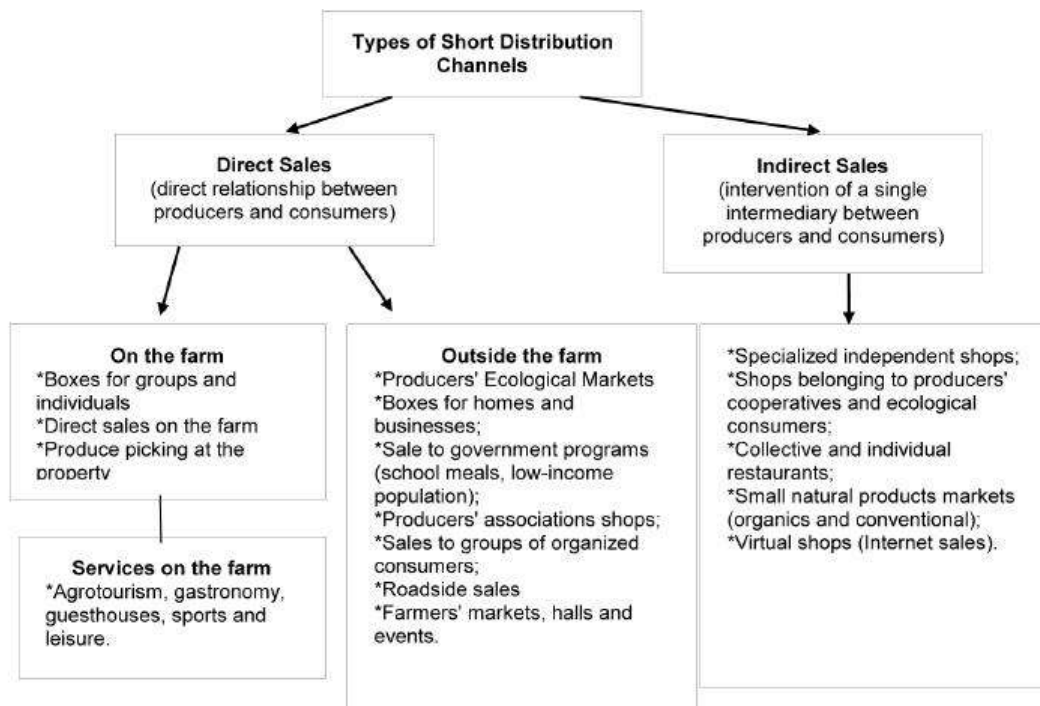


Fig.1: CCC types for eco-based products

Source: Darolt (2016)

The CCCs, in their processes of (re)approximation between producers and consumers, put into discussion, even in a subtle way, the way in which society is structured based on globalization and profit maximization, showing plausible alternatives of another relationship between the two links of production chains (FERNANDES; SAMPAIO, 2008; LEFF, 2001; VEIGA, 2007). For this, the consumer in the CCC becomes a social agent that promotes citizenship, that is, in addition to supplying food and nutritional security, it ends up generating the well-being of the community (GOMES, 2006).

For its potentialization and strengthening in several countries around the world, the CCCs in many cases need consumers to pay a premium for the product as a value-adding agent, and so that everyone involved can maintain their processes and have better survival conditions (OLIVEIRA et al., 2008).

In general, but above all in European countries, especially in France, the CCCs have, in recent years, been enhancing Family Farming in 4 (four) fundamental modalities: (i) Farmer's Markets; sites intended for commercialization without middlemen and managed by associations and with the support of local public policies; (ii) Collective points of sale; they are fixed points (stores)

that sell their products and are managed by associations; (iii) Associations pour le Maintien d'une Agriculture Paysanne (AMAP); a system where partnerships are established between consumers and producers, with the socialization of production processes and with guaranteed purchases and even advance payments; (iv) Supply in local schools (CHIFFOLEAU, 2008).

Within this same modality of AMAP, and with principles of collectivity, cooperation and reciprocity, commercial networks are established using cooperatives and associations of producers and consumers. In Brazil, this strategy is very present in the southern region, with the inclusion of at least 5 (five) "large" cooperatives that manage to strengthen Family Agriculture by distributing healthy foods to the three states of the region; Rio Grande do Sul, Santa Catarina and Paraná, and reaching more distant markets such as the insertion of its products in São Paulo. In this strategy, consumers are able to have access to products with a fairer price, accessible and with food and nutrition security, in addition to establishing the possibilities of volunteer work in the organization of networks (DAROLT, 2012).

Another modality of CCC that strengthens Family Farming and provides a considerable gain in food and nutritional security is the supply of products to the teaching units of the state and federal public network, as well as deliveries to support entities such as nursing homes, day care centers, hospitals inside others. In Brazil, this modality had its reach enhanced after the implementation of public policies, which regulated access and control mechanisms through programs such as: Food Acquisition Program (PAA) and the National School Feeding Program (PNAE) (MALUF, 1999). However, in recent years, the PAA has been the target of numerous setbacks and has drastically reduced its use as a marketing and strengthening strategy for Family Farming. That is why,

According to Villa Real and Schneider (2011), the PNAE underwent important transformations for the insertion of Family Agriculture in CCC. As a landmark of this transformation, we can mention the decentralization of public power purchasing processes, favoring small family farmers. With the support of Brazilian legislation, the PNAE started to mandate that at least 30% of the expenses allocated to school meals must be purchased from Family Farming, and with respect to regionality, eating habits and the establishment of menus adapted to each region and with broad social control with the inclusion of the School Feeding Council (CAE). The same authors point out that the advances of this policy provided;

transfer of income directly to the surrounding producers with local purchases; the approximation between food producers and consumers - in this case, students from purchasing schools, the possibility of revitalizing local production circuits, promoting the heating of the local and regional economy. With regard to production, it diversifies the range of products, there is an increase in the production of food for consumption, preserving natural resources (VILLA REAL E SCHNEIDER, 2011, p. 71).

However, even with these significant advances in the PNAE as a strategy to strengthen the commercialization of Family Farming in short circuits, there are challenges to be overcome for its realization in a broad manner.

Promote infrastructure logistics in schools (storage, food transport, food distribution centers, equipment and utensils for meal production); Develop specific actions for large cities; Discuss health and tax legislation; Strengthening social control; Expansion of the intersectoriality of public policies; Strengthening, together with education managers, the culture of family farmer participation in institutional markets, especially school meals; Ensure the presence of the nutritionist as technically responsible for school meals; Inclusion of organic food in school meals and Ensuring the dissemination of information (SILVA, 2011, p. 21-22).

Finally, in relation to CCC modalities, as a strategy to strengthen Family Farming, we approach open markets, which many theorists consider as the main form

of short circuits. Basically, the open market is established with the association of producers who organize themselves in a place to sell their products directly to consumers (GUZZATTI, SAMPAIO E TURNES, 2014).

However, in a more careful look, open fairs are cultural, educational and socially interactive spaces, and provide relationships for exchanging experiences between producers and consumers (DAROLT, 2012). Therefore, open fairs are spaces for building knowledge between rural and urban,

the fair space has provided the reciprocal knowledge of farmers and their experiences, a fact that could hardly occur if other more individualized marketing channels were used (GODOY; ANJOS, 2007, p. 366).

As limiting elements of open fairs, Darolt (2012) highlights the lack of diversification of products offered, which favors the consumer's move to the conventional market.

The CCCs allow, in addition to changes and income-generating potential, to reflect on changes in development conceptions going beyond economic growth, because for them to work, greater interaction between those involved is needed. Resulting in territorial development processes and other forms of sustainable development (JACQUIAU, 2000). The CCCs provoke new consumption strategies, and this favors the emergence of more organized communities with the potential to influence the formulation and implementation of public policies, that is, it allows the creation of new modes of development in confrontation with the ideal position of economic growth.

III. FOOD AND NUTRITIONAL SECURITY IN THE CONTEXT OF SHORT CIRCUITS OF COMMERCIALIZATION

According to Assis (2003), with the agricultural modernization process, especially after the Second World War, there was a great increase in the problems of environmental degradation, combined with the concentration of land ownership and social exclusion, due to the poor distribution of wealth and the increasing hunger in the world. As a result, in the 1960s and 1980s, alternative proposals emerged in the world for the exclusionary and degrading modernization of the environment. Becoming known as the "alternative agriculture", which emerged from the need to differentiate

themselves from the dominant technical models that are widely disseminated, from those more committed to social and environmental issues (CANAVESI et. al., 2016).

Among the ecologically-based "alternative agriculture" models, agroecology stands out. In its concept, it is defined as "citizen endosomatic processes" (MOLINA, 2011), with an understanding of the elements beyond the technical-agronomic aspects of agroecosystems, but the social, environmental elements and a balanced relationship between them. According to Molina (2011) it means guaranteeing the food distribution and safety processes that involve the production, preparation and transformation, transport, distribution, conservation and preparation of food. Thus, agroecology comes as a form of ecological management of natural resources through collective social action, capable of promoting, in counter-hegemony, the expansion of access and improvement of food quality and ensuring Food and Nutritional Security (CANAVESI et. al. , 2016).

Ecologically-based agriculture is in line with the Sustainable Development Goals (SDGs), which aim to eliminate hunger in Latin America and the Caribbean, which requires the construction of food systems, integrating agriculture with nutrition. Thus, a sustainable food system is one that provides nutritious and affordable food for all, to meet not only current human needs and those of future generations, but also the delivery of food, economic, environmental and nutritional products and services.

In the process of structuring a healthy food system, one of the focuses must be nutrition, which in turn must alleviate malnutrition. For that, it must provide an increase in the availability of food, not only in terms of volume, but also in terms of accessibility, diversity, sustainability and nutritional characteristics. The improvement of food systems is capable of ensuring good nutrition, for physical and cognitive development, well-being, as well as enabling good maternal nutrition, allowing the birth of healthy children, which is the key to breaking the intergenerational cycle of poverty (FAO & PAHO, 2017).

In this sense, food and nutrition security is essential for the construction of new "models" of development, which favor the full development of individuals, improvements in production, conservation of the environment, guarantee of quality of food and life for the population. Thus, the equation of economic growth is aligned with social equity, especially quality food. In this way, the debates were aligned not only in Brazil but in the world of food and nutrition security with those of promoting agroecology and other alternative agriculture.

From this perspective of advancing food and nutritional security, in addition to enabling the sale of products from Family Farming that produce on the principles of alternative agriculture. They were created in Brazil, the PAA and PNAE, as a result of the struggles of family farmers who have great difficulties in accessing public policies and markets. These programs are based on school meals and other institutions that support the Brazilian population. In this process, the access of family farming to marketing strategies that fit into the CCC logic was enhanced. For its strengthening, in addition to access, actions to support prices, market guarantee and production qualification were promoted (SAMBUICHI et al., 2019).

These two programs have enabled significant improvements in food and nutrition security, especially for children, youth and adults. It is also added to the strengthening of CCCs in Family Agriculture, as deliveries are made directly by producers in schools and social support institutions.

School feeding is an important public institutional action for the realization of food security, and comes with the purpose of supplying food to specific populations, in particular those of school age, and supporting family farming with marketing via CCC. Law No. 11,947 of 2009 provides that public basic education (kindergarten, elementary and high school, including youth and adults, indigenous people, quilombolas and those enrolled in specialized educational services) must contribute to the development and schooling of students, with formation of healthy eating habits thanks to the provision of quality food and food and nutrition education actions.

According to Schmitt & Grisa (2013) such programs allowed the economic insertion of family farmers, the promotion of local development dynamics, the creation of new commercial spaces, the enhancement of short production and consumption circuits and the social reproduction of family production units.

Thus, the experiences of short commercialization circuits based on government purchases carried out by the PAA and PNAE solidify Family Agriculture, which guarantees basic principles for Food and Nutritional Security, preserves traditional foods, with a focus on balanced nutrition, safeguarding agrobiodiversity and the sustainable use of natural resources, as well as an opportunity for sustainable local development, farmer autonomy, their identity, social protection and the well-being of communities and the generation of employment and income (EMBRAPA, 2014).

In addition to the programs mentioned, we can mention the open fairs, as a driver of the CCCs and as a promoter of nutritional food security for producers and

consumers, as with the direct relationship both will have access to nutritionally rich foods (SILVA et al., 2017). The open fairs take place in public spaces and periodically, they are places where there is exchange of goods between producers, in addition to providing the flow of local agricultural production. The fairs contribute to close commercial relationships, through the direct contact between the producer and the final consumer, in addition to providing local experience, tradition and culture (Pierri & Valente, 2015).

Research on fairs has highlighted that the attractiveness of fairs in relation to other forms of retail is due to the higher quality of the products and its outstanding characteristic of being harvested or produced close to the day of sale, but, above all, in the characteristic dynamics of price negotiation and differentiated service (face to face with the producer) (SILVA et al., 2017). Furthermore, "Fairs are also an important strategy for the social reproduction of family farming" (Silvestre, Calixto and Ribeiro, 2005, p. 4). Thus, open fairs are successful examples of CCC with the goal of conserving natural resources, food and nutrition security, reciprocal relationships, trust, fair trade and food quality, environmental conservation, respect for traditions and the possibility of local development.

IV. SHORT CIRCUITS OF MARKETING IN THE WORLD: INITIATIVES, CHALLENGES AND SIMILARITIES

The establishment of new relationships between family producers and consumers through short commercial circuits (CCC) can bring other advantages, in addition to the economic dimension, contributing to the overcoming of problems caused by the Green Revolution, such as those related to security food, the socio-environmental crisis and territorial development (GUZZATTI, CIOCE SAMPAIO and ALECIO TURNES, 2014). The strategies of these marketing circuits, based on greater proximity between consumer and producer as well as on a relationship of reciprocity, can contribute to the construction of a fair market, better integrating the countryside with the city.

The concept of reciprocity is part of the so-called free economy and solidarity economy, and is therefore a guiding element for understanding the social construction of these short circuits and the so-called proximity markets. (SABOURIN, 2018). Briefly, Sabourin presents the idea of reciprocity as an economic principle that generates ethical and human values, feelings of friendship, justice, identity, language and imagination, that is, something that goes beyond the exchange relationship. (SABOURIN, 2013).

In this context, many experiences have arisen inside and outside the country, proving that the existence of a new logic more suited to the universe of Family Farming is possible. The conventional circuits of large sales networks linked to large companies in the agro-industrial sector do not allow for an effective participation of family farmers, as they are unable to compete and insert themselves fairly in this global distribution chain. The need to seek a social construction aimed at the so-called fair market is evident. Many types of commercialization circuits have proven to be effective in this purpose of serving Family Agriculture, among which cooperatives and associations of producers, open fairs, home sales, farmer's houses, colonial products, stand out. certified organic products, institutional markets and cooperation networks. In this article, we will emphasize three types of short commercial circuits, open fairs, government purchases and producer and consumer networks, bringing reports of experiences present in Brazil, Colombia, France and Italy.

In the context of reciprocity, according to Sabourin (2018), fairs are old mechanisms, representing the first interface of direct contact between producer and consumer, allowing a reciprocal relationship to be established there with affective values of friendship, loyalty, trust and respect. Examples like this can be found in Brazil, as well as in Africa, Bolivia and France, adds the author, all retaining similarity in those aspects derived from this contact between producer and consumer.

Among the CCCs in Brazil, without a doubt, the open market plays a prominent role, as it is present in most Brazilian municipalities, taking place in public spaces organized weekly or daily. They are important for meeting the needs of producers and consumers with regard to the supply and consumption of local food production, generating income and work, in addition to becoming a space for sociability that unites tradition and culture. (SILVA et al., 2017). Model and Denardin (2014) highlight open markets as excellent marketing channels for Family Farming, with unique characteristics not found in other forms of commerce such as solidarity, proximity, trust, knowledge exchange and inclusion of social segments with lower purchasing power.

Also in Brazil, we can highlight experiences with networks of producers and consumers, which are forms of organization of family farmers with the aim of integrating themselves into short commercial circuits. According to Wilkinson (2010) apud Oliveira, Grisa and Niederle (2020), the so-called alternative, proximity markets value many aspects present in Family Farming products, such as their origin, the artisanal way and sustainability, organic or

agroecological. These networks integrate strategies such as the formation of producer groups, cooperatives, fairs, institutional purchases and participatory certification processes (seal), prioritizing the direct sale of agroecological foods. In this profile, the Ecovida Agroecology Network stands out, integrating groups, associations and cooperatives of family farmers, (OLIVEIRA, GRISA and NIEDERLE, 2020).

Garrido (2015) discusses the Food Acquisition Program (PAA) considering the challenges of its implementation in Colombia. In Brazil, the PAA was one of the structuring actions of the Zero Hunger Program of 2003, and constituted a public policy that played a structuring role in production, supply and consumption, with the participation of traditional peoples, settlers, family farmers, extractivists, from in order to meet the distribution and consumption of social assistance networks, public food facilities, population groups and families in a situation of food insecurity. Between 2003-2010, around R\$ 3.5 billion were invested in the acquisition of 3 million tons, involving 160 thousand family farmers in more than 2,300 Brazilian municipalities.

In the Colombian case, several initiatives were inspired by the Zero Hunger policy, such as the Bogotá sin hambre – no hunger program, in which peasant markets were articulated with school feeding programs, community eaters and highly vulnerable populations; and specifically, based on the PAA, the Instituto Colombiano de Bienestar Familiar (ICBF) developed the institutional purchasing model in Local Purchases of the School Feeding Program (PAE). However, as this is a first effort, the PAE did not manage to be as relevant for local economies as the contracts consider local purchase synonymous with purchase in the national territory and limit purchases to a maximum of 10%.(GARRIDO, 2015)

Based on previous experience, the project Strengthening of family agriculture was formulated as an agri-food model for food self-sufficiency and the generation of surpluses linked to institutional markets and with the support of local governments as a State policy, selecting public purchases from the PAE, prioritizing school eaters, directly benefiting 800 producer families, without establishing monthly or annual amounts of money, nor percentage of purchases. The execution was carried out by the FAO³ and PMA⁴ considering four components, such as producers and organization with the capacity to offer food; production of self-consumption for food safety; institutional markets articulated with family farming;

³ Food and Agriculture Organization of the United Nations.

⁴ World Food Program appears in 1963 established by the FAO.

positioning of Family Farming on public agendas. Although it is a project of limited scope due to the low percentage that the School Feeding Program has in the Colombian GDP, it presents a significant volume of food (700 t/day), showing the relevance of Family Farming and the potential of the PAE in its promotion. (GARRIDO, 2015)

According to FAO, Brazil and Colombia, in addition to international cooperation, have been exchanging successful experiences in the organization of Family Agriculture for the social construction of markets. The Semeando Capabilities Project, in a recent virtual seminar, presented Colombian initiatives such as the Rural Agroecological Markets Network of Vale do Cauca with 58 organizations and 300 families that produce according to agroecological principles; and the Association of Organic Producers La Tulpa, formed by 50 peasant and indigenous families, who weekly sell agro-ecological products, with a loyal base of customers, restaurants and stores. (FAO, 2020)

According to data from the French Agency for the Development and Promotion of Organic Agriculture, in France most food purchases in general are made in long circuits. However, part of consumers still prefer to buy in short circuits (33% buy at producer fairs (marché paysan); 29% in specialized stores and 19% directly on properties, which represented 48% of the total value of purchases) for reasons of health, quality, flavor and food and nutrition security, where these alternative networks bring new exchange principles, values and traditions in the relationships between producers and consumers. (DAROLT et al., 2016)

Darolt et al (2016) cites other successful CCC experiences such as Collective Selling Points (PVC), Consumer Associations (AMAP – Association for the Maintenance of Peasant Agriculture) and sales on properties. In France there is a preference for PVC, which are collective stores of producers that operate all year round, with fairs being more seasonal due to the difficult climate. The sale in PVC emerged in the late 1970s and aims to improve the working conditions of the farmer, reduce the time spent on marketing and offer consumers diversity, regularity and quality of typical products in the region. (DAROLT, et al., 2016)

Another well-established modality in France is the diversified baskets for organized groups of consumers, the AMAPs, inspired by Community Supported Agriculture (Community Supported Agriculture). They arise from the 2000s onwards, being the result of a greater social engagement of consumers and participation in social inclusion groups. There are also sales on the properties,

which are very widespread, especially for wines, cheeses and traditional products. (DAROLT et al. op. cit).

The Associations pour le Maintien d'une Agriculture Paysanne (AMAP) were based on the Teikei models, developed in Japan in the 1970s and on the Community Support Agriculture (CSA), which appeared in the United States in the 1990s (OLIVEIRA et al. ., 2010). This modality of CCC has been gaining a lot of space in several countries, including Brazil, with experiences being developed in all regions of the country, and the prevailing name is "Communities that Sustain Agriculture (CSA)". The fundamental basis is established with the alliance between consumers and producers, where the logic of fair prices and advance payments prevails, which favors and enhances the production of family farmers. In this context, a rescue of cooperation, citizenship and collective thinking-doing is established (GUZZATTI, SAMPAIO AND TURNES, 2014). According to Gasc (2011), until 2010 there were 1,200 AMAPs in France with the inclusion of 50,000 consumer families.

Another important milestone of this modality is the establishment of a contract to follow the collectively established agreements, which suggest weekly delivery with pre-established products with guaranteed quality, in addition to following the debated modes of production, which in general prevails the agro-ecological and organic. In relation to consumers, production risks are established, advance payments and acceptance of seasonal and regional products, that is, possible harvest losses are socialized (GASC, 2011).

Also in France, Chiffolleau (2019) analyzes the trajectory of the Grabels market, a small town of 7000 thousand inhabitants, located in the suburb of Montpellier, in the south of the country. The experiment, started in 2008, was supported by INRA⁵ whose research into short food supply chains (CCAA) helped to develop a 'hybrid' outdoor market, mixing producers and retailers, but focusing on short chains and local products. Among the main characteristics, we have that the condition for farmers is that most of their products come from their own production, and in the case of retailers, directly from local farms; a committee was installed with local authorities, consumers and sellers in a form of collegiate governance; There was also social control by the sellers themselves through the creation of a labeling system that, in addition to guaranteeing the origin and quality of the products, also served to exchange knowledge.

Chiffolleau (2019) presents the analysis of a cooperation project developed in Central Italy between an

⁵ French National Institute for Agricultural Research.

agricultural cooperative that produces organic pasta (La Terra and il Cielo) and 50 solidary buying groups (Gruppi di Acquisto Solidale - GAS). This form of cooperation took place through a long participatory process based on cost transparency for customers, and fair and stable prices for producers, thus creating a "Solidarity Economy Pact" between the parties, a relationship within a broader framework of principles of the social and solidarity economy. This pact established aspects such as purchase commitment with advance payment, contribution to a project support fund, shared risks and discounts, all in order to optimize a fair trade relationship managed from the perspective of proximity markets (SABOURIN, 2018).

According to Anjos and Caldas (2017), Italy is a country that has a rich and diverse food culture, which makes it almost a cultural identity, which transcends borders and is transmuted over time. In this context, the direct sales markets of agri-food products and alternative agri-food networks (AFN⁶) have emerged with ample possibilities for contributing to this very striking identity. The authors analyzed the trajectory of the main Italian agrarian organization, Coldiretti, responsible for the creation of the Campagna Amica project.

According to Anjos and Caldas (2017), the National Confederation of Direct Growers (Coldiretti), recognized as the largest agrarian organization in Italy and Europe, currently has 1.6 million farmers and emerged after the Second World War. As a union organization, from the beginning its interests were focused on producers whose income came from their work and their family.

The Campagna Amica project, initially a farmer markets, evolved towards the establishment of a brand identified through a seal, guaranteeing origin and a standard of excellence for agrifood products, as well as a direct sales network with more than seven thousand points throughout Italy. Campagna Amica is structured around axes that bear its brand: farmers' markets with genuine Italian products and preferably at km zero; the accredited farms where the farmer sells his products directly, encouraging face-to-face interaction and agritourism; the Italian winery that resembles gourmet markets, located in cities, for the sale of products from agricultural chains controlled by Coldiretti; the Buy and Offer Groups, formed by people who collectively purchase food products and redistribute them among the participants. In summary, there are 1,228 markets in Campagna Amica, 6,195 points of sale and 140 wineries, a network throughout the Italian territory. (ANJOS and CALDAS, 2017)

The initiatives presented here converge towards the same objective, which is to emphasize the ability of Family Farming to provide healthy food, while ensuring greater environmental and social sustainability, as its mode of production tends towards an effective conservation of the environment and valuing the human capital. The CCCs emerge as viable alternatives for promoting these family farmers, as they are based on principles of equity, solidarity, protagonism, creating a new socially fairer dynamic, with ample possibilities to leverage local development. In the European scenario, the initiatives, mainly in France and Italy, are already more consolidated, reaching a greater degree of organization. It is also evident that, despite the advances in these CCC modalities, the challenges faced are many.

V. FINAL CONSIDERATIONS

The CCCs in their multiple modalities have similar ways of organization and control, and are developed in several countries, thus demonstrating the potential for strengthening Family Farming, but even with countless searches in the literature for the preparation of this work, it was not possible to establish numbers and quantities commercialized by the CCCs in their modalities, requiring more in-depth studies on their reach in the commercialization and income generation processes.

With its distribution in several countries, the CCC stand out as a great potentiator of Family Farming worldwide, and maintain similarities in relation to the challenges and forms of organization, mainly in relation to the establishment of cooperation between consumers and producers, access to markets demanding, indicating that they are in the process of expansion. However, for their expansion and strengthening, the CCCs need public development policies, so that they continue to guarantee access to pesticide-free food, food and nutritional security, as well as environmental preservation. In addition, they must contribute to the generation of income for Family Farming, strengthening its organizational processes and its protagonism.

Finally, the CCC modalities analyzed in this work, such as open fairs, distributed in large parts of Brazilian cities and in other countries, demonstrate their potential as an income generator and as a place for exchanges between the rural-urban and between the rural - rural, promoting reciprocity, trust and access to healthy food. Also worth mentioning are the networks of producers and consumers, which demonstrate a new way of bringing the two poles together, and with shared responsibility so that everyone can obtain gains in terms of food and income. Government procurement, especially the PAA and

⁶ Alternative food networks.

PNAE, demonstrate that a debate on the formulation is necessary.

REFERENCES

- [1] ALIAGA, M. A.; SANTOS, S. C.; TRAD, L. A. B. **Política(s) de segurança alimentar e nutricional: narrativas de líderes e moradores de um bairro popular de Salvador, Bahia, Brasil.** *Saúde Soc.* São Paulo, 2019, v.28, n.4, p.124-136.
- [2] ANJOS, F. S. D.; CALDAS, N. V. A dinâmica dos circuitos curtos de comercialização: o caso do Projeto Campagna Amica na Itália. *Sociedade e Estado*, Brasília, v. 32, n. 3, p. 771-789, Set./Dez. 2017.
- [3] ASSIS, R. L. **Globalização, Desenvolvimento Sustentável e Ação Local: O Caso da Agricultura Orgânica.** *Cadernos de Ciência & Tecnologia.* 2003; 20(1): 79-96.
- [4] BRASIL. **Lei n o 11.346, de 15 de setembro de 2006. Cria o Sistema Nacional de Segurança Alimentar e Nutricional – SISAN – com vistas a assegurar o direito humano à alimentação adequada e dá outras providências.** *Diário Oficial da União* 2006; 18 set.
- [5] CANVESI, F. C. C.; MOURA, I. F.; SOUZA, C. **Agroecologia nas políticas públicas e promoção da segurança alimentar e nutricional.** *Segur. Aliment. e Nutr.*, dez. 2016, Campinas, v.23, n.esp., p.1019-1030. DOI: <http://dx.doi.org/10.20396/san.v23i2.8635617>.
- [6] CAPORAL, F.; PETERSEN. P. **Agroecologia e políticas públicas na América Latina: o caso do Brasil.** *Agroecologia.* 2012; 6:63-74.
- [7] CHIFFOLEAU, Y. et al. A construção participativa de novos modelos econômicos em cadeias curtas de abastecimento alimentar. *Journal of Rural Studies*, v. 68, p. 182-190, Maio 2019.
- [8] CHIFFOLEAU, Y. Les circuits courts de commercialisation en agriculture: diversité et enjeux pour le développement durable. In: Ma réc hal , g. (Ed.). **Les circuits courts alimentaires: bien manger dans les territoires.** Dijon:Educagri, 2008. p. 21-30.
- [9] CORREIA, T., Cristóvão, A., Costa, D., Guimarães, H., Rodrigo, I., Tibério, L.& A. Baptista, (2013). **Recomendações de Medidas de Política de Apoio aos Circuitos Curtos Agro-Alimentares: período de programação 2014-2020 (Relatório Final)**, ISA, UE, UTAD, julho 2013.
- [10] DAROLT, M. R. **Conexão ecológica: novas relações entre agricultores e consumidores.** Londrina: IAPAR, 2012.
- [11] DAROLT, M. R. et al. Redes alimentares alternativas e novas relações produção-consumo na França e no Brasil. *Ambiente & Sociedade*, São Paulo, v. XIX, n. 2, p. 1-22, abr.-jun. 2016.
- [12] DAROLT, MOACIR ROBERTO et al. **ALTERNATIVE FOOD NETWORKS AND NEW PRODUCER-CONSUMER RELATIONS IN FRANCE AND IN BRAZIL.** *Ambiente & Sociedade* [online]. 2016, v. 19, n. 2 [Accessed 20 November 2021] , pp. 01-22. Available from: <<https://doi.org/10.1590/1809-4422ASOC121132V1922016>>. ISSN 1809-4422. <https://doi.org/10.1590/1809-4422ASOC121132V1922016>.
- [13] DECOOX, M. C.; PRÉVOST, S. **Circuits courts: une valeur ajoutée pour les territoires.** Paris: Réseau Rural Français, 2010. Disponível em: <http://www.reseaurural.fr/files/dossier_de_presse_circuits_courts.pdf>. Acesso em: 23 out. 2020.
- [14] DELGADO, G. **Reestruturação da economia do agronegócio – anos 2000.** In: Stedile JP, Estevam D. *A questão agrária: o debate na década de 2000.* São Paulo: Ed. Expressão Popular; 2013. p. 57-87.
- [15] EMBRAPA. **Relatório executivo – agricultura familiar: construindo uma agenda com visão de futuro.** Brasília: Embrapa, 2014.
- [16] FAO – FOOD AND AGRICULTURE ORGANIZATION. **The state of food insecurity in the world: strengthening the enabling environment for food security and nutrition.** Roma, 2014.
- [17] FAO e OPAS. **2016 América Latina e Caribe: Panorama de Segurança Alimentar e Nutricional – sistemas alimentares sustentáveis para acabar com a fome e a má nutrição.** Santiago, 2017.
- [18] FAO. Programa de Cooperação Internacional Brasil-FAO. **FAO, 2020.** Disponível em: <<http://www.fao.org/in-action/programa-brasil-fao/noticias/ver/pt/c/1312831/>>. Acesso em: 29 outubro 2020.
- [19] FERNANDES, V.; SAMPAIO, C. A. C. Problemática ambiental ou problemática socioambiental? a natureza da relação sociedade meio ambiente. **Desenvolvimento e Meio Ambiente**, Curitiba, v. 18, p. 87-94, 2008.
- [20] GARRIDO, H. C. C. Abordagem territorial da segurança alimentar: articulação do campo e da cidade no Programa de Aquisição de Alimentos: considerações sobre o caso colombiano. **NERA**, Presidente Prudente, n. Especial, p. 51-69, 2015.
- [21] GASC, M. **Les AMAP: un partenariat entre consommateurs et producteurs.** Paris: Observatoire du Management Alternatif, 2011.
- [22] GODOY, I. F.; ANJOS, F. S. **A importância das feiras livres ecológicas: um espaço de trocas e saberes da economia local.** In: Congresso Brasileiro de Agroecologia, 2., 2007, Porto Alegre. **Anais...** Porto Alegre: ABA, 2007. p. 364-361.
- [23] GOMES, D. V. Educação para o consumo ético e sustentável. **Revista Eletrônica do Mestrado em Educação Ambiental**, Porto Alegre, v. 16, p. 18-31, jan./ jun. 2006. Disponível em:

- <<http://www.remea.furg.br/edicoes/vol16/art02v16.pdf>>. Acesso em: 25 out. 2020.
- [24] GOODMAN, D.; DUPUIS, E. M.; GOODMAN, M.K. **Alternative food networks: knowledge, practice, and politics**. Abingdon: Routledge, 2012.
- [25] GUZZATTI, T. C.; CIOCE SAMPAIO, C. A.; ALECIO TURNES, V. Novas relações entre agricultores familiares e consumidores: perspectivas recentes no Brasil e na França. **Organizações Rurais & Agroindustriais**, v. 16, n. 3, p. 363-375, 2014.
- [26] IBGE – INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. **Pesquisa nacional por amostra de domicílios: segurança alimentar 2013**. Rio de Janeiro, 2014.
- [27] MALUF, R. S. J. **Ações públicas locais de abastecimento alimentar**. São Paulo: Polis, 1999.
- [28] MARCOS, V. **Agroecologia e campesinato: uma nova lógica para a agricultura do futuro**. Agrária, São Paulo, 2007, n° 7, pp. 182-210.
- [29] MARQUES, P. E. M.; RETIÉRE, M.; ALMEIDA, N.; SANTOS, C. F. **A participação da agricultura familiar no Programa Nacional de Alimentação Escolar: estudo de casos em municípios paulistas da região administrativa de Campinas**. *Segur. Aliment. Nutr.*, 2017, Campinas, v. 24, n. 2, p. 101-112, jul./dez.
- [30] MARSDEN, T.; BANKS, J.; BRISTOW, G. Food supply chain approaches: exploring their role in rural development. *Sociologia Ruralis*, Wageningen, v. 40, n. 4, p. 424-438, 2000.
- [31] MATTE, A.; NESKE, M. Z.; BORBA, M. F. S.; WAQUIL, P. D. & SCHNEIDER, S. (2014) **A realocização e o mercado de cadeias curtas na pecuária familiar do território Alto Camaquã no sul do Rio Grande do Sul**. En: 7º Encontro de Economia Gaúcha. PUC, Porto Alegre.
- [32] MOLINA, M. G. **Introducción a la agroecología. Cuadernos Técnicos. Série Agroecología y ecología agrária**. Valencia: Sociedad Española de Agricultura Ecológica (SEAE); 2011.
- [33] OLIVEIRA, C. D. S.; PERAFÁN, M. E. V. Gestão social no âmbito do Programa Desenvolvimento Sustentável de Territórios Rurais. In: **Encontro da Rede de Estudos Rurais**. Belém: Rede de Estudos Rurais, 2012.
- [34] OLIVEIRA, D.; GRISA, C.; NIEDERLE, P. Inovações e novidades na construção de mercados para a agricultura familiar: os casos da Rede Ecovida de Agroecologia e da RedeCoop. **Redes Online**, St. Cruz do Sul, v. 25, n. 1, p. 135-163, janeiro-abril 2020.
- [35] PEIXINHO, Albaneide Maria Lima. **A trajetória do Programa Nacional de Alimentação Escolar no período de 2003-2010: relato do gestor nacional**. *Ciência & Saúde Coletiva* [online]. 2013, v. 18, n. 4 [Acessado 20 Novembro 2021], pp. 909-916. Disponível em: <<https://doi.org/10.1590/S1413-81232013000400002>>. Epub 07 Maio 2013. ISSN 1678-4561. <https://doi.org/10.1590/S1413-81232013000400002>.
- [36] PERES, A. C. **O ronco da fome: no semiárido nordestino, histórias de resistência aos cortes que podem levar o Brasil de volta ao Mapa da Fome**. Radis, Rio de Janeiro, 2018, v. 186, p. 15-24.
- [37] PIERRI, M. C. Q. M. & VALENTE, A. L. E. F. (2015) **A feira livre como canal de comercialização de produtos da agricultura**. In: *53º Congresso de Economia e Sociologia Rural*. Alagoas.
- [38] SABOURIN, E. Comercialização dos produtos agrícolas e reciprocidade no Brasil. **Estudos Sociedade e Agricultura**, Rio de Janeiro, v. 21, n. 1, p. 5-33, 11 dez. 2013.
- [39] SABOURIN, E. Construcción social de circuitos cortos y de mercado justo: articulación entre intercambio y reciprocidade. **Theomai Journal**, n. 38, p. 150-167, 2018.
- [40] SAMBUICHI, R. H. R. **Texto para discussão – Programa de Aquisição de Alimentos e Segurança Alimentar: modelo lógico, resultados e desafios de uma política pública voltada ao fortalecimento da agricultura familiar**. / Instituto de Pesquisa Econômica Aplicada. - Brasília: Rio de Janeiro: Ipea. Brasília, 2019.
- [41] SAMBUICHI, Regina Helena Rosa et al. **O Programa de Aquisição de Alimentos (PAA) como estratégia de enfrentamento aos desafios da COVID-19**. *Revista de Administração Pública* [online]. 2020, v. 54, n. 4 [Acessado 20 Novembro 2021], pp. 1079-1096. Disponível em: <<https://doi.org/10.1590/0034-761220200258>>. Epub 28 Ago 2020. ISSN 1982-3134. <https://doi.org/10.1590/0034-761220200258>.
- [42] SANTARELLI, M. **Da democratização ao golpe: avanços e retrocessos na garantia do direito humano à alimentação e à nutrição adequadas no Brasil**. Brasília, DF: Fian Brasil, 2017.
- [43] SCARABELLOT, M. & SCHNEIDER, S. (2012) **As cadeias agroalimentares curtas e desenvolvimento local: Um estudo de caso do município de Nova Veneza, SC**. *Revista Faz Ciência* V.15 (20). 101-130.
- [44] SCHMITT, C.J.; GRISA, C. **Agroecologia, mercados e políticas públicas: uma análise a partir dos instrumentos de ação governamental**. In: Niederle PA, Almeida L, Machado F. *Agroecologia: práticas, mercados e políticas para uma nova agricultura*. Curitiba: Kairós Edições; 2013. p.215-265.
- [45] SCHNEIDER, S. & FERRARI, D. L. (2015) **Cadeias curtas, cooperação e produtos de qualidade na agricultura familiar: o Processo de Realocização da Produção Agroalimentar em Santa Catarina**. *Organizações Rurais & Agroindustriais*. V. 17(1). 56-71.

- [46] SCHNEIDER, S. Mercados e agricultura familiar. In: Marques, F. C.; Conterato, M. A; Schneider, S. (Orgs). **Construção de mercados e agricultura familiar: desafios para o desenvolvimento rural**. Porto Alegre: Editora da UFRGS, 2016. cap. 4. p. 93-140.
- [47] SILVA, M. L. Relatório da Coordenação de Monitoramento do Controle Social e Agricultura Familiar do PNAE. In: _____. **Oficina nacional com prefeitos, prefeitas e gestores municipais do PAA: modalidade de compra direta local da agricultura familiar**. Brasília: FNDE, 2011. Disponível em: <<http://www.fnde.gov.br>>. Acesso em: 20 out. 2020.
- [48] SILVA, M.N.; CECCONELLO, S. T.; ALTEMBURG, S. G. N.; SILVA, F. N.; BECKER, C. **A agricultura familiar e os circuitos curtos de comercialização de alimentos: estudo de caso da feira livre do município de Jaguarão, RS, Brasil**. Revista Espacios, vol. 38 (Nº 47) Ano 2017. Pág. 7.
- [49] SILVA, S. P. **A trajetória histórica da segurança alimentar e nutricional na agenda política nacional: projetos, discontinuidades e consolidação**. Rio de Janeiro: Ipea, 2014.
- [50] SILVESTRE, L. H. A.; RIBEIRO, Á. E. M. **Subsídios para a construção de um programa público de apoio à feira livre no vale do São Francisco, MG**. Organizações Rurais & Agroindustriais, 2011, V. 13(2). 186-200.
- [51] SONNINO, R.; MARSDEN, T. Beyond the divide: rethinking relations between alternative and conventional food networks in Europe. **Journal of Economic Geography**, Oxford, v. 6, p. 181-199, 2006.
- [52] VERANO, T. D. C.; MEDINA, G. D. S. Comercialização por agricultores familiares em feiras municipais: quantificação, participação e localização no estado de Goiás. **Interações**, Campo Grande, v. 20, n. n. 4, p. 1045-1056, out./dez. 2019.
- [53] VILLA REAL, L. C.; SCHNEIDER, S. O uso de programas públicos de alimentação na reaproximação do pequeno produtor com o consumidor: o caso do programa alimentação escolar. **Estudo & Debate**, Lajeado, v. 18, n. 2, p. 57-79, 2011. Disponível em: <<http://www.univates.br/revistas/index.php/estudoedebate/article/view/125/200>>. Acesso em: 10 out. 2020.

Social Cartography of Terreiro and Traditional Peoples' Agriculture: An Interdisciplinary Dialogue for Agroecological Transition

Luciano de Oliveira Costa¹, Gáudia Maria Costa Leite Pereira², José Cláudio Rocha³, Jairton Fraga Araújo⁴, Lucia Marisy Souza Ribeiro de Oliveira⁵, Edonilce da Rocha Barros⁶, Luzi Borges⁷, Augusto Araújo Santos⁸, Nayara Silva Santana⁹, Raimundo Nunes de Oliveira¹⁰

¹ Doctoral student, Postgraduate Program in Agroecology and Territorial Development, Bahia State University (UNEB) Campus Juazeiro - BA, Brazil.

² Doctoral student, Postgraduate Program in Agroecology and Territorial Development, Rural Federal University of Pernambuco (UFRPE) Campus Recife - PE, Brazil.

^{3, 4, 6} Teacher, Department of the Program in Agroecology and Territorial Development, Bahia State University (UNEB) Campus Juazeiro - BA, Brazil.

⁵ Teacher, Department of the Program in Agroecology and Territorial Development, Federal University of Vale do São Francisco (UNIVASF) Campus Petrolina - PE, Brazil.

⁷ Teacher, Santa Cruz State University (UESC) Ilhéus - BA, Brazil.

⁸ Teacher, Federal Institute of Alagoas (IFAL), Doctor in Vegetable Production Santana do Ipanema - AL, Brazil.

⁹ Teacher, State Center for Professional Education of the Cocoa and Chocolate Forest Milton Santos, Master in Letters: Language and Representations, Arataca - BA, Brazil.

¹⁰ Teacher, Basic Education in the municipal network of Arataca, Master in Teaching and Ethnoracial Relations, Arataca - BA, Brazil.

Received: 29 Sept 2021,

Received in revised form: 09 Nov 2021,

Accepted: 18 Nov 2021,

Available online: 24 Nov 2021

©2021 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— Family farming, Agroecology, terreiro community, participatory mapping, sociogeography, territoriality.

Abstract— This article presents a social cartography of terreiro and its contribution to the agroecological transition in the municipality of Arataca/Bahia/Brazil. Participatory mapping was an important sociogeographical tool used to contribute to the strengthening of ethno-racial relationships and environmental preservation in the southern territory of Bahia/Brazil, focusing on the experience with agriculture of traditional peoples in the community-terreiro: Ilê Axé Ijexá Omi T'Odé (House of Energy of the Ijexá Nation Água do Caçador), from the perspective of its social transformation. It addresses concepts, principles and the step-by-step of its realization, seeks to describe its territoriality composed of the signs of Afro-Brazilian cosmology and its relationship with the Atlantic Forest, transforming it into a territory of environmental protection and sacred to its people. The research to obtain the data was qualitative analytical, searching for classical and contemporary authors who address the subject, as well as valuing the speeches of social actors who integrate the community. The final considerations point to the increasing need to scientifically evaluate social actions in order to qualify entrepreneurial organizations and also to satisfy family farming in the region.

I. INTRODUCTION

The idea of writing this article came up in the PhD Program in Agroecology and Territorial Development, interdisciplinary modality, which is an association formed between the Federal University of São Francisco Valley, Federal Rural University of Pernambuco and the State University of Bahia, during the field visit to Ilê Axé Ijexá Omi T'Odé (House of Energy of the Ijexá Nation Água do Caçador) in the municipality of Arataca - Bahia/Brazil, an opportunity in which it was possible to map, through the Social Cartography of Terreiro (CST), the territories of ancestral memories, the sociogeographic spaces and the soils of traditional peoples' agriculture, which have contributed to the agroecological transition in the municipality.

Interdisciplinarity was used as a method to collaborate in the production of data, as well as to promote dialogue and the exchange of knowledge between the areas of academic scientific power and the traditional community.

The terreiro community is a space organized by traditional peoples of African matrix that currently use a cartographic look to highlight their symbolic marks. As a cultural expression, education makes it possible to understand interdisciplinarity in order to build a vision of the doings and customs of a cultural group or even a society, since it determines behaviors defining worldviews.

Geography and Culture have always been part of human life. Even before the science of geography and religious institutions, the human being already practiced geography and somehow worshipped nature. To understand the meaning attributed to the traditional spaces of African matrix, we turn to the study of cultural geography.

We sought to analyze the geographic organization and spatialization of the landscape as a whole, especially the location and the man-machine interface that permeates these elements, their changes and their contribution to the process of spatial change. We sought to analyze the geographic territorial organization and spatialization in the landscape of a terreiro community as a whole, maintaining a dialogue between the community, the sacred spaces and agroecology for the preservation of ecosystems, creating a cartography of this terreiro community space with specific existing elements, specifically targeting the location and human-machine interfaces.

THEORETICAL REFERENCE

Currently, Social Cartography has been a research tool, especially for social and human areas, has presented essential gains by directing new looks and providing the

construction of the "state of the art" through dialogue between the academic curricular components and the knowledge built in the various traditional communities.

According to Acelrad and Coli (2008), since 1990 there have been many mapping initiatives proposing to include local populations in the map production process and that these actions have been practiced by various governmental and non-governmental institutions. Thus, some concepts have been emerging in this field of socio-territorial dispute, as is the case of (Herlihy and Knapp 2003), which defines participatory mapping as one that recognizes the spatial and environmental knowledge of local populations, inserting them in more conventional models of knowledge.

Highlighting the look at its methodological roots vis-à-vis "participatory observation" and "collaborative research methodologies". Thus, Colchester (2002) also brings coherence within the community by reaffirming the value and especially the relevance of traditional knowledge by instilling respect for elders and traditional resource management practices.

Therefore, in the XXI century, other concepts on mappings have been built in Brazilian lands, as is the case of the concept of Social Cartography of Terreiros already researched in the Brazilian northeast, having as a result some cartographic productions cited here: The first Mapping of Black Religious Sites and Monuments of Bahia (MAMNBA), with the realization of the Project "Mapping of Black Religious Sites and Monuments of Bahia" - carried out in the period from 1982 to 1987.

In 2006, the Project of Land Regularization of Terreiros was executed with the Mapping of the Terreiros of Salvador, there were about 1,164 registered communities made by the Center of Afro-Oriental Studies (CEAO) - Federal University of Bahia (UFBA) (UFBA 2006). Another mapping action of the terreiros was registered in the "Caderno 09 - Terreiros de Candomblé de Cachoeira e São Félix," released by the Institute of Artistic and Cultural Heritage of Bahia (IPAC) (Lobo 2015).

In the territory of Southern Bahia/Brazil, in 2013, a research was conducted called: "Águas do Leste: um olhar sobre terreiros: mapeamento de comunidades religiosas de matriz africana da Bacia do Leste (BA)" (Amim 2013).

In 2016, a mapping entitled Ijexá was conducted by the doctoral professor Vilson Caetano de Souza Júnior, with the objective of instituting the request for tombamento of Ilê Axé Kalé Bokum in the city of Salvador - Bahia/Brazil. The publication of the book: "Candomblé e umbanda no sertão: cartografia social dos terreiros de Senhor do Bonfim/BA" (Marques et al. 2018) served as a framework for the discussion of terreiro peoples with the strengthening of ethnic-racial public

policies in the territory of the northeastern semi-arid region.

In the year 2020, the research entitled: "Exu, orientation paths: traditional knowledge of Ijexá matrix, afro-geographic of an Ogan", conducted by Mestre Raimundo Nunes de Oliveira, presented the mapping of terreiro communities, heritages of the Ijexá nation in southern Bahia (Ajagunan 2021).

In the face of some initiatives, the Social Cartography of Terreiros is still an unusual tool, either because of ignorance of how to do it or because of the mistaken understanding of social agents when they do not dimension the legitimacy of this intervention, however "they believe that the actors involved in these mappings do not find incentive or time to write about their experiences or are reluctant to make them public because of the political, legal, economic and cultural sensitivities involved" (Chapin et al. 2005, p. 17).

Actions such as these have caused numerous damages to the territoriality of each region and catastrophic socio-environmental impacts, causing devastation and soil erosion, contamination of water resources mainly in their sources, affecting biodiversity by causing the extinction of Brazilian flora and fauna (Santana and Nunes 2021) and essentially promoting the disappearance of traditional knowledge disseminated in rural communities (Lazzari and Souza 2017). With this, there is an increase in government economic dependence with the creation of welfare programs, accompanied by the reduction of job vacancies mainly for young black people, stimulating rural exodus and social exclusion (Grisa and Schneider 2015).

It is believed that an alternative to change this scenario would be to encourage the production of research on other forms of agriculture, including the agriculture of traditional peoples, as well as to value the work of the Technical Assistance and Rural Extension (ATER) provided to farmers that represents a paradigm shift and encourages the agroecological transition. In this sense, the National Policy on Technical Assistance and Rural Extension for Family Agriculture and Agrarian Reform (PNATER) and the National Program for Technical Assistance and Rural Extension in Family Agriculture and Agrarian Reform (PRONATER) were instituted in 2010, amending Law No. 8,666 of 21 June 1993 (Diesel et al. 2015).

According to Ferreira and Felício (2021), one of the fundamental concepts of agriculture of traditional peoples is the respect and love for the land and nature, this translates all the care that should be taken with the soil and with the preservation of biomes. They also indicate that the problem of world hunger is not caused by millennial

agricultural techniques, they generate a multiplicity of medicinal plants and a diversity of foods with more than 500 plants, their look is for polyculture.

Therefore, this article reports the challenge of building a participatory mapping in Ilê Axé Ijexá Omi T'Odé in Arataca - Bahia/Brazil, from the knowledge of traditional peoples' agriculture, based on the experiences in the Social Cartographies of Terreiros built in the Brazilian Northeast. Thus, its construction will promote the studies on agroecological practices in the identity territory South of Bahia, furthermore, recognized as a space of resistance against the attacks and violence caused in the sacred territory - the Atlantic Forest.

Ensuring and valuing food traditions through the exchange of knowledge, recipes and food within and between territories is vital. The agriculture of traditional peoples has been responsible for preserving and maintaining the seeds of food and medicinal plants even when they become rare on the plates of Brazilian families.

Altiere (2012, p. 105) conceptualizes Agroecology as "a holistic study of agroecosystems, covering all environmental and human elements. Its conception should be formulated starting from the north in which are correlated the cross-cutting themes addressing the theme of local culture and family farming, both discussed in the classroom, as in the school environment, guided in the legal documents of the educational institution. Interdisciplinarity, expressed in this concept, corroborates so that the proposed dialogue enables new effective actions in the process of agroecological transition.

II. METHODOLOGY

2.1 Characterization of the study area

The locus of this study was the Ilê Axé Ijexá Omi T'Odé, which is a sacred territory for being a space of preservation of Afro-Brazilian culture and worship of African matrix of the Ijexá people coming from African lands brought by Mejjigã, an African priestess, victim of the African/Brazilian diaspora.

This ancestral heritage was inherited to Babalorixá Ajalá Deré (Ruy do Carma Póvoas), who granted the honor to Babalorixá Omisilé (Luciano de Oliveira Costa), to continue preserving his ancestral heritage with the foundation of Ilê Axé Ijexá Omi T'Ode, in the city of Arataca - BA.

The terreiro community is inserted in the Atlantic Forest biome, with a tropical climate, in an environmentally important region, since it is located in the area between the conservation units of the Serra das Lontras National Park and the Serra do Baixão Wildlife

Refuge, both Permanent Preservation Areas (APP)¹Correia 2017), having its lands bathed by the waters of the Una River, also called Rio Aliança located in an environmental buffer zone (Paula et al. 2013).

Arataca (indigenous name meaning jaguar trap) is a town of agricultural base served by conventional family farming in the plantation of cocoa (*Theobroma cacao*), coffee (*Coffea*) and pepper (*Piper nigrum*). In the nineteenth century had its economy strengthened in the monoculture of rubber (*Hevea brasiliensis* L) and cocoa planting.

Family farming has been stimulated by small farmers and peasant women, and family farmers of the Landless Rural Workers Movement (MST)², which has been installed since the 1990s in the municipality; as well as by the existing terreiro communities: Terreiro de Yemanjá which is located in the São Raimundo neighborhood, Terreiro de Oxóssi located in the Feijão Semeado neighborhood and the Ilê Axé Ijexá Omi T'Odé located on the highway - BA 676, Km 01, between the junction of Rio Branco and the town of Arataca.

The terreiro community was founded on December 27, 2011 and, since 2017 is part of the Assistential, Cultural, Educational and Religious Organization Água do Caçador, a civil society, under the CNPJ inscription 27.811.894/0001-56, recognized as a public utility asset by the municipality of Arataca, through Law No. 198 of May 21, 2021, for the services provided in the social, environmental, cultural, religious, educational and health fields.

Currently, it is composed of about fifty members, including sons, daughters, friends who participate in environmental (ecological Afro-Brazilian tourism), cultural (workshops on Afro-Brazilian knowledge and flavors), educational (visits and open classes on African heritage in Brazil), and social (meetings on the health of black people), and also religious rituals (celebrations of the patron orixás Oxóssi and Oxum).

Visits to the terreiro community happen frequently by Arataca's residents, farmers, researchers, students and friends; some partnerships involving cultural and educational actions have already been made with the participation of the community in the Terra Vista Settlement and some educational institutions as the State

Center of Professional Education of Forest, Cocoa and Chocolate Milton Santos, the State College Bráulio Xavier, and the Municipal Council of Education of Arataca.

2.2 Methodological procedures

The paths of this research, suggested as methodological assumptions, as well as the definition of the strategy and approach of these studies, their tools, data production carried out in conversation with the social actors involved, were intended to highlight the research as innovative, as well as the process carried out in the production of the material collected. The study was developed under a multimethodological ideological look, which aggregates the basic concepts: memory, resistance and identity, dialoguing with the universe of agroecological transition and the interlining of interdisciplinarity.

However, it follows the guidelines for participatory research, under the bias of social cartography through participatory mapping. The focus was directed to the social, environmental and geographical reality, but attentive to the principle of observation in everyday life. The written and oral communication served as a register, prevailing the meaning and significance of the objects and reference points existing in the sacred territory. The challenge is to dialogue with a participant and interdisciplinary research that presents in its complexity a wealth of elements, an inexhaustible field of knowledge. The collection of data in the field was directed to new looks seeking to produce data not yet explored.

Participatory research (Gil 2008) is part of a dynamic process belonging to a collective and community social action. Divided into three simultaneous and complementary stages: investigative research, socio-environmental education and participatory mapping, they become methodological actions aimed at social and human transformation. The exchange of knowledge promotes human learning and contrasts with the universe of linguistics, cartographic engineering, geography and traditional knowledge making the action interdisciplinary. The qualitative approach was an assertive option for this research in which it united the geography of terreiro, social actors, ancestral memory and human ecology in a socio-environmental cartography of terreiro.

According to Minayo (2001) qualitative research seeks to answer very particular questions and inquiries. Its concern, in the humanities and social sciences, with a level of reality that cannot be disqualified, is evidenced in the preciousness of what it observes. That is, it works with a universe full of meanings, motives and attitudes, which corresponds to a more complex territory in relationships, processes and phenomena that should not be minimized to the operationalization of variables.

¹ The Permanent Preservation Areas (APP) are places covered or not, by native vegetation, with the environmental function of preserving water resources, landscape, geological stability, biodiversity, the genetic flow of fauna and flora, protect the soil and ensure the well-being of human populations (BRASIL 2012).

² The MST is a peasant social movement that emerged in 1984 in Brazil. The goal of the MST is to carry out agrarian reform, practice ecological food production, and improve living conditions in the countryside (Bezerra 2019).

The memories, landscapes and perceptions helped to enrich the participatory mapping, but were essential to the impressions of the social agents who participated in the entire process. Thus, the techniques necessary for the production of information in this research and the final production will be carried out through participatory mapping generating the CST Ilê Axé Ijexá Omi T'Odé.

The field of qualitative research is made up of methodological possibilities, enabling dynamic strategies, adhering to other investigations and discoveries. The observation field was a fundamental instrument for the concreteness of this mapping. However, it was found in the field visit a rich source of access to information about a phenomenon, either by the opportunity to generate new conceptions or through the analysis and problematization of an idea in depth. It was built from a dialectical perspective, an arsenal of necessary information, leaving the cartographic tool even richer in its details.

The strategy of using participatory mapping and the interdisciplinary modality was essential to the result of the research, providing it with precious elements of indispensable information and materials.

III. RESULTS AND DISCUSSION

Building a CST is an immense challenge for a community, especially when it proposes a dialogue with the agriculture of traditional peoples, a theme that presents

an enormous complexity because it is a type of agricultural production that is millennial and often unattractive to commercial agricultural production.

However, when the challenge is accepted, it is necessary to begin the studies by means of spatial recognition, walking through the geographical, symbolic and subjective spaces. In the case of the cartography that we propose to construct, it was necessary to dialogue with the elements of ancestral memory, orality and concepts constructed along the way. For this reason, all the archive found is of great importance and serves as material to enrich the work.

When we talk about cartography, we understand a multi-spatial geography. A social cartography was idealized to identify these symbols that exist within a religious terreiro of African matrix, from the natural symbol of the existence of humanity, where one can clearly perceive the earth, fire, water and air, to the symbols existing today, working in the transformation of space by man, these elements constitute this space and allow another dynamic for its understanding.

Today, the candomblé terreiros serve as a place for research and studies of all the existing education modalities in Brazil. The cartographic sketch shows a sketch of the space that supports all the information in a mental map with the elements pertinent to the sacred (Ajagunan 2021).

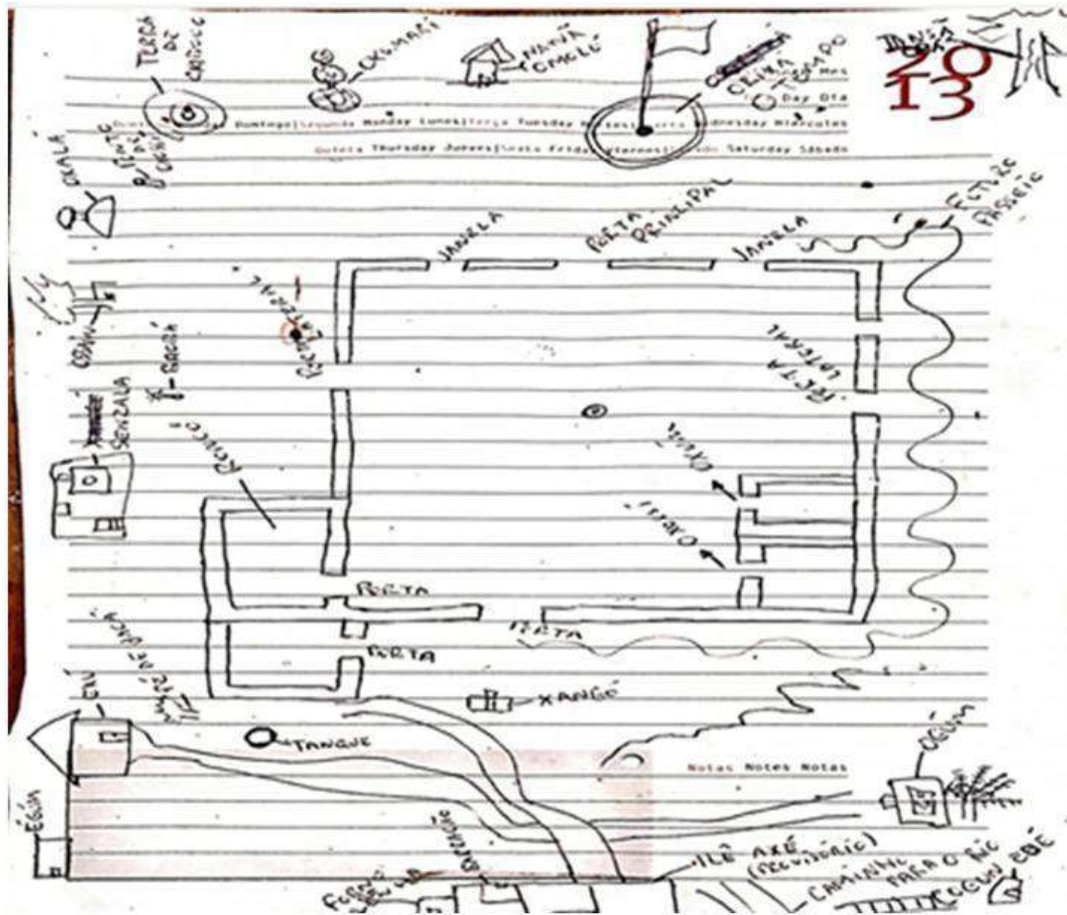


Fig.1 - Cartographic sketch of Ilê Axé Ijexá Omi T'Odé, 2013.

Source: authors' personal file.

Figure 1 represents the first cartographic sketch of the geospatial, environmental, sacred and cultural construction drawn by a community member in the year 2013, where he did a reading of his own initiative, seeking the assistance of his elders residing in the community, using conversation and listening as fundamental tools for recording the information.

3.1 Analysis of the cartographic sketch of Ilê Axé Ijexá Omi T'Odé (2013)

Analysis carried out from the geographical, symbolic and subjective spaces, with a geospatial look at the sacred.

3.1.1 Geographic space

The community Ilê Axé Ijexá Omi T'Odé is located in the former Arco-íris Farm, now registered in the land registry office as Bom Jesus I farm, is situated 5 km from the city of Arataca, in the Southern Bahia Identity Territory - Brazil. It occupies 3 hectares of mountainous land of the Atlantic Forest biome of the tropical zone. It is located at the foot of the Serra das Lontras National Park,

so it is considered an APP. It is bathed by the Rio Una, also called Rio Aliança, from whom it enjoys its waters for personal use and feeds crops and animals. It lies on the borders of the Terra Vista Settlement, coordinated by the MST, the Fazenda Maravilha forest reserve, the BA 676 highway and the Rio Aliança.

3.1.2 Symbolic space

The cartographic sketch had its gaze directed to spatial issues realizing the importance of territorial geography for the construction of sacred spaces, in particular the shack, which had as a reference for its construction, the Rio Aliança, the place where Oxum (goddess of fresh water, rivers and waterfalls and mother creator of the ilê) lives.

The geography of the terreiros of the Ijexá Nation in southern Bahia follows some precepts: the shack is built in the middle of the land, having as access 4 doors allowing communication with the cardinal points: east, north, south and west, strengthening communication with

the rising and setting sun that orchestrates the day and night.

It can be observed in the positions of the pegis, which are sacred points for the African gods, which also represent, symbolically, a geospatial structure of the city-states of Africa and their nations in past times, which are located around the central shed and bring in their itans (African tales and myths) the relationship with their gods and the geographical territory represented by the African "city-states".

3.1.3 Subjective space

The affectivity with nature produces a relationship beyond classification as systems. For the people of Nagô Ijexá heritage from Southern Bahia - ancestral heritage of Ilê Axé Ijexá Omi T'Odé - nature is sacred and "without leaves there is no orixá," therefore, it must be preserved, cared for and handled correctly.

In the cartographic sketch of Image 1, we find the presence of ancestral memory in the sacred trees, corresponding to their territory and their orixá, we observe that between the place called cafeteria and pegi (place of worship) of the orixá Oxalá (the great father of creation) there is a white juerana (*Mimosa verrucosa*), a tree native to the Atlantic Forest, the symbolic representation of the entire ancestral framework of the orixá Ossãe (responsible for the leaves and for healing through the Nagô Ijexá people); a little further down between the cafeteria and the house of the orixá Exú (the lord of the paths and information technologies) is a jackfruit tree (*Artocarpus heterophyllus*), very common native tree of the Atlantic Forest, for the Nagô people has a symbolic representation, is the lady Apaoká (the mother of the orixá Oxóssi).

In the upper right part of the sketch is a rubber tree (*Hevea brasiliensis*), a tree symbol of the city of Arataca because it represents the golden period and commercial expansion, where the Orixá Iansã/Oyá (goddess of fire and lightning) is settled; on the lower part

behind the pegi of the orixá Ogum (the lord of agriculture and iron) is a palm tree (*Elaeis guineensis*), fruit tree of African origin very common in the region, is the fundamental fruit in the production of dendê oil, widely used in Brazilian cuisine.

In face of this cartographic drawing mapped by the people of Ilê Axé Ijexá Omi T'Odé, it can be seen that the trees and plants carry in their DNA - deoxyribonucleic acid - their ancestral memory, expressed in the interrelationship between the sacred of African matrix and the Nago Ijexá people.

3.2 Social cartography of the terreiro built on the paths of the Agroecological Transition - an interdisciplinary look

Analysis carried out of the cartographic survey, with participatory mapping of Ilê Axé Ijexá Omi T'Odé (2019 - 2021) from the spaces: geographical, symbolic and subjective, with a geospatial, environmental, sacred and cultural look.

In the years 2019 to 2021, some changes occurred in the geographic space of the terreiro community, among them, there was an expansion of 1 more hectare, totaling 4 hectares of land designated for environmental preservation, for the appreciation of the culture of African matrix and essentially to strengthen the religious tradition of the Nagôs people of the Ijexá nation of South Bahia from the Ilê Axé Ijexá Orixá Oxalufã (House of the life force of the Ijexá nation of the orixá Oxalá Oxalufã).

The new hectare is part of the forest reserve of the terreiro, integrating the area considered the Forest of the orixá Oxóssi (patron saint of the house), environmental, ancestral and sacred territory reserved for the care and precepts of the hunter orixás, the owners of the forest. In the mapped area below it is possible to get a reading of the whole space destined to the terreiro community.

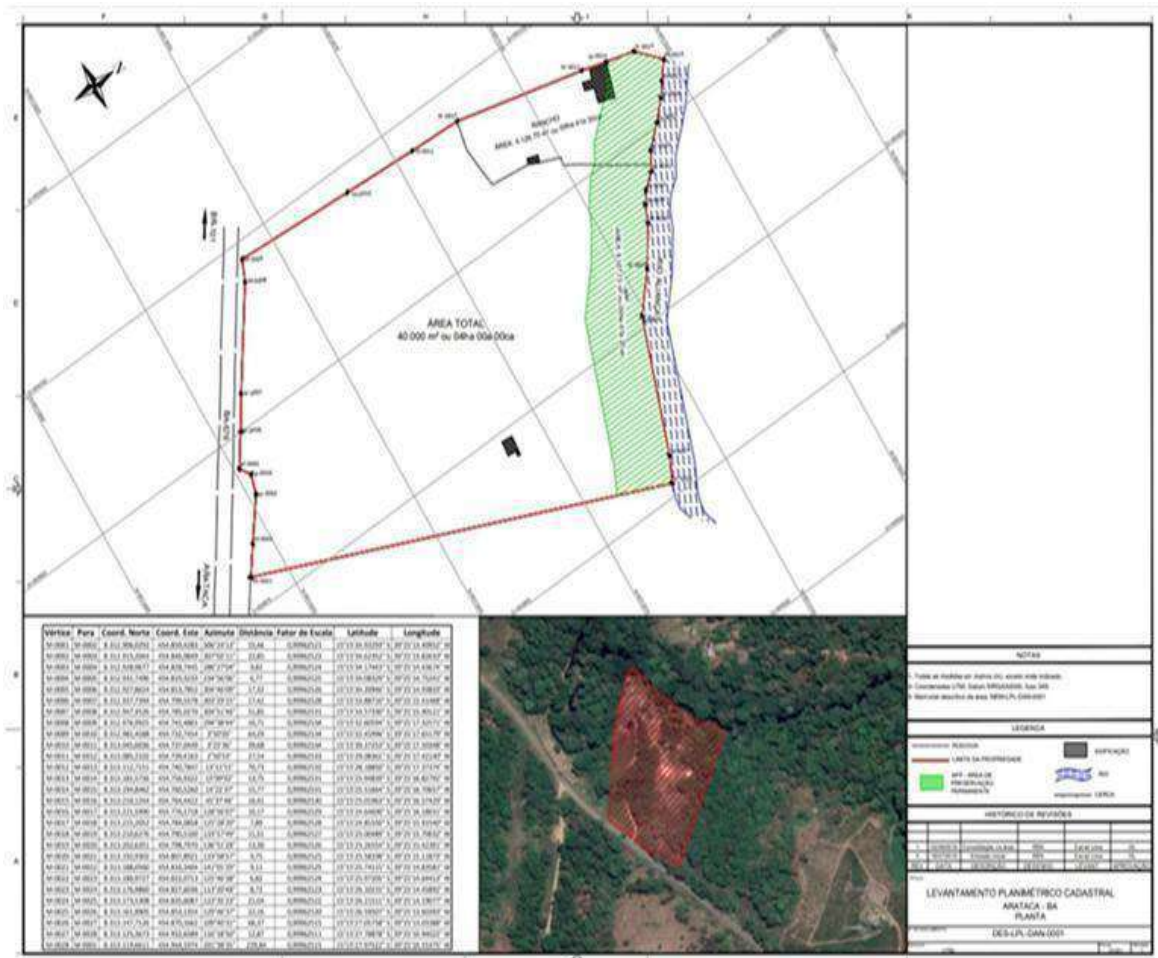


Fig.2: Mapping of the 4 hectares occupied by Ilê Axé Ijexá Omi T'Odé,

Source: authors' personal file.

In Figure 2, we can observe the planimetric cadastral survey of the location of Ilê Axé Ijexá Omi t'Odé in the city of Arataca, southern region of Bahia, on the banks of the BR-101, which has four hectares. Composed in its extension of land with a diversity in natural wealth, as well as, forest resources, rivers, fruit trees, ornamental plants, species of wild fauna, mainly some reptiles.

All the space where there was human intervention is organized within an agroforestry structure, presenting in its middle a shed construction for religious, social and cultural events with a metrage of 225 m², and in the upper left part a construction with kitchen and living quarters for the daily living of the community. In the locations near the Una/Aliança River, the riparian forest is preserved and above it a house, where Mr. Fernando and Mrs. Maria, members and caretakers of the Ilê Axé Ijexá Omi T'Odé, live.

Most of the mapped area is composed of preserved native vegetation with a diversity of plants and wild animals that enrich and feed the agro-ecosystems and is

built through intercropping. It has in its neighboring areas an abundance of woods, water resources and water springs, located on BR 676, in the forest reserve of the Maravilha Farm and in Mr. Louro Camacã's cocoa plot, located in the Terra Vista Settlement.

Near the terreiro community, we find the surrounding areas, which are worked with conventional agriculture, in particular, with the intensive monoculture planting of coffee (*Coffea*), providing a uniform environment, modifying the biodiversity of the soil microflora, with the unbridled intensive use of pesticides that affect the areas of environmental preservation, brought by air current and through the waters of the river Alliance causing environmental crime, especially for aquatic life. Aiming to minimize environmental impacts, agroecology arises, opposing the conventional system and focusing on agriculture from an ecological perspective.

In Ilê Axé Ijexá Omi T'Odé nothing is dissociated: the sacred is integrated with nature, which communicates with the community and interacts with the society of which

it is part. Thus, there is a relationship of interdependence, collective and cosmic to ensure its existence, between the beings that are part of this system. It is understood that the geography of a terreiro community should be interpreted under a holistic vision, correlated to its reference points and its memories recorded in the ancestral subconscious.

The jackfruit tree is an exotic fruit species originating from the Indian Subcontinent (Azad and Haq 1999), introduced into the Atlantic Forest, leafy, considered a staple food for rural communities; however, for people of African matrix religion, in Brazil, the jackfruit tree came to be worshipped as Iyá Apaoká, which represents a sacred, feminine tree, the mother of the orixá Oxóssi (the great hunter).

Like the jackfruit (*Artocarpus heterophyllus*), other trees cannot be missing in a terreiro community, such as the white gameleira (*Ficus dolaria*), which carries in its symbolic representation the being of a sacred tree, masculine, known as the orixá Tempo for the Bantu peoples and Iroko, for the Yoruba, orixás (African gods) who know everything and see everything, is the lord of the stars and of cosmic balance, dialogues with day and night, rain and sun. Furthermore, he is the witness of earthly lives, since he witnesses yesterday, today and tomorrow. Among others are: the akoko (*Newbouldia*), obi or cola-nut (*Cola acuminata*), orogbo (*Garcinia Kola*) and the African baobab (*Adansonia digitata*).

Thus, it is understood that the gods of African matrix that were brought to Brazil are correlated to nature itself and its elements, having the power to represent themselves in various forms and ways. The interaction develops in communication with the cosmology of beings, when represented through plants. Everything in it is sacred, therefore, everything in it is used: the root, the stem, the fruit, the juice, the powder, the leaves, which have innumerable uses through sacred rituals, they are used for bathing, smoking, teas, shaking, harmonizing environments, leaf beds and feeding the soil. Plants have a time and purpose for being harvested, with a purpose, they are medicines that bring relief to the health: physical, mental and spiritual of living beings who believe in this knowledge.

From the year 2019 the community has undergone a transformation of conception, this when the current babalorixá (religious leader of African matrix) becomes a student of the 1st class of the PhD Program in Agroecology and Territorial Development (UNIVASF) and, in his studies perceives the insertion of chemical products / industrialized entering the gates of terreiro communities, acting drastically against the agriculture of traditional peoples. Thus, dialogues have been held involving an agronomist, religious community and local

residents, seeking to find alternatives to strengthen the traditional agriculture of terreiros in current times, as well as dialogue with the practices of agroecological transition, used by men and women farmers in the region.

We will present some experiences based on the dialogue between the agricultural practices of traditional terreiro peoples and the agroecological transition practices carried out at Ilê axé Ijexá Omi T'Odé.

Some actions were carried out based on the agriculture of traditional peoples and grounded in agro-ecological transition processes, thus were cultivated within the community to ensure environmental preservation, as presented in Table 1:

Table 01- Agro-ecological practices developed at Ilê Axé Ijexá Omi T'Odé, 2020/2021.

Territory of Ilê Axé Ijexá	Within the total occupied area one can see the territorial immensity of the Atlantic Forest vegetation where the community is located.
Serra das Lontras National Park	The terreiro community is part of the buffer zone of the National Park, has contributed to environmental preservation actions and occupies a seat on the Municipal Environmental Defense Council (CODEMA).
Alliance River	One can admire the beauty of the water mirror reflecting the nature and the riparian forest so important for the conservation of the riverbanks. Its waters supply the entire city of Arataca, as well as the surrounding towns, cut the land of Ilê Axé Ijexá Omi T'Odé, being of great value to the territory, as it has a variety of aquatic species. Its waters are consecrated to Oxum (the mother of sweet waters), orixá that rules the terreiro community.
The implementation of the Agroforestry System (SAF)	With the planting of fruit trees in consortium with native fruit trees, among them the marmixa (<i>Pradosia lactescens</i>) a fruit tree in extinction in the Atlantic Forest.
Medicinal herb beds	Planting of medicinal herbs in the form of sustainable beds.
Mosaic garden - Integrated and Sustainable Agroecologic	Partnership between the Secretariat of Environment and Agriculture of the Municipality of Arataca and the terreiro community. Use of agro-ecological syrup and plant consortia to keep pests and insects away.

al Production (PAIS)	
Daily practices carried out in the terreiro community	Performing daily activities such as tending the vegetables, feeding the animals and promoting fishing using sustainable trapping experiments.
Preservation of fruit trees and endangered trees in the Atlantic Forest	The diversity of fruit trees: jackfruit, cocoa, cupuaçu, açaí, guava, lemon (still cultivated in the cabruca system ³) and marnixa are fruits that are part of the cuisine in the terreiro.

Based on the data presented through the cutout made between ecosystems and agro-ecosystems built in the Atlantic Forest of Southern Bahia, it can be seen that the cartographic mapping built by the Ilê Axé Ijexá Omi T'odé shows compelling information with the concern between the relationship between society and nature, the need to preserve the environment is present in the actions recorded and narrated. The collective construction is seen as something necessary for the survival of the terreiro community, however the daily coexistence is built respecting the existing boundaries in the universe of sacred and human, which coadunam before the time of coexistence.

The words uttered by Póvoas (2002) when he talks about the principles, respect, precept and secrecy that are vital for the maintenance of a terreiro community, strengthen the communication established between praxis and theory existing in the already pre-established paradigms. Thus, the constructed triad feeds the systems that govern and promote the balance of the Atlantic Forest.

The experiences carried out have enabled the formation and awareness of social transforming agents to act in their communities, with agroecological actions and practices integrated into the transition process, proposing changes in already crystallized habits of conventional agriculture and allowing to experience other forms of agricultural cultures. The existing correlation between knowledge and learning has promoted interactive dialogue in the field of ethnic, environmental and sacred territorial dispute.

³ **Cabruca** is an agroforestry production **system** in which cocoa is grown under the shade of native species of the original forest. This **system** is important because it favors the maintenance of biodiversity by avoiding the removal of native Atlantic Forest trees (IDAF 2021).

We can see that the environments interact with each other, forming epistemological systems of complex knowledge, building correlations of how to communicate with the elements that make up and complete the collaborative system of plants, animals and humans. Therefore, if one of the agro-ecosystems presents some anomaly, the whole environmental network system suffers damage, needing time to restructure itself, as is the case with the application of chemicals and insecticides, their use compromises an entire life-generating system. And this, the CST Ilê Axé Ijexá Omi T'Odé presented that the care of biodiversity stimulates the functioning of the entire ecological system interacting in the form of environmental network producing primarily a quality food.

Dilmário Conceição, son of Ilê, interviewed in the cartographic process, says "that the animals appear and coexist with us, here is a preservation area, here the orixá is nature and nature is the orixá. I am a son of Iroko (African God), Iroko is a tree. Based on these remarks, it is corroborated that the construction of awareness of the care for the biodiversity of ecosystems is ancient and ancestral, and the process of agro-ecological transition is based on these teachings.

Within a terreiro community the lessons are transmitted through orality registered in the memories of the elders. Mr. Fernando, a terreiro resident, points out that when referring to agriculture and interdisciplinarity, nothing is lost, because all the food used is reused or serves again to feed terrestrial or aquatic life. As is the case of the agro-ecological syrup produced with cattle manure and leftover leaves that serve as baths for spiritual healing in sacred rituals.

IV. CONCLUDING REMARKS

The construction of a CST presented other views, beyond the geographical spaces, being possible the construction of correlations between the magic of the sacred, added to the diversity of knowledge production, expressed in the transdisciplinarity of knowledge promoting the realization of transformative actions to human beings and the environment.

The mapping carried out revealed that the daily life of a terreiro community presents a complexity in its social structure, where people live and interact with agro-ecosystems, perceiving themselves as part of them. There is no space without life; all places are filled with a great diversity of living beings that are part of an information system related to science and culture.

The agro-ecological transition is an attitude of awareness, therefore, it has a day and an address to start, it is necessary to have an effective plan for its realization, to know how to dialogue with peers, that is, a good strategy

for the actions and practices to be collectively realized. Every process has its time and part of the construction of the organization carried out by its social actors, so programming and knowledge are essential. It is emphasized that its epistemological bases were built on the paths of agriculture of traditional peoples.

However, it is known that terreiro communities are spaces of ancestral, cultural, social and religious territoriality, may differ while the designs of their social cartographies, however bring the same principles: to build their purposes, without destroying what is most precious to them - the forests, the waters and the air and the land.

It fell to the participant research from an interdisciplinary look transcend to a transdisciplinary view, develop actions and communication strategy between agriculture of traditional peoples and agroecological transition, being evidenced even more the wealth of detail, when made reading the points highlighted by social cartography, which records the historical marks of struggle and resistance, as well as their interrelationship with the existing agroforestry system in Ilê Axé Ijexá Omi T'Odé.

REFERENCES

- [1] Acselrad, H., & Coli, L. R. (2008). Disputas Cartográficas e disputas territoriais. In *Cartografias Sociais e Território*. UFRJ, IPPUR.
- [2] Ajagunan, R. N. de O. (2021). Reflexões sobre o processo de pesquisa-criação-ensino materializada por meio da escrita autoral do livro “Exu, caminhos de orientação: Saberes de tradição Ijexá, afro-geografias de um ogan”. *ABATIRÁ - Revista de Ciências Humanas e Linguagens*, 2(3), 1–524.
- [3] Altieri, M. (2012). *Agroecologia bases científicas para uma agricultura sustentável* (1ª). Ed. Vozes.
- [4] Amim, V., & (Org.). (2013). *Águas do leste: um olhar sobre terreiros: mapeamento de comunidades religiosas de matriz africana da Bacia do Leste (BA)*. Editus. http://www.uesc.br/editora/livrosdigitais2/aguas_do_leste.pdf
- [5] Azad, A. K., & Haq, N. (1999). *Germplasm catalogue of Jackfruit in Bangladesh*. International Center for Underutilized Crops.
- [6] Bezerra, J. (2019, setembro 6). *Movimento dos Trabalhadores Rurais Sem Terra (MST)*. Web Page. <https://www.todamateria.com.br/movimento-dos-trabalhadores-sem-terra-mst/>
- [7] BRASIL. (2012, maio 25). *LEI Nº 12.651, DE 25 DE MAIO DE 2012*. http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/12651.htm
- [8] Chapin, M., Lamb, Z., & Threlkeld, B. (2005). MAPPING INDIGENOUS LANDS. <https://doi.org/10.1146/annurev.anthro.34.081804.120429>, 34, 619–638.
- <https://doi.org/10.1146/ANNUREV.ANTHRO.34.081804.120429>
- [9] Colchester, M. (2002). O mapeamento como ferramenta para garantir o controle comunitário: alguns ensinamentos do sudeste asiático. In *WRM* (Número Boletim nº 63).
- [10] Correia, P. B. (Coordenador). (2017). *Plano Estratégico para Revitalização da Bacia do Rio Cachoeira: Diagnóstico Socioambiental e Institucional* (Vol. 1, Número 1). VS Ambiental. http://www.meioambiente.ba.gov.br/arquivos/File/Projeto_Cachoeira/RI1_DiagnosticoAmbiental.pdf
- [11] Diesel, V., Dias, M. M., & Neumann, P. S. (2015). Pnater (2004-2014): da concepção à materialização. In *Políticas públicas de desenvolvimento rural no Brasil* (p. 107–128). UFRGS.
- [12] Ferreira, J., & Felício, E. I. (2021). *Por terra e território: caminhos da revolução dos povos no Brasil*. Teia dos Povos. <https://docero.com.br/doc/cxcxe88>
- [13] Gil, A. C. (2008). *Métodos e Técnicas de Pesquisa Social* (6ª). ed. Atlas.
- [14] Grisa, C., & Schneider, S. (Org.). (2015). *Políticas Públicas de Desenvolvimento Rural no Brasil*. UFRGS. <http://www.ufrgs.br/pgdr/publicacoes/livros/outras-publicacoes/politicas-publicas-de-desenvolvimento-rural-no-brasil>
- [15] Herlihy, P. H., & Knapp, G. (eds). (2003). Maps of, by and for the Peoples of Latin America. *Human Organization. Journal of the Society for Applied Anthropology*, 62(4), 303–314.
- [16] IDAF, I. de D. A. e F. do E. S. (2021). *Sistema de cabruca poderá ser utilizado como área de reserva legal no Espírito Santo*. <https://idaf.es.gov.br/sistema-de-cabruca-podera-ser-utilizado-como>
- [17] Lazzari, F. M., & Souza, A. S. (2017, novembro). Revolução verde: impactos sobre os conhecimentos tradicionais. *4º Congresso Internacional de Direito e Contemporaneidade*. <http://coral.ufsm.br/congressodireito/anais/2017/4-3.pdf>
- [18] Lobo, G., & (Org.). (2015). *Terreiros de Candomblé de Cachoeira e São Felix: Vol. Caderno IP*. Fundação Pedro Calmon - IPAC. https://drive.google.com/file/d/0B3D0pMS8V_3senZGbhI ZZy1YQlk/view?resourcekey=0-J8jxYoDitVmTzNi4TPvw-Q
- [19] Marques, J., Silva, G. C. (Anastácia), Novaes, J. A., Marques, R., & Tomáz, A. (2018). *Candomblé e Umbanda no Sertão: cartografia social dos Terreiros de Senhor do Bonfim BA (2018)*. SABEH. <https://docplayer.com.br/111263411-Candomble-e-umbanda-no-sertao-cartografia-dos-terreiros-de-candomble-e-umbanda-de-senhor-do-bonfim-ba-2018.html>
- [20] Minayo, M. C. de S. (Org.), Deslandes, S. F., Neto, O. C., & Gomes, R. (2001). *Pesquisa Social: teoria, método e criatividade* (18ª). Ed. Vozes. <https://wp.ufpel.edu.br/franciscovargas/files/2012/11/pesquisa-social.pdf>
- [21] Paula, F. C. F. de, Gomes, A. R., Fandi, A. C., Falcão Filho, C. A. T., Mattos, J. B., & Santos, D. A. dos. (2013).

Aliança das Águas – Documento de informação e apoio para a gestão da área de influência do Parque Nacional da Serra das Lontras, municípios de Una, S. J. da Vitória e Arataca, sul da Bahia – Brasil. IESB.
<https://silo.tips/download/livro-serra-das-lontras>

- [22] Póvoas, R. do C. (2002). *A fala do santo*. Editus.
- [23] Santana, A. D. de, & Nunes, J. O. R. (2021). Relação sociedade-natureza e degradação ambiental no modo de produção capitalista: um esforço de síntese. *Geoambiente On-line*, 39.
<https://www.revistas.ufg.br/geoambiente/article/view/65414>
- [24] UFBA. (2006). *Mapeamento dos Terreiros de Salvador*.
<http://www.terreiros.ceao.ufba.br/apresentacao>

Femur Fractures: Hospitalization, Deaths and Temporal Trend in the Southeast Region of Brazil

Fraturas de Fêmur: Internações, Óbitos e Tendência Temporal na Região Sudeste do Brasil

Eros Silva Cláudio¹, Geovana Alves Teles², João Pedro Lima Gemha³, Saulo Ricardo Bueno Brescancin⁴, Sérgio Marcolino Rosa⁵

¹Médico residente em Ortopedia e Traumatologia do Hospital Municipal Dr. Mário Gatti, Campinas-SP, Brasil.

Graduação em Medicina pela Universidade de Gurupi (UNIRG), Gurupi-TO, Brasil. eros_claudio@hotmail.com

²Médica residente em Ortopedia e Traumatologia pelo Hospital Municipal Dr. Mário Gatti, Campinas - SP, Brasil.

Graduação em Medicina pelo Centro Universitário de Anápolis (UniEvangélica), Anápolis- GO, Brasil.

³ Médico residente em Ortopedia e Traumatologia do Hospital Municipal Dr. Mário Gatti, Campinas-SP, Brasil.

Graduação em medicina pela Universidade Metropolitana de Santos (UNIMES), Santos - SP, Brasil. jp_gemha@hotmail.com

⁴ Membro Titular em Ortopedia e traumatologia pela SBOT.

Chefe da Residência médica em Ortopedia e Traumatologia pelo Hospital Municipal Dr. Mario Gatti, Campinas-SP, Brasil.

Graduação em Medicina pela Universidade do Vale do Sapucaí, Pouso Alegre - MG, Brasil. saulobrescancin@yahoo.com.br

⁵Membro titular em Ortopedia e Traumatologia pela SBOT. Chefe do Serviço de Ortopedia e Traumatologia do Hospital Municipal Dr.

Mario Gatti, Campinas -SP, Brasil. Graduação em medicina pela Pontifícia Universidade Católica de Campinas (PUCCAMP), Campinas-SP, Brasil. sergiomrosa13@gmail.com

Received: 09 Sept 2021,

Received in revised form: 03 Nov 2021,

Accepted: 13 Nov 2021,

Available online: 24 Nov 2021

©2021 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— Femur fractures, hospitalizations, deaths, temporal tendency, Brazil

Abstract—The present study aimed to demonstrate the prevalence of hospitalizations, deaths and the temporal trend of femoral fractures in the Southeast region of Brazil. All hospitalizations due to bone fractures in the Southeast region of Brazil during the years 2016 to 2020 were selected, considering the most recent period of available data and with fewer corresponding studies in the literature. Through tabnet application filters, hospitalizations corresponding to the ICD-10 of femoral fracture according to gender, age, federative unit, deaths in addition to the expenses of each of these hospitalizations in the selected period were collected. There was a higher prevalence of hospitalizations among women and in the population over 60 years of age, especially those over 80 years of age. The temporal trend of increasing hospitalizations was statistically significant in individuals over 60 years of age, demonstrating the need for specific care aimed at minimizing the consequences that the senescence process brings with it.

I. INTRODUCTION

As fraturas de fêmur são um importante problema de saúde pública em todo o mundo^{1,2}. Sua alta incidência, morbimortalidade além dos elevados custos do tratamento e do potencial incapacitante, fazem desse tipo de lesão um ponto de alerta para autoridades mundiais³.

Mesmo países desenvolvidos, como Estados Unidos da América, Suécia e Noruega, apresentam elevados gastos com as fraturas de fêmur⁴. No Brasil, de igual modo, as internações por esse tipo de fratura demandam investimento de quase 60 milhões de reais anualmente. Quando somado ao gasto com possíveis sequelas e

incapacidade de trabalho, nota-se como das fraturas de fêmur têm um grande impacto em saúde e na economia⁵.

Esse tipo de fratura é amplamente prevalente em todas as faixas etárias. Na população jovem, os traumas de grande energia, como acidentes automobilísticos, são a causa mais comum de fratura femoral. Na população idosa prevalecem os mecanismos de baixa energia, como quedas⁶. Vale ressaltar ainda que à medida que a população envelhece, esse tipo de fratura torna-se ainda mais prevalente em decorrência das alterações da microarquitetura óssea, características do processo de senescência². Dessa forma, com o envelhecimento populacional, a compreensão acerca do comportamento epidemiológico dessas fraturas se faz de suma importância.

A Região Sudeste é a mais populosa do país, concentrando cerca de 42% de toda a população do Brasil. Essa região é ainda a segunda com maior população de idosos, ficando atrás apenas da região Sul⁷. Por concentrar o maior conglomerado de pessoas, conta também com o maior número de afecções em saúde de todo o país, e, conseqüentemente, os maiores gastos.

Nesse contexto, a compreensão acerca do comportamento epidemiológico das fraturas de fêmur nessa região é de suma importância. O presente estudo objetivou demonstrar a prevalência das internações, óbitos e a tendência temporal das fraturas de fêmur na Região Sudeste do Brasil. O entendimento das afecções em saúde nessa localidade permite não só o planejamento de estratégias para direcionamento do cuidado clínico regional como também auxilia todo o restante do país, uma vez que possíveis melhorias no planejamento de intervenções nessa localidade podem corroborar com a redução nos custos ao cuidado em saúde, posteriormente direcionados para as demais regiões.

II. METODOLOGIA

Trata-se de um estudo epidemiológico descritivo. A obtenção dos dados foi realizada pelo Sistema de Informações Hospitalares, disponível no portal eletrônico

Tabela 1 – Internações por fratura de fêmur entre os anos de 2016 e 2020 na Região Sudeste, estratificadas por sexo

SEXO	2016	2017	2018	2019	2020	Total
Masculino	22.834	23.695	23.581	24.634	23.168	117.912
Feminino	22.877	23.936	24.722	26.148	24.065	121.748
Total	45.711	47.631	48.303	50.782	47.233	239.660

A população caucasiana somou a maioria (46,4%; n=111.372) das internações por fratura de fêmur ao longo dos anos analisados, seguidos da raça parda com 31,5% (Tabela 2). Cerca de 37 mil pacientes (15,5%) não tinham

do Departamento de Informática do SUS (DATASUS), pela aplicação TABNET⁸.

Foram selecionadas todas as internações decorrentes de fraturas ósseas na Região Sudeste do Brasil durante os anos de 2016 a 2020, considerando o período mais recente de dados disponíveis e com menos estudos correspondentes na literatura. Coletou-se através dos filtros da aplicação TABNET as internações correspondentes ao CID-10 de fratura de fêmur conforme sexo, idade, unidade federativa, óbitos além dos gastos de cada uma dessas internações no período selecionado. Os dados foram tratados inicialmente no programa Microsoft Excel 2010, onde foram calculados as frequências, porcentagens e mortalidade por causa específica de fratura de fêmur.

A tendência temporal de internações e da mortalidade por fratura de fêmur foi calculada através do programa *JoinPoint* versão 4.8.0.0, idealizado inicialmente para análise dos padrões de câncer, mas amplamente utilizado na área da epidemiologia atualmente⁹. O software permite a análise da variação percentual anual (*Annual Percentage Change – APC*), que demonstra a tendência ao decréscimo, se negativa, ou acréscimo, se positiva, com intervalo de confiança de 95% (IC95%). Definiu-se como variável independente o ano de ocorrência e como variáveis dependentes a taxa de internação e a taxa de mortalidade em cada ano, com o número de internações ou de óbitos divididos pela população projetada de cada ano, com os valores ajustados para 10.000 habitantes.

III. RESULTADOS

Entre os anos de 2016 e 2020, foram internados 239.660 pacientes nos serviços de saúde da Região Sudeste do Brasil com o diagnóstico de fratura de fêmur pelo CID-10 S72. Em todo o período observado, o sexo feminino prevaleceu no número de internações, totalizando 50,8% (n=) como observado na Tabela 1. A média de dias de internação também foi maior entre as mulheres, variando de 7 a 9 dias de internação, quando comparada aos homens, que permaneceram internados por 6 a 8 dias, no máximo.

informações sobre raça/cor, revelando a falha na complementação dos prontuários médicos, já conhecida e prevalente em todos os setores da saúde. A ausência dessas

informações coloca em cheque as possíveis conclusões desse achado.

Tabela 2 – Internações por fratura de fêmur entre os anos de 2016 e 2020 na Região Sudeste, estratificadas por cor/raça

COR/RAÇA	2016	2017	2018	2019	2020	Total
Branca	21.516	22.147	22.461	23.160	22.088	111.372
Preta	1.711	2.179	2.540	2.836	3.152	12.418
Parda	13.981	14.492	15.617	16.791	14.816	75.697
Amarela	390	535	593	655	662	2.835
Indígena	10	3	4	6	7	30
Sem informação	8.072	8.262	7.094	7.316	6.514	37.258
Total	45.680	47.618	48.309	50.764	47.239	239.660

Nesse mesmo período, observou-se que os lactentes, pré-escolares e escolares somam a minoria nos atendimentos por fratura de fêmur, totalizando juntos 4,1% das internações totais. A faixa etária de 20 a 29 anos de idade possui constantemente um valor maior de internações anuais por fratura de fêmur quando comparada às faixas etárias anteriores e posteriores. No total, mais de 22 mil internações por esse tipo de fratura ocorreram nessa faixa etária. Notou-se ainda que, conforme a idade aumenta, ocorre um incremento significativo no número de internações por fratura de fêmur. Acima dos 60 anos de

idade, passam de 5 mil casos/ano, valores estes que sofrem incremento de cerca de 150% quando comparados aos casos de internação nos idosos acima de 80 anos no mesmo período (Tabela 3). Apesar na maior prevalência de internações nos idosos acima de 80 anos, a média de dias de internação foi a mesma para toda a faixa etária acima dos 60 anos de idade, sendo de 8,4 dias. A diferença maior, como esperado, se dá na comparação da média de internação da população idosa (acima de 60 anos) com os escolares e pré-escolares, que permaneceram, em média, 4 dias nos leitos hospitalares.

Tabela 3 - Internações por fratura de fêmur entre os anos de 2016 e 2020 na Região Sudeste, estratificadas por faixa etária

FAIXA ETÁRIA	2016	2017	2018	2019	2020	Total
Menor 1 ano	107	109	109	88	95	508
1 a 4 anos	609	624	632	667	625	3.157
5 a 9 anos	566	518	500	454	443	2.481
10 a 14 anos	855	848	823	684	602	3.812
15 a 19 anos	2.014	1.994	1.814	1.835	1.651	9.308
20 a 29 anos	4.368	4.589	4.416	4.606	4.448	22.427
30 a 39 anos	3.080	3.033	2.992	3.124	2.816	15.045
40 a 49 anos	2.834	2.840	2.869	2.948	2.628	14.119
50 a 59 anos	3.855	3.986	4.059	4.264	3.992	20.156
60 a 69 anos	5.407	5.953	6.026	6.715	6.253	30.354
70 a 79 anos	8.555	8.942	9.447	9.897	9.135	45.976
80 anos e mais	13.461	14.195	14.616	15.500	14.545	72.317
Total	45.711	47.631	48.303	50.782	47.233	239.660

No que tange à mortalidade desses pacientes, optou-se por estratificar o número de óbitos até 59 anos agrupando as faixas etárias compreendidas em 20 anos de intervalo. Isso se deu, pois, a frequência de óbitos por fratura de fêmur nessas faixas etárias, especialmente

infantil, é baixa (Tabela 4). As crianças e adolescentes, além dos menos acometidos por fratura de fêmur, compõem também a população com menor morbimortalidade em comparação às demais, sendo registrados apenas 71 óbitos (8%) por fratura de fêmur ao longo dos 5 anos observados.

Tabela 4 - Óbitos por fratura de fêmur entre os anos de 2016 e 2020 na Região Sudeste, na população de 0 a 59 anos

FAIXA ETÁRIA	2016	2017	2018	2019	2020	Total
0 a 19 anos	26	7	10	18	10	71
20 a 39 anos	83	72	62	81	54	352
40 a 59 anos	101	84	83	94	93	455
Total	210	163	155	193	157	878

As faixas etárias compreendidas na população idosa foram estratificadas de 10 em 10 anos para que fosse perceptível a diferenciação da prevalência de óbitos, como demonstra a Tabela 5. Observa-se que os óbitos dobram

quando compara-se a faixa etária de idosos entre 60 e 69 anos e os entre 70 e 79 anos e sofre um incremento de 400% quando compara-se os idosos entre 70 e 79 anos com os acima de 80 anos de idade.

Tabela 5 - Óbitos por fratura de fêmur entre os anos de 2016 e 2020 na Região Sudeste, na população acima de 60 anos

FAIXA ETÁRIA	2016	2017	2018	2019	2020	Total
60 a 69 anos	125	165	146	180	148	764
70 a 79 anos	331	380	404	408	370	1.893
80 anos e mais	1.136	1.191	1.275	1.364	1.208	6.174
Total	1.592	1.736	1.825	1.952	1.726	8.831

A população com a menor taxa de mortalidade foi a de 10 a 14 anos, sendo de 0,05 ao longo de todos os anos analisados. Como esperado, a maior taxa de mortalidade se deu entre os idosos acima de 80 anos, com um valor de 8,56 para cada 10.000 habitantes ao longo do intervalo estudado.

Ao analisar a Região Sudeste por Unidades Federativas (UF), nota-se que o estado com maior concentração de internações por esse tipo de fratura foi o

estado de São Paulo, local este que corresponde também à maior densidade demográfica da região analisada e do Brasil. Em São Paulo concentra-se mais da metade (50,9%; n=122.136) do total de internações de toda a Região Sudeste. A distribuição das internações corresponde à população dos estados, sendo que logo depois de São Paulo, Minas Gerais demonstrou o maior número de hospitalizações por fratura de fêmur.

Tabela 6 – Distribuição das internações por fratura de fêmur da Região Sudeste entre as Unidades Federativas, entre os anos de 2016 e 2020

UF	2016	2017	2018	2019	2020	Total
Minas Gerais	12.413	13.305	13.362	13.904	12.821	65.805
Espírito Santo	2.051	2.106	2.112	2.285	2.112	10.666
Rio de Janeiro	7.458	7.890	8.531	9.181	7.943	41.003
São Paulo	23.758	24.317	24.304	25.394	24.363	122.136
Total	45.680	47.618	48.309	50.764	47.239	239.660

Quando se trata dos gastos com esse agravamento em saúde, observa-se que a faixa etária com menor índice de internações e menor tempo de hospitalização corresponde

com os menores gastos, que se concentram especialmente entre os menores de 1 ano, em que não houve gastos acima de 70 mil reais ao ano. De forma análoga, a população acima

de 80 anos demandou o maior investimento na abordagem intra-hospitalar das fraturas de fêmur, chegando a custar mais de 42 milhões de reais no ano de 2019, correspondendo

sozinhos a 33,1% do total gasto em todos os anos (Tabela 7).

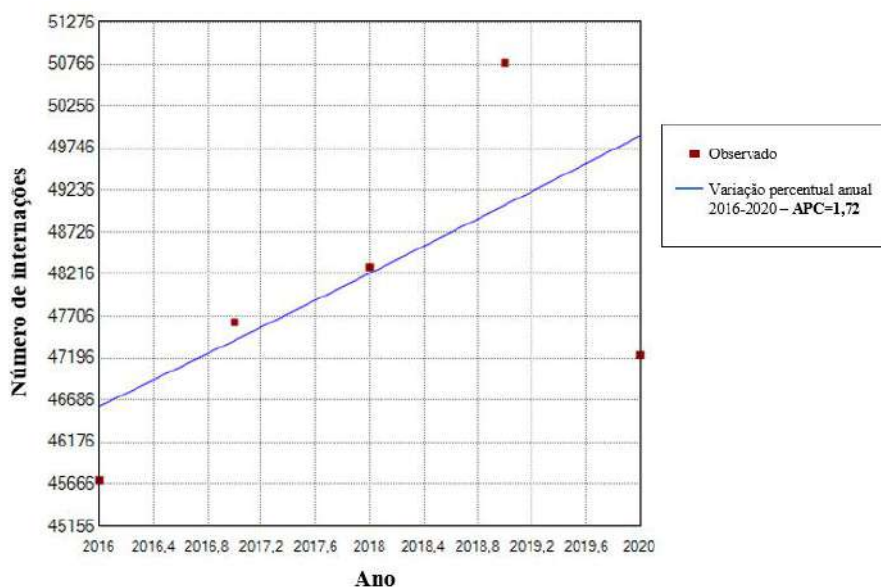
Tabela 7 – Gastos totais em reais do atendimento por fratura de fêmur entre os anos de 2016 e 2020 na Região Sudeste

FAIXA ETÁRIA	2016	2017	2018	2019	2020	Total
Menor 1 ano	68.938	67.108	48.468	28.304	50.905	263.724
1 a 4 anos	309.085	381.039	385.885	430.282	413.714	1.920.004
5 a 9 anos	777.036	716.133	624.336	621.981	594.167	3.333.653
10 a 14 anos	1.173.653	1.299.227	1.119.280	1.007.965	964.904	5.565.029
15 a 19 anos	4.366.786	4.214.148	4.001.708	4.101.724	3.735.972	20.420.339
20 a 29 anos	10.214.599	10.424.591	10.097.645	11.136.382	10.561.472	52.434.689
30 a 39 anos	7.012.929	6.798.603	6.839.536	7.236.648	6.474.765	34.362.480
40 a 49 anos	6.045.132	6.137.134	5.990.023	6.567.675	5.891.863	30.631.827
50 a 59 anos	8.165.880	8.759.225	8.880.288	9.669.263	8.808.916	44.283.573
60 a 69 anos	12.497.550	14.426.048	14.714.913	16.909.337	15.646.966	74.194.813
70 a 79 anos	21.245.346	22.515.731	24.985.825	26.848.366	24.205.577	119.800.844
80 anos e mais	34.680.848	36.868.166	38.922.976	42.537.176	39.132.429	192.141.595
Total	106.557.782	112.607.152	116.610.883	127.095.104	116.481.648	579.352.570

Quando observadas em conjunto, vale destacar que os parâmetros que tangem a prevalência de internações tiveram uma tendência de acréscimo entre os anos de 2016 e 2020. A tendência foi de um incremento de 1,72% nas internações, ao ano. Não foi observada diferença estatística nesse acréscimo anual ($p=0,26$), indicando que esse achado

pode não ter relevância estatística (Gráfico 1). Entretanto, vale ressaltar que quando compara-se os anos de 2019 com 2020 isoladamente, nota-se claramente um decréscimo no número de internações, fator este que pode ter influenciado no resultado estatístico.

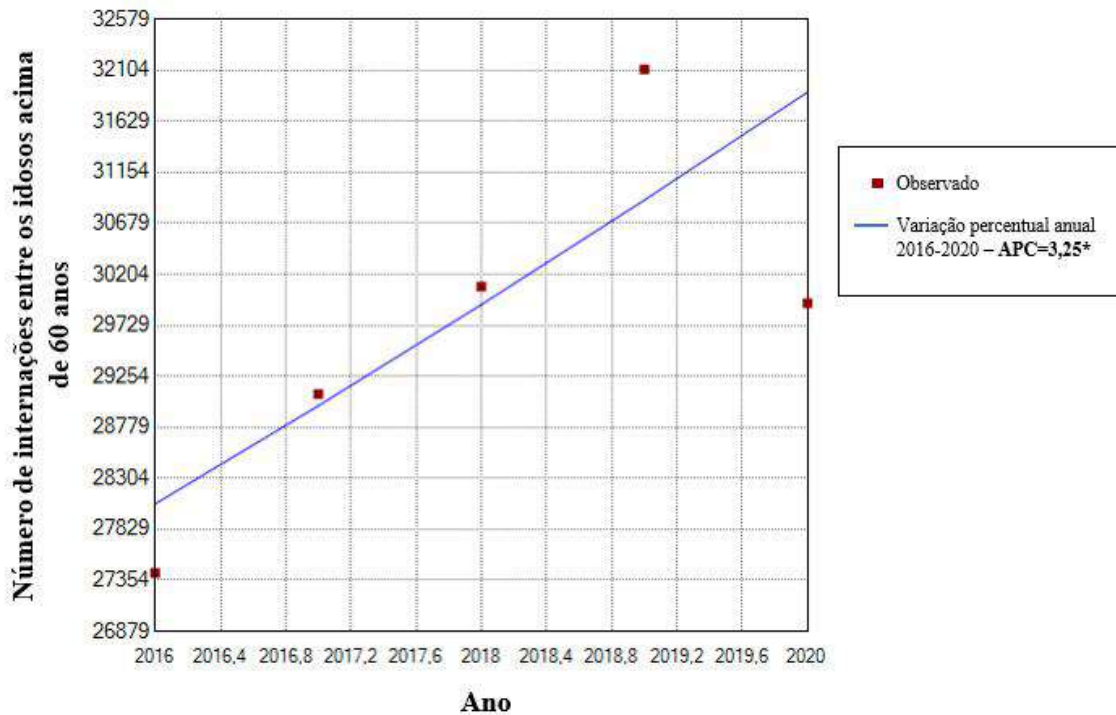
Gráfico 1 – Variação percentual anual do número de internações por fratura de fêmur da Região Sudeste entre os anos de 2016 e 2020



Avaliou-se ainda a tendência de acréscimo anual nas internações estratificando as populações por idade. Nos menores de 60 anos, observa uma tendência ao decréscimo no número de internações anualmente, com queda de aproximadamente 0,7% ao ano. Entretanto, entre a população com mais de 60 anos, a mais acometida com as

fraturas de fêmur, observou-se um incremento de 3,25% no número de internações anualmente estatisticamente significativo ($p < 0,05$) demonstrando a tendência de ascensão dessa curva ao longo dos anos (Gráfico 2) permitindo, inclusive, projetar que essa curva tende a permanecer em ascensão para os próximos anos.

Gráfico 2 – Variação percentual anual do número de internações por fratura de fêmur na população acima de 60 anos atendida da Região Sudeste entre os anos de 2016 e 2020



Analisou-se a variação percentual anual das internações estratificando os sexos (Tabela 8). Notou-se que a tendência de crescimento é maior no sexo feminino, porém não foram observadas ascensões estatisticamente significantes. A variação percentual anual da taxa de

mortalidade também foi avaliada. Há, notoriamente, uma tendência à ascensão da taxa de mortalidade, tanto geral, quanto entre os maiores de 80 anos, entretanto, também não foi verificada significância estatística.

Tabela 8 – Variação percentual anual do número de internações e da taxa de mortalidade por fratura de fêmur da Região Sudeste entre os anos de 2016 e 2020

		Tendência temporal
		ACP (IC95%)
Faixa etária		
	0-59 anos	-0,73 (-2,0 – 0,6)
	>60 anos	3,25 (0,7 – 5,9)*
Sexo		
	Feminino	2,43 (-0,4 – 5,3)
	Masculino	0,97 (-0,4 – 2,3)
Taxa de mortalidade		
	Geral	1,20 (-0,8 – 3,3)
	>80 anos	0,5 (-1,0 – 2,9)

IV. DISCUSSÃO

As fraturas de fêmur e sua alta taxa de morbimortalidade, especialmente em idosos, têm se tornado assunto de discussões epidemiológicas e foco no planejamento de ações preventivas em todo o mundo. Além de sua alta prevalência e altos custos associados ao tratamento, conservador ou cirúrgico, a incapacidade física e/ou funcional também é fator frequente nos casos desse tipo de fratura^{1,2}. Dessa forma, além de aumentarem os gastos com a atenção quaternária, soma-se ainda os muitos casos de improdutividade pelas sequelas que podem ocorrer. As análises epidemiológicas sobre esse tipo de fratura demonstram que, dos pacientes acometidos com fratura de fêmur, cerca de 50% necessitam do uso de cadeiras de rodas ou ficam acamados. Não obstante, mais de 30% desses pacientes retornam para seus lares com a necessidade de cuidadores ou de dispositivos auxiliares de marcha¹⁰.

O presente estudo observou a maior prevalência de internações por fratura femoral no sexo feminino. Essa tendência de maior acometimento no sexo feminino foi observada em outros estudos realizados em outros estados da Região Sudeste¹¹, em outras regiões do país como Nordeste¹² e Sul¹³ e estudos feitos fora do Brasil¹⁴. Isso pode ser justificado pela composição hormonal feminina. A redução dos níveis de estrogênicos ao longo dos anos no organismo feminino, estimula a remodelação, com uma consequente diminuição significativa da formação óssea. Estima-se que a partir dos 40 anos de idade, as mulheres percam cerca de 0,5% da massa cortical anualmente e, após a menopausa, essa perda da densidade mineral óssea pode chegar a 3% ao ano¹⁵.

Observou-se durante a análise que a maioria dos pacientes que necessitaram de internação em decorrência da fratura de fêmur era de cor branca. Isso pode ter se dado pela maior população branca residente na Região Sudeste. Esse é um aspecto em comum com a Região Sul cujo estudo de Oliveira et al. (2017) demonstrou o mesmo achado¹³. A população branca tem, naturalmente, uma maior tendência à osteoporose, tanto pela maior prevalência de hipovitaminose D quanto pelos baixos picos de massa óssea ao longo da vida¹⁶. Outras regiões do país obtiveram achados diferentes, especialmente por conta do preenchimento incompleto dos prontuários, como demonstra os achados de Porto et al. (2019) em que a maior prevalência de fraturas ocorreu em pacientes registrados como “cor ignorada”¹².

A faixa etária mais acometida foi a dos idosos, acima de 60 anos, com destaque especial para aqueles com idade maior a 80 anos, cuja prevalência de fraturas e mortalidade foram as maiores em todo o estudo. Outros

estudos investigando fraturas de fêmur demonstraram, de igual forma, que a prevalência desse tipo de fratura aumenta proporcionalmente à idade^{11,12,14,17}. Com o passar dos anos, além da fragilidade óssea decorrente do processo de envelhecimento, por vezes agravada pela osteoporose, os idosos respondem pior aos tratamentos invasivos, como as cirurgias. A intervenção cirúrgica costuma ser a abordagem inicial das fraturas femorais e a abordagem conservadora não cirúrgica é reservada para pacientes não ambulantes previamente à fratura ou pacientes muito frágeis para tolerar um procedimento cirúrgico⁶. Quando a terapêutica operatória não é realizada, por vezes, os pacientes evoluem com sério comprometimento da mobilidade⁶. Estudos prévios demonstram que o sucesso do tratamento dessas fraturas depende de um conjunto de fatores. O tempo decorrido do trauma até o momento da cirurgia³, a estabilidade da fratura e o estado funcional prévio do paciente são fatores fundamentais que afetam significativamente o sucesso terapêutico¹¹.

Mesmo dentre os pacientes manejados em tempo, a mortalidade por fratura de fêmur é bastante heterogênea pois depende dos fatores supracitados. Entretanto, esse índice apresenta-se globalmente elevado dado a gravidade desse acometimento, especialmente para a população idosa, variando entre 4,4%¹², 5%¹³, 13%¹⁸ e 24%¹¹. No presente estudo, a mortalidade chegou a 8,3% nos idosos acima de 80 anos internados.

No presente estudo, observou-se a tendência de incremento de casos de internações por fraturas de fêmur em todas as faixas etárias ao longo dos anos analisados. Esse achado, apesar de não estatisticamente significativo, demonstra o grave problema de saúde pública que esse agravo representa e sua tendência ao aumento. Um estudo realizado por Araújo et al. (2020) demonstrou que esse incremento de internações está ocorrendo desde o ano de 2008, em nível nacional¹⁷. Para o sexo masculino na Região Sudeste, o presente estudo demonstrou que houve um acréscimo de 0,97% ao ano enquanto o sexo feminino crescimento de 2,43%. Esses achados também são encontrados de semelhante modo em nível nacional, com incremento de casos nos dois sexos e mais acentuadamente no feminino¹⁷. São achados comuns também a estudos realizados em Portugal, que demonstraram que número global de fraturas femorais proximais em nesse país mostrou tendência de aumento entre 2005 e 2013, especialmente em mulheres¹⁴.

Para a faixa etária acima de 60 anos, houve um incremento significativo de 3,25% na taxa de internações. Esse achado também é compartilhado por outros estudos, que evidenciam que a população de maior fragilidade no que tange as fraturas de fêmur, são os idosos^{14,17}. A

literatura demonstra que as lesões de baixa energia são o modo mais comum de lesão nessa faixa etária, com grande impacto para as quedas da própria altura, em pé¹⁹. Esses achados demonstram que a abordagem nos idosos deve ser cautelosa e levar em consideração diversos fatores. A atenção aos medicamentos prescritos nessa faixa etária, que podem ser ainda mais deletérios ao equilíbrio e propriocepção, além da conscientização de familiares e cuidadores é extremamente importante.

A população acima de 80 anos demandou o maior investimento na abordagem intra-hospitalar das fraturas de fêmur, necessitando de investimento de cerca 42 milhões de reais no ano de 2019, correspondendo sozinho a 33,1% do total gasto em todos os anos. Estudo realizado no estado do Paraná demonstrou que os custos das internações por fratura de fêmur também são elevados¹³. Por possuir uma densidade populacional muito maior, os gastos demandados por esse agravo em saúde na Região Sudeste são proporcionalmente muito maiores. Esse fato evidencia a necessidade de implementação de programas de prevenção desse tipo de fratura, especialmente na população idosa, cuja causa tem maior potencial prevenível.

V. CONCLUSÃO

Verificou-se a maior prevalência de internações entre as mulheres e na população maior de 60 anos de idade, com destaque aos maiores de 80 anos. A tendência temporal de aumento de internações se mostrou significativa estatisticamente nos indivíduos com mais de 60 anos, demonstrando a necessidade de cuidados específicos voltados a minimizar as consequências que o processo de senescência traz consigo. Nessa perspectiva, o investimento de fundos no planejamento de intervenções direcionadas a essa população pode contribuir para menores taxas de internação, menor mortalidade e menores gastos em saúde pública.

RESUMO

As fraturas de fêmur são um importante problema de saúde pública em todo o mundo, tanto por sua alta incidência e morbimortalidade como também pelos elevados custos do tratamento e do potencial incapacitante desse tipo de agravo em saúde. A Região Sudeste é a mais populosa do país, somando cerca de 42% de toda a população do Brasil, e concentrando, conseqüentemente, o maior número de fraturas de fêmur de todo território nacional. A compreensão acerca do comportamento epidemiológico das fraturas de fêmur nessa região é de suma importância, portanto, o presente estudo objetivou demonstrar a prevalência das internações, óbitos e a tendência temporal das fraturas de fêmur na Região Sudeste do Brasil entre os anos de 2016 e 2020. Observou-se um total de 239.660

internações por fraturas de fêmur no período observado, sendo a maioria em indivíduos do sexo feminino e acima de 60 anos de idade, especialmente entre os maiores de 80 anos. Ao longo dos anos observados, notou-se uma tendência significativa de acréscimo no número de internações para a população idosa, fato este não observado para as demais faixas etárias. Os gastos com esse tipo de fratura demonstraram-se bastante expressivos e a taxa de mortalidade para a população idosa acometida por esse agravo foi de 8,56 ao longo dos anos observados. Esses achados evidenciam que o investimento de fundos no planejamento de intervenções direcionadas a essa população pode contribuir para menores taxas de internação, menor mortalidade e menores gastos em saúde pública, devendo ser incentivados.

REFERÊNCIAS

- [1] Guerra M, Viana R, Feil L, Feron E, Maboni J, Vargas A. Mortalidade em um ano de pacientes idosos com fratura do quadril tratados cirurgicamente num hospital do Sul do Brasil. *Revista Brasileira de Ortopedia*, 2017; 52(1):17-23.
- [2] Black DM, Geiger EJ, Eastell R, Vittinghoff E, Li BH, Ryan DS & Adams AL. Atypical femur fracture risk versus fragility fracture prevention with bisphosphonates. *New England Journal of Medicine*, 2020; 383(8), 743-753.
- [3] Myers, P., Laboe, P., Johnson, K. J., Fredericks, P. D., Crichlow, R. J., Maar, D. C., & Weber, T. G. (2018). Patient mortality in geriatric distal femur fractures. *Journal of orthopaedic trauma*, 32(3), 111-115.
- [4] Loures FB, Chaoubah A, Maciel VS, Paiva EP, Salgado PP, Netto AC. Custo-efetividade do tratamento cirúrgico da fratura do quadril em idosos no Brasil. *Rev Bras Ortop* 2015; 50(1):38-42.
- [5] Dhanwal D, Dennison E, Harvey N, Cooper C. Epidemiology of hip fracture: Worldwide geographic variation. *Indian Journal of Orthopaedics*. 2011; 45(1):15.
- [6] von Keudell A, Shoji K, Nasr M, Lucas RBA, Dolan R, Weaver M. Treatment options for distal femur fractures. *Journal of orthopaedic trauma*, 2016; 30, S25-S27.
- [7] Instituto Brasileiro de Geografia e Estatística (IBGE). Projeções e estimativas da população do Brasil e das Unidades da Federação. 2016. [acessado 2021 Ago 20]. Disponível em: <<http://www.ibge.gov.br/apps/populacao/projecao>>.
- [8] Brasil. Ministério da Saúde. Departamento de Informática do SUS. Informações em Saúde (TABNET). Disponível em: <<http://www2.datasus.gov.br/DATASUS/index.php?area=02>>.
- [9] 9. Joinpoint Regression Program, Version 4.6.0.0 -April 2018; Statistical Methodology and Applications Branch, Surveillance Research Program, National Cancer Institute.
- [10] Abdel M, Watts C, Houdek M, Lewallen D, Berry D. Epidemiology of periprosthetic fracture of the femur in 32644

- primary total hip arthroplasties. *The Bone & Joint Journal* 2016; 98-B(4):461-467.
- [11] Petros RSB, Ferreira PEV & Petros RSB. Influência das fraturas do fêmur proximal na autonomia e mortalidade dos pacientes idosos submetidos a osteossíntese com haste cefalomedular. *Revista Brasileira de Ortopedia*, 2017; 52, 57-62.
- [12] Porto AO, de Matos Leal CB, Rios MA, Fernandes TSS, Fernandes ESF & Ferreira RBS. Características sociodemográficas e custo de hospitalizações por fratura de fêmur em idosos na Bahia. *Journal Health NPEPS*, 2019; 4(2), 297-309.
- [13] Oliveira CC & Borba VZC. Epidemiologia das fraturas de fêmur em idosos e seu custo para o estado do Paraná, Brasil. *Acta Ortopédica Brasileira*. 2017; 25(4), 155-158.
- [14] Silva J, Linhares D, Ferreira M, Amorim N, Neves N & Pinto R. Tendências Epidemiológicas das Fraturas do Fêmur Proximal na População Idosa em Portugal. *Acta Médica Portuguesa*. 2018; 31(10).
- [15] Amadei SU, Silveira VÁS, Pereira AC, Carvalho YR & Rocha RFD. A influência da deficiência estrogênica no processo de remodelação e reparação óssea. *Jornal Brasileiro de patologia e medicina laboratorial*, 2006; 42, 5-12.
- [16] Silva SKV, de Andrade FRN & Macedo IK. Fatores predisponentes à osteoporose em idosos. In CIEH-Congresso Internacional Envelhecimento Humano. *Rev. CIEH, Editora Realize*, 2017.
- [17] Araújo LB, Garces TS, Sousa GJB, Moreira TMM, Pereira MLD, Damasceno LLV & Gomes LA. Tendência de hospitalizações por fratura de fêmur no Brasil: uma série temporal. *Brazilian Journal of Development*, 2020; 6(5), 28499-28510.
- [18] Myers P, Laboe P, Johnson KJ, Fredericks PD, Crichlow RJ, Maar DC & Weber TG. Patient mortality in geriatric distal femur fractures. *Journal of orthopaedic trauma*, 2018; 32(3), 111-115.
- [19] Elsoe R, Ceccotti AA & Larsen P. Population-based epidemiology and incidence of distal femur fractures. *International orthopaedics*, 2018; 42(1), 191-196.

Modeling of a new Probabilistic Education Quality Indicator - CPP_QEdu

Márcia de Freitas Siqueira Sadok Menna Barreto¹, Annibal Parracho Sant'Anna²

¹Centro Universitário La Salle do Rio de Janeiro, UNILASALLE-RJ, Rio de Janeiro, Brazil

²Universidade Federal Fluminense – UFF – LATEC, Rio de Janeiro, Brazil

Received: 27 Sept 2021,

Received in revised form: 10 Nov 2021,

Accepted: 16 Nov 2021,

Available online: 24 Nov 2021

©2021 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 education. Quality indicators. Multi Criteria Decision Making. Composition of Probabilistic Preferences.*

Abstract— *This research aims to propose a new probabilistic indicator of quality of education, CPP_QEdu. The proposed indicator intends to be more accurate than the existing ones, as it covers four dimensions of the quality of education: pedagogical, cultural, social, and financial, based on the definition of quality of education proposed by the United Nations Educational, Scientific, and Cultural Organization (UNESCO). The problem that arises in the construction of an indicator of educational quality is that its components seek to measure subjective values. This makes it necessary to introduce imprecision in the analysis to reduce evaluation errors. Thus, in addition to the comprehensiveness of dimensions, an important aspect of this study is the use of the Composition of Probabilistic Preferences (CPP), a multicriteria method to support the manager in the decision-making process that considers imprecision from the beginning. Finally, it is worth highlighting the possibility of application of the proposed indicator, using the variables of the quality panel proposed by the United Nations Development Program (UNDP) and the incorporation of this index in the Human Development Index (HDI).*

I. INTRODUCTION

According to the United Nations Development Programme (UNDP), the Human Development Index (HDI), created by the Pakistani economist Mahbub ul Haq with the collaboration of the Indian Nobel laureate in Economics Amartya Sen, is intended to contrast with a widely used indicator, the Gross Domestic Product (GDP), which considers only the economic dimension of development. The HDI has been measured annually since 1990, incorporating some changes over the years. The HDI is composed of three dimensions: income, health, and education.

The HDI uses school attendance in the education dimension, but this measure may not be enough to evaluate the quality of education provided in each country. This justifies the need to insert a quality indicator for education,

motivating this research, which will also have the objective of incorporating a probabilistic component in the evaluation of the quality of education.

The most widely used definition of quality in education is that of citizens who can read and interpret in their mother tongue and have the skills to apply mathematical logic reasoning in their daily lives [28]. In this sense, there are tests such as the Programme for International Student Assessment (PISA) and, at the national level, the Brazilian System for Basic Education Assessment (SAEB), the Brazilian High School Exam (ENEM) and the Brazilian Student Performance Exam (ENADE), focused on higher education.

But can these evaluations alone provide a good picture of quality education? This work proposes to look beyond these evaluations, considering other factors that can have an

impact on this quality. Such as the teacher's qualification and how the school environment with internet access broadens the classroom education. The ratio of the number of students per teacher is also an important factor, because its reduction enables teaching with a more individualized look.

The present research aims to build a probabilistic indicator of quality of education more comprehensive than the existing ones from an interdisciplinary approach, using the structural bases of probabilistic modeling, which in this work will be the Composition of Probabilistic Preferences (CPP), developed by Annibal P. Sant'Anna since 2001. The incorporation of this indicator of the quality of education, contemplating the dimensions of pedagogical, cultural, social and financial quality, allows to amplify the relevance of the HDI.

The concept of quality of education used in this work may change over time. Thus, we can reformulate the criteria according to the new needs of society. However, the methodology used to construct the index can continue to be used.

In a search in the literature, no probabilistic index of the quality of education was found with the breadth of the developed index, contemplating the pedagogical, cultural, social and financial dimensions. Most of the indexes are not probabilistic and contemplate only the pedagogical dimension.

The structure of this research is divided into five sections detailed below.

Section 1 is composed of the introduction to the theme, through the contextualization of the problem, justifying the need to create an index of quality of education that comprises other criteria and that can be aggregated to the HDI.

Section 2 describes the criteria that are being used to construct the CPP_QEdu indicator.

Section 3 presents the modeling and methodology used to construct the indicator.

Section 4 shows the calculation for extending the HDI by incorporating the proposed education quality index.

Section 5 presents the analysis of the results of the application of the developed index to the states and municipalities of Brazil.

II. DESCRIPTION OF THE CPP_QEdu CRITERIA

As seen earlier, the quality of education can be understood from various perspectives. Based on this diversity, UNESCO points out four dimensions that make up quality: pedagogical, cultural, social, and financial.

The pedagogical dimension is the effective fulfillment of the curriculum. For this, we can use evaluation tools like PISA, SAEB, ENEM, and ENADE.

In the cultural dimension, curricula need to be in accordance with the diverse regional cultures, and for this the teacher needs to have adequate training. The well qualified teacher who uses an appropriate curriculum develops strategies to make school more interesting and, consequently, reduces dropouts and increases school attendance. Thus, the teacher's training will be the criterion used in the cultural perspective.

From the social perspective, UNESCO associates the quality of education with its contribution to equity. In this sense, it checks whether the school is, in a democratic way, giving the opportunity for students of the same age group to have access to the same content, as anywhere on the planet. The use of the Internet in the teaching-learning process provides equal access to information. For this reason, the percentage of schools with Internet access will be used as an indicator to represent the social indicator.

From the economic point of view, quality refers to efficiency in the use of resources allocated to education. To represent this criterion, the number of students per teacher will be used. In this item, there is a counterpoint: more students per teacher would be less costly, but would have lesser benefit. Thus, reducing the number of students per class characterizes the quality in the use of resources [59][60].

The United Nations Development Programme (UNDP) Human Development Report 2019[56], which has a central theme of human development inequalities in the 21st century, elaborates a quality of human development dashboard with three quality indicators. This Quality of Human Development dashboard is a table containing a selection of 14 indicators associated with the quality of health, education, and income. The three health quality indicators are: health expectancy lost, number of doctors, and number of hospital beds. The seven education quality indicators are: pupil-teacher ratios in elementary school, primary teachers trained to teach, proportion of elementary school with Internet access, proportion of secondary schools with Internet access, and the Programme for International Student Assessment (PISA) results in math, reading, and science. The four quality of life indicators are: the proportion of vulnerable jobs, the proportion of the rural population with access to electricity, the proportion of the population using improved drinking water sources, and the proportion of the population using improved sanitation facilities.

Based on the quality of education indicators used by UNDP in the Quality of Human Development panel and the

Quality of Education dimensions pointed out by UNESCO, seven criteria were used to compose the CPP_Qedu, covering these four dimensions. The criteria are the number of students per teacher, percentage of schools with Internet access, percentage of teachers with higher education, SAEB Mathematics score for the Elementary School - Early Years, SAEB Portuguese Language score for the Elementary School - Early Years, SAEB Mathematics score for the Elementary School - Final Years, and SAEB Portuguese Language score for the Elementary School - Final Years.

In the UNDP indicator, the pupil-teacher ratio in elementary school is used, while in the CPP_Qedu the ratio between the number of pupils per teacher in primary and secondary education in Brazil is used as an equivalent criterion. The second criterion used is the percentage of teachers with higher education in primary and secondary schools in Brazil, corresponding to the ratio of primary teachers trained to teach. The third criterion, percentage of primary and secondary schools in Brazil with Internet access, is analogous to two indicators: the proportion of elementary school with Internet access and the proportion of secondary schools with Internet access. The remaining four criteria are the SAEB (Basic Education Evaluation System) scores for Mathematics and Portuguese Language of the two phases of elementary school. This assessment developed by the Brazilian government is similar to the Programme for International Student Assessment (PISA) in mathematics and reading.

III. CPP_Qedu DATA MODELING

The modeling will use Composition of Probabilistic Preferences(CPP) [45], based on the application of probability theory in decision support. CPP is a methodology developed to take into account, in the composition of multiple criteria, the presence of imprecision in preference evaluations. Inaccuracy is inherent in the subjectivity and errors of evaluation in decision making processes. Thus, a random component is recognized for the evaluation of each alternative under each criterion.

CPP deals with rules for combining evaluations by different criteria or different experts in terms of choice probabilities. It starts by the evaluation of the preference of each alternative by the probability of that alternative being chosen among the others. To arrive at this result, the preference given by the value of a performance attribute is not treated as a precise and definite measure of preference, but as a random variable.

Thus, a probability distribution is associated with each measurement, in a manner similar to that employed in fuzzy sets theory [64] to replace exact numbers with measures of

relevance to the points in the intervals around them. The initial exact measurements are considered as parameters for locating probability distributions of the possible values that in other evaluations under similar circumstances would be assigned to the same option. This replacement of exact measurements with probability distributions constitutes the **first step** of CPP, according to Sant'Anna (2015)[46].

The **second step** refers to the choice of a probability distribution that is identified, or even approximately assumed, to be characteristic of the disturbances affecting the measurements, with the exact values as location parameters.

The **third step** involves two computations. The probabilities that the i -th alternative is superior (M_{ij}) and inferior (m_{ij}) to the others are calculated for each j -th criterion. According to equations (1) and (2),

$$M_{ij} = \int_{D_{x_i}} \left[\prod_{j \neq i} F_{X_j}(x_j) \right] f_{X_i}(x_i) dx_i \quad (1)$$

$$m_{ij} = \int_{D_{x_i}} \left[\prod_{j \neq i} (1 - F_{X_j}(x_j)) \right] f_{X_i}(x_i) dx_i \quad (2)$$

where F_{X_j} represents the cumulative distribution function (cdf), f_{X_i} the probability density function (pdf) and D_{x_i} the domain of the random variable x_j , as in Sant'Anna et al (2012)[42]. The calculations are performed for each alternative under each criterion.

In the **fourth step**, the joint probabilities M_{ij} and m_{ij} are composed into global preference scores under different decision points of view. Compositions based on M_{ij} are called progressive because they are associated with gain maximization. Compositions based on m_{ij} are called conservative, because they are associated with loss minimization. On the other hand, maximizing M_{ij} and minimizing m_{ij} in all criteria are called pessimistic compositions, while optimistic ones are based on satisfaction in only at least one criterion with the maximum or minimum preference. Four points of view then emerge.

The Progressive-Pessimistic (PP) viewpoint calculates preference by the probability of being the best according to all the criteria considered. The calculation is performed according to the hypotheses of independence and maximum dependence, which portray the extremes of correlations between variables, respectively, by Equations (3) and (4).

$$PP_i = \prod M_{ij} \quad (3)$$

$$PP_i = \min M_{ij} \quad (4)$$

The Progressive-Optimistic (PO) viewpoint uses the probability of being the best according to at least one of the criteria considered, calculated according to Equations (5) and (6).

$$PO_i = 1 - \prod (1 - M_{ij}) \quad (5)$$

$$PO_i = \max M_{ij} \quad (6)$$

The Conservative-Pessimistic (CP) viewpoint uses the probability of not being the worst in all the criteria considered and is calculated from Equations (7) and (8).

$$CP_i = \prod (1 - m_{ij}) \quad (7)$$

$$CP_i = 1 - \max m_{ij} \quad (8)$$

Finally, the Conservative-Optimistic (CO) viewpoint uses the probability of not being the worst in at least one of the criteria considered, and is calculated according to Equations (9) and (10).

$$CO_i = 1 - \prod m_{ij} \quad (9)$$

$$CO_i = 1 - \min m_{ij} \quad (10)$$

The problem that arises in the construction of an indicator of quality of education is that its components seek to measure subjective values, which are affected by political and methodological problems. It is also necessary to consider the aspect of sustainability in education, contemplating the balance between the dimensions of quality of education proposed in this work. All aspects considered are equally important in the composition of this indicator.

The initial transformation into preference probabilities solves the problem of choice of scales, transforming the measures of each dimension into probabilities of reaching a frontier of better or worse performance in that dimension. And it contributes to improving the efficiency of decisions, since it improves the level of precision with respect to quality.

In this paper, the conservative-optimistic probabilistic composition (CO) approach will be used: in which the alternative is evaluated by the probability that it is no worse than the sample by at least one of the criteria. Conservative-Optimistic composition seeks the goal of escaping the large social differences that exist in Brazil and in the world in the particular aspects considered, while hoping that the momentum generated in some dimension will have the effect of causing advances in others.

IV. HDI EXPANSION

4.1 HDI calculation

The Human Development Index (HDI) is a summary of measures in three dimensions, which are the key to human development. A long and healthy life in the health dimension, access to knowledge represented in the education dimension, and a decent economic standard, which is the income dimension. The HDI is the geometric mean of the normalized indices for each of the three dimensions.

As of 2010, a new calculation method was developed to construct the index, according to Technical Note 1 of the HDI report. In this new calculation, UNDP continues to combine the three dimensions, health, education and income, but uses new variables in some dimensions:

In the health dimension, it uses life expectancy at birth in the locality in question. The variable is the same, but there was a change in the calculation, because there was a change in life expectancy in the world.

To construct the life expectancy index (IEV), we use equation (11):

$$(IEV) = \frac{EV-20}{85-20} \quad (11)$$

Where EV is life expectancy at birth, IEV is 1 when life expectancy at birth is equal to or greater than 85 years and 0 when life expectancy at birth is equal to or less than 20 years.

In the Education dimension, today it uses the arithmetic average of the observed number of years of schooling and the expected number of years of schooling for that location, truncated at 15 and 18, respectively. Previously, the literacy rate and the schooling rate were used. As literacy is no longer a problem in most countries, this value has become less significant.

To construct the education index (IE), we do the following calculations:

First, we construct the index of average years of study (IAME), that is, years that a person aged 25 or older spent in formal education, equation (12).

$$(IAME) = \frac{AME}{15} \quad (12)$$

where 15 is the maximum projected in this indicator for 2025.

Next, we construct the expected years of schooling index (IAEE), that is, the expected number of years of schooling a child will achieve at birth, equation (13).

$$(IAEE) = \frac{AEE}{18} \quad (13)$$

where 18 years is the equivalent of obtaining a master's degree in most countries.

The education index (IE) is calculated by taking the simple arithmetic average of the two indexes (IAME) and (IAEE), represented in equation (14).

$$(IE) = \frac{(IAME)+(IAEE)}{2} \tag{14}$$

In the income dimension, Gross National Income (GNI) per capita (GNIPc) is used, with a new calculation.

$$(IR) = \frac{\ln(GNIPc)-\ln(100)}{\ln(75000)-\ln(100)} \tag{15}$$

where IR is 1 when GNI per capita is equal to or greater than \$75000 and 0 when GNI per capita is \$100. GNI per capita is the dollar value of a country's final income in a year, divided by its population.

Finally, the HDI is calculated by the geometric mean of the indices, from equations (11), (14) and (15).


$$HDI = \sqrt[3]{(IEV).(IE).(IR)} \tag{16}$$

To extend the HDI with the education quality index proposed in this paper, at first, the 7 education quality indicators from the human development quality dashboard proposed by UNDP in 2018 are used.

4.2 Calculation of CPP_QEdu with data from UNDP's Human Development Quality Panel

In a first step, the missing data were replaced by the median of the human development quality scoreboard proposed by UNDP in 2018, Table 1. This includes most countries as far as PISA data is concerned.

Table 1: Human Development Quality Scoreboard - UNDP - 2018



https://docs.google.com/document/d/1giKf9_E2huxDWLX3K4E0UdEfJcMhCFrAAFWKgzGwPck/edit?usp=sharing

We use the seven criteria from the panel, Table 1, to compose the index. These data are normalized, passing the minimum to zero and the maximum to one. After this standardization of the data, we randomize them, using these values as the mode of a triangular distribution with extremes zero and one. These values are then used to calculate the probabilities of maximizing (Mij) and minimizing (mij) the data. Assuming independence, we use the following combinations of maximization and minimization to find the four profiles:

Conservative/Optimistic: $CO_i = 1 - \prod_j m_{ij}$, (17)

Conservative/Pessimistic: $CP_i = \prod_j (1 - m_{ij})$, (18)

Progressive/Optimistic: $PO_i = 1 - \prod_j (1 - M_{ij})$, (19)

Progressive/Pessimistic: $PP_i = \prod_j M_{ij}$. (20)

where \prod denotes the product operator.

The comparison rules adopted are the conservative ones, which are based on the distances to the worst performing extremes, equations (17) and (18). The justification is that the goal of the analysis is to identify the countries that need more help with respect to education quality. The optimistic conservative composition and the pessimistic conservative composition are analyzed.

In the optimistic approach, the country is evaluated using the probability that it is not the worst in the sample by at least one of the criteria. This assumption captures the hope of escaping underdevelopment in any of the particular characteristics considered by generating favorable momentum to advance in the other dimensions. This optimistic assumption, combined with an assumption of statistical independence, results in a score that is calculated using the complement of the product of the probabilities of showing the worst assessment in each dimension. In the pessimistic approach, the country is evaluated using the probability of not being the worst in all criteria. As there was no significant difference in the ranking, Table 2, we opted to present only the result of applying the Conservative/Optimistic approach to compose the HDI.

In Table 2, the following countries were excluded: Armenia, Gabon, Haiti, Iraq, Libya, Palau, Sudan, Syrian Arab Republic, Timor-Leste, Turkmenistan, Venezuela, which did not have at least one data in the UNDP quality panel. For this reason, the HDI ranking was recalculated without these countries to compare with the IDH_QEdu.

4.3 Calculation of IDH_QEdu

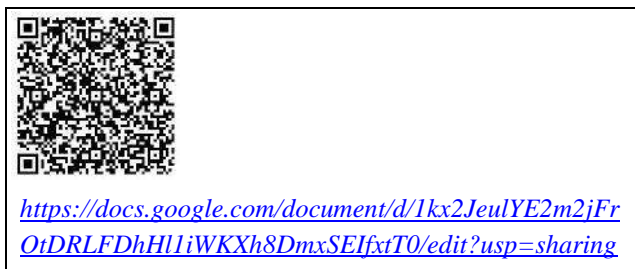
To extend the HDI education index, we use the index CPP_QEdu(CO), which will be introduced in the arithmetic mean IE of the HDI, equation (21), introducing the quality of education in the indicator, equation (22).

$$(IEQ) = \frac{(IAME) + (IAEE) + CPP_QEdu(CO)}{3} \tag{21}$$

$$IDH_QEdu = \sqrt[3]{(IEV).(IEQ).(IR)} \tag{22}$$

In Table 2, we present the results comparing the HDI ranks with the extended HDI (IDH_QEdu), removing the 11 countries that did not have quality data.

Table 2: Expanded HDI ranking - 2018, compared to the HDI.



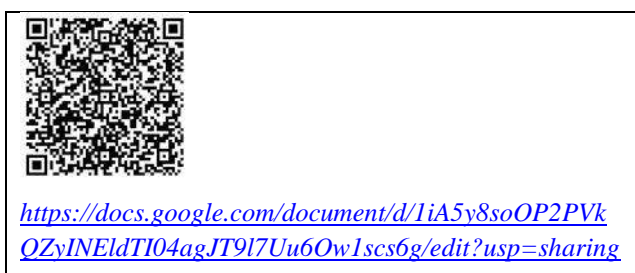
The quality indicator did not impact, significantly, the rank of the first quartile countries; there were small changes in positions. But it had a positive impact on some countries in the second quartile, such as Panama, which rose 16 positions in the ranking. Costa Rica also had a significant position change. However, the countries that were impacted the most were those in the 4th quartile, many of which had significant changes in their positions for better or worse. Thus, the indicator is able to identify the countries that have been seeking improvements in the quality of education; a change in some criterion can impact the change in position.

V. ANALYSIS OF THE RESULTS

5.1 Analysis of the Brazilian States

For a first analysis of the adequacy of CPP_Qedu with SAEB data, the data of Brazilian states from the year 2017 were used, Table 3:

Table 3: Indicators per Brazilian State



To analyze the results obtained with these data, we began with a comparison of the 2017 Municipal Human Development Index (MHDI) results by states with the results of the Conservative-Optimistic axis of the CPP. We started with the MHDI Education, a synthetic index of the education dimension that is part of the MHDI composition, which is composed of three dimensions: longevity, education, and income. This indicator is obtained through the geometric average of the subindex of children and young people's school attendance, with a weight of 2/3, and the subindex of the adult population's schooling, with a weight of 1/3. The CPP-QEdu has seven criteria, based on the new

education quality indicator, these results are described in Table 4.

In this first analysis, three states show significant differences in the comparison. The state of Roraima appears in fourth place with the MHDI-Education methodology, demonstrating an excellent job in getting children into school and improving the schooling level of the adult population. However, this state does not seem to have given much importance to the quality of the education offered, since with the CPP_QEdu it appears in 20th position, highlighting the importance of analyzing the quality criteria in the human development indexes.

Table 4: Comparison of the Indexes per Brazilian State



Looking at Ceará and Mato Grosso do Sul, we observe that these states still need to improve the inclusion of all children in school and increase the schooling of the adult population, as they appear in the 14th and 15th positions in the MHDI Education ranking. However, it can be seen that they are moving in this direction, as they are in a median position in this ranking. When we examine the results of the CPP_QEdu, which focuses on the quality of education, we see that, although this inclusion is happening more slowly, these states appear in the 5th and 6th positions in this ranking, which indicates that these states are investing in the quality of education offered.

In Figure 1, in the radar graph that compares the rankings of the two methodologies, the Education MHDI ranking with the CPP_QEdu ranking from the conservative-optimistic point of view, a very distinct design can be seen in the methodologies, that is, the Education HDI ranking is very different from the CPP_QEdu ranking in most states, confirming the importance of using indicators that evaluate the quality of the education offered and not only how long a student has been in school. There is no point in staying a long time in a school that offers a precarious teaching-learning process.

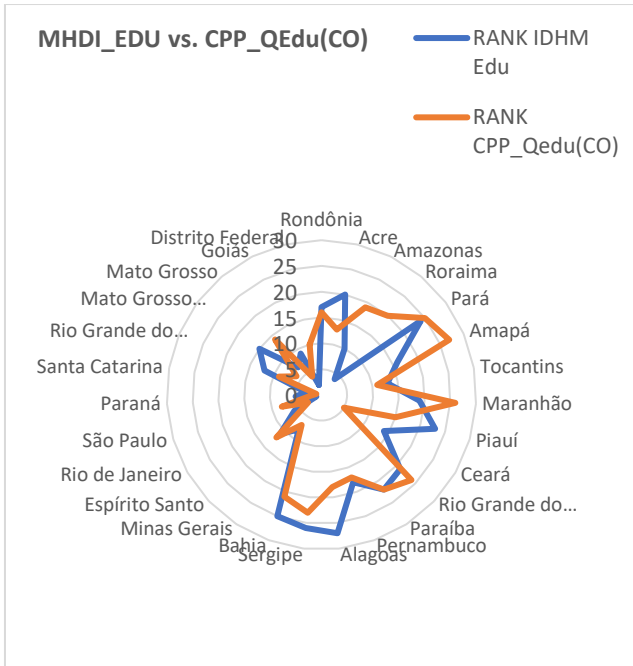


Fig.1: Spider graph comparing the results of the MHDH_EDU with the CPP_QEdu

Source: Authors

To verify the influence of SAEB scores on the CPP_QEdu indicator, we compared the performance of the CPP_QEdu indicator with the CPP_SAEB. The CPP_SAEB was calculated with the four SAEB score criteria per state (SAEB Math score for Primary School Mathematics, SAEB Portuguese Language score for Primary School Mathematics, SAEB Math score for Primary School Mathematics, Final Years, and SAEB Portuguese Language score for Primary School Portuguese Language, Final Years), as shown in Table 5.

It can be seen that the states of São Paulo and Minas Gerais were strongly influenced by the SAEB scores. However, when the results of Rio de Janeiro and Rio Grande do Sul are analyzed, it is observed that the SAEB score had little influence on the CPP_QEdu ranking, so the other three criteria had a strong influence on the result. This analysis is important to show that the CPP_QEdu index is not focused only on content quality and that the other criteria are also influencing the ranking.

Observing, in Figure 2, the radar chart, which compares the CPP_QEdu with the CPP_SAEB with the same conservative-optimistic point of view, there is a very close approximation of the two curves. In this view, there is a strong influence of SAEB scores on the CPP_QEdu indicator.

Table 5: Comparison of CPP_QEdu with the SAEB performance index

https://docs.google.com/document/d/1vyScEYQh7WJBn_nTvK8UuRh-zF_itRJ1tBd7oy7K9VLc/edit?usp=sharing

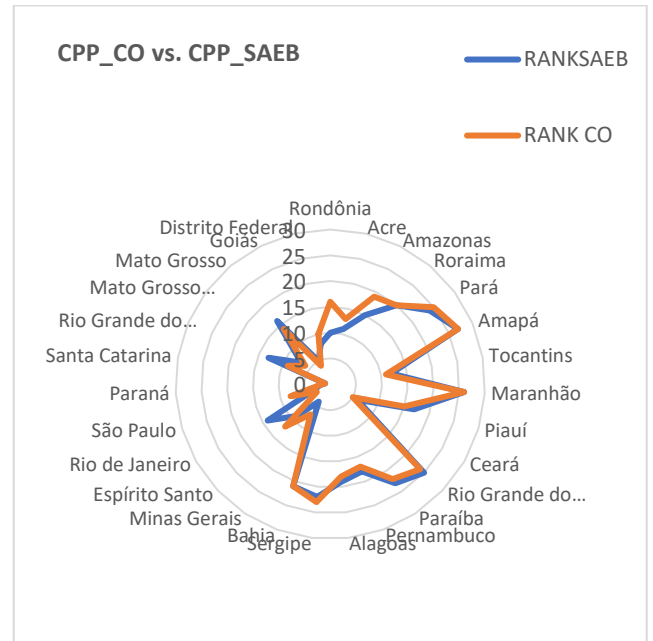


Fig.2: Spider graph comparing CPP_SAEB results with CPP_QEdu (CO)

Source: Authors

Although the context of the problem better fits the Conservative-Optimistic point of view, it is considered relevant to verify the sensitivity of the model, comparing it with the result of the application of the compositions by the other points of view, Table 6.

In this sensitivity analysis, we verify the consistency of the state of Santa Catarina which, under different points of view, remains in first place in the ranking, that is, the state with the best quality of education in the country. In this same analysis, we find the state of Pará among the worst in Brazil from all points of view.

Table 6: Comparison of the Four Viewpoints of CPP_QEdu

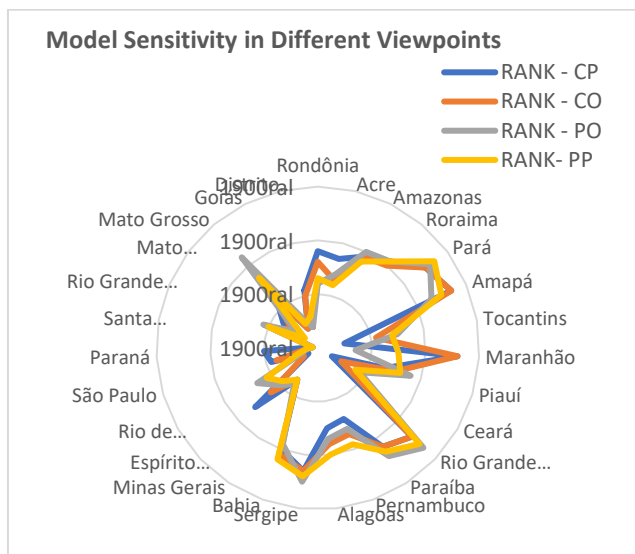


Figure 3: Spider graph comparing the Four Viewpoints of CPP_QEdu

Source: Authors

At the same time, the states of Rio de Janeiro and Ceará behave much better in the conservative profiles, where losses are minimized. As most of the criteria are close to the maximum, the states of São Paulo and the Federal District behave much better in the progressive profile.

Figure 3 shows the behavior of the rankings in the four approaches analyzed. It can be seen that the four approaches have similar results, with the distortions previously analyzed.

5.2 Analysis of Brazil's Municipalities

An analysis of the municipalities was also carried out. The same variables were used: number of students per teacher, percentage of schools with Internet access, percentage of teachers with higher education, SAEB Mathematics score for the Elementary Beginning Years, SAEB Portuguese Language score for the Elementary Beginning Years, SAEB Mathematics score for the

Elementary End Years, and SAEB Portuguese Language score for the Elementary End Years.

As for missing data, to be expected in a dataset of all Brazilian municipalities, including representation from municipalities far away from urban centers, it is interesting to note that few municipalities had missing data. To impute values, we used the following procedure. First, the values of each variable were rescaled to the interval [0,1]. Then, the missing values were imputed with the median of the values of the other variables in the municipality.

Two analyses were conducted keeping the data for the explanatory variables of performance quality fixed at their 2019 values. For the variables assessing the results of curriculum delivery effectively, i.e., the SAEB variables, 2017 data were considered in the first analysis and 2019 data in the second.

To avoid the effects of data imprecision from variables representing smaller presences, the comparison was limited to the municipalities in the top quartile in the ordering of municipalities by size, represented by the number of students enrolled in 2019. In this quartile are municipalities with 6180 students or more. Of the total 5570 municipalities in the database, the top quartile consists of 1393 municipalities.

To provide an objective comparison of the differences, a selection of data from extreme municipalities from the extreme states is presented here, that is, the states of Santa Catarina, Paraná and Rio de Janeiro on one side, and the states of Amapá, Maranhão and Pará on the other.

Initially, the differences in the size of these states should be noted. Amapá has only 6 municipalities in the analyzed quartile, Maranhão 96 and Pará 102. On the other side, Santa Catarina has 52 municipalities in the upper quartile, Paraná has 71 and Rio de Janeiro 54.

Table 7: CPP_QEdu Resources and Rank Values of Municipalities in the Extremes



In Table 7, one can observe the expected distance between the values corresponding to municipalities at the two extremes, but one can also highlight the variation between the availability of educational resources within the

states. Thus, in Macapá, capital of Amapá, the percentage of teachers without higher education is much lower than in the other municipalities of the state, while the proportion of schools with Internet resources is much higher. In Maranhão and Pará, the internal variability comes from the fact that, while municipalities like Santa Quitéria do Maranhão and Porto de Moz rank last among the municipalities in all the states, the municipalities in Maranhão and Pará, as a whole, rank better than those in Amapá, Table 5.

Tables 8 and 9 allow us to compare, respectively, the performances of the municipalities in the lower end and the upper end listed in Table 7. The values in these tables are, respectively, the probabilities of presenting the worst and the best score in each of the tests considered in the index. These probabilities allow the comparison to be free from the effect of the possible variation in the difficulty of the tests from one year to another.

Table 8: Odds of Lowest Scoring Municipalities in the Worst-Ranked States



Table 9: Odds of Highest Score of Top-Ranked Municipalities in Top-Ranked States



From the point of view of the values recorded in these tables, the highlight is the agreement between the results of the two years.

It should also be noted that these probabilities are calculated in R with remarkable precision despite the large size of the data set, 1393 municipalities. Even with the separation into quartiles, we still have over 1000 (almost 1400 in the top quartile) municipalities in the same group. This comparison of such large samples, however, proved feasible, even though CPP compared each alternative with all the others.

VI. CONCLUSION

The present research achieved the goal of constructing a probabilistic indicator of quality of education that is more comprehensive than existing ones. From an interdisciplinary approach, using the structural basis of the probabilistic modeling offered by CPP. To extend the HDI, the developed index, CPP_QEdu, was incorporated. The incorporation of this education quality indicator contemplates the dimensions of quality, pedagogical, cultural, social, and financial, proposed by UNESCO, extends the relevance of the HDI.

The variables representing these dimensions were based on the human development quality dashboard proposed by UNDP in 2018. That body developed the dashboard, but did not develop a measure that could be incorporated into the HDI, as was done in this research. These variables that were used to construct the indicator per country are adequate, as they contemplate the dimensions of quality proposed by UNESCO.

In this work, a CPP_QEdu indicator was also constructed for the states and municipalities of Brazil, where the Ministry of Education works with a quality indicator, the IDEB, which, however, only considers the pedagogical and social dimensions. To construct the CPP_QEdu at the national level, variables equivalent to those in the UNDP panel were used. All variables used to compose the index cover all basic education in the states or municipalities, without restricting the segment of education. The PISA scores (Mathematics, Portuguese Language and Science) were substituted by SAEB scores (Mathematics, Portuguese Language) in two segments, for greater national coverage. The indicator constructed is more comprehensive than the IDEB and can contribute to the construction of better public policies that provide higher quality education in the country.

The dimensions of quality of education that were incorporated into the CPP_QEdu were based on the dimensions of quality proposed by UNESCO and on the variables used in the panel on quality of human development developed by the UNDP. At the beginning of the research, other variables were evaluated to compose the index, but as the research evolved, we concluded that these dimensions were already broad enough. The standardized tests in the case of PISA and SAEB to compose the pedagogical dimension are appropriate, because they evaluate the knowledge acquired by the students. In the ratio of students per teacher to compose the financial dimension, the balance of this ratio ratifies the efficiency in the use of resources directed to education. The teacher needs to have adequate knowledge to develop a curriculum in accordance with cultural differences, making the school more attractive.

In this way, the teacher's training is propitious to compose the cultural dimension. And the access to the Internet to compose the social dimension is justified by the equality in the reach of information.

The previously existing indexes do not have probabilistic features and, for the most part, evaluate the quality of education only from the pedagogical point of view. Only the IDEB, a national indicator, is calculated from crossing of student performance data with approval rate, evaluating two dimensions.

As future work, it is suggested to consider the importance of introducing a variable that evaluates gender inequalities in access to education, in Brazil and in the world, since these differences are relevant in several places. Another analysis can be done by separating the municipalities that are in rural regions from the essentially urban ones; the evaluation was done by the number of students attended in the region, but there was no separation by type of region. The approval rate and the grade/age distortion are variables that can be introduced in the index, because, when composed with the standardized tests, they help to identify when students are approved without having acquired knowledge. An important study at the moment would be an analysis of the impact of the COVID 19 pandemic on the quality of education, as well as including new educational modalities as criteria.

REFERENCES

- [1] Albo., Y.; Lanir, J.; Rafaeli, S. A (2019) Conceptual Framework for Visualizing Composite Indicators. *Social Indicators Research*, Vol.141(1), pp.1-30.
- [2] Angilella, S.; Catalfo, P.; Corrente, S.; Giarlotta, A.; Greco, S.; Rizzo, M.(2018) Robust sustainable development assessment with composite indices aggregating interacting dimensions: The hierarchical-SMAA-Choquet integral approach. *Knowledge-Based Systems*, Vol.158, pp.136-153.
- [3] Araújo, Marciano Vieira de. A. (2017) *Evolução do Sistema Educacional Brasileiro e seus Retrocessos*. Revista Científica Multidisciplinar Núcleo do Conhecimento. Ano 2, Vol. 1. pp 52-62.
- [4] Arcidiacono, S. G.; Corrente, S.; Greco, S.(2019) As simple as possible but not simpler in Multiple Criteria Decision Aiding: the robust-stochastic level dependent Choquet integral approach. *European Journal of Operational Research*, 240(1), 172-182.
- [5] Barro, R. J.; Lee, J. W.(2016) Dataset of Educational Attainment. Disponível em: <http://www.barrolee.com/data/dataexp.htm>. acesso em 15/05/2019.
- [6] Blömeke, S.; Delaney, S.(2012) Assessment of teacher knowledge across countries: a review of the state of research. *ZDM*, Vol.44(3), pp.223-247.
- [7] Brasil. (2018) Ministério da Educação. Instituto Nacional de Estudos e Pesquisas Educacionais. Resultados do SAEB 2017: Brasil. Brasília. Disponível em: <http://portal.inep.gov.br/web/guest/educacao-basica/saeb> acesso em 15/11/2018.
- [8] Brasil, INEP(2019) Disponível em: <http://portal.inep.gov.br/web/guest/indicadores-educacionais> acesso em 27/05/2019.
- [9] Bruntland, Gru; Khalid, Mansour; Agnelli, Susanna et al. (1987) Our Common Future, 'Brundtland report'. TIMSS e PIRLS Centro de Estudos Internacionais Disponível em: <https://timssandpirls.bc.edu/> acesso em 15/05/2019.
- [10] Çiftçi, S. Koza; Yildiz, Pinar.(2019) The Effect of Self-Confidence on Mathematics Achievement: The Metaanalysis of Trends in International Mathematics and Science Study (TIMSS). *International Journal of Instruction*, Vol.12(2), p.683.
- [11] Çilingirtürk, A. & Koçak, H.(2018) Human Development Index (HDI) Rank-Order Variability. *Social Indicators Research*, 137(2), 481-504.
- [12] CONFEMEN. PASEC.(2019) Disponível em: <http://www.pasec.confemen.org/> acesso em 25/05/2019.
- [13] David, E. A. et al (2014) Aspectos da Evolução da Educação Brasileira. *Revista Eletrônica de Educação da Faculdade de Araguaia*, 5: 184-200.
- [14] Demirbolat, AyseOttekin.(2018) Democracy, Human Development, and Happiness Indices as Precursors of International Student Success. *Journal of Education and Learning*, Vol.7(1), p.237.
- [15] De Souza, R. G.; Climaco, J. C. N.; Sant'Anna, A. P.; RochaA, T. B.; Do Valle, R. A. B.; Quelhas, O. L. G.(2016) Sustainability assessment and prioritisation of e-waste management options in Brazil. *Waste Management*, Vol.57, pp.46-56.
- [16] Edwards, S., Garcia Marin, A. (2015) Constitutional rights and education: An international comparative study. *Journal of Comparative Economics*, Vol.43(4), pp.938-955.
- [17] Gavião, L. O.; Lima, G. B. A.; Sant'Anna, A. P.; Maciel, G. F. S. V. (2019) Composição probabilística de preferências com abordagem empírica em problemas multicritério. *Gestão & Produção*, Vol.26(2).
- [18] Gimenez, G.; Martin-Oro, Á.; Sanau, J. (2018) The effect of districts' social development on student performance. *Studies in Educational Evaluation*, Vol.58, pp.80-96.
- [19] GRONINGEN GROWTH AND DEVELOPMENT CENTRE (GGDC) (2018) Disponível em: <https://www.rug.nl/ggdc/> acesso em 15/11/2018.
- [20] Gustafsson, J.E.; Nilsen, T.; Hansen, K. Y. (2011) School characteristics moderating the relation between student socio-economic status and mathematics achievement in grade 8. Evidence from 50 countries in TIMSS 2011. *Studies in Educational Evaluation*.
- [21] Iida, A.M.F. (Org.). (2015) *Números do Ensino Superior Privado no Brasil 2014: ano base 2013*. – Brasília: ABMES Editora, 2015.
- [22] LLECE(2019) Disponível em: <http://www.unesco.org/new/en/santiago/education/education-assessment-llece/> acesso em 25/05/2019.

- [23] Jan, Polcyn. (2018) Human development level as a modifier of education efficiency Management, Vol.22(2), pp.171-186, 01 December.
- [24] Karruz, Ana. (2018) Through Rainy Days: Advancing Education and Health amidst an Unfavorable Local Economy. Revista de Sociologia e Política, Vol.26(68), pp.121-153.
- [25] Krishnakumar, J.; Nagar, A. (2008) On Exact Statistical Properties of Multidimensional Indices Based on Principal Components, Factor Analysis, MIMIC and Structural Equation Models. Social Indicators Research, Vol.86(3), pp.481-496.
- [26] Ma, J.; Vachon, T.; Cheng, S. (2019) National Income, Political Freedom, and Investments in R&D and Education: A Comparative Analysis of the Second Digital Divide Among 15-Year-Old Students. Social Indicators Research, Vol.144(1), pp.133-166.
- [27] Mariano, E. B., Sobreiro, V. A., & NascimentoRebelatto, D. A. (2015) Human Development and Data Envelopment Analysis: a structured Literature Review. Omega, 54, 33–49.
- [28] Mello, Liliane Ribeiro De; Bertagna, Regiane Helena. (2016) Apontamentos iniciais sobre qualidade educacional: resultados do IDEB e fatores socioeconômicos. Revista Ibero-Americana de Estudos em Educação, Vol.11(3), pp.1132-1148,p2.
- [29] Mullis, I.V.S., Martin, M.O., Goh, S., & Cotter, K(2016). TIMSS 2015 Encyclopedia: Education Policy and Curriculum in Mathematics and Science.
- [30] Mullis, I. V. S., Martin, M. O., Goh, S., & Prendergast, C. (2017)PIRLS 2016 Encyclopedia: Education Policy and Curriculum in Reading.
- [31] Nanaj, A. &Duka, R. (2017) The Dynamic of Poverty Measurement Indexes, from HDI to MPI. Academic Journal of Business, Administration, Law and Social Sciences, 3(1), 52-62.
- [32] Natoli, R. & Zuhair, S. (2011) Measuring Progress: a Comparison of the GDP, HDI, GS and the RIE. Social Indicators Research, 103(1), 33-56.
- [33] Nir, A. E.; SharmaKafle, B. (2013) The effect of political stability on public education quality. International Journal of Educational Management, Vol.27(2), pp.110-126.
- [34] OECD. PISA (2015) Results in Focus. Disponível em: <http://www.oecd.org/pisa/pisa-2015-results-in-focus.pdf> acesso em 15/11/2018.
- [35] OECD. PISA(2019) Disponível em: <http://www.oecd.org/pisa/> acesso em 15/05/2019.
- [36] Qin, L.; Bowen, D. H. (2019) The distributions of teacher qualification: A cross-national study. International Journal of Educational Development, Vol.70.
- [37] R Core Team. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, 2018. Disponível em: <https://www.R-project.org/>, acesso em 15/05/2019.
- [38] Sant’Anna, A. P. (2002) Data envelopment analysis of randomized ranks. PesquisaOperacional, 22(2), 203–215.
- [39] Sant’Anna,AnnibalParracho. (2010) Probabilistic composition of criteria for schedule monitoring. PesquisaOperacional, Vol.30(3), pp.751-767.
- [40] Sant’Anna, A. P.; De Senna, V.; Pereira, H. B. B. (2011)Composition of probabilistic evaluations of preferences: a case of criteria applied to isolated and clustered options. (Report).International Transactions in Operational Research, Vol.18(4), p.513-14.
- [41] Sant’Anna, A. P., Ribeiro, R. A. &Dutt-Ross, S. (2011) Employing the components of the Human Development Index to drive resources to educational policies. Social Indicators Research, Dec 2011, Vol.104(3), pp.523-532.
- [42] Sant’Anna, A. P., Gomes, L. F. A. M., Costa, F. F. da, Rangel, L. A. D., Faria, M. J. da S., Ferreira, R. G., ... Senna, V. de.(2012) Análise multicritério baseada em probabilidades de preferência. In V. F. de Oliveira, V. Cavenaghi, & F. S. Másculo (Eds.), Tópicos emergentes e desafios metodológicos em Engenharia de Produção: casos, experiências e proposições - Volume V (p. 258). Rio de Janeiro: ABEPRO.
- [43] Sant’Anna, A. P.; Meza, L. A.; Ribeiro, R. O. A. (2014) Probabilistic composition in quality management in the retail trade sector. International Journal of Quality & Reliability Management, Vol.31(6), pp.718-736.
- [44] Sant’Anna,, A. P. (2015a)Probabilistic Human Development Indices.Brazilian Journal of Operations & Production Management, Vol.12, 136-146.
- [45] Sant’Anna, A. P. (2015b) Probabilistic Composition of Preferences: Theory and Applications. Heidelberg: Springer.
- [46] Sant’Anna, A. P., Costa, H. G. & Pereira, V. (2015) CPP-TRI: a sorting method based on the probabilistic composition of preferences. International Journal of Information and Decision Sciences, 7(3):193–212.
- [47] Sant’Anna, A. P.; Costa, H. G.; Nepomuceno, L. D. O.; Pereira, V. A(2016) Probabilistic Approach Applied to the Classification of Courses by Multiple Evaluators. PesquisaOperacional, Vol.36(3), pp.469-485.
- [48] Sant’Anna, A. P., Lima, G.B.A. &Gavião, L.O. (2018) A Probabilistic Approach to the Inequality Adjustment of the Human Development Index, PesquisaOperacional 38(1): 99-116.
- [49] Sant’Anna, A. P., Lima, G.B.A. Sant’Anna, L. A. F. P &Gavião,, L. O. (2019) Two-Stage Composition of Probabilistic Preferences. Annals of Data Science, online first, available at <https://link.springer.com/article/10.1007/s40745-018-0177-9>, 2019.
- [50] Sant’Anna, A. P. & Sadok, M.F.S.M.B. (2020) Inequality Assessment by Means of a Probabilistic Human Development Index, Social Indicators Research, 148(3), 733-746.
- [51] Scheerens, J.; Blömeke, S. (2016) Integrating teacher education effectiveness research into educational effectiveness models. Educational Research Review, Vol.18, pp.70-87, 2016
- [52] Schleicher, A. (2013), “Education for all”, OECD Yearbook, OECD Publishing. Disponível em: www.oecd.org/forum/education-for-all.htm acesso em 15/05/2019.
- [53] Sheykhjan, T. M. (2015) Quality Education for Social Development and Human Well-being, VISION 2030:

- Contributions of Educational Researches on National, 123-128.
- [54] Spaulding, Seth; Chaudhuri, Ranjan. (1999) UNESCO's World Education Report: its evolution, strengths and possible futures. *International Journal of Educational Development*, Vol.19(1), pp.53-63.
- [55] UNDESA. (2017) *World Population Prospects: The 2017 Revision*, New York. Disponível em: <http://esa.un.org/unpd/wpp> acesso em 15/05/2019.
- [56] UNDP (2019). *HumanDevelopmentReport* Disponível em: <http://hdr.undp.org/sites/default/files/hdr2019.pdf> acesso em 15/12/2020.
- [57] UNDP (2018). *HumanDevelopmentIndicesandIndicators* Disponível em: http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf acesso em 15/05/2019.
- [58] UNESCO.(2008) *Educação de qualidade para todos: um assunto de direitos humanos*. 2. ed. – Brasília: UNESCO, OREALC.
- [59] UNESCO.(2002)*Laboratório Latinoamericano de Evaluación de la Calidad de la Educación. Estudio cualitativo de escuelas con resultados destacables en siete países latinoamericanos*. Santiago de Chile.
- [60] UNESCO(2003)*Proyecto Regional de Indicadores Educativos. Alcanzandolas metas educativas: Informe Regional*. Santiago de Chile.
- [61] VanHiel, Alain; VanAssche, Jasper; De Cremer, David; Onraet, Emma; Bostyn, Dries; Haesevoets, Tessa; Roets, Arne; (2018) Can education change the world? Education amplifies differences in liberalization values and innovation between developed and developing countries. *PLoS ONE*, Vol.13 (6), p.1-9.
- [62] WORLD BANK (2018). *World Development Indicators database*. Disponível em: <http://data.worldbank.org> acesso em 15/05/2019.
- [63] WORLD BANK ICP (2017) *Fundamentals of Purchasing Power Parities*. Disponível em: <http://pubdocs.worldbank.org/en/332341517441011666/PPP-brochure-2017-webformat-rev.pdf> acesso em 15/05/2019.
- [64] Zadeh, L. A. (1965) Fuzzy sets. *Information and Control*, Vol. 8, pp. 338–353.

Evaluation of the performance of *Spodoptera frugiperda* caterpillars after contamination by bacteria and yeast

Sarah Lúcia Pantaleão Pereira¹, Wesley Botelho Sousa², Tainá Marques Sampaio³,
Mônica Hitomi Okura⁴

^{1,3,4}Federal University of Triângulo Mineiro, UFTM, Engineering School, Uberaba, MG, Brazil.

²Federal University of Triângulo Mineiro, UFTM, Uberaba, MG, Brazil

Received: 21 Sept 2021,

Received in revised form: 11 Nov 2021,

Accepted: 19 Nov 2021,

Available online: 24 Nov 2021

©2021 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— *Baculovirus*, *Biological Control*,
S. frugiperda.

Abstract— The increase in the use of pesticides in the field has been bringing serious implications for the human health and the environment. In order for pesticides to be lethal only to target pests, the idea of biological control, which proposes eliminating pests from specific pathogens, avoiding causing harm to human beings and their environment, emerged. Baculoviruses, a virus that cause pathogenicity for specific insects, has been used as biological control. However, its laboratory production faces difficulties, one of which is the contamination of the caterpillars used (*S. frugiperda* - the main pest of soybean and maize) by undesirable microorganisms. The objective of this work was to evaluate the behavior of caterpillars used for the production of Baculovirus after contamination by previously identified microorganisms. For this, was identified the microorganisms present in the caterpillars: *Staphylococcus aureus* (22.5%), *Staphylococcus sp.* (42.5%), *Klebsiella oxytoca* (2%), *Pseudomonas aeruginosa* (8%), *A. flavus* and *Penicillium sp.* (52%) and yeasts (72%). Subsequently, these microorganisms were inoculated individually in healthy caterpillars, which were observed for a period of 12 days, in an ideal environment (temperature 25 ° C and Humidity 70%). It was concluded that the bacteria *Pseudomonas aeruginosa* and *Klebsiella oxytoca* proved very harmful to the caterpillar, causing weight loss and early death. The caterpillars contaminated by fungi had similar behaviors. The caterpillars contaminated by the bacteria *Staphylococcus aureus* and *Staphylococcus sp.* until the 9th day showed no difference in the weight gain rate when compared to the control group. Among the caterpillars of the control group there was no death.

I. INTRODUCTION

After the second world war, with the green revolution, which aimed to modernize agriculture and increase productivity, there was a major transformation in the field, such as the introduction of new technologies, machines, genetic improvement and agrochemicals. In Brazil, pesticides and chemical fertilizers gained ground in agribusiness in the 1970s, after the implementation of the

National System of Rural Credit (SNCR). According to this system, the amount of loans granted depended on the percentage of money to be spent on pesticides. In this way, pesticide sales increased 945.51% between 1998 and 2008 [1].

While Brazil celebrates being a world leader in the agribusiness sector, Brazil also leads a growing dependence on pesticides. According to ANVISA [2]

Brazil is responsible for 1/5 of the world consumption of pesticides, using 19% of the pesticides produced in the world. According to FAO data [3], Brazil appears in the world ranking in first place in spending on pesticides and in seventh when analyzed the amount of pesticide used per area. In the last 40 years, Brazil increased its consumption of pesticides by 700%, while the agricultural area increased 78% in the same period [4].

Between 2002 and 2012, IBGE evaluated a 155% increase in the use of pesticides in Brazil, having jumped from three kilograms per hectare to seven kilograms per hectare. IBGE also classified that 30% of the pesticides used in Brazil are classified as very dangerous [5].

The introduction of pesticides and pesticides in the field includes many benefits such as increased food production due to reduced crop losses and consequently a considerable increase in economic potential. However, this unbridled introduction has serious implications for human health and the environment.

Among the problems caused by the intensive use of pesticides include: the contamination of food, soil, water, animals, the poisoning of farmers, the resistance of pests to active ingredients, the intensification of the emergence of new diseases; the biological imbalance, changing the cycling of nutrients and organic matter; the elimination of beneficial organisms and the reduction of biodiversity [4].

Based on studies, man, animals and the environment are in a dangerous route of contamination by pesticides, since they have great accumulative potential due to their solubility, adsorption, displacement, persistence and toxicity characteristics. Ideally, pesticides should be lethal to target pests but not to non-target species such as man [6; 7].

The damage to man and the environment has brought great concern to various segments of society and has led to a growing demand for new alternatives. The biological control, inserted in the integrated pest management, is one of the viable options to meet the desires of society in the constant search for sustainable solutions.

Biological control was defined [8] as "the action of parasitoids, predators and pathogens in maintaining the density of another organism at a lower level than would normally occur in their absences".

The basic idea of biological control is to control agricultural pests and insects that transmit diseases from the use of their natural enemies, which can be other beneficial insects, predators, parasitoids or microorganisms, such as fungi, viruses or bacteria. The main objective of applying biological control is to control healthy pests, without leaving residues that harm food, the

environment and human health [4]. Embrapa has been researching on biological control since the 1980s, aiming at the sustainability of ecosystems by improving the quality of agricultural products, reducing environmental pollution and preserving natural resources. In one of the pioneer works, started in 1984, a survey of the main natural enemies of this pest was done in several corn producing regions of Minas Gerais state, including Sul de Minas, Vale do Rio Doce and Alto Paranaíba. During the survey, between 1984 and 1989, more than 14,000 caterpillars were collected, where several parasitoids of the base orders Diptera and Hymenoptera were found, including several caterpillars killed by virus [9]. This survey extended to the state of Paraná, where a high rate of parasitized and virus-killed caterpillars was detected [10].

Species of the genus *Spodoptera* are widely distributed worldwide and among the 30 described species, half are considered pests of various crops of great economic importance. Among them, *Spodoptera frugiperda* (J.E. Smith) stands out as it feeds on more than 80 plant species, including cotton, corn and soybean, and can cause losses of up to 73% of agricultural production [11]. Until 2007, this pest was controlled with the application of chemical insecticides. Later, transgenic plants were introduced, allowing genotypes with higher productivity, quality and resistance to insects to be obtained [12]. However, some factors such as tropical climate, massive production without intervals or harsh winters caused the infestation of caterpillars precisely in transgenic plants.

In order to contribute to the fight against the caterpillars *S. frugiperda*, the biological control was introduced, which has as main objective to control agricultural pests and insects from the use of their natural enemies. The baculoviruses are an option for biological control of caterpillars in corn and belong to a group of viruses that have pathogenicity to insects [13]. Baculoviruses are from the family Baculoviridae, have double circular single strand DNA and have great potential to affect arthropods. They have the genera nucleopolyhedrovirus (NPV) and granulovirus (GV) which act in the epithelial cells of the midgut of insects [14]. Among the types of isolates, I-18, I-19 and I-6NR, isolate 6-NR is the only one that does not cause liquefaction of the insect tegument immediately after death, which facilitates the collection of dead caterpillars and the production of biological insecticides on a large scale [15].

The emergence of a commercial formulation of *B. spodoptera* is seen by farmers as an important alternative for pest control, which can be combined with other control tactics. However, to become possible, some characteristics of Baculovirus *spodoptera*, such as, for example, the purity of the viral inoculum produced, are essential for

satisfactory development on an industrial scale. In this work, the performance of *Spodopera frugiperda* caterpillars will be evaluated when contaminated by other microorganisms, which is still one of the problems that reduce and hinder the industrial production, raising costs and decreasing quality. In the Baculovirus production process, the caterpillar *S. frugiperda* feeds on baculovirus-contaminated maize leaf and becomes infected by penetrating the viral bodies into its digestive system. The protective protein matrix of the virus is disrupted by the alkaline pH (approximately 11) of the caterpillar gut, and then the virions are released into the digestive lumen of the caterpillar. During the infection process, the insect becomes weakened, loses its motor and feeding capacity, and dies in approximately 5 to 8 days with a discolored body compared to healthy caterpillars. Two days after the death of the caterpillar, the insect's body ruptures, releasing a large amount of virus [16].

This material is purified and its biological activity is verified to evaluate the efficiency of the viral inoculum produced so that it can be used as biological control of pests. Despite the advance in research related to Baculovirus in recent years, its multiplication in laboratory still faces difficulties. According to Sousa [17], knowing the environment favorable to the development of *S. frugiperda* species is essential to optimize the virus production.

Among the factors that influence the virus production in laboratory are: the environmental conditions at the time of production (temperature, pH, humidity, air flows, photoperiod, pressure); the host biology (age, sex and development stages), the concentration and activity of the virus and the purification of the viral inoculum (decontamination by fungi, bacteria and other viruses).

Baculoviruses have been studied as biological control agents since the 1960s [18] and have been extremely promising for their specificity and for being harmless to other living beings and the environment.

II. MATERIALS AND METHODS

2.1 Isolation of contaminating microorganisms

Dead caterpillars of *S. frugiperda* (2nd instar) provided by a biological control industry of Uberaba were used in this study. Fifty samples of dead caterpillars were used, which were macerated in a sterilized pistil. After maceration, a 1 g sample was diluted in 9 ml of 0.1% saline water (10⁻¹), followed by serial dilutions of 10⁻² and 10⁻³.

To evaluate the growth of filamentous fungi and yeasts, the Spread Plate technique was used, where dilutions were

inoculated on plates containing Potato Dextrose Agar (PDA) culture medium and were incubated at 25°C for 5 days. To evaluate the growth of bacteria, the Pour Plate technique was used, placing the dilutions (10⁻¹ to 10⁻³) on Petri plates pouring Brain Heart Infusion (BHI) agar medium. The plates were incubated at 37°C for 48 hours and then the growth was counted per CFU (n°/dilution) [19].

2.1.1 Identification of Filamentous Fungi

For the identification of filamentous fungi, the microcultivation and macrocultivation techniques were used [19]. The plates were incubated at 25°C for 5 days.

2.1.2 Bacteria Identification

After growth in BHI Agar medium, Gram staining was performed to identify the bacteria for the first time.

For Gram-positive bacteria, the catalase and coagulase tests were used and for Gram-negative bacteria, the biochemical series: Motility (SIM- Sulfate, Indole, Motility), Triple Iron Sugar Medium (TSI), Urea and Citrate were used [2].

2.2 Inoculation of microorganisms isolated and identified in second-stage caterpillars

After isolation and identification of bacteria and fungi, these microorganisms were inoculated individually in "healthy" caterpillars (without apparent contamination) provided by the company, and later the development of contaminated caterpillars was evaluated. These microorganisms were divided into seven different groups, being formed by 50 caterpillars of each group. A group with 50 caterpillars was inoculated with Baculovirus as positive control and another group of the same amount of caterpillars were not contaminated by microorganisms being considered negative control. A total of 450 caterpillars were used.

For the inoculation of the caterpillars, new and organic castor oil plant leaves were immersed in hypochlorite solution with purified water at a concentration of 2% for approximately 20 minutes. After this procedure the leaves were washed in four (4) containers with purified water to remove all excess hypochlorite. Then the castor oil plant leaves were placed in clean sieves to remove excess

moisture and cut uniformly (Figure 1).

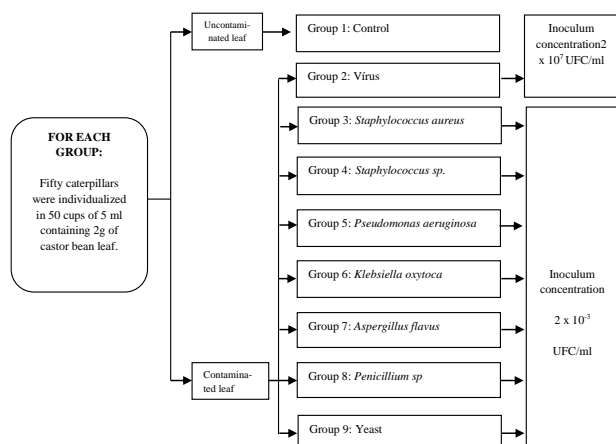


Fig.1. Schematic representation of the division of the inoculated groups in the study.

2.2.1 Monitoring the performance of caterpillars

The parameters observed in the caterpillars during the experiment were: the amount of food consumed by each one; the weight variation (in g); their color and survival.

The microorganism inocula were prepared at a concentration of 2×10^{-5} CFU/ml in Brain Heart Infusion (BHI) broth. The hygienized castor oil plant leaves were individually passed through the inocula and after removing the humidity, they were placed in 50 ml coffee cups with PVC lids, as shown in Figures 02 and 03.



Fig.2. Caterpillar on castor bean leaf.



Fig.3: Trays with identified cups.

For the control group, 2g of hygienized castor bean leaf and one healthy caterpillar previously weighed and measured were placed in each of 50 cups. The cups were capped. The same procedure was repeated, but with leaves contaminated with each of the seven identified microorganisms (*Staphylococcus* sp., *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Klebsiella oxytoca*, *Aspergillus flavus* and yeast) and with the virus. From day 3, after feeding on the leaves, the caterpillars were fed Greene's artificial diet (Table 1), considered the most appropriate for the species [20].

Table 01: Composition of Greene's artificial diet.

Ingredient	Quantity
White beans	102,90g
Wheat Germ	82,30g
Soy Farfel	41,20g
Milk powder	30,90g
Brewer's yeast	51,40g
Ascorbic acid	4,90g
Sorbic acid	2,50g
Nipagin	4,10g
Vitamin solution	8,20ml
Tetracycline	0,10g
Formaldehyde (40%)	4,90ml
Agar	18,90g
Water	1400.00ml

Source: Busato, (2006).

The caterpillars were monitored for 12 days. On the odd days (1st, 3rd, 5th, 7th, 9th 11th days), they were weighed in order to check the weight gain of caterpillars. The diet was weighed to verify the consumption per caterpillar, and the characteristics coloration and survival were observed. On these days, after weighing, the diets were observed. On these days, after weighing, the diets and the cups were exchanged. On even days, only the caterpillars were observed (coloration and survival). The

observed colorations were divided into three parameters: brown, black and pinkish/clear.

During the experiment, humidity and temperature parameters were used, of 70% and 25° \pm 1°C, respectively, conditions considered ideal for the growth of *S. frugiperda* caterpillars [17].

2.2.2 Statistics for the evaluation of the weight gain of caterpillars

For the statistical analysis of the results, the weight gain rate of the 9 groups was considered: group of healthy caterpillars (control) and the groups of caterpillars contaminated with Virus, *Pseudomonas aeruginosa*, *Klebsiella oxytoca*, *Staphylococcus aureus*, *Staphylococcus* sp., *A. flavus*, *Penicillium* sp. and Yeast. First, an exploratory analysis of the data was performed and the outliers (discrepant data) were excluded considering the non-commitment of the sample size. Afterwards, the comparison of weight gain rate averages was performed, and it was possible to evaluate the difference in weight gain averages of each group in relation to the control.

The ANOVA test was used for the analyses. The distribution of the weight gain rates of most groups was not normal, but when the sample size is greater than 20, the ANOVA test provides reliable data. In the present study, after eliminating the discrepant data, the sample sizes ranged between 45 and 50 for all groups. The statistical tests to compare the weight gain means of the nine groups were performed with confidence degrees of 95%, considering non-normal distribution and unequal variances. For different variances, Welch's ANOVA test was assumed. For simultaneous analysis of difference of means, Games Howell's test was used for different variances and Tukey's test for equal variances.

III. RESULTS

3.1 Identification of micro-organisms

In 2% (1/50) of the caterpillars no growth of microorganisms was observed. In 52% (26/50) of the caterpillars filamentous fungi grew, having been identified in 96% of the caterpillars the fungus *Penicillium* sp. and in 11% the fungus *A. flavus*. Growth of yeasts was observed in 72%. The growth of bacteria was observed in 75% of the caterpillars, being 22,5% identified as *Staphylococcus aureus*, 42,5% *Staphylococcus* sp., 8% *Pseudomonas aeruginosa* and 2.0% as *Klebsiella oxytoca*. The results of the identification of bacteria and fungi are shown in Figure 4.

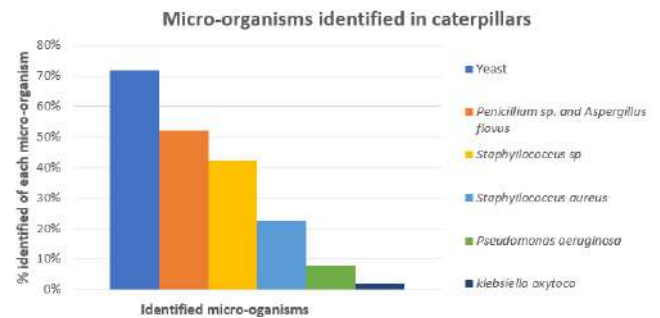


Fig.4. Microorganisms isolated and identified in *S. frugiperda* caterpillars.

As can be seen, a greater amount of fungi (yeasts and filamentous fungi) than bacteria (*Staphylococcus aureus*, *Staphylococcus* sp., *Pseudomonas aeruginosa* and *Klebsiella oxytoca*). Among the bacteria, a significant amount belonging to the genus *Staphylococcus* was identified and, to a lesser extent, *Pseudomonas aeruginosa* and *Klebsiella oxytoca* were identified.

Rolim [21], in an analysis of the diversity of the gut microbiota of adults of *S. frugiperda* indicated the existence of at least six phyla of Bacteria, being Proteobacteria, Bacteroidetes and Firmicutes the most common. Most bacteria isolated in culture medium from *S. frugiperda* belong to the phylum Firmicutes with the genus *Bacillus* being the most abundant [22]. Caterpillars collected in corn cartridges showed abundance of *Klebsiella oxytoca* phylotypes [23].

Although a wide variety of bacterial phylotypes have been characterized and associated with lepidopteran intestines, their role in caterpillar physiology and adaptation is poorly known [24; 25].

3.2 Monitoring the performance of caterpillars after inoculation with microorganisms

3.2.1 Assessment of weight gain

The weight gain evaluation was performed on the odd days of the experiment. On day 3, the results of the simultaneous Games-Howel tests for the differences in mean weight gain rates from day 1 to day 3 indicated that: Statistically, the mean weight gain rates of the groups of caterpillars contaminated with *Pseudomonas aeruginosa*, *Klebsiella oxytoca* and *Penicillium* sp. were significantly different from the mean weight gain rates of the control group. This result can be seen in Figure 05.

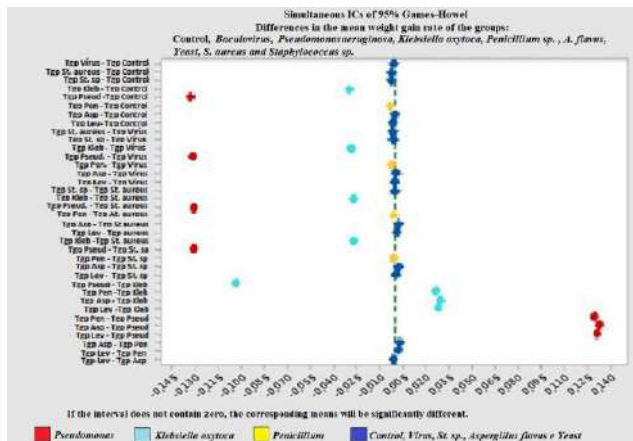


Fig.5. Difference in mean weight gain rate of the groups: Control, Baculovirus, Pseudomonas aeruginosa, Klebsiella oxytoca, Penicillium sp., A. flavus, Yeast, S. aureus and Staphylococcus sp.

It is also possible to state that the difference in the mean weight gain rate of the caterpillars contaminated with *Pseudomonas aeruginosa* was more significant than the difference in the mean weight gain rate of the caterpillars contaminated with *Klebsiella oxytoca* and the impact on the group contaminated with *Penicillium sp.* was even smaller.

The other groups of caterpillars (contaminated with *Baculovirus*, *Staphylococcus aureus*, *Staphylococcus sp.*, *A. flavus*, and yeast) had no difference in the rate of weight gain in this period.

On day 5, 90% of the caterpillars contaminated with *Pseudomonas aeruginosa* bacteria, which had already lost weight from day 1 to day 3, died. Therefore, it was not possible to use the weight gain data of the caterpillars contaminated with *Pseudomonas aeruginosa* from day 5.

The results of the simultaneous Games-Howel tests for the differences in the mean weight gain rates from the third to the fifth day indicated that: Statistically, the mean weight gain rates of the groups of caterpillars contaminated with *Klebsiella oxytoca* and *Baculovirus* were significantly different from the means of the control group. This result can be seen in Figure 6.

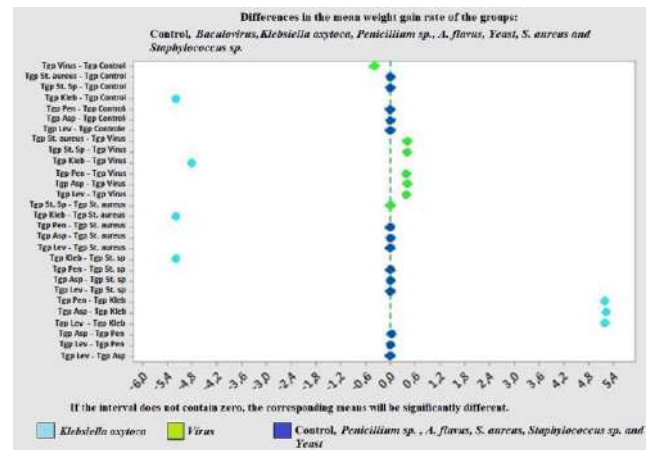


Fig.6. Difference in mean weight gain rate of the groups: Control, Baculovirus, Klebsiella oxytoca, Penicillium sp., A. flavus, Yeast, S. aureus and Staphylococcus sp.

It was possible to state that the difference in mean weight gain of the group contaminated by *Klebsiella oxytoca* bacteria in relation to the control group was more significant than the difference in mean weight gain of the group contaminated by virus. The other groups showed no difference in mean weight gain from the third to the fifth day compared to the control group.

On day 7, 95% of the caterpillars contaminated with *Klebsiella oxytoca* bacteria had already shown significant weight loss from day 1 to 5, and died. Therefore, it was not possible to use the weight gain data of the caterpillars contaminated with *Klebsiella oxytoca* from day 7. Between days 5 and 7, 10% of the virus-infected caterpillars had died, but data were still available to continue evaluating the weight gain rate of these caterpillars.

The results of Tukey's simultaneous tests for the differences in the mean weight gain rates from day 5 to day 7 indicated that: Statistically, the mean weight gain rates of the groups of caterpillars contaminated with *Baculovirus* and the groups contaminated with the fungi *A. flavus*, *Penicillium sp.* and Yeast were significantly different from the means of the control group. The caterpillars contaminated with the bacteria *S. aureus* and *Staphylococcus sp.* showed no difference in relation to the control group. These results are shown in Figure 07.

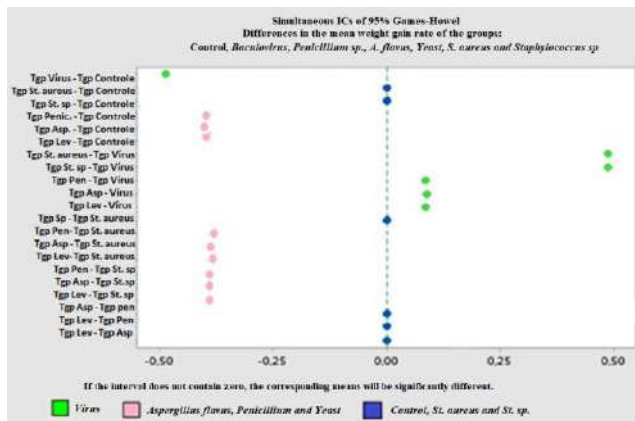


Fig.7. Difference in mean weight gain rate of the groups: Control, Baculovirus, Penicillium sp., A. flavus, Yeast, S. aureus and Staphylococcus sp.

The groups contaminated by Baculovirus, A. flavus and Penicillium sp. gained less weight than the control group and the groups contaminated by S. aureus and Staphylococcus sp. bacteria showed no difference in weight gain compared to the control group.

On day 9, it was observed that 90% of the Baculovirus contaminated caterpillars, which had already shown a significant decrease in weight gain relative to the control since day 5, died. Therefore, it was not possible to use the weight gain data of the caterpillars contaminated with Virus from day 9. Between day 7 and 9, also 84%, 80% and 90% of the caterpillars contaminated with the fungi Penicillium sp., A. flavus and yeast, respectively. Thus, the evaluations continued only with the control groups and the groups contaminated with bacteria Staphylococcus aureus and Staphylococcus sp., which until day 9 showed no difference in the mean weight gain.

The results of Tukey's simultaneous tests for the differences in the mean weight gain rates from day 9 indicated that: Statistically, the mean weight gain rates from day 7 to day 9 of the groups of caterpillars contaminated with S. aureus and Staphylococcus sp. bacteria were equal to each other and significantly different from the control group, as can be seen in Figure 8.

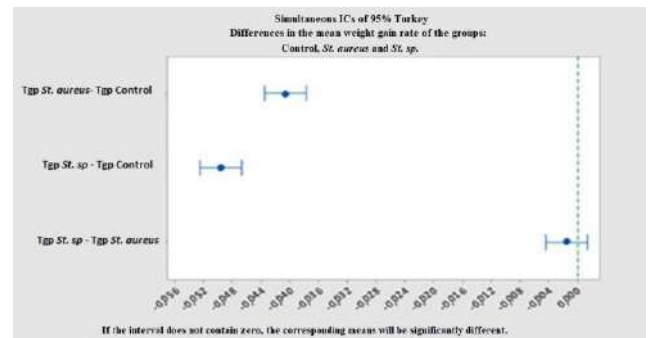


Fig.8. Difference in mean weight gain rate of the groups: Control, S. aureus and Staphylococcus sp.

On the 11th day, no caterpillar died. Again, the growth rate of the groups of caterpillars contaminated with S. aureus and Staphylococcus sp. were equal among themselves and statistically different when compared to the control group, as shown in Figure 9.

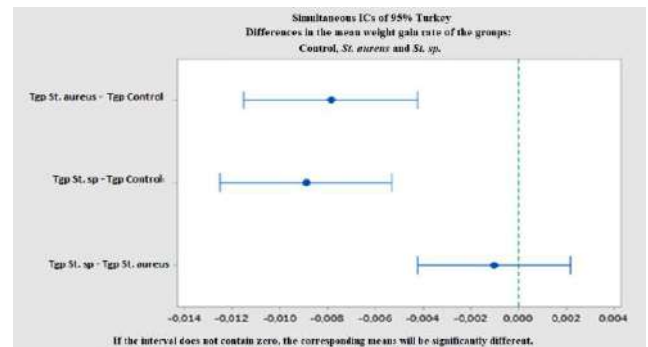


Fig.9. Difference in mean weight gain rate of the groups: Control, S. aureus and Staphylococcus sp.

3.2.2 Assessment of food intake by groups of caterpillars

For the evaluation of food intake by the caterpillar groups, the rate (%) of leaf and diet consumed during the experiment was used.

As observed in Figure 10 between days 1 and 3, the food intake was higher for all groups when compared to the other days, because the caterpillars fed on leaves. After the 3rd day, they began to feed on diet and therefore the average intake was lower.

In the injection rate observed on the 3rd day, a significant difference was observed only in the injection of diet by caterpillars contaminated by Klebsiella oxytoca and Pseudomonas aeruginosa. The other groups did not show significant difference in the feed injection.

On day 5, we also observed a much lower dietary intake rate of the Klebsiella oxytoca and Pseudomonas aeruginosa contaminated groups and a significant decrease in intake by the virus contaminated group when compared

to the control group. On the 7th day, the caterpillars of the groups contaminated by *Klebsiella oxytoca* and *Pseudomonas aeruginosa* had died, so the evaluation continued to be done only with the other groups. On this day, there was a very significant decrease in diet injection by the group contaminated by viruses and a decrease in diet injection by the groups contaminated by fungi began to be observed.

On the 9th and 11th days, it was not possible to weigh the diet of the groups contaminated with *Staphylococcus* sp. and *Staphylococcus aureus* because they were pupating, and at this stage, the diet could not be removed because it would disturb the development process. Therefore, it was possible to evaluate only the food injection of the control group.

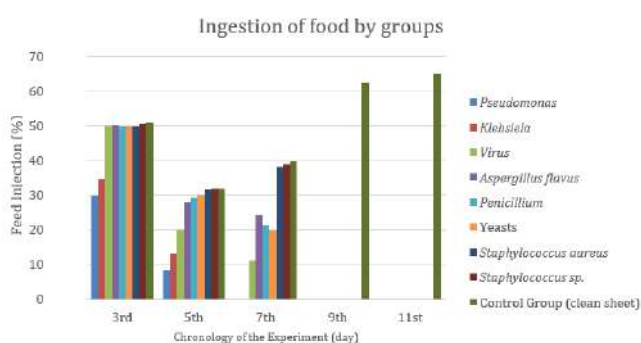


Fig.10. Evaluation of dietary intake by the contaminated groups.

3.2.3 Evaluation of the color and death of the caterpillars during the experiment

Color and life assessments of caterpillars were performed on even days.

By the second day, no difference in color could be observed, and no caterpillars had died.

On the 4th day, it was found that 60% of the group of caterpillars contaminated by *Pseudomonas aeruginosa* and 27% of the group of caterpillars contaminated by *Klebsiella oxytoca* had died. The dead caterpillars showed black coloration when compared to the live caterpillars.

On day 6, 65% of the group of caterpillars contaminated by bacteria *Klebsiella oxytoca* and 5% of the group of caterpillars contaminated by *Baculovirus* were found to have died. The caterpillars killed by the bacteria *Klebsiella oxytoca* showed black coloration when compared to the live caterpillars and the caterpillars killed by viruses showed light coloration when compared to the live caterpillars.

By day 8, 79% of the *Baculovirus* contaminated group of caterpillars had died. The caterpillars killed by viral

contamination had a light pinkish coloration. Also on this day, 60% of the fungus-contaminated caterpillars died. The caterpillars killed by fungus were brown in color.



Fig.11. Pupal transformation process of the group contaminated by *Staphylococcus aureus* and *Staphylococcus* sp.

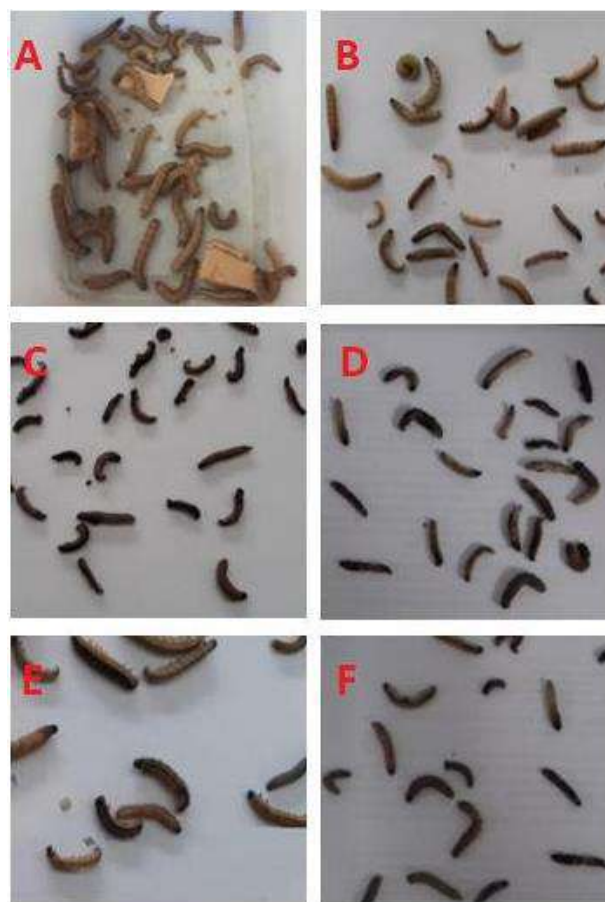


Fig.12: Coloration of the caterpillars according to the inoculated. A) Control group, color: brown; B) Virus contaminated group, color: light pink; C) *Pseudomonas aeruginosa* contaminated group, color: black; D) *Klebsiella oxytoca*, color: black; E) *Aspergillus flavus* contaminated group, color: dark brown; F) *Penicillium* sp. contaminated group, color: dark brown.

By day 10, 90% of the *Baculovirus* contaminated group of caterpillars, 84%, of the *Penicillium* sp. 80% of the caterpillars contaminated with *A. flavus* and 90% of the caterpillars contaminated with yeast had died. Visually, as shown in Figure 11, the caterpillars contaminated with

Staphylococcus sp. and *Staphylococcus aureus* showed accelerated development because some of them began the process to pupate, while no caterpillar in the control group showed this behavior.

On the 12th day no death of caterpillars was observed and 40% of the caterpillars contaminated by *Staphylococcus aureus* and 30% of the caterpillars contaminated by *Staphylococcus* sp. became pupae, while no caterpillars of the control group became pupae.

It was observed that each microorganism when developed in the caterpillar showed different coloration (Figure 12).

There was no death of any of the caterpillars in the control group.

3.2.4 General Evaluation

Table 02. Monitoring of the development of caterpillars after contamination with the microorganisms isolated in this study.

Days of observation	Performance of caterpillars compared to the control group
2	There was no difference with respect to color, size, or amount of food ingested.
3	A significant difference was observed in the rate of weight gain among caterpillars contaminated with <i>Pseudomonas aeruginosa</i> , <i>Klebsiella oxytoca</i> and <i>Penicillium</i> sp. A significant difference was observed in the rate of diet intake in groups contaminated with <i>Pseudomonas aeruginosa</i> , <i>Klebsiella oxytoca</i> .
4	Death of 60% of the group of caterpillars contaminated by bacteria <i>Pseudomonas aeruginosa</i> and 27% of the group of caterpillars contaminated by <i>Klebsiella oxytoca</i> . Death by bacteria showed a black coloration.
5	Death of 90% of the caterpillars contaminated with bacteria <i>Pseudomonas aeruginosa</i> . Significant difference in weight gain and dietary intake of the groups contaminated with <i>Klebsiella oxytoca</i> and virus.
6	Death of 65% of the group of caterpillars contaminated with <i>Klebsiella oxytoca</i> bacteria and 5% of the group of caterpillars contaminated with viruses. Caterpillars of the <i>Klebsiella oxytoca</i> group died with black coloration and the caterpillars killed by viruses had a light

	pinkish coloration.
7	Death of 95% of the caterpillars contaminated with the <i>Klebsiella oxytoca</i> bacterium. Very significant decrease in diet intake and weight gain by the virus-contaminated group. Groups contaminated with fungi began to show a decrease in weight gain and dietary intake.
8	Death of 79% of the group contaminated by virus. Death of 60% of the caterpillars contaminated by fungus. Caterpillars killed by virus were light pink and fungus-contaminated caterpillars were brown
9	Death of 90% of the group contaminated by <i>Baculovirus</i> , 84%, 80% and 90% of the caterpillars contaminated with the fungi <i>Penicillium</i> sp. <i>A. flavus</i> and yeast, respectively. Caterpillars killed by fungi showed brown coloration and caterpillars killed by <i>Baculovirus</i> , light coloration. It was not possible to evaluate the diet intake of the groups contaminated by <i>Staphylococcus aureus</i> and <i>Staphylococcus</i> sp.
10	The caterpillars contaminated by bacteria <i>Staphylococcus</i> sp. and <i>Staphylococcus aureus</i> showed acceleration in development, since some of them started the process for pupal transformation.
11	The caterpillars contaminated by bacteria <i>Staphylococcus</i> sp. and <i>Staphylococcus aureus</i> showed difference in weight gain rate and continued the process of transformation into pupa.
12	There was no death. 40% of the caterpillars in the <i>Staphylococcus aureus</i> group and 30% of the caterpillars in the <i>Staphylococcus</i> sp. group pupated, while no caterpillars in the control group pupated.

IV. DISCUSSION

It was possible to observe that the decrease in the food intake rate corroborates with the results of weight gain and death presented, that is, as the groups had a decrease in their food intake rate, they also decreased their weight gain rate and as a consequence presented early death in relation to the control group.

Regarding the group contaminated by Baculovirus, the results of death and color go in agreement with Moscardi and Souza [16] who state that after the process of infection of the caterpillar by *Baculovirus*, the insect becomes debilitated, losing its motor and feeding capacity and dies between the 5th and 8th days with discolored body.

Considering the development of groups contaminated by fungi, the genus *Aspergillus* presents some species that are pathogenic to insects, but also has members that are pathogenic to vertebrates. *A. flavus* has been considered for use as entomopathogen, but the use of these fungi has not been proposed due to safety issues. Infections by *Aspergillus* in birds, other animals and humans have been widely reported [26]. No specialized literature has reported the presence of *A. flavus* as an entomopathogen to *S. frugiperda* caterpillars, but several species of Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera and Isoptera have been reported as susceptible to this fungus [27]. Senna Nunes et al [28] evaluated, in vitro, the action of *A. flavus* on adults of *Musca domestica* Linnaeus (Diptera: Muscidae) and obtained up to 100% mortality of insects in seven days of evaluation and with a concentration of 10^8 .mL⁻¹ conidia.

The transformation of the caterpillars contaminated with *Staphylococcus aureus* and *Staphylococcus* sp. into pupae may have occurred due to some biological requirement. Busato et. al [29] found that populations collected in different locations and hosts had different larval stage durations, possibly due to different nutritional requirements due to adaptation to the host of origin or due to different environmental requirements regarding temperature and relative humidity.

According to Sarmiento et al [30], at the end of their larval period, the caterpillars penetrate the soil, where they become reddish pupae measuring approximately 15mm in length. Therefore, it can be stated that the pupae formed in these groups had normal development conditions, as can be seen in Figure 6.

V. CONCLUSIONS

It is concluded that the bacteria *Pseudomonas aeruginosa* and *Klebsiella oxytoca* were the most harmful to the caterpillar *S. frugiperda*, causing weight loss after only 3 days of contamination.

The caterpillars contaminated by fungi (*A. flavus*, *Penicillium* sp. and Yeast) had similar behaviors, having started the decrease in weight gain around day 5 and died around day 8.

The groups of caterpillars contaminated with bacteria *S. aureus* and *Staphylococcus* sp. up to day 9 showed no

difference in weight gain rate when compared to the control group. Between the 10th and 12th day, the caterpillars in these groups showed a decrease in weight gain and visually it was possible to observe an acceleration in their development as they became pupae before the caterpillars in the control group.

ACKNOWLEDGEMENTS

This work was supported by CAPES, CNPq and the Federal University of Triangulo Mineiro

REFERENCES

- [1] Gesiele Veríssimo, Maria I. Kós, Tatiana R. Garcia, Jannine A. S. Ramos, Carolyne C. Souza, Josino C. Moreira, Armando Meyer (2016). Pesticide exposure among students and their families in Nova Friburgo, Rio de Janeiro. *Ciência e Saúde Coletiva* (ISSN: 1413-8123 (P) | 1678-4561 (O)), 23(11), 3903-3911. <https://doi.org/10.1590/1413-812320182311.27592016>
- [2] ANVISA, 2013. AGÊNCIA NACIONAL DE VIGILÂNCIA SANITÁRIA. Microbiologia clínica para o controle de infecção relacionada à assistência à saúde. Module 5: Technology in health services: description of the culture media used in microbiological examinations. Brasília, DF. Available at:
- [3] https://www20.anvisa.gov.br/segurancadopaciente/images/documentos/iras_moduloTecnologias_MeiosDeCultura.pdf
- [4] Food and Agriculture Organization of the United Nations (2018). World food and agriculture – Statistical Pocketbook. (ISBN 978-92-5-131012-0). 1 (1), 254p.
- [5] EMBRAPA, 2019. Empresa Brasileira de Pesquisa Agropecuária. Available at: <https://www.embrapa.br/tema-controle-biologico/sobre-o-tema>
- [6] IBGE, 2002. Instituto Brasileiro de Geografia e Estatística.
- [7] Jorgeana A. J. Benevides, Gloria Marinho (2015) Degradation of Pesticides by Fungi - A Review. *Holos* (ISSN: 1807-1600) 31 (2) 110-129. <https://doi.org/10.15628/holos.2015.1488>.
- [8] Md. Wasim Aktar, Dwaipayan Sengupta, Ashim Chowdhury (2009) Impact of pesticides use in agriculture: their benefits and hazards. *Interdisciplinary Toxology* (ISSN: 1337-6853) 2(1), 1-12. <https://doi.org/10.2478/v10102-009-0001-7>
- [9] Paul DeBach (1964). Biological control of insect pests and weeds. London: Chapman and Hall, 844 p.
- [10] Fernando H. Valicente (1989) Levantamento dos inimigos naturais de *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) em diferentes regiões do estado de Minas Gerais. *Anais da Sociedade Entomológica do Brasil, Jaboticabal*. (ISSN: 0301-8059), 18 (1), 119-127. <https://doi.org/10.37486/0301-8059.v18i1.573>

- [11] Fernando H. Valicente, Marliton R. Barreto (1999) Levantamento dos inimigos naturais da lagarta do cartucho do milho, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae), na região de Cascavel, PR. Anais da Sociedade Entomológica do Brasil, Jaboticabal. (ISSN: 0301-8059), 28(2), 333-337. <https://doi.org/10.1590/S0301-80591999000200018>
- [12] Michael G. Pogue (2002) A world revision of the genus *Spodoptera* Guenée (Lepidoptera: Noctuidae). Memoirs of the American Entomological Society (ISSN: 0065-8170) 43(1) 201-202.
- [13] Laudete M. Sartoreto, Cleber W. Saldanha, Maisa P. M. Corder (2008) Genetic transformation: strategies and applications for genetic improvement of forest species. Rural Science (ISSN: 0103-8478), 38 (3), 861-871. <https://doi.org/10.1590/S0103-84782008000300046>
- [14] Andréa F. Almeida (2010) Estratégias de produção in vitro de bioenceticida viral: Influências do isolado, da cinética e do modo de operação. Tese (Doutorado) - Universidade Federal de Rio Grande Do Norte, Natal. 133p.
- [15] King, L. A.; Posse, R. D. (1993) The baculovirus expression. System: a laboratory guide. Transactions of the American Microscopical Society (ISSN: 0003-0023), 112 (1), 90-91.
- [16] Fernando H. Valicente, Edmar S. Tuelher (2009) Controle Biológico da Lagarta do Cartucho, *Spodoptera frugiperda*, com Baculovírus, Ministério da Agricultura, Pecuária e Abastecimento 14p.
- [17] Flávio Moscardi, Marlinda L. Souza (2020) Baculovirus for pest control. Revista Biotecnologia Ciência & Desenvolvimento (ISSN: 2238-6629), 24 (1), 21-29.
- [18] Wesley B. Souza (2015). Characterization of *Baculovirus spodoptera* as to pH and temperature variations. Dissertação (Mestrado) Universidade Federal do Triângulo Mineiro.
- [19] PAYNE, C.C. (1986) Insect pathogenic viruses as pest control agents. Fortschritte der Zoologie (ISSN: 0071-7991), 32, 183-200
- [20] Neusely da Silva, Valéria C. A. Junqueira, Neliane F. A. Silveira, Marta H. Taniwaki, Renato A. R. Gomes, Margarete M. Okazari (2007) Manual de Métodos de Análise Microbiológica de Alimentos e Água. São Paulo: Livraria Varela (ISBN: 978-85-212-1225-6), 3, 552.
- [21] Gustavo R. Busato, Mauro S. Garcia, Alci E. Loeck, Marcelo Zart, Adrise M. Nunes, Oderlei Bernardi, Fabiana S. Andersson (2006) Adequacy of an artificial diet for the "corn" and "rice" biotypes of *Spodoptera frugiperda* (Lepidoptera: Noctuidae). Bragantina (ISSN: 0006-8705) 65(2), 317-323. <https://doi.org/10.1590/S0006-87052006000200014>
- [22] Adrian A. S. G. Rolim, Fernando L. Cõnsoli (2014). Intestinal microbiota and isotopic signature of *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae) adults as markers to identify the food source of immatures. University of São Paulo, Piracicaba. <http://www.teses.usp.br/teses/disponiveis/11/11146/tde-05012015-155654/>
- [23] John J. S. Ausique (2014) Characterization of microorganism communities associated with the mesenterium of *Diatraea sacharalis* and *Spodoptera frugiperda*. University of São Paulo, Piracicaba. https://teses.usp.br/teses/disponiveis/11/11146/tde-16032010-161656/publico/John_Ausique.pdf
- [24] Poliene M. Costa (2016) Characterization of the bacterial community associated with the intestinal tract of *Spodoptera frugiperda* from different diets. University of São Paulo, Piracicaba. https://teses.usp.br/teses/disponiveis/11/11137/tde-26042016-104030/publico/Poliene_Martins_Costa_versao_revisada.pdf
- [25] Natarajan G. Parya, Abhishek Ojha, Mayur K. Kajla, Anand Raj, Raman Rajagopal (2012) Host plant induced variation in gut bacteria of *Helicoverpa armigera*. PLoS One (ISSN: 1932-6203) 7(1)
- [26] <https://doi.org/10.1371/journal.pone.0030768>
- [27] Yonggi Shao, Erika Arias-Cordero, Huijuan Guo, Stefan Bartram, Wilhelm Boland (2014) Vivo Pyro-SIP assessing active gut microbiota of the cotton leafworm, *Spodoptera littoralis*. PLoSOne (ISSN: 1932-6203) 9(1) <https://doi.org/10.1371/journal.pone.0085948>
- [28] R. M. Pereira, et al. Segurança no emprego de entomopatógenos (1998) In: ALVES, S. B. Controle Microbiano de Insetos. Piracicaba: FEALQ. 171-191.
- [29] Sérgio B. Alves (1998) Controle microbiano de insetos. FEALQ, 4(2), 1163p.
- [30] Márcia de Senna-Nunes, Gisela L. da Costa, Vânia R. E. P. Bittencourt, Edson J. Souza (2002) In vitro evaluation of the fungi *Aspergillus flavus* and *Penicillium corylophilum* on housefly (Diptera: Muscidae) adults. Parasitología Latinoamericana (ISSN: 0717-7712) 57, 9-14. <http://doi.org/10.4067/S0717-77122002000100004>
- [31] Gustavo R. Busato et al. (2004) Fertility life table of *Spodoptera frugiperda* (J.E. Smith, 1797) (Lepidoptera: Noctuidae) populations on maize and irrigated rice leaves. Revista Brasileira de Agrociência (ISSN: 0104-8996) 10(4), 449-455.
- [32] SARMENTO R.A. et al, 2002. Review of the biology, occurrence and control of *Spodoptera frugiperda* (Lepidoptera Noctuidae) in corn in Brazil.

Polymerization shrinkage of composite resins: consequences and control

Sonielly Passos da Silva¹, Susana Hellen da Costa Lima¹, Raísa Castelo^{2,3,*}

¹Undergraduates at the Dentistry School of Centro Universitário do Norte – Ser Educacional, Brazil

²PhD in Dentistry (Oral Rehabilitation) at University of São Paulo – USP, Brazil

³Professor of Centro Universitário do Norte – Ser Educacional, Brazil

*Corresponding author: dra.raisacastelo@gmail.com

Received: 19 Sept 2021,

Received in revised form: 03 Nov 2021,

Accepted: 15 Nov 2021,

Available online: 26 Nov 2021

©2021 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— *composite resin, polymerization
shrinkage, bonding, biomechanical
properties.*

Abstract — *Bonding strategies associated with the aesthetic and conservative properties of resin materials have increased their popularity in restorative dentistry. Direct composite restorations are one of the most prevalent medical interventions on the human body, with millions of composite restorations placed each year around the world. The optimal performance of these restorations depends on the proper polymerization of the resin component, which is characterized by the transformation of monomers into polymers, accompanied by volumetric reduction of the material. Despite several improvements in new restorative materials in recent years, the disadvantages related to polymerization shrinkage of resin composites remain a clinical problem. The aim of this study is to explore, through an integrative literature review, the causes of polymerization shrinkage of composite resins, as well as their risks and how to control them, in order to obtain long-lasting restorations. A consequence of shrinkage stress can be related to the detachment along the restoration/tooth interface or restoration margins, resulting in internal and marginal gaps, microcracks of one or both restorative material and tooth structure, marginal stain, and cusp deflection.*

Clinical Relevance - *Clinicians must understand the concept of polymerization shrinkage stress and realize that the quality of composite resin restorations depends on the successful management of these efforts.*

I. INTRODUCTION

The search for highly esthetic treatments, through minimally invasive procedures, resulted in the wide use of direct adhesive restorations with composite resin on anterior and posterior teeth. In order to achieve functional success and a natural appearance for direct restorations, is important to understand the properties of composite resins, how the adhesion process to enamel and dentin works, and use appropriate restorative technique (ALENCAR et al., 2016).

When choosing restorative material, the advantages, disadvantages and characteristics of this material are evaluated, such as aesthetics, mechanical properties, surface finish and cost-effectiveness. With the aesthetic demand in restorative procedures, a gradual replacement of metallic alloys and silver amalgam restorations by resin systems took place. The clinical use of composite resin has expanded in restorative dentistry, with indication for direct and indirect restorations, mainly due to its aesthetic quality and good physical properties (VINAGRE et al., 2016).

Direct composites promote a strengthening of the tooth structure and good clinical performance. However, there are some problems related to the direct restoration technique, such as polymerization shrinkage, which has been one of the most considered issues in restorative dentistry in recent years. Several factors influence the contraction stress, such as the cavity configuration, the speed at which polymerization occurs, in addition to the elastic modulus and the contraction itself, inherent to the resin material (SOARES et al., 2017).

Clinically, the stress resulting from polymerization shrinkage can induce traction forces on the lateral walls and pulp wall of a cavity preparation, promoting the appearance of cracks or fissures, due to the displacement of the restorative material from the tooth margin. These cracks can cause fluid infiltration between the tooth and the restoration, marginal pigmentation, postoperative sensitivity, and secondary caries. (SILVA et al., 2017).

To reduce the stress generated during the polymerization of composite resins, without compromising their mechanical properties, the gradual light curing technique could be considered. It has been experimentally demonstrated that a slow polymerization reaction can cause minor damage to the adhesive interface, increasing the possibility of material flow, prolonging the pre-gel phase of the composite resin and, consequently, reducing shrinkage stress, resulting in less induction, mechanical stress and, therefore, lower rates of cracking and marginal leakage (SCARIOT et al., 2017).

The aim of this study is to explore, through an integrative literature review, the causes of polymerization shrinkage of composite resins, as well as their risks and control, in order to obtain long-lasting restorations.

II. LITERATURE REVIEW

2.1 Composition of composite resins

Composite resins are a complex mixture of monomers (resin matrix) mixed with inorganic filler particles. To bond the filler particles to the resin matrix, the particles are coated with silane, a bonding agent. Other additives are included in the formulation, such as photoinitiator, which initiate polymerization, and compounds that can adjust viscosity and improve radiographic opacity (MARTINS et al., 2017).

The resin matrix is composed of aliphatic or aromatic dimethacrylate monomers. Monomers like Bis-GMA - bisphenol-A-glycidyl methacrylate and triethylene glycol dimethacrylate - TEGDMA play a fundamental role in the potential of polymerization shrinkage of resins. Usually used together, this system presents relatively satisfactory

clinical results, but there are still properties that need to be improved, such as resistance to abrasion (PAMPULHA et al., 2015; SOARES; PINTO, 2019).

Filler particles provide dimensional stability to the resin matrix and improve its properties, reducing polymerization shrinkage, water sorption and thermal expansion coefficient, providing an increase in tensile, compression and abrasion resistance, and increasing the elastic modulus of the composite resin (ARAÚJO et al., 2019).

During the initial development of composite resins, material properties were shown to depend on the formation of a strong bond between the inorganic filler and the organic matrix (resin). The union of these two phases is obtained by coating the charge particles with a binding agent, silane (NOBRE; GOMES, 2020).

2.2 Polymerization shrinkage

The shrinkage of a composite resin during polymerization appears as a major problem without an effective solution. This contraction occurs as a result of the rearrangement of the monomers in a smaller space, that is, the monomers bind to form polymers and occupy a smaller space, in volume. Before polymerization, the distance between molecules is 0.3 to 0.4 nm, determined by Van der Waals forces. When the covalent bonds between the monomers are established, the distance between them can reduce to 0.15 nm, resulting in volumetric contraction. This phenomenon happens due to the shortening of the polymer chains, inherent to the polymerization reaction. Clinically, it can favor the formation of a marginal gap in restorations, as the contraction forces can be greater than the bond strength provided by the adhesive system used (SILVA et al., 2017).

The shrinkage of composite resins can be divided into two phases, pre-gel and post-gel, since material shrinkage is the result of both. During the polymerization shrinkage, in the pre-gel phase, the molecules can slide and reach new positions and orientations, neutralizing the polymerization shrinkage stress. The gel point is the transition stage in which the resin changes from a fluid to a viscous state. From this moment, in the so-called post-gel phase, the material obtains a higher elastic modulus, losing its ability to drain and start transferring the tension generated by the material to the tooth-restoration interface (SCARIOT et al., 2017).

According to Silva et al. (2017), there are two types of contraction:

- *Free shrinkage*: When resins do not adhere to any surrounding surface, the shrinkage and shrinkage vectors (direction of shrinkage) will not be affected by any

bonding agent. In this way, the composite resin will contract towards the center of the mass. As consequence, there will be no difference between the pre-gel and post-gel phases. As long as the contraction is not limited or hampered, the stress of the contraction will not occur (SILVA et al., 2017).

- *Effective shrinkage*: If the resin is bonded to a single surface, shrinkage will be affected by this adhesive condition. Shrinkage towards the center of mass will not be possible, as the resin is not able to detach from the adhesive surface. Therefore, the lost volume will be compensated by the contraction towards the bonded surface. Again, there will not be a major difference between the contraction vectors of the pre-gel and post-gel phases, nor will contraction stress occur because there will be a bonded surface and a free surface to compensate for the contraction (SILVA et al., 2017).

In most dental cavities, contraction will be limited by the opposing walls of the cavities. Once polymerization starts, shrinkage occurs. However, in the pre-gel phase, the loss of volume can be balanced by the plasticity of the resin from the free surfaces to the bonded surfaces. Due to this compensation, there will be no increase in polymerization shrinkage of the dentin-resin interface. When the gel point is being reached, the resin becomes more rigid, and could prevent shrinkage. At that moment, the contraction tension or the force that pulls the resin from the dentin walls increases at the dentin-resin interface (TORRES et al., 2019).

2.2.1 Clinical consequences

Although polymerization shrinkage is the cause, the shrinkage stress resulting from the reduction in material volume can be considered to be the mechanism responsible for a number of problems encountered with the adhesion of restorations to the tooth. This tension can cause traction forces on the cavity preparation walls and promote the appearance of cracks at the tooth-restoration interface that can cause fluid infiltration, marginal pigmentation, postoperative sensitivity, secondary caries, restoration loss and even fracture of the remaining tooth (VINAGRE et al., 2016).

2.2.2 Clinical control of polymerization shrinkage

In order to control the clinical damage generated by the polymerization contraction, it is important to control the photoactivation process and use incremental technique, aiming to reduce the C-factor (SILVA et al., 2017).

Chemically activated resins have less polymerization shrinkage because their pre-gel phase is longer, unlike photopolymerizable resins, which polymerize faster and gelation occurs seconds after the material is exposed to the

light source, making it impossible to handle the reaction of polymerization by the professional. Therefore, there is not enough time for its drainage and, the lower this capacity, the greater the retraction stresses, which can be detrimental to the success of adhesion, favoring the formation of cracks (TORRES et al., 2019).

In 2000, Bouschlicher et al. found that the use of a more intense light source led to more rapid development of shrinkage stresses in the early stages of polymerization, when the bond between the hard tissue and the composite resin is still being established. Luo et al. in 2002, reported a linear relationship between the intensity of the light used and the contraction of polymerization that occurred, that is, the greater the light intensity, the greater the contraction found (SILVA et al., 2017).

Using low intensity or soft onset of light curing can improve edge quality without compromising the composite's physical properties. This effect can be attributed to the elongation of the resin's plasticity and the decrease in post-gel phase contraction (PAMPULHA et al., 2015; SILVA et al., 2017).

In recent years, manufacturers have been producing light curing devices with programs that allow the adjustment of light intensity, enabling the use of different gradual photoactivation techniques: steps, ramps and pulses. Increasing the intensity in the steps means reducing the power and making it available for a certain period. The device then increases the power to maximum levels, which are maintained until the end of the cycle. In the ramp technique, there is a gradual increase in light intensity until reaching the maximum level, which is also maintained for a certain period, until a degree of conversion is reached. Finally, the increase of power in pulses, also called late pulse, implies the reduction of light emission for a few seconds (3-5 seconds), followed by a waiting period (3-5 seconds), to then expose the composite resin at maximum light power, completing the conversion reaction. Thus, it can be seen that there are several options to reduce the polymerization reaction rate, however, it is vital to understand that the basic principle is related to the initial reduction in power density followed by an increase to adequate levels, to achieve an acceptable conversion degree of the composite resin (DAMASCENO et al., 2020; SILVA et al., 2017).

An important factor in reducing polymerization stress is the cavity configuration factor or "C-factor". The shrinkage stress in some chemically activated resins is related to the relationship between the adhesion area and the free area. The amount of free area is directly proportional to the flow (or elastic deformation) of the material, relieving, in part, the stresses generated by

volumetric contraction. However, there are still doubts about the real importance of this factor in the shrinkage stresses of a light-curing composite resin, as it has a shorter period to alleviate stresses (ALENCAR et al., 2016).

The horizontal insertion technique uses composite resin layers, each less than 2.0 mm thick. This technique has been reported to increase the C-factor and therefore to increase the shrinkage stresses between opposing cavity walls. The oblique technique is performed by placing a series of wedge-shaped composite increments. Each increment is photoactivated twice, first through the cavity walls and then through the occlusal surface, to direct the polymerization vectors towards the adhesive surface. This technique reduces C-factor and avoids distortion of the cavity walls (BACCHI; PFEIFER, 2016; SOARES et al., 2017).

In the vertical stratification technique, small increments are placed in the vertical pattern starting from one wall, that is, buccal or lingual, and taken to another wall. The polymerization starts behind the wall, that is, if the buccal increment is placed on the lingual wall, it will be cured from outside the lingual wall. This reduces the gap in the gingival wall that is formed due to polymerization shrinkage, therefore, postoperative sensitivity and secondary caries (BARATIERI; MONTEIRO JÚNIOR, 2015; SILVA et al., 2017).

The centripetal accumulation technique offers a number of advantages when posterior composite resin restorations are indicated. This technique employs thin metal matrix bands and wooden wedges, eliminating the need for clear matrix bands, which may not provide firm contact areas and anatomical proximal contours and are difficult to use for many professionals. Furthermore, recent studies do not indicate any impairment of metal matrix bands in the formation of cervical gaps (NUNEZ et al., 2015; LACERDA et al., 2019).

III. METHODOLOGY

Integrative review, with a qualitative approach, whose data collection was carried out from May to September 2021, developed in five stages. In the first two stages, the justification, question and objective of the research were outlined. In the third stage, the Scielo, Pubmed and Lilacs databases were defined as research sources.

In the fourth stage, the inclusion criteria were: articles focused on the causes of polymerization shrinkage of composite resins, as well as their risks and how to control, in order to obtain long-lasting restorations, published from January 2015 to December 2020, containing the words

"Contraction", "Polymerization" and "Composite Resin", or in the title, abstract or keywords. In the fifth stage, an evaluation and critical reading of the compiled articles was carried out so that they could support the results, exposed through a flowchart (Figure 1) and enriching the discussion, using content analysis for theoretical evaluation.

IV. RESULTS AND DISCUSSION

In the first stage of the study, 787 articles were found, which were initially related to the proposed theme. After reading the titles of selected articles, 75 articles were selected. After reading the abstracts, only 59 studies were selected to be included in the critical and full reading. Finally, 19 studies met the inclusion criteria, as shown in Figure 1.

The development of adhesive restorative materials is the main feature of current Dentistry. Despite all the technology applied in the development of composites, the presence of a polymer matrix as a basic component of this type of material causes shrinkage during polymerization by photoactivation (ALENCAR et al., 2016). The study by Scariot et al. (2017) show that the shrinkage of a composite resin is a natural molecular phenomenon and a consequence of the approximation of the monomer during the formation of the polymer chain. Contraction forces originating within the material are transmitted, in part, to the adhesive interface between the tooth and the restoration, which can result in cusp deflection and gap formation. These gaps allow oral fluids and bacterial penetration which are the main factors producing clinical problems such as marginal percolation, secondary caries, and postoperative sensitivity. In the meantime, Silva et al. (2017) demonstrates that to minimize the tensions of the contraction forces during and after the polymerization process, it is important to know and use technical resources.

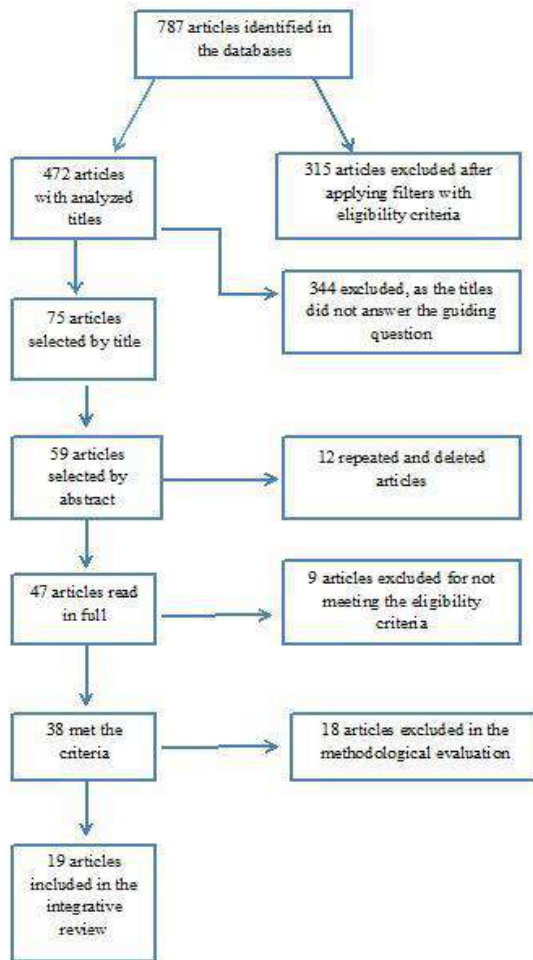


Fig. 1: Selection of articles for review.

An important factor in reducing polymerization stress is the C-factor. Some authors (CARVALHO; PIEROTE, 2020; SOARES et al., 2020) observed that the shrinkage stress in some chemically activated resins is related to the relationship between the adhesion area and the free area (called cavity configuration factor or "Factor C"). For these same authors, the amount of free area is directly proportional to the flow (or elastic deformation) of the material, partially relieving the stresses generated by volumetric contraction. However, there are still doubts about the real importance of this factor in the shrinkage stresses of a light-curing composite resin, which has a shorter period to alleviate stresses.

Factor C is related to the flowability of composite resin-based materials, which is an important phenomenon for relieving shrinkage stresses at the tooth/restoration interface. In the studies by Ishikiriama et al. (2017), it was observed that the greater the factor C, the greater the tension at the adhesive interface, regardless of the volume increments in chemically activated resins. To alleviate

these stresses, there must be a considerable free area (low Factor C) and a longer pre-gel phase, allowing for better resin flow and stress relief.

In the aforementioned study, a constant volume of composite resin and the delayed pulse technique were used in groups B and D, with 2x2 (Factor C 0.33) and 3x2 (Factor C 0.6) bases, and it was observed that the surfaces free flow allowed the composite resin to flow, relieving some of the polymerization stress with less shrink force. These results are in agreement with other authors (BACCHI; PFEIFER, 2016; SOARES et al., 2017). However, for groups E and F, with higher C Factors (1.5), which means larger areas of adhesive surfaces in relation to free surfaces, the contraction values were greater, regardless of the activation technique used. These results demonstrate the importance of C-Factors and similar observations have been reported, as in the study by Pampulha et al. (2015). It is important to emphasize that composite resin was included in the studies by Ishikiriama et al. (2017) in a single increment, and for cavities with high Factor C, it is recommended to use the incremental technique and modulation by light activation to reduce Factor C.

Another important factor in controlling polymerization shrinkage stresses is light intensity. As highlighted by Lacerda et al. (2019), a low light intensity increases the period in which the resin remains with a low modulus of elasticity (pre-gel phase), allowing molecular accommodation and relieving the contraction stress. Thus, Silva et al. (2017) reinforces that the techniques able to modulate the polymerization process were developed to minimize shrinkage problems. One technique that has been recognized is pulse delay: polymerization starts with a low light intensity for a short period, followed by a light-free interval and then conventional activation allowing for reasonable conversion rates. The light-free interval allows some time for the pre-gel phase to be extended, allowing the material to flow during the initiation of the polymerization reaction and relieving some of the stress generated by the resin's shrinkage. Some authors (PAMPULHA et al. 2015; SCARIOT et al. 2027) emphasize that this technique reduces polymerization shrinkage forces when compared to the single pulse technique, enhancing adhesive forces and not reducing surface hardness.

In the study by Ishikiriama et al. (2017), the combination of the delayed pulse technique and low Factor C resulted in lower contraction forces, probably due to better material flow during the pre-gel phase and a rearrangement of polymer chains. For groups A, B, C and D with reduced C-factor (0.33 and 0.6, respectively), significant differences were found between the two light

activation techniques, demonstrating that the polymerization technique is also important to alleviate stresses arising from polymerization shrinkage when sufficient free area is available. Authors who compared the conventional and gradual light activation techniques found similar results that the gradual light activation did not compromise the bond between tooth and restoration (SILVA et al., 2017). However, according to Ishikiriama et al. (2017), for 6x2 bases with superior C-factor (1.5), the activation technique was not significant, demonstrating that the small free area present in this cavity configuration was not able to relieve tensions. Therefore, according to the results obtained in this study, the use of the pulse delay technique for composite resin polymerization can result in restorations with less stress at the tooth/adhesive restoration interface. Furthermore, a free surface is necessary to allow the flow of the composite resin and the consequent relief of tension forces arising from polymerization shrinkage. When small amounts of free surfaces are present to relieve these stresses (high C-factor), even the pulse delay technique is not able to decrease the intensity of the contraction forces.

Baratieri and Monteiro Júnior (2015) mention that high shrinkage and/or high shrinkage stress can lead to failure of the bond between the resin composites and the tooth structure. As for Damasceno et al. (2020), the uncured resin content determines the amount of shrinkage and tensile modulus. Therefore, the use of pre-polymerized agglomerates will improve the shrinkage properties as seen in Heliomolar resin, while high polymerization rates and low flow factors have a deteriorating effect on the shrinkage properties.

Aiming to promote stress relief, the reduction of polymerization shrinkage in proximal cavities, guided by adhesive properties and thermal expansion coefficient similar to the tooth, some authors obtained better results with the glass ionomer cement (GIC) used as a base on the cervical wall of these restorations, which characterizes the so-called "sandwich technique" (DAMASCENO et al., 2020; SILVA et al., 2017).

In the study by Veras et al. (2020), the GIC using the same technique showed similar performance in relation to composite resins (GZ250, GSDR and GBFP) as a base material during the evaluations, which corroborates the studies by Haller and Trojanski (2019) and Güngör et al. (2017), who showed no improvement with the use of a base in CIV compared to adhesive systems used with conventional resins.

Consensus in direct comparisons of studies using glass ionomer cements is difficult to obtain, since there is a wide variety of materials available with different formulations

and characteristics (VERAS et al., 2020). In addition, for the authors, the use of healthy teeth and younger patients may have reduced the possibility of better sealing of these materials compared to adhesive systems used in association with composite resins due to the lower probability of the presence of dentinal sclerosis induced by stimuli to this substrate, which is more common in senile teeth or teeth affected by caries lesions, where the performance of the material would be optimized.

Thus, it was verified the importance of the present study in the use of new light curing methods to reduce polymerization shrinkage in composite resin restorations; encourages further research to obtain restorative procedures with greater clinical durability. All this aims to ease the contraction of composite resins when light activated, using new resources such as changing their composition or using new photoactivation techniques. Thus, it was demonstrated how photoactivation techniques are able to reduce the contraction stress, which implies a better clinical performance of the restoration. It is always recommended to have a thorough knowledge of the materials and equipment used, for example, due to the great diversity within each type of photo-activator lamp on the market, without neglecting the lamp intensity as well as the exposure time, wavelength required, etc.

V. CONCLUSION

Polymerization shrinkage stress is an undesirable and unavoidable characteristic of restorations found in the dental clinic that can compromise restoration success. Clinicians must understand the concept of polymerization shrinkage stress and realize that the quality of composite resin restorations depends on the successful management of these efforts.

REFERENCES

- [1] ALENCAR, A. A. et al. Avaliação da contração de polimerização de duas resinas comerciais: ensaio clínico randomizado. Jornada Odontológica dos Acadêmicos da Católica – JOAC, v. 2, n. 2, 2016.
- [2] BACCHI, A.; PFEIFER, C.S. Rheological and mechanical properties and interfacial stress development of composite cements modified with thio-urethane oligomers. Dent Mater. v. 32, n. 8, p. 978-86, 2016.
- [3] BARATIERI, L. N.; MONTEIRO JUNIOR, S. Odontologia Restauradora - Fundamentos e Possibilidades. 2 ed. São Paulo: Santos Editora, 2015. v. 1.
- [4] CARVALHO, G.; PIEROTE, J. General aspects of bulk fill resins: a literature review. Research, Society and Development. v. 9, n. 7, p. 1- 29, 2020.
- [5] DAMASCENO, R. F. et al. Efeito da saturação de cor na profundidade de polimerização de resina composta

- nanohíbrida. Revista Eletrônica Acervo Saúde. v. 1, n. 42, p. 1-9, 2020.
- [6] ISHIKIRIAMA, S. et al. The influence of "C-factor" and light activation technique on polymerization contraction forces of resin composite. J Appl Oral Sci. v. 20, n. 6, p. 603-6, 2017.
- [7] LACERDA, L.R. et al. New generation bulk-fill resin composites: Effects on mechanical strength and fracture reliability. Journal of the Mechanical Behavior of Biomedical Materials, v. 96, n. 1, p. 214-218, 2019.
- [8] NOBRE, D. F; GOMES, C. Resina composta tipo bulk fill-um avanço na odontologia restauradora. Cadernos de odontologia do UNIFESO. v. 2, n.1, p.24-33, 2020.
- [9] NUNEZ, C.C. et al. State of the art of bulk-fill resin-based composites: a review. Revista Facultad de Odontologia Universidad de Antioquia, v. 27, n. 1, p. 177-196, 2015.
- [10] PAMPULHA, I. et al. Inibição da polimerização de resinas compostas por materiais usados como matrizes oclusais. Rev Port. Est. v. 56, n. 1, p. 51-57, 2015.
- [11] PRIGOL, J. et al. Avaliação da rugosidade superficial de uma resina composta com uso de diferentes polidores. Journal of Oral Investigations, Passo Fundo, v. 9, n. 1, p. 13-25, 2020.
- [12] SCARIOT, R. C. et al. Abordagem dos Cirurgiões Dentistas em Relação a Fotopolimerização de Resinas Compostas. Journal of Oral Investigations, Passo Fundo, v. 6, n. 1, p. 38-49, 2017.
- [13] SCHNEIDER, A. C. et al. Influência de três modos de fotopolimerização sobre a microdureza de três resinas compostas. Polímeros. v. 26, n. 3, p. 37-42, 2016.
- [14] SILVA, F. J. et al. Técnicas para reduzir os efeitos da contração de polimerização das resinas compostas fotoativadas. SALUSVITA, Bauru, v. 36, n. 1, p. 187-203, 2017.
- [15] SILVA, J. D. et al. Forças de contração de polimerização em resinas compostas constituídas com novas matrizes orgânicas e fotoativadas por diferentes técnicas. Rev Odontol Bras Central. v. 26, n. 79, p. 21-25, 2017.
- [16] SOARES, A. F.; PINTO, A. C. Taxa de sucesso de restaurações com resina composta bulk-fill: Revisão de literatura. Id on Line Rev. Mult. Psic. v.13, n.47, p. 397-409, 2019.
- [17] SOARES, C. J. et al. Polymerization shrinkage stress of composite resins and resin cements – What do we need to know? Braz. Oral Res. v. 31, n. 1, p. 49-63, 2017.
- [18] TORRES, L. H. et al. Estudo in vitro do efeito do tempo de fotopolimerização na pigmentação de resinas compostas. Arch Health Invest. v. 8, n. 8, p. 443-447, 2019.
- [19] VINAGRE, A. et al. Cuspal Displacement Induced by Bulk Fill Resin Composite Polymerization: Biomechanical Evaluation Using Fiber Bragg Grating Sensors. International Journal of Biomaterials. v. 16, n. 1, p. 1-8, 2016.

Analysis of the Greenhouse Gas Emissions Inventory in a Photographic Paper Finishing Industry in the Manaus city

Edfran da Cruz Magalhães¹, Simone da Silva²

¹Student of the Professional Master's in engineering, Process Management, System and Environmental at the Instituto de Tecnologia e Educação Galileo da Amazônia – ITEGAM, Brazil

²Professor and researcher of the Professional Master's in Engineering, Process Management, System and Environmental at the Instituto de Tecnologia e Educação Galileo da Amazônia – ITEGAM, Brazil

Received: 16 Sept 2021,

Received in revised form: 09 Nov 2021,

Accepted: 19 Nov 2021,

Available online: 26 Nov 2021

©2021 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— Gas emissions, greenhouse effect, photo paper, chemical industries.

Abstract— In the Manaus Free Zone, the processing industry of photographic paper is poorly representative and, is classified as a Chemical Industry. This type of photographic industry has environmental aspects in all its production processes, including those that only benefit the already emulsified photographic papers, transforming them into sizes and formats necessary for later use in photo printing laboratories. From this perspective, the problem to be investigated in this dissertation was limited to emissions of greenhouse gases (GHG) in scope 1 and 2, using the protocol of the Brazilian GHG Protocol Program (PBGHGP) thus enabling the inventory of data and the estimation of the total GHG emission in a native industry of photographic paper processing. As a result of the analysis, it was found that the main source of GHG comes from the cooling system in the consumption of refrigerant R410A and that the control and/or management of these gases are possible to be adopted, because the industry has an implemented environmental management system capable of managing this environmental aspect.

I. INTRODUCTION

The emission of greenhouse gases (GHG) has a direct effect on our climate and the environment. Climate change, its consequences, and agreements to reduce and/or stabilize emissions of these gases have been debated by major world leaders for centuries. In the year 2021, the United Nations (UN) brought together the world's largest conference on climate change, COP26, in the Scottish city of Glasgow. This conference brought together approximately 200 countries to promote actions aimed at achieving the objectives of the Paris Agreement and the United Nations Framework Convention on Climate Change.

The way industries see the minimization of environmental pollution has changed in recent years. Until the 1980s, the focus was the end-of-pipe treatment, that is,

the impact was allowed for the subsequent treatment of effluent, waste or emission. The Management of Greenhouse Gases (GHG) has become an increasingly important topic in global corporate agendas, due to the repercussions that have shown the issues of climate and environment. Companies have invested in actions that aim to reduce greenhouse gas emissions and disseminate results to promote sustainable consumer-oriented marketing, as well as to help understand the climate study.

The greenhouse gases inventory is an instrument that allows companies to assess and account for GHG emissions from all sources defined in groups of activities associated with the company. The inventory is fundamental for the formulation of business policies adapted to the new trends of the global market and aims to analyze the degree of emission and, with this, plan its

reduction or compensation, mitigating the environmental impact.

The problem to be investigated will be limited to GHG emissions in scope 1 and 2, through the use of tool of the Brazilian GHG Protocol Program (PBGHGP) thus enabling the inventory of data and the estimation of the total GHG emission in a native industry of photographic paper processing. Although the statistical data show a low percentage of GHG emissions in the industrial sector, the emission of GHG in the state grew alarmingly, making it necessary to analyze in a factual way the context of emissions from industrial processes.

II. LITERATURE REVISION

2.1 Greenhouse Gas Inventory

The unbridled emission of GHG into the atmosphere, particularly the emission of carbon dioxide, ends up exacerbating the greenhouse effect and thereby triggering a series of problems affecting the entire planet, such as global warming itself and the compromise of atmospheric air, can trigger a few respiratory diseases. For (Fernandes; Nogueira & Jimenez, 2020), the impacts caused by the emission of GHGs affect not only the place where such emission occurs, but the commitment is worldwide.

According to Monzoni (2008) participants of the PBGHGP must include in their inventory of emissions all GHG regulated by the Kyoto Protocol. They are: Carbon Dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Perfluorocarbons (Pfc) Hidrofluorcarbon (Hfcs), Trifluoreto de Nitrogênio (NF₃) and Hexafluoride de Enxofre (SF₆). These gases are from anthropogenic sources, the first three being considered the most abundant.

In addition, methane (CH₄) takes less time in the atmosphere than carbon dioxide (CO₂). However, CH₄ is much more efficient when it comes to trapping radiation than CO₂, and CH₄ has an estimated global warming potential of 21 times greater than CO₂ in a 100-year time span. However, in relation to CO₂, its time of permanence in the atmosphere is measured in about 150 years Fernandes *et al.* (2020).

According to Dutra *et al.* (2019) to be able to measure the air quality of a given region, it is necessary to monitor the emission of the group of pollutants, either by their occurrence or by the adverse effects caused. Also according to the authors, in addition to the subsequent control, it is of paramount importance that the emission of GHGs is continuously controlled, in order to verify the possible levels of GHGs that a given industry is emitting in a given location (Dutra *et al.*, 2019).

A balance is sought between GHG emissions and their removals, to find a level of sustainability between human actions and the environment. In this sense, it can be said that among the sources of GHG emissions are: industrial activities; fuel burning and deforestation. While from the perspective of the removals of such emissions are forests to help the preservation of the environment (Dutra *et al.*, 2019).

In the context of what is mentioned by Dutra *et al.* (2019), it is of paramount importance to have the cooperation of the industries of a given region so that there is efficient monitoring of GHG emissions. Thus, one realizes the importance of the application of this case study, in the face of the verification of emission control GHGs, conducted in the industry that will be the target of the analysis of this research, given that it is in the region of Manaus/AM, where the state of Amazonas itself has been considered a major emitter of GHGs nationwide.

According to the PBGHGP tool, Scopes 1 and 2 contain the type of GHGs emissions, where Scope 1 includes emissions derived from the derived combustion categories, mobile combustion and fungible emissions and Scope 2 including emissions derived from the energy purchase category. The GHG Protocol (Greenhouse Gas Protocol) of the Brazilian program defines the aspects inherent to scopes 1 and 2, to calculate the emission of GHGs. Thus, the case study applied to the target industry of this research will investigate the data presented by Scope 1 (direct emissions) and Scope 2 (indirect and mandatory emissions from the acquired energy consumption). The development of the case study was guided by the survey of the gases emission inventory, contemplating the steps shown below by Fig. 1.

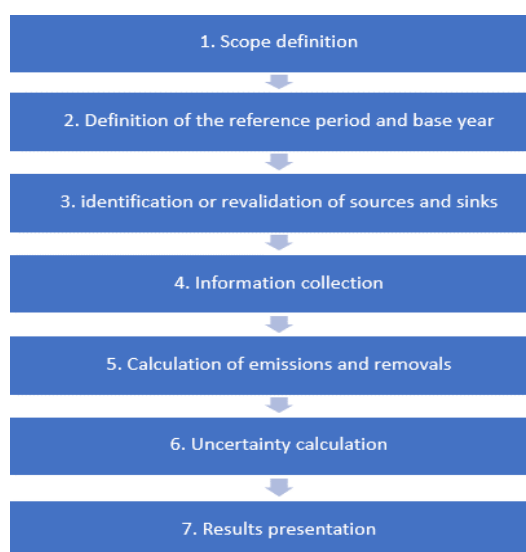


Fig. 1: Steps for the survey of GHG emissions

Source: IPCC, (2006).

According to Brazil, De Souza, & De Carvalho (2009) the emission factor is an expression of the emission associated with a unit of activity of the source. Emission factors report the amount of equivalent CO2 emitted per unit of activity. Thus, they express how intensive a given activity is.

Table 1 shows the emission factors in kilogram of gas per unit of measurement, performed after identifying the activity of scope 1 or 2 and its respective quantitative.

Table 1 - Examples of emission factors.

Activity	Activity data	Emission factor
Consumption of electric power	Quantity in kWh	kgCO2/kWh
Burning of natural gas in boiler	Quantity of natural gas (m3)	kgCH4/m3
Power generation in generator set (diesel cycle)	Diesel consumption (liter)	kgN2O/liter

Source: Authors, (2021).

When detailed information is not available, there is the option of using emission factors available in the literature. In this case, it is important to be careful to employ factors that are as close to reality and, if possible, conservative. Conservative factors are those that overestimate some emission, due to the ignorance of some information. For example, if the alcohol content in petrol is unknown and should be considered as the lowest possible value, as this results in the highest GHG emission possible. This way, a price is paid for ignorance, without prejudice to the scenario of the company's emission with stakeholders (BRASIL *et al.*, 2009).

Also, according to the Fundação Getúlio Vargas [FGV] (2011, p. 8) the carbon dioxide equivalent (CO2e) is the unit of measurement used to compare the radiation intensity of a given GHG to that of carbon dioxide. Thus, CO2e should be used to calculate the mass of a given GHG, which should be multiplied by its global warming potential (GWP). In the same sense, it should be emphasized that greenhouse gas emissions can be measured by the total mass of a GHG released into the atmosphere (FGV, 2011, p. 8). Fig. 2 gives the sequence of the operations to be performed, to obtain the result of carbon dioxide equivalent.

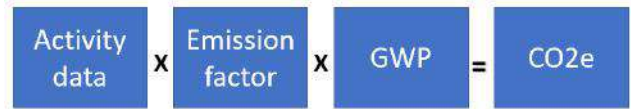


Fig. 2: Steps for the survey of GHG emissions

Source: Authors, (2021).

The emissions of each GHG (CO2, CH4, N2O etc.) are calculated separately and subsequently converted to carbon dioxide (CO2) equivalence based on its global warming potential. As regards GWP, this is the factor that will describe the impact deferred by the radiative force of a unit, which is based on the mass of a given GHG, relative to the CO2 equivalent unit in each period (FGV, 2011).

The elaboration of inventories is the first step for an institution or company to contribute to the fight against climate change, a critical phenomenon that afflicts humanity at the beginning of this century. Knowing the emission profile, from the diagnosis guaranteed by the inventory, any organization can take the following step: to establish strategies, plans and targets for reducing and managing greenhouse gas emissions, engaging in solving this huge challenge to global sustainability (Monzoni, 2008).

The GHG Protocol tool, with a version adapted to the Brazilian reality, launched by PBGHGP, has a methodology compatible with the standards of the International Organization for Standardization (ISO), thus allowing and facilitating the management of their GHG.

Part 1 of the technical standard of the Brazilian Association of Technical Standards [ABNT] NBR ISO 14.064-1: 2007 "Specification and guidance to organizations for quantification and reporting of emissions and removals of greenhouse gases" details principles and requirements', aiming at the planning, development, management and communication of inventories.

2.2 Environment and legal aspects

Based on economic growth and technological development, the great benefits of this evolution are notorious. However, this development has resulted in a series of negative side effects which arise directly on the environment, causing its degradation and, consequently, reducing the quality of human life, as well as deteriorating the legal prospects for environmental preservation (Rolim, 2000).

Thus, the environment became the object of protection and several discussions on its preservation. In this context, it is of paramount importance to highlight the conceptualization of the environment, permeating by the legal concept established by Law N. 6.938, promulgated

on August 31st, 1981, which deals exactly with the National Environment Policy (NEP). In its art. 3, item I, the said legal act establishes the concept of the environment, this being: "the set of conditions, laws, influences and interactions of a physical, chemical and biological order, which allows, houses and governs life in all its forms" (Lei n. 6938, 1981).

In the same sense, NBR ISO 14001:2015 also presented a conceptualization of the environment, stating that this is a "neighborhood in which an organization operates, including air, water, soil, natural resources, flora, fauna, human beings and their interrelationship" (ABNT, 2015). However, in Brazil, the legal definition of the environment positive by art 3, item I, of NEP, as already highlighted above (Lei n. 6938, 1981). Given that such a concept is broad and contemplates the whole set of man-made goods that can affect their existence, whether natural or not (Krzyszczak, 2016).

Since 1981, through the promulgation of the NEP, with the advent of Law No 6.938, the actions applied to the environment have gained a preventive conception, from the perspective of adopting measures that anticipate human actions, to mitigate the negative effects on the environment, rather than just to correct them. In addition, NEP itself began to consider the environment as a public asset, and it should receive greater security and protection, considering its collective use in a past, present and future vision (Lei n. 6938, 1981).

By adopting a new concept on environmental preservation, the NEP has paved the way for new legal aspects applied to environmental issues at the national level. These aspects gained – in 1988-a normative force of constitutional order, with the advent of the Federal Constitution of 1988 NEP (Constituição da República Federativa do Brasil, 1988).

Thus, the 1988 Law cited above inserted in its normative body explicit rules on environmental preservation, directing legal responsibility to the Legislator to develop infraconstitutional norms that encompass the preservation and maintenance of the environment in the face of human actions, thus contemplating the objectives of the NEP and adopting a civil responsibility-legal for harmful practices NEP (Lei n. 6938, 1981; Constituição da República Federativa do Brasil, 1988).

Thus, when speaking about the environment, it is irrefutable to analyze the legal aspects that fall on the protection of the same, because this has been considered a social and collective right since the promulgation of the Citizen Constitution of 1988 which, He also defined environmental balance as a condition for achieving a dignified life in society, in conjunction with the legal

principles of NEP (Lei n. 6938, 1981; Constituição da República Federativa do Brasil, 1988).

The Federal Constitution of 1988 was the first to adopt environmental standards, previously these norms were only included in the infraconstitutional legislation by the NEP in 1981. The Magna Carta of 1988 is recognized for encompassing a series of social and fundamental rights, popularly known for valuing social welfare and also named the Green Constitution, precisely because it has a strong framework of environmental guidelines. Thus, it is known that the environment is indispensable for a balanced human life and thus, the legal act has inserted into its normative body aspects that seek environmental preservation (Constituição da República Federativa do Brasil, 1988).

This constitutional law contains a list of principles that are adopted by environmental law. Such principles appear both explicitly and implicitly and should be observed as guiding principles for balanced human, political and economic development. The principle of the dignity of the human person; the principle of responsibility; the precautionary principle; the principle of sustainable development; the principle of the polluter- the principle of community participation and the principle of the social function of property (Constituição da República Federativa do Brasil, 1988; Fiorillo, 2018).

It is worth highlighting here the National Policy on Climate Change (NEP), instituted by Law n. 12,187 of 2009, which formalized a voluntary commitment made by Brazil, before the United Nations and its Convention-Framework on climate change and reduction of GHG emissions. In its article 12, this law formalizes the commitment to have actions to mitigate GHG emissions in favor of the reduction of 36.1% to 38.9% of their greenhouse gas emissions.

Thus, the 2015 Paris Agreement was an extremely important point for the climate change regime caused by GHG emissions and managed by the United Nations. Thus, this agreement brings a global approach, allowing several countries to voluntarily adhere to the aforementioned global agreement (Peixer, 2019). However, through Decree n. 9,073 of June 5th, 2017, Brazil became the consignee of this agreement, assuming the reduction of GHG emissions progressively until 2030.

According to Dal Forno (2017), the legal framework linked to the environment has conceived a new perception about the need for environmental preservation to maintain a balanced environment. After the advent of the Federal Constitution of 1988, more specifically from the 1990s, originated the concept that companies started to do a certain "homework" thus fulfilling all the requirements

imposed by environmental legislation in force in the country (Dal Forno, 2017).

Such legal conception awakened the need for the application of Environmental Management in the face of the materialization of legal objectives linked to environmental preservation. It was precisely this set of legal requirements that gave rise to the so-called Environmental Management System (EMS), a system that articulates directly with the perception of the environmental impacts that can be degenerated by the commercial activities practiced by a given enterprise and that start to be managed through the use of Environmental Management (Dal Forno, 2017).

The EMS is managed through ABNT NBR ISO 14001:2015, which has a few requirements with guidelines for the use and implementation of an Environmental Management System. This standard has an international character, included directly in the ISO 14000 series of standards, bringing a branch of requirements for organizations to implement EMS in their industrial operations (ABNT, 2015).

In this context, it should be noted that the atmospheric imbalance caused by GHG emissions is a global concern and causes a great impact on public interests based on the preservation of the environment. Thus, it is essential for the present study a brief analysis on the emission of GHGs in the context of environmental preservation.

2.3 Emissions of greenhouse gases

Climate change has been the subject of global discussions that seek to protect the climate system for the sake of its preservation for present and future generations. Thus, there is a clear concern about human activities that corroborates the substantial increase in greenhouse gas (GHG) concentrations in the atmosphere (Torres; Ferman & Sbragia, 2016).

The GHGs are gaseous compounds that have the absorption capacity of high frequency radiation of infrared origin, causing the accumulation of this radiation in the atmosphere, which directly contributes to the increase of temperature. The high concentration of GHG in the atmosphere ends up increasing the amount of heat retained, which is aggravated by the unbridled increase in the emission of these gases due to human actions and activities, thus raising the problem of global warming (Aguiar; Fortes & Martins, 2016).

It is worth noting that of all the infrared radiation that falls on the earth, about 70% is absorbed by the oceans and the soil, 30% is reflected into space, while a residual fraction is absorbed by the atmosphere. With the increase of GHG emission the atmosphere amplifies its absorption

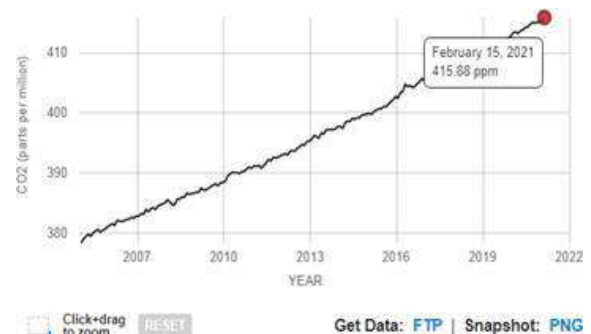
capacity of infrared radiation, due to the accumulation of GHG on the surface that ends up increasing this absorption condition, degenerating a series of damages to the biome of the environment (Torres; Ferman & Sbragia, 2016).

Among the existing GHGs, the ones with the greatest relevance in relation to their high harmful power for the increase of the greenhouse effect: carbon dioxide (CO₂); methane (CH₄); nitrous oxide (N₂O) and water vapor (H₂O).

For Aguiar *et al.* (2016), given the data presented by the reports released by the IPCC, it can be confirmed that the largest responsible for GHG emissions is human activity. The data in the fourth report exposed this statement with about 90% certainty, pointing to human actions as the major cause of the intensification of the greenhouse effect by the large GHG emissions.

The report also pointed out in the middle of this century the unbridled rise in temperature, together with the reduction of soil moisture caused by the scarcity of rainfall, may gradually replace the Amazon rainforest - characterized by a tropical climate - by savannas, as well as the vegetation of the semi-arid region by a vegetation typical of arid lands (Aguiar *et al.*, 2016).

The global report presented by the National Aeronautics and Space Administration (NASA) of 2021, clearly shows that GHG emissions have been growing wildly over the years, going against the objectives of maintaining the climatic conditions of the planet. According to the report, at the beginning of the 20th century the concentration of GHG in the Earth's atmosphere was 300 ppm (parts per million), while the data verified in 2021 already denoted a concentration percentage of approximately 416 ppm by the month of February of that year (National Aeronautics and Space Administration, 2021). Such data can be contacted through representative analysis of graph 1 below.



Graphic 1: Global GHG emissions - 2007 to 2021.

Source: NASA, (2021).

At the national level, it is opportune to highlight that the largest GHG generating sources in Brazil - according to the SEEG report issued between 2010 and 2018 - are: energy; transport; industry; agriculture; waste treatment; and changes in land use and forests. In this same context, SEEG points out that the state of Amazonas leads the ranking of the largest emitters of GHG in Brazil. According to SEEG, seven Amazonian municipalities emit about 29.7 million tons of CO₂, because of deforestation, which is higher than the emissions of countries like Chile, Uruguay and others (Seeg, 2020).

However, given the analysis performed by SEEG, 2020, it is observed that Brazil increased its GHG emissions between the years 2010 to 2019, going in the opposite direction to the legal objectives, especially regarding the goal set by the NEP. The data can be verified by graph 2, cited below.



Graphic 2: Global GHG emissions - 2007 to 2021.

Source: SEEG, (2021).

III. MATERIALS AND METHODS

The focus of this study was to identify the sources to identify the sources generating GHG in a processing industry of photographic paper in the city of Manaus/AM, through the analysis of data of scope 1 and 2, of the period of two years (2019 and 2020), through the tool PBGHGP, a tool adapted to the Brazilian reality, as shown in Fig. 3, which will account for the emission of CO₂e.



Fig. 3: Scope and activities generating GHGs

Source: FGV, (2021).

The industry has a physical size of approximately 6,661.54 m² and according to the National Environment Policy (Law no. 6,938 of August 31st, 1981, Art. 17- D.), for the purposes of the Environmental Control and Inspection Rate, the company is framed as Large Size, for

annual sales of over 12 million. In addition, the operational framework of the industry consists of about 26 (twenty-six) contract employees (Brazilian labor regulations - CLT) and 7 (seven) service providers (resident outsourced).

The division of the industry sectors focuses on: productive processes (encompasses the Receiving, Stock, Shipping sector, in addition to the QC), utilities/maintenance, administrative support and sewage treatment, located at its headquarters in the city of Manaus, which has 100% of the operational control for scopes 1 (direct) and 2 (indirect) of the PBGHGP tool for GHG inventories. Scope 3 (indirect) was not applicable as it is not considered mandatory.

The survey was conducted in the first half of 2021, specifically between January and June of the same year. With the aim of analyzing GHG emissions in the timeline, 2019 was defined as the base year for conducting the corporate inventory of the industry, given that the industry had not carried out any other GHG inventory previously. The following year, 2020, will be used for comparative analysis.

The universe and population carried out in the study focuses on the aspects that permeate how to supply sources of operational control in the production process, purchase of energy, treatment of effluents and others.

The research used statistical data that were indispensable for the foundation of the present study and the indication of the size of the impacts generated by the problematic that was addressed here. Therefore, the case study was applied in a determined industry of photographic paper processing in the region of Manaus/AM, using some materials and methods that could contribute to the capture, measurement, treatment, analysis and discussion of the data obtained.

In addition, in the practical phase, the analytical, quantitative and qualitative method was adopted, where the data were processed and pointed out within these three perspectives, in order to quantify and qualify the practical context of GHG emissions within the organization. We also analyzed the EMS scenario within the organization, verifying that this system is adopted and used, directing the researcher to make possible suggestions that can be used in this organization.

The study was also permeated by the analysis of legislation dealing with the problem worked here, to demonstrate how the issue is worked in the political-legal framework. As advantages we highlight the participation of industry, in the industrial context, which represents direct participation in global GHG emissions, as well as its strategic location, since the State of Amazonas has

achieved significant GHG emissions, negatively impacting the indexes promoted by Brazil and that make up world emissions, thus distancing itself from the objectives to which the country is co-signatory.

On the other hand, the disadvantages perceived by the study were all included in the measurement of the centralization of the analysis. However, the parameters achieved by the analysis were satisfactory for the extraction of the results that can be used to increase the effective participation of the industry.

IV. RESULTS AND DISCUSSION

Whereas the Amazon region has assumed a significant position in the ranking of national GHG emitters, it is of great importance for the present study to evaluate, separately and concomitantly, as such industry has positioned itself in the face of the control of its GHG emissions in Scopes 1 and 2.

Summarily, it is essential to highlight the delimitation of the macro-process. As the photographic paper processing industry has no participation in other organizations, regarding the definition of organizational boundaries, the approach used was operational control. This stage basically consisted of the identification of the organizational structure of the industry, over which it has direct control, and the characterization of its processes. These steps were described in image 4, highlighted below, to understand the processes involved in the study.

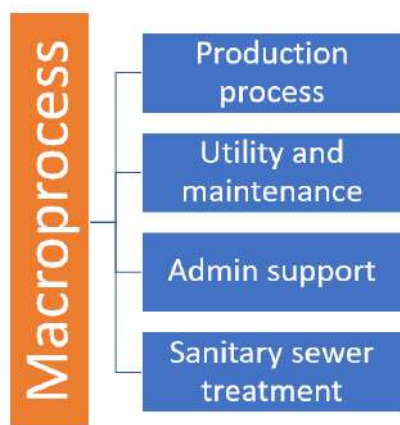


Fig. 4: Industry macro process (photographic paper finishing)

Source: Authors (2021).

The study in relation to PBGHGP, for scope 1, was marked only in the analysis of stationary and mobile fuels, fugitive emissions and effluents. Whereas Scope 2 was guided only by the analysis of localized electricity. The data for the year 2019 served as a base year for the factual

analytical study. These results are shown in Table 2, below.

Table 2 - Sources of direct emission - Scope 1

Scope 1	Data from activity (Source description)	Emission element (type)	Amount	
			Year 2019	Year 2020
Combustion stationary	Power Generator Group	Diesel oil	200 liters	600 liters
Mobile Combustion	Lawnmower	Automotive gasoline	80 liters	120 liters
Fugitive emissions	Air conditioning system (equipment)	R410-A	22.7 kg	22.7 kg
Effluents	Treatment of liquid effluents (anaerobic process)	Biological effluent	861.2 m ³	653.8 m ³

Source: Authors, (2021).

For stationary combustion, there was a 200% increase in the volume of fuel consumed between 2020 and 2019. As for commercial automotive gasoline, in the mobile combustion category, an increase in consumption was identified by 50% when compared to the previous year. These fuels are used respectively in the power generating group and in the lawnmower.

It was identified during the study that the industry paralyzed its activities in the months of April to June 2020, a rainy period in the city, which may have contributed to the growth of undergrowth (grass). This period of downtime also resulted in a 24% reduction in the volume of effluents generated in 2020, when compared to the 2019 results.

Fugitive emissions remained stationary at 22.68 kg between 2019 and 2020, with no increase, much less reduction. Such emissions arise from leaks or any other

type of unintentional and irregular release of vapors and gases. In addition, fugitive emissions are difficult to control. GHG emissions by refrigeration and air-conditioning equipment, from the perspective of the mass balance (Kyoto) remained stationary at 47.34 t CO₂e, according to the quantity transferred, between 2019 and 2020, as can be seen in Table 3, below.

Table 3 - GHG emissions by refrigeration and air-conditioning equipment - Mass balance (Kyoto).

Source record	Gas or compound	GW P	V E -	Source record	Gas or compound	GW P
2019	R-410A	2.088	-	22.68	-	47.34
2020	R-410A	2.088	-	22.68	-	47.34

Source: Authors, (2021).

Therefore, knowing that the study applies to Scopes 1 and 2, the indirect emissions defined in Scope 2 were also catalogued, in addition to identifying the non-applicable activities, within the same comparative used in the Scope 1 analysis, focusing on the income statement between 2019 and 2020. These results can be measured in Table 4, highlighted below:

Table 4 - Sources of direct emission - Scope 2

Emission element (type)	Amount		Unit of Measurement
	Year 2019	Year 2020	
Electricity	595,8	484,736	MWh

Source: Authors, (2021).

It is of great importance for the study to demonstrate the comparison of GHG emissions in tons, recorded between 2019 and 2020, to understand quantitatively the parameters measured between both years, thus enabling the expansion of the perception of the ecological-legal responsibility of the company. These results can be verified in Table 5 below.

Table 5 -GHG emissions in ton – 2019/2020

GHG	Emissions in metric ton of CO ₂ equivalent (tCO ₂ e) for the year 2019		Emissions in metric ton of CO ₂ equivalent (tCO ₂ e) for the year 2020	
	Scope 1	Scope 2 (addresses gem by "location")	Scope 1	Scope 2 (addresses gem by "location")
CO ₂	0.60	43.61	1.6	30.89
CH ₄	0.87	-	0.5	-
HFCs	47.34		47.3	
Total tCO₂e	48.82	43.614	49.47	30.89

Source: Authors, (2021).

Emissions in tons of CO₂e for Scope 1 in 2020 were 1.32% higher than in 2019. However, in Scope 2, there was a reduction of 29.19%, which is equivalent to more than 12.5 tons of CO₂e. The Scope 2 emissions are unique and exclusively derived from the purchase and consumption of electric energy. Thus, it can be said that while the electric energy consumption of Scope 2 decreased by 19% in 2020, the reduction of its emissions was 10.19% higher than the energy consumption. Given the results perceived in the face of the reduction of localized electricity, it is explicit that the highest reduction rates occurred precisely in the period in which the industry had its activities paralyzed by COVID-19. When the activities were resumed the reductions continued to exist, but in a timid way, perhaps due to the low productive demands in the face of the instabilities presented by the market. In this context, there is clearly a need for industry to continue to proactively engage in activities that seek to reduce this type of consumption, since it focuses on global GHG emissions.

It was also possible to identify that more than 95% of the tons of CO₂e of Scope 1, in both years, were due to fugitive emissions from the climate system used by the industry. These fugitive emissions were stationed at 22.68 Kg in both years (2019/2020) and are equivalent to 47.4 tCO₂e.

V. CONCLUSION

Based on the results presented by the case study, which evaluated the GHG emissions of this industry based on PBGHGP, scopes 1 and 2, it has been found that for Scope 1 data GHG emissions have changed, which means that industry needs to be more attentive to the emissions captured by this target, since the reduction of these GHG levels is mandatory and not optional and can thus bring legal harm to this company.

Therefore, considering that during 2020 the industry targeted by the case study was closed for a period due to the social isolation caused by Covid-19, it should be noted that a reduction in GHG emissions of scope 1 would be favorable, although the increase does not have a highly problematic amplitude. But, considering that the Amazon region needs to present an improvement in the GHG emission framework, it is understood that the state industries need to be more careful in controlling such emissions.

Regarding the emissions measured in scope 2, there was a relevant reduction in the indexes, clearly noting that the period of closure of the industry may have corroborated for such a reduction, which did not occur in scope 1. As the reduction of Scope 2 emissions is optional, consideration should be given to the importance of assessing and better controlling Scope 1 emissions to reduce them and to contribute to increasing local, state and national GHG emissions.

Finally, it should be noted here that this research is not exhausted, since it was limited to the analysis of a given company, in each region. Thus, it is suggested that new studies be surveyed to investigate whether other sectors or branches of industry in the city of Manaus had a similar profile, what are the main sources of GHG emissions and whether the critical period of the Covid-19 pandemic established a similar emission profile in the Amazon, thus producing material that denotes the importance of a greater commitment of those involved in this context.

REFERENCES

- [1] Associação Brasileira de Normas Técnicas (2015). NBR ISO 14001:2015. Rio de Janeiro: ABNT
- [2] Associação Brasileira de Normas Técnicas (2007). NBR ISO 14.064-1:2007. 1. Rio de Janeiro: ABNT,
- [3] Aguiar, L.V., Fortes, J.D.N., & Martins, E. (2016) Neutralização compensatória de carbono – estudo de caso: indústria do setor metal mecânico. Eng Sanit Ambient, Retrieved from: <https://www.scielo.br/pdf/esa/v21n1/1413-4152-esa-21-01-00197.pdf>
- [4] Lei n. 6938, de 31 de agosto de 1981. Versa sobre a Política Nacional do Meio Ambiente (PNMA). Retrieved from: http://www.planalto.gov.br/ccivil_03/leis/16938.htm
- [5] Constituição da República Federativa do Brasil de 1988. Versa sobre as normas constitucionais do país. Retrieved from: http://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm
- [6] Lei n. 12187, de 29 de dezembro de 2009. Versa sobre a inclusão da Política Nacional sobre Mudança do Clima - PNMC e dá outras providências. Retrieved from: http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2009/lei/12187.htm
- [7] Decreto n. 9073, de 5 de junho de 2017. Versa sobre a promulgação brasileira do Acordo de Paris sob a Convenção-Quadro das Nações Unidas sobre Mudança do Clima. Retrieved from: http://www.planalto.gov.br/ccivil_03/_ato2015-2018/2017/decreto/d9073.htm
- [8] Brasil, G. H., De Souza, P. A., & De Carvalho, J. A. (2009). Inventários corporativos de gases de efeito estufa: métodos e usos. *Sistemas & Gestão*, v. 3, n. 1, p. 15-26. Retrieved from: <https://www.revistasg.uff.br/sg/article/view/SGV3N1A2>
- [9] Dal Forno, M.A.R. (2017). *Fundamentos em Gestão Ambiental*. 1 ed. Rio Grande do Sul: UFRGS.
- [10] Dutra *et al.* (2019). Análise de Deslocamento dos Poluentes de Emissões na Cidade de Manaus, Brasil. *Revista Brasileira de Geografia Física* v.12, n.01, 039-056. Retrieved from: https://www.researchgate.net/profile/Helder-Relvas/publication/332817600_Revista_Brasileira_de_Geografia_Fisica_Analise_de_Deslocamento_dos_Poluentes_de_Emissoes_na_Cidade_de_Manus_Brasil/links/5ccb0b1e92851c3c2f8167d9/Revista-Brasileira-de-Geografia-Fisica-Analise-de-Deslocamento-dos-Poluentes-de-Emissoes-na-Cidade-de-Manaus-Brasil.pdf
- [11] Fernandes, R. P.R., Nogueira, M.A., & Jimenez, I.J.T. (2020). Estudo de caso no aterro de resíduos sólidos urbanos de Manaus/AM. *BIUS - Boletim Informativo Unimotrisaúde em Sociogerontologia*, v. 23 n. 17: EDITORIAL DO BIUS DE DEZEMBRO/2020. Retrieved from: <https://periodicos.ufam.edu.br/index.php/BIUS/article/view/8344>
- [12] Fundação Getúlio Vargas (2011). Especificações de Verificação do Programa Brasileiro GHG Protocol. Programa Brasileiro GHG Protocol. Retrieved from: <http://bibliotecadigital.fgv.br/dspace/bitstream/handle/10438/30258/especificacoes-ghg2011.pdf?sequence=1&isAllowed=y>
- [13] Fiorillo, C.A.P. (2018). *Curso de Direito Ambiental Brasileiro*. 18 ed. São Paulo: Saraiva.
- [14] IPCC. (2006). *Incertezas*. Retrieved from: https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_3_Ch3_Uncertainties.pdf
- [15] Krzyszcak, F.R. (2016) As diferentes concepções de meio ambiente e suas visões. *REI – REVISTA DE EDUCAÇÃO*

- DO IDEAU, Vol. 11 – Nº 23 – Janeiro - Junho, ISSN: 1809-6220. Retrieved from: https://www.passofundo.ideau.com.br/wp-content/files_mf/037781a20b7271d160dc922d7d1b9c44355_1.pdf
- [16] Monzoni, M. (2008) Contabilização, quantificação e publicação de inventários corporativos de emissões de gases de efeito estufa. Programa Brasileiro GHG Protocol, 2 ed. São Paulo: FGV. Retrieved from: <http://bibliotecadigital.fgv.br/dspace/themes/Mirage2/pages/pdfjs/web/viewer.html?file=http://bibliotecadigital.fgv.br/dspace/bitstream/handle/10438/15413/Especifica%20a7%20%20do%20Programa%20Brasileiro%20GHG%20Protocol.pdf?sequence=1&isAllowed=y>
- [17] National Aeronautics and Space Administration (2021). Carbon Dioxide, Latest Measurement: February 2021, 416 ppm. Climate NASA, 2021. Retrieved from: <https://climate.nasa.gov/vital-signs/carbon-dioxide/>
- [18] Peixer, J. F. B. (2019). A contribuição nacionalmente determinada do Brasil para cumprimento do acordo de Paris: metas e perspectivas futuras. Tese (Doutorado em Direito) – Florianópolis: Universidade Federal de Santa Catarina – UFSC, 346f. Retrieved from: <https://repositorio.ufsc.br/bitstream/handle/123456789/199009/PDPC1446-T.pdf?sequence=-1&isAllowed=y>.
- [19] Rolim, A. M. (2020). A reciclagem de resíduos plásticos pós-consumo em oito empresas do Rio Grande do Sul - 2000. Dissertação (Mestrado em Administração) - Porto Alegre: Universidade Federal do Rio Grande do Sul, 142f. Retrieved from: <https://www.lume.ufrgs.br/bitstream/handle/10183/2397/000273408.pdf?sequence=1>
- [20] SEEG (2020). SEEH 8: Análise das emissões brasileiras de gases de efeito estufa e suas implicações para as metas de clima do Brasil 1970-2019. Retrieved from: https://seeg-br.s3.amazonaws.com/Documentos%20Analiticos/SEEG_8/SEEG8_DOC_ANALITICO_SINTESE_1990-2019.pdf
- [21] Torres, C., Fermam, R.K.S., & Sbragia, I. (2016). Projetos de MDL no Brasil: Oportunidade de mercado para empresas e para novas entidades operacionais designadas. Ambiente & Sociedade, São Paulo v. XIX, n. 3 n p. 199-214. Retrieved from: https://www.scielo.br/pdf/asoc/v19n3/pt_1809-4422-asoc-19-03-00199.pdf

Diagnosis and proposal of an alternative system for the supply and treatment of water in the Mato Stream, municipality of Simonésia-MG.

Mariza Silva Bitarães Dias, Rosane Gomes de Oliveira, Walber Gonçalves de Souza, Daniel Rodrigues Silva, Wederson Marcos Alves and João Batista Alves dos Reis

Received: 11 Sept 2021,

Received in revised form: 04 Nov 2021,

Accepted: 16 Nov 2021,

Available online: 24 Nov 2021

©2021 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— *Diagnosis. Water supply,
Alternative water treatment Quality of life.*

Abstract— *Basic sanitation services are essential to promote the improvement of quality of life and human dignity. The present study took place in the hydrographic microbasin of the third tributary of the Mato Stream, located in the São Braz community, in the municipality of Simonésia-Minas Gerais. This work aimed to diagnose the supply and propose an alternative system for the treatment of water consumed by the local community. To obtain the diagnosis, field research of an exploratory nature “in loco” was necessary. Visits were carried out at the water catchment points and the situation was investigated. of them, to later select alternatives to water treatment that meet local conditions through literature review research. It was found that the water supply was constituted by individual alternative systems, under the sole responsibility of the users. A worrying scenario was observed, in which in most cases, water was consumed without any type of treatment, and there was a lot of degradation around the contribution basins and water sources, impacts related to agriculture, in addition to others arising from the presence of animals and dumping solid and liquid waste without prior treatment.*

I. INTRODUCTION

Basic sanitation services are essential to promote the improvement of quality of life and human dignity, however, the disorderly growth of cities, combining the lack of planning and the non-definition of management priorities, mainly related to the cultural issue, states the situation of basic sanitation as one of the biggest problems faced in the country.

Access to basic sanitation services is guaranteed by law, in a universal, equal and integral way. In the last decade, there have been some advances in their coverage, however, the basic sanitation scenario in Brazil is still worrying and far from ideal. AND estimated that only 83.7% of the Brazilian population has access to treated water, and only 61.8% has sewage collection. In addition, there are problems related to the collection and inadequate

disposal of solid waste in urban drainage (TRATA BRASIL, 2019)

The municipality of Simonésia-MG has 18,298 inhabitants, around 61% live in rural areas (IBGE, 2010); having coffee cultivation as its main economic activity. And with regard to basic sanitation, it is estimated that 81.68% of the urban population has an adequate water supply; 99.23% of urban domestic sewage is collected but not treated (SNIS, 2019).

In addition to untreated sewage, resulting from inadequate sewage disposal, which is commonly released into water courses, open air, or rudimentary septic tanks, which can contaminate surface and groundwater used to supply homes, it is very common in rural communities o consumption of water without any type of treatment, a situation that puts the health of people in these places at risk.

Therefore, a diagnosis of the water supply situation was carried out, and an alternative water treatment system was proposed in the microbasin located in the São Braz Community, in Simonésia-MG. Thus, due to the precarious sanitation conditions observed in this area, in view of the need for improvements in the living and health conditions of families and the environment. It was also intended with this proposal, to give a new perspective to the problems of rural basic sanitation in this region, which sometimes, due to misinformation, do not fully understand the serious sanitary problem and the lack of sanitation, which in this way promote the inaction and lack of understanding of the inhabitants of this community regarding the real problems that exist in the issue of rural sanitation.

II. MATERIAL AND METHODS

2.1 Characterization of the study area

The municipality of Simonésia is located in the São Braz community, 207 km from the capital of Belo Horizonte, in the Mata Mineira zone (Fig.1) and the coordinate relations at the central point, de is between 20°07'21.74"S and 42°00'10.05"W. Access to the region is

via the MG-111 highway. It has an area of 489.51km², a population of 18,298 inhabitants, around 61% live in rural areas, and a demographic density of 37.39 inhabitants/km² (IBGE, 2010); with a per capita GDP of 8622.44 reais, it occupies the 677th position in the ranking of the state of Minas Gerais. According to IPEA, it occupies the 642th position in the state ranking when it comes to the Human Development Index, with an HDI of 0.632. In 2010, 88.94% of the population had a bathroom and piped water in their homes.

The region in which the municipality is located is included in the Tropical Atlantic Domain. It has topographical, geological and biodiversity contrasts in the forest domain (GALINDO-LEAL & CÂMARA, 2005).

Coffee cultivation is the predominant economic activity. The plantations are located on a half slope to the thalwegs, and generally occupy areas with a strong slope and high altitude (Fig. 2). They are permanent crops, and often have soil changes caused by chemical fertilizers, correctives, pesticides, used without proper management, which can cause contamination. In addition, it has hilltops susceptible to the risk of mass movements (FUNDAÇÃO BIODIVERSITAS, 2011).



Fig.1: Geomorphological aspects in the municipality of Simonésia-MG.

Source: Authors (2021).

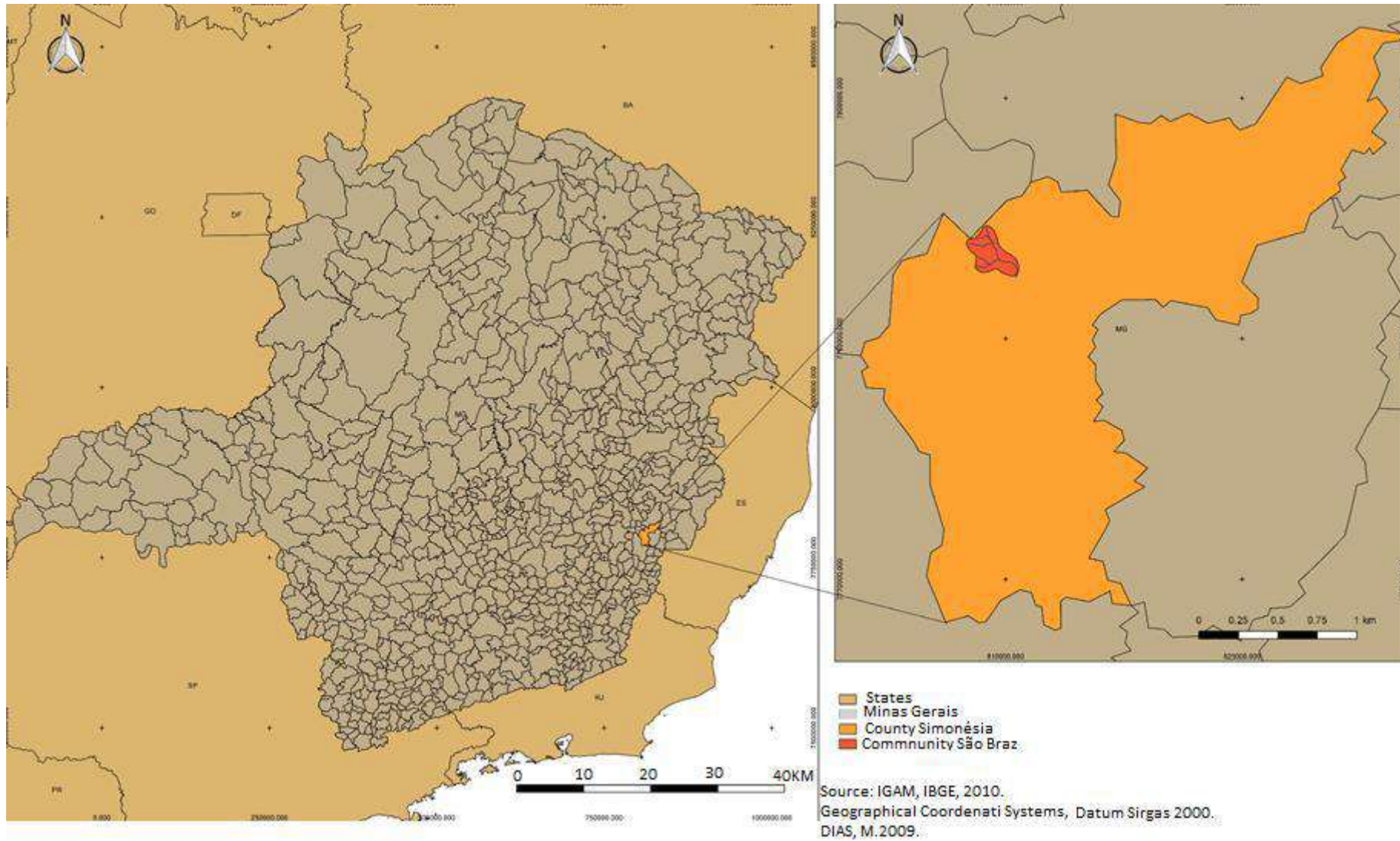


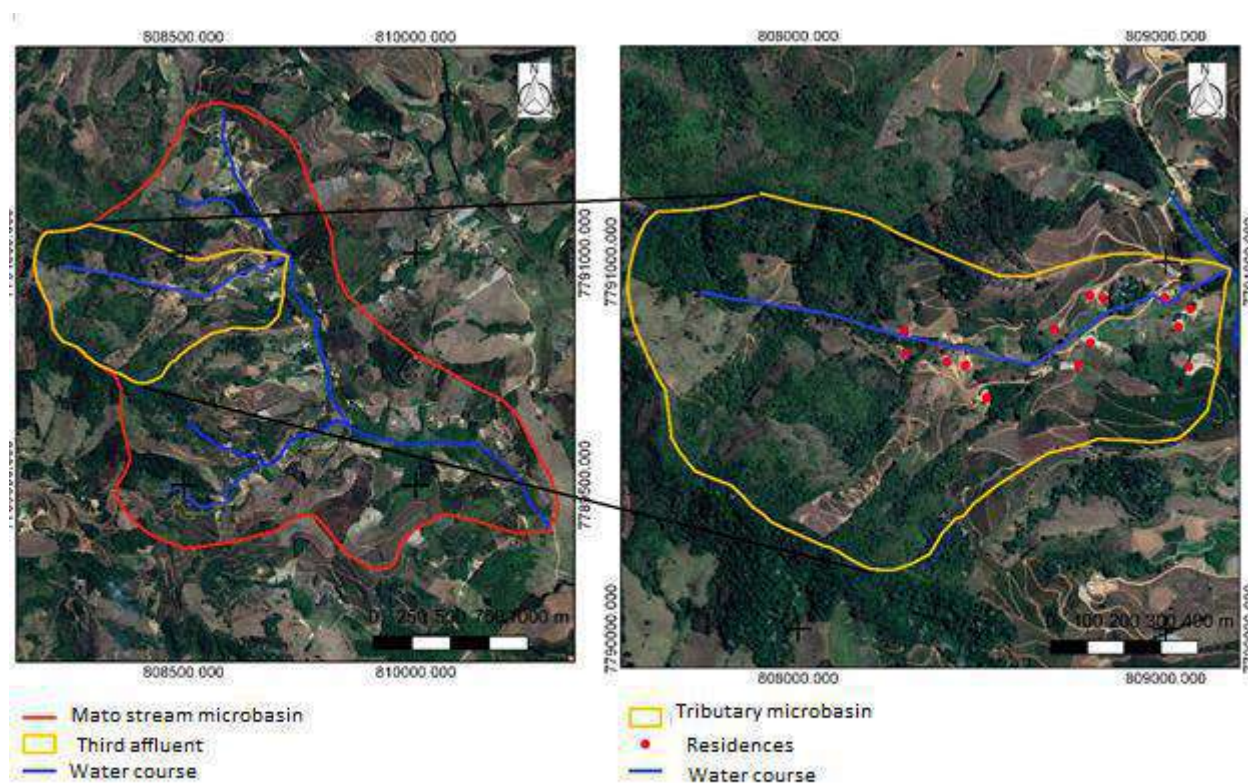
Fig.2: Location of the municipality of Simonésia-MG.

Source: Authors (2019).

The area determined for the study consisted of a portion of the São Braz community, located in the municipality of Simonésia - MG, the microbasin of the third tributary of the Mato Stream, consists of a hydrographic basin up Stream of an important natural heritage of the municipality. , the Cachoeira do Marreco, with great relevance in regional ecotourism. The area is also part of the Ecological Corridor that links the RPPN Mata do Sossego-Simonesia to the RPPN Feliciano Miguel Abdala-Caratinga, important conservation units that house the northern muriqui primate (*Brachyteles hypoxanthus*I), whose species is endemic to Minas Gerais and Espírito Santo, and is one of the most threatened with extinction in the world (FUNDAÇÃO BIODIVERSITAS, 2011). This micro-basin of the Mato Stream has 14 residences, with a population of 53 inhabitants (figure 3).

The delimitation of the microbasin was carried out by remote sensing, observing the relief and the altimetric dimensions, as they determine the direction of drainage flow; which was based on the topographic map SE-23-ZD-VI – Caratinga, available in the library of the Brazilian Index of Geography and Statistics (IBGE), satellite images from Maxar Technologies (2019), available on Google, and Shapefiles from courses in 'water available at the Instituto Mineiro de Gestão das Águas (IGAM), in the format – SHP (in GIS Databases). The processing was done with the help of Qgis® software - version 2.18.3 and Google Earth Pro.

The delimitation by remote sensing is important for demarcating the area to be studied and where the field work will be carried out, being a guiding instrument.



Source: IGAM, Google, 2018.
Geographic coordinate systems: Darum, Sirgas. Zone 23S

Fig.3: Location of the microbasin of the third tributary of the Mato Stream.

Source: Authors (2021).

The hydrographic microbasin of the third tributary of the Stream do Mato, has a territorial area of 107 ha and maximum and minimum altitudes of 1336m and 947m. The land use and occupation in the region is very diversified Fig.4. Family farming is the main economic activity, with a predominance of coffee (24.59ha), but there

are areas for the cultivation of vegetables (2.65ha) such as cabbage, tomatoes, cauliflower, broccoli, green beans, among others (figure 5 and 6); and specific areas for different crops (2.66ha), such as cassava, potato, avocado, yam, banana, and so on. There are pastures for cattle (6.9ha) and eucalyptus (0.54ha).

The water used for irrigation in this area comes from the main river of this microbasin, which is fundamental for the livelihood of the families who live there.

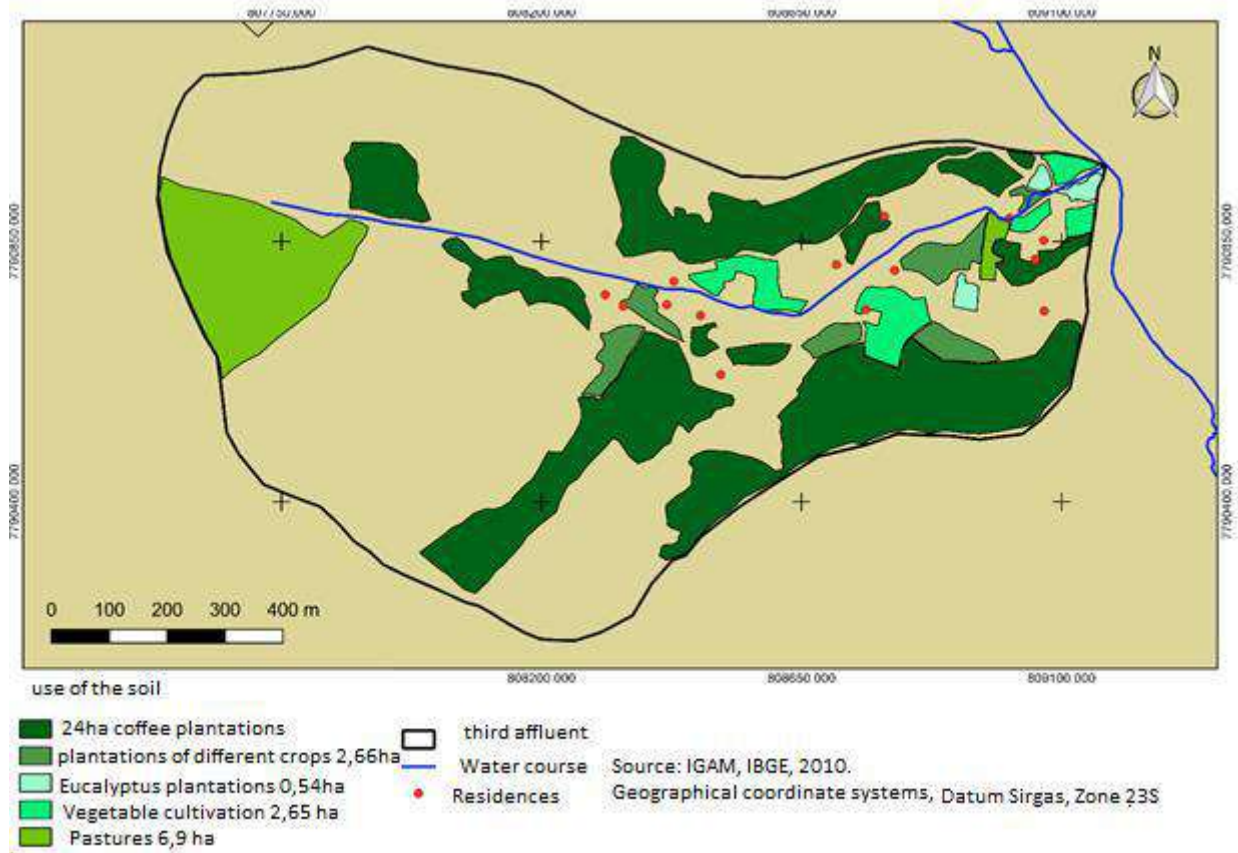


Fig.5: Land use in the microbasin of the third tributary of the Mato Stream.

Source: Authors (2020).



Fig.6: Vegetable planting.

Source: Authors (2020).

2.2 research structure

To carry out the diagnosis of the water supply system, a field research was carried out, of an exploratory nature, through a bibliographical survey to support the study, and provide a deepening of knowledge regarding the ideal alternative treatments for rural locations, and to help in decision-making. The bibliographic research was performed in several sources, such as: scientific books, sanitation manuals, procedures and sanitary surveillance, periodical articles, current regulations.

2.3 Field research

The field research took place in the microbasin of the third tributary of the Mato Stream in the period from 25/04/2021 to 02/05/2021, to obtain a diagnosis of the water supply system for human consumption in this region, visits were carried out at the points of water abstraction using observation procedures and photographs, in order to investigate their situation in a clear and visual way, and to collect geographic coordinates and altimetric quotas.

At each point, geographic coordinates and altimetric dimensions were removed, using the Waze@ application version 4.72.0.0 installed on a mobile phone. Afterwards, the collected data were processed in the Excel-version 2016 software, and a map was drawn up containing all water catchment points in the region under study.

The map was made with data collected in the field and inserted into the file structure in the Qgis@ software - version 2.18.3, from satellite images from Maxar Technologies (2019), available on Google Earth Pro.

2.4 Suggestion of a technological alternative for water treatment

After characterizing the water supply in the area under study and pointing out possible problems, improvements to the system were suggested, such as alternative technologies for treatment.

The selection of the most suitable technology for water treatment was considered through a research in the literature, in which some alternative sources of more common water treatment were raised, and a comparative table was elaborated with their advantages and disadvantages.

III. RESULTS AND DISCUSSION

3.1 Characteristics of the water supply system

Through field research carried out in the study area, it was found that the water supply system in the watershed of the third tributary of the Mato Stream is

composed of individual alternative systems, under the sole responsibility of the user, having only abstraction, adduction of raw water, and reservation and distribution to the points of use, as shown in the diagram in Figure 7.

The water used to supply homes comes from springs and the water course (surface catchment), from direct intake, being transported by PVC pipes to the reservoir (water tank), and distributed to the points of use of the residence, such as faucets, showers, and toilets, without receiving any type of treatment. It is known that surface water sources are more susceptible to contamination, which poses a risk to the health of the population served, requiring greater expenditure on treatments (LIBÂNIO, 2008). Surface springs also present, in most cases, changes in the quality of raw water, due to seasonal variations between periods of rain and drought (BRASIL, 2007), which demands attention, and implies, in some cases, interruption of supply.

The adduction of raw water in the studied area is carried out by gravity, with the exception of a spring, which reduces the consumption of electricity. PVC tubes are used in this process, which Medeiros Filho (2009) claims to have excellent corrosion resistance, due to their composition, being less subject to attack by water and aggressive terrain.

Medeiros Filho (2009) also says that the smooth walls of the tube facilitate the flow, being able to provide a flow rate of up to 1.4 times greater than that of cast iron, under the same conditions.

For the reservation, polyethylene water tanks are used, with a storage capacity of 200 to 500 L, which distributes the liquid through PVC tubes to the points of use of the residence. In this context, Funasa (2017), pays attention to the possibility of water contamination in the reservoir, and highlights the need to take preventive and protective measures, such as the adoption of periodic cleaning, adequate structures, ventilation tube, waterproofing, cover, spillway, among others.

Most of the water is consumed in natura. The only type of treatment observed is the use of clay filters with ceramic candles with activated charcoal, however, in only 5 of the 14 homes. The clay filter has high efficiency in removing particles (turbidity), E. coli, and microorganisms, according to studies by (SILVA, 2016).

Silva, 2016, reports that around 98 and 99% were found to remove turbidity, and reduce between 4 and 5 logs of E. coli, using clay filters in their study. However, Heller & Pádua (2010), warn about the exclusive use of the filter to make drinking water potable, suggesting a combination of filtration with home disinfection. These data further

expose the precariousness of the supply in the studied area and highlight the need to adopt other measures to improve water quality.

3.2 Description of water catchment points

According to what was observed in the field, there are a total of 8 water collection points, which supply

14 homes. At each point, geographic coordinates and altimetric dimensions were taken, shown in table 1. According to the data collected in loco, a map was created (Figure 8), containing this location and location.

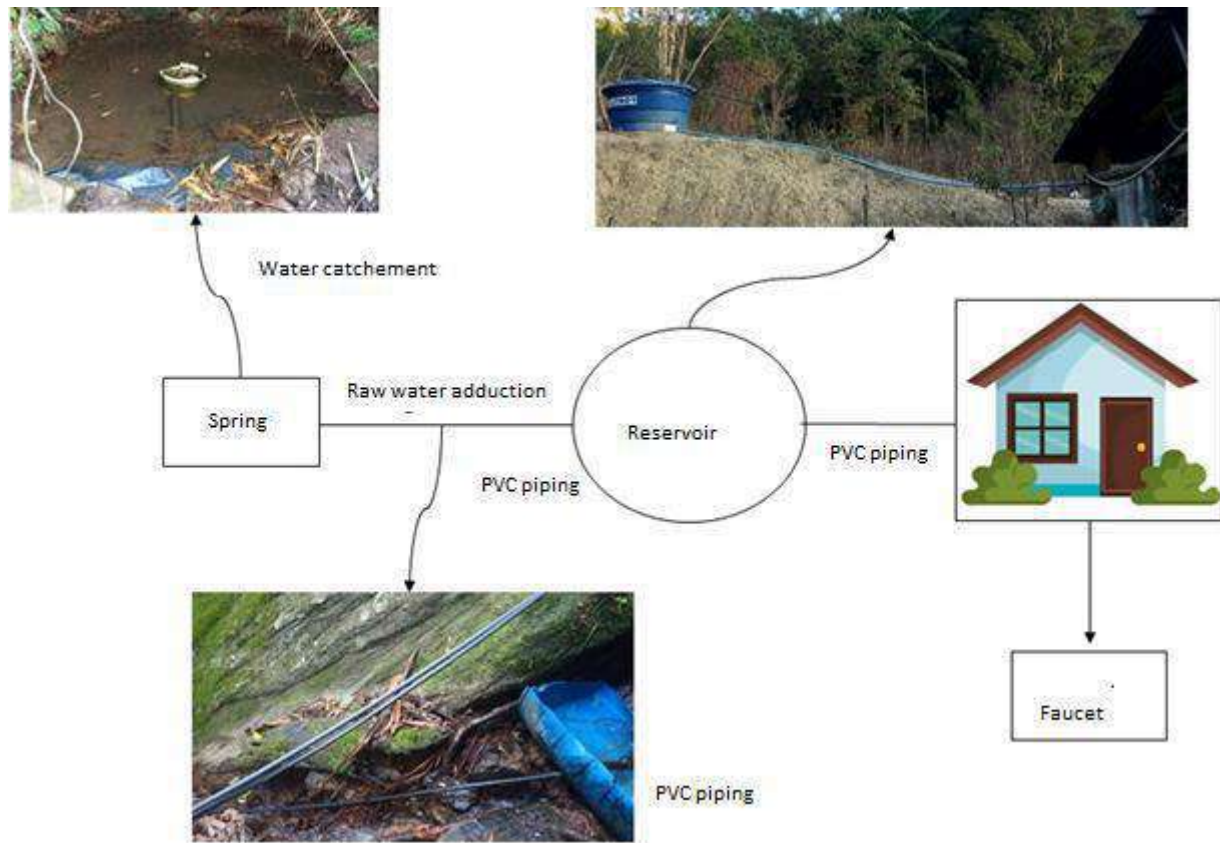


Fig.7: Scheme of the water supply system used.

Source: Authors (2021).

Table1: Geographic location of catchment points.

catchment points	Altitude (m)	Latitude (UTM)	Longitude (UTM)
P1	1075	7790803.44 m S	808225.08 m E
P2	1219	7790385.38 m S	808138.96 m E
P3	1181	7790424.02 m S	808182.13 m E
P4	1036	7790591.32 m S	808453.11 m E
P5	1012	7790616.55 m S	808593.54 m E
P6	994	7790756.67 m S	808642.28 m E
P7	992	7790762.17 m S	808662.17 m E
P8	969	7790788.43 m S	808831.72 m E

Source: Author (2021).

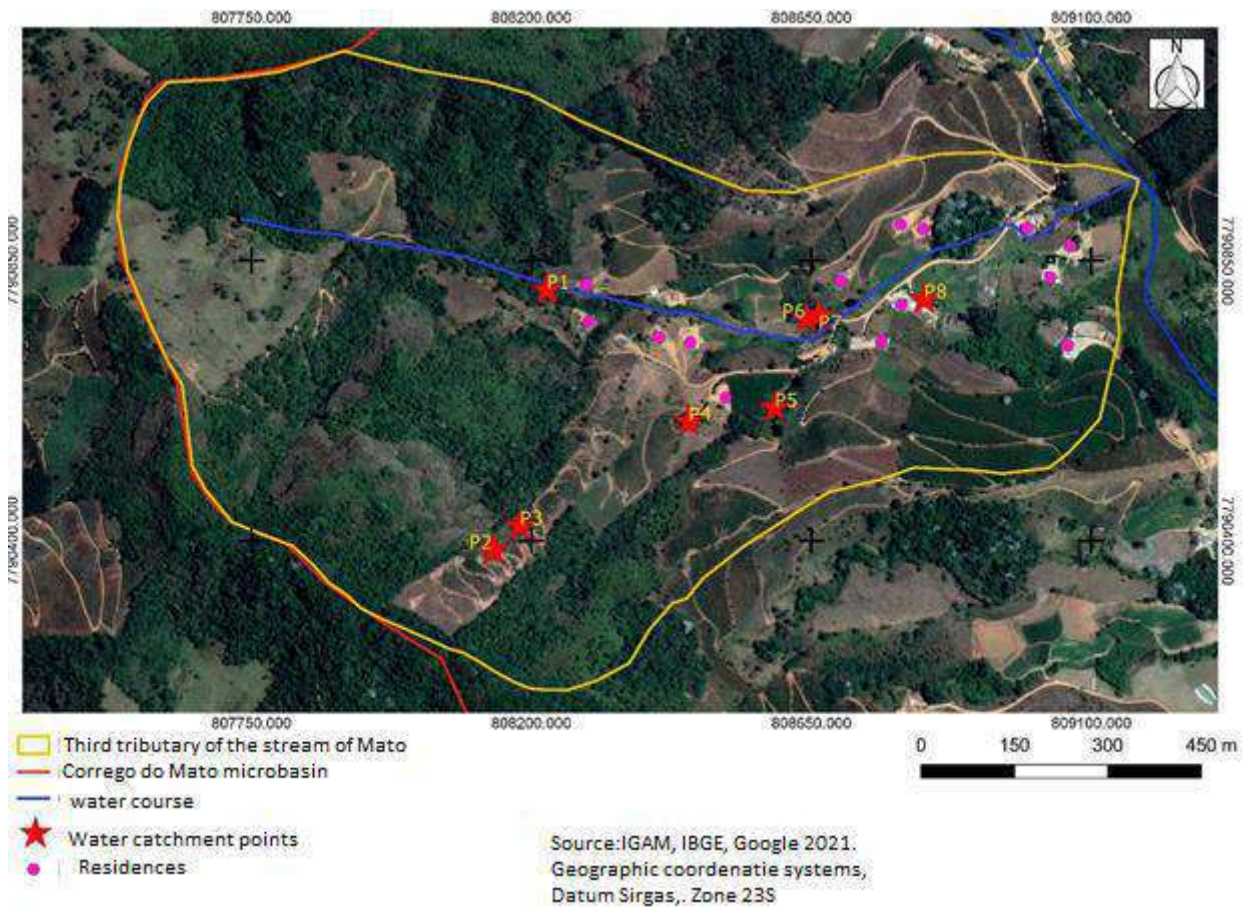


Fig.8: Location of water collection points for supplying homes.

Source: Authors (2021).

• **Vegetation**

The plant species found in the surroundings and in the springs are remnants of the Atlantic Forest, as shown in Figure 9. It was possible to identify some of them, presented in table 2, according to their popular and scientific name.

Table 2: Common plant species identified in water sources.

Local popular name	Scientific name
Palm heart	<i>Euterpe edulis</i>
Fern	<i>Cyathea delgadii</i>
Catscraper	<i>feathery acacia</i>
Bromeliad	<i>bromeliad</i>
fish roasting	<i>polysphaera vernonia</i>
Fern	<i>Pteridium aquilinum</i>
Embaúba	<i>Cecropia</i>
Cedar	<i>Cedrela fissilis</i>
Manacá da Serra	<i>Tibouchina mutabilis</i>
Bamboo	<i>Merotachys</i>

Source: Authors (2021).



Fig.9: Vegetation found in the study area.

Source: Authors (2021).

3.3 P1-Water catchment point 1

The first source of water intake is located at approximately 1075m of altitude. It is a perennial Stream, supplied by a hillside spring, which concentrates the largest

number of individual users of this microbasin, supplying 5 homes, as can be seen in Figure 10. Each user is responsible for the implementation and individual maintenance of the system itself, having reports of disputes over the use of the source.

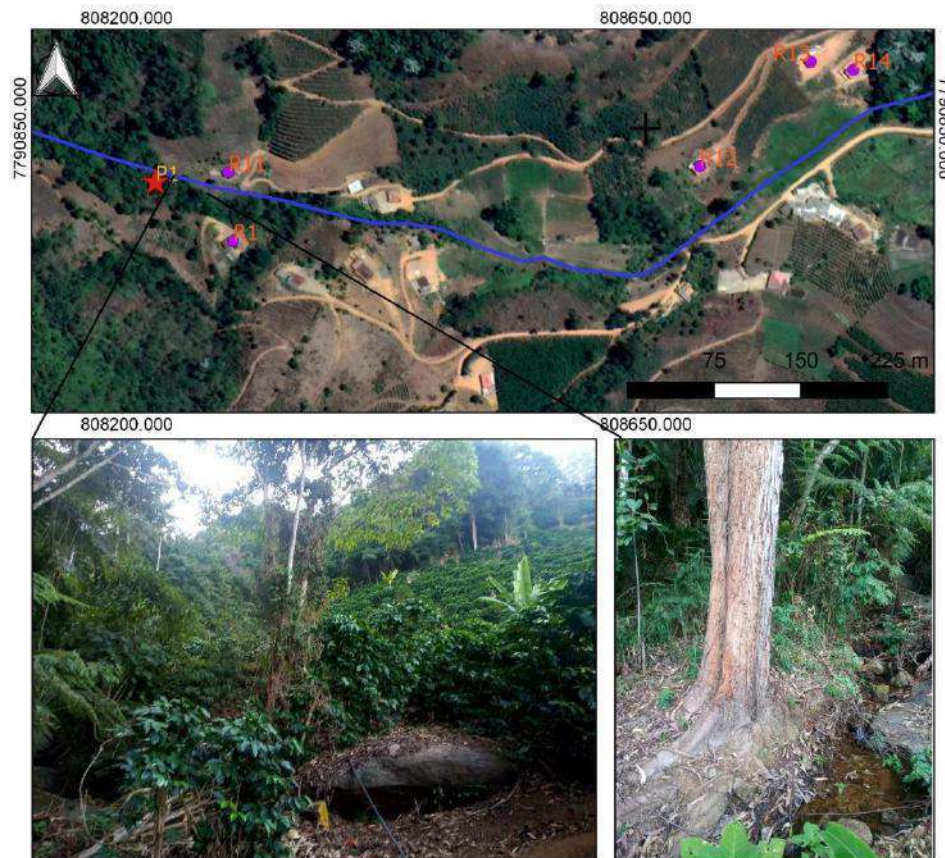


Fig.10: Location and perspective around P1.

Source: Authors (2021).

The collection takes place from the watercourse, using 1" or ¾" PVC pipes, being inserted in the most favorable places for the adduction of water, with the help of rocks found in the place. These ducts are inserted with the tip protected with a porous material, usually improvised with onion bags, fabrics or pieces of sieve, which allow the liquid to flow and at the same time, retain particles such as sand, branches, leaves and insects.

The water has a transparent and odorless visual appearance. However, there is the presence of biodegradable organic matter such as branches, flowers and leaves, which, when decomposed, naturally release nutrients such as nitrogen and phosphorus, responsible for water fertilization. However, Esteves (1998) states that, under natural conditions, these nutrients are limiting, as they are in low concentration compared to those required for the proliferation and maintenance of algae.

Furthermore, De Filippo (2000) mentions that in shallow water courses, such as the one analyzed, the vertical movements are more intense, which reduces the phosphorus sedimentation rate. What may explain the absence of algal blooms visible to the naked eye in the watercourse,

however, also serves as an alert to the possibility of algal blooms if there is a greater supply of nutrients due to human activities.

- **significant anthropic action**

It was observed that there was the suppression of part of the natural vegetation for the implantation of coffee cultivation in point 1 of collection.

The vegetation on the banks of rivers plays a fundamental role in protecting the river. In addition to reducing siltation and/or erosion, it also influences the rainwater infiltration process, reducing surface runoff. And its replacement by agricultural practices poses a risk to the quality of water in the source, due to the transport of chemical residues from the use of fertilizers and pesticides, which can contaminate the water supply.

3.4 P2 and P3-Water catchment point 2 and 3

The second capture point is located at approximately 1219m altitude, having a central coordinate point 7790385.38 m S and 808138.96 m E, shown in figure 11.

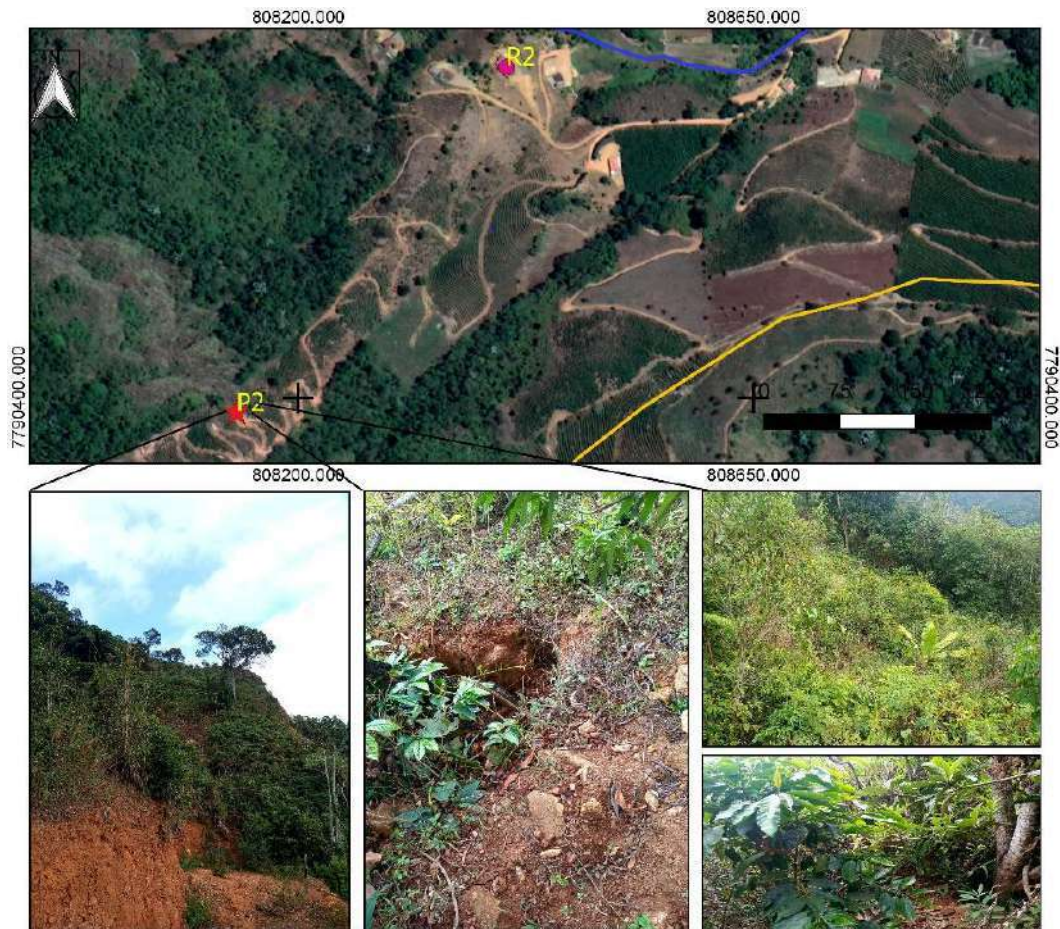


Fig.11: Location and perspective around P2.

Source: Authors (2021).

This point consists of a perennial slope spring in which there is no flow. Water infiltrates near the outcrop. The collection is carried out with the introduction of a 1" PVC pipe where there is a fountain, which transports water to a small asbestos box, from where the adduction begins.

It was noted that there is a lot of plant-derived debris at the site, which makes it impossible to see the water, and which can cause clogging of the pipes, in addition to interrupting abstraction. Also, it was observed that there is decomposition of this organic matter, which can influence the water quality.

At this point, the collection is carried out precariously, improvising a water intake tank with an asbestos box to ensure the flow, however, the use of this material is prohibited due to its danger, exposing these people to the risk of developing serious diseases when consume this water.

Asbestos consists of a fiber of mineral origin, composed of hydrated silicates of magnesium, iron, calcium and sodium. Over the last 100 years, it has been widely used in Brazil as a raw material for the production of asbestos

cement artifacts, especially for the civil construction industry. However, scientific studies have proven its high carcinogenic potential, at any stage of production, transformation and use. This culminated in November 2017, with the ban on marketing and producing asbestos across the country (CASTRO, et al., 2003; HONAIN, 2021).

In the inspection "in loco", the interior of the box developed mosses, pioneer plants, avascular, which have bioaccumulative characteristics, being widely used as bioindicators of heavy metals and atmospheric pollution.

The location of the location is a favorable scenario for water contamination. In the vicinity of the collection point, animal feces were found, traces of the presence of horses, as shown in figure 12. This situation can be aggravated by the physical conditions of the site, an area that presents erosion and sediment drag problems (figure 24). In addition, the container where the water intake takes place does not have a lid, and is located under a fruit tree, which can attract birds due to the supply of food, which can defecate on the spot.



Fig.12: Presence of animal feces close to the collection point.

Source: Authors (2021).

The third capture point is located at about 1181m altitude, having a central coordinate point 7790424.02 m S and 808182.13 m E, is close to P2, as can be seen in Fig.13.

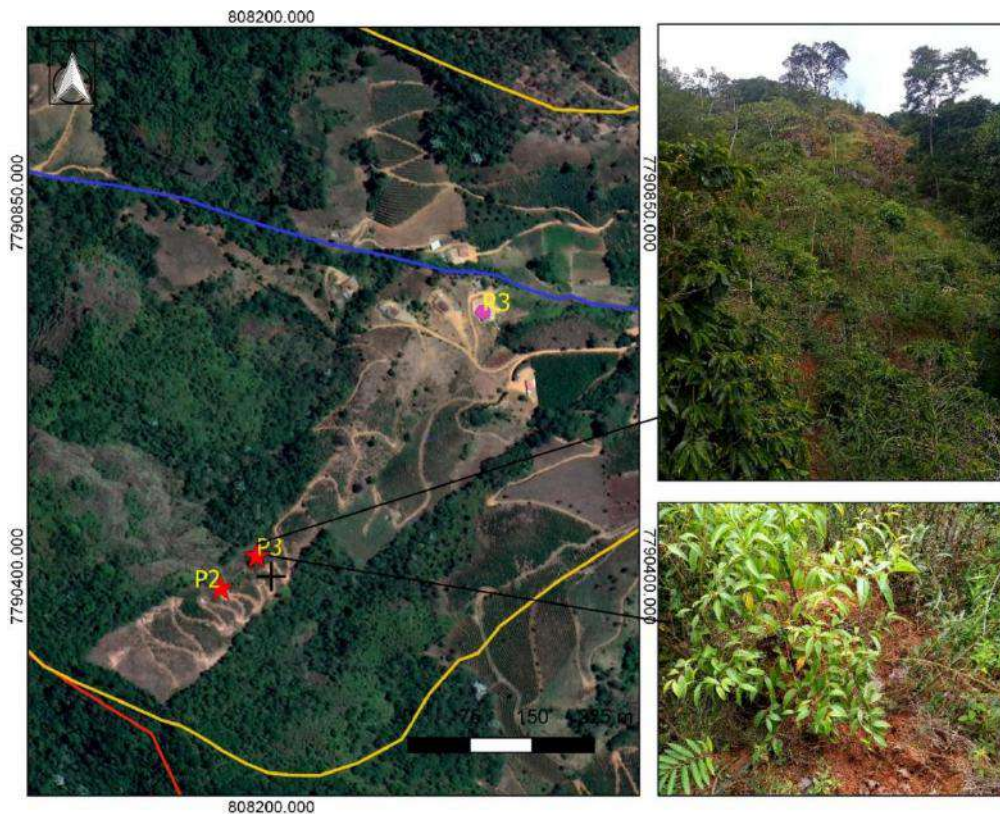


Fig.13: Location and perspective of the surroundings of P3.

Source: Authors (2021).

The collection of water at point 3 takes place directly from the spring, where a small dam was carried out and the PVC pipe inserted. The presence of sludge was identified, which leaves the water with a yellowish color and can modify its taste and odor. In the vicinity of the capture site, traces of the presence of animals were also detected.

- **Most significant anthropic action**

Through field research, it was noted that the area where points P2 and P3 are located, represents a great risk for maintaining the quantity and quality of water in these springs. In addition to the presence of animals, it was also observed that the region has steep slopes that are susceptible to mass movements.

The top forest, important for water infiltration and maintenance of the water table, as well as for the protection of the soil against erosive agents, was removed to make way for coffee cultivation. The situation was aggravated by the construction of roads, which serve as paths for the runoff and make the soil more suitable for the detachment of particles and drag of material, as can be seen in Fig. 14.



Fig.14: Erosive process caused by floods.

Source: Authors (2021).

In the rainy season of 2020, there was a large release of soil in the area due to the situation exposed above, shown in Fig.15.



Fig.15: Mass movement occurred in the area in question.

Source: Authors (2021).

3.5 P4-Water catchment point 4

The fourth capture point is located at an altitude of 1036m, with a central point of coordinates 7790591.32 m S and 808453.11 m E, which supplies a residence.

It consists of a perennial lowland spring, which requires equipment to carry out the suction and hold of water, illustrated in Fig. 16.



Fig.16: Suction and water holding in P4.

Source: Authors (2021).

The process uses a submerged pump, Sapo type, ½ CV of power, powered by electricity, and ¾” PVC piping, which pumps the water to the reservoir. The source has little fluid movement, with slow flow, which implies greater sedimentation of particles and microorganisms (protozoa), however, accentuates the color and allows the proliferation of algae and cyanobacteria, as cited by Brasil (2007).

- **Most significant anthropic action**

It is highlighted in Fig.17, that in this source, the vegetation consists of banana trees cultivated around it. This fact is due to the popular belief that this species brings benefits in terms of increasing the amount of water.

In addition, it is observed that the land where the source is located has a concave shape, which implies the surface runoff towards the source. Another aggravating factor is the cultivation of coffee around this area and throughout the catchment basin.



Fig.17: Location and perspective of the surroundings of P4.

Source: Authors (2021).

3.6 P5-Water catchment point 5

The catchment source 5 consists of a slope spring, located at an altitude of 1012m with a central point of coordinates 7790616.55 m S and 808593.54 m E.

The collection takes place at a natural waterfall point, with favorable conditions for drainage and water intake, as can be seen in Fig.18.

It was observed that the water has a light yellowish color, with the presence of mud and rust, which changes the flavor and odor. In addition, its domestic use without proper treatment sets up some inconveniences, such as stains on clothes, incrustations on surfaces, and clogging of filters.



Fig.18: Water abstraction at point 5.

Source: Authors (2021).

- **significant anthropic action**

Fig.19 presents a perspective through the processing of satellite images and photographic record, in relation to the geographic location of the catchment source 5, and the anthropic activities that can interfere in the quality and quantity of water.



Fig.19: Location and perspective of the surroundings of P5.

Source: Authors (2021).

The red arrow in Fig. 19 indicates where the capture point 5 is located in relation to the geographic space. Note that it is also an area of concave terrain, with steep slopes, where the flow converges to the source. There is also coffee growing.

The use of herbicides in this area was identified, as suggested by the presence of dead vegetation, illustrated in Fig. 20.



Fig.20: Use of herbicides on plant cover.

Source: Authors (2021).

3.7 P6 and P7-Water catchment points 6 and 7

The capture points 6 and 7, consist of individual springs, being considered shallow springs, located at 994 and 992m of altitude, respectively. They are located on the right bank of the main watercourse of the hydrographic microbasin of the third tributary of the Mato Stream.

In Fig. 21, the geographic position of P6 and P7 can be seen from satellite images, as well as the

photographic record of these two points, with emphasis on the capture. The main river of this microbasin can also be seen.

The sources present a slow flow, with smooth movements, favorable to the sedimentation of heavier particles.



Fig.21: Location and perspective of the surroundings of P6 and P7.

Source: Authors (2021).

Fig. 22 illustrates the water catchment from P6. It should be noted that an intervention was carried out to allow for water intake and flow regulation, which consisted of a dam with soil, stones and canvas, ensuring the amount of water needed to meet the demand of this user.

To carry out the capture, a system was improvised to avoid the collection of sedimented particles, consisting of a perforated bucket, with a pipe inserted at this point, as can be seen highlighted in Fig.22. However, it was noticed in this system, the development of a biofilm layer¹ wrapping the bucket. The adduction is carried out by gravity, through a 3/4" PVC pipe.

¹Biofilm: consists of a polymeric matrix with a gelatinous appearance, adhered to a solid surface. They have a huge

diversity of microbial species, often found algae, fungi, protozoa, bacteria and viruses (CHAVES, 2004).



Fig.22: Water abstraction at P6.

Source: Authors (2021).

- **significant anthropic action**

It was found that there is the development of agricultural activities in the vicinity of the basin of

contribution of the springs. There are banana and cassava cultivation, as shown in Fig.23. The presence of solid waste in the main watercourse was also observed.



Fig.23: Agricultural activities in the vicinity of P6 and P7.

Source: Authors (2021).

3.8 P8-Peonto water abstraction 8

The catchment spring 8, located at 969m of altitude, consists of a spring. It is responsible for supplying 3 residences.

To protect the source, a masonry box with a slab roof was built, sealed with pieces of wood, as illustrated in the image in Fig. 24. The capture takes place inside it, with the insertion of a 1½" PVC tube , which then branches to individually supply the 3 residences.



Fig.24: Water abstraction from P8.

Source: Authors (2021).

- **significant anthropic action**

The catchment basin has several impacts, being devoid of natural vegetation cover and banana trees being cultivated. In addition, the site is occupied by houses and sheds for the processing of coffee, with a lot of people and vehicle traffic.

He also noted that downStream from the source, it consists of a floodplain, in which the land was drained to facilitate the implementation of agricultural activities.

Another source of impact observed and highlighted in the set of images in Fig. 25, as 'DE', consists of the discharge of domestic sewage and effluents from swine production, also existing at the site.



Fig.25: Location and perspective of the surroundings of P8.

Source: Authors (2021).

3.9 Important discussions about catchment points

Von Sperling (2005) states that the characteristics of raw water depend on natural conditions and on the use and occupation of land in the hydrographic basin. In this sense, the results presented in the previous topics demonstrate that the situation in the studied area poses a risk to the quality and quantity of water available in the supply, and especially to the health and quality of life of the population, corroborating Daniel (2001), which states that the control of the spread of waterborne diseases is linked to the protection of water sources.

At all 8 catchment points, problems related to watershed degradation were observed. The Brazilian Forest Code provides, through legislation No. 12.651, of May 25, 2012, that Permanent Protection Areas -APP's are considered to be the marginal strips of any watercourse and springs, according to some criteria. Among these criteria, 30m of APP is considered for water courses up to 10m wide,

which fits the analyzed one, and 50m for springs. However, it was noted that it is not met in the analyzed points.

The protection of native vegetation in the contribution basins of water sources, riparian forests, and hilltops is fundamental for the quality and quantity of water. In this regard, Tunisi & Tunisi (2010) discuss the costs of treating water from protected springs and argue that they can reach up to R\$ 3.00 (three reais) per 1,000 m³, while in degraded and deforested springs, the cost can reach R\$ 300.00 (three hundred reais) per 1,000 m³. What is even more worrying is that the water consumption in the analyzed microbasin is carried out without any treatment, or when there is, it consists of a simple filtration.

Grossi (2006) emphasizes that riparian forests act as filters, preventing chemical residues and sediments from reaching the watercourse. They also provide a physical and biochemical barrier against the entry of sources far from water courses, in addition to attenuating the impacts of the

raindrop directly on the soil, which can cause the detachment of particles and contribute to the siltation of rivers.

In addition to the degradation of APP's, agricultural practices, especially traditional, also cause impacts on the soil. It was found that the main economic activity developed in the area under study is coffee growing, which corresponds to 65.9% of agricultural practices developed there, occupying an area of 23% of the micro-basin. This activity was identified in the vicinity of 5 of the 8 water sources.

According to Lopes et al., (2014), traditional coffee growing is characterized by the artificialization and simplification of agro-systems, being highly dependent on pesticides and chemical fertilizers. This causes a serious ecological imbalance, such as the loss of fauna and flora biodiversity and contamination and degradation of water resources. This activity impoverishes the soil, and subjects it to erosive processes, which leads to the loosening and carrying of particles into the watercourse, causing siltation. This is aggravated on terrain with a steep slope. In the process, particles from agrochemicals can also be carried into the watercourse, which may contain heavy metals. In this sense, Brasil (2007) highlights that substances such as heavy metals and pesticides,

The health effects arising from exposure to pesticides can be acute or chronic, as shown in Table 6.

They can occur immediately, in months, years or even decades after exposure, manifesting in various diseases such as cancers, but congenital formations, endocrine, neurological and mental disorders (CARNEIRO et al., 2015).

In addition to these impacts, the presence of animals was also observed in two of the springs, dumping of effluents from pig farming and domestic use in the vicinity of another.

Dias et al., (2008), analyzed in their study the presence of *Giardia* spp. and *Cryptosporidium* spp. in water from a surface water supply that contained human and animal populations in the basin area, and found geometric mean results in the order of 3.92 oocysts/l for *Giardia* spp. and 3.62 oocysts/l for *Cryptosporidium* spp. This shows the potential for contamination in a population that consumes water from sources with human and animal presence. This is also highlighted by Amaral (2011), which puts the health of the inhabitants of this region at risk.

3.10 Selection of the technological alternative for water treatment

From the bibliographical survey on some of the most common alternative sources of water treatment, table 3 was created, indicating their advantages and disadvantages.

Box 3: Advantages and disadvantages of alternative sources of water treatment.

Technology	Benefits	Disadvantages	Reference
Ozonation	More efficient disinfection when compared to the use of chlorine, chlorine dioxide and chloramines in inactivating bacteria, protozoa and viruses; Oxidation of micro pollutants that cause taste and odor in water; Reduction in the dosage of coagulants; Oxidation of macro pollutants; Reduction of chlorine dosage in post-chlorination; Decrease in the concentration of trihalomethane precursors; Algae annihilation; Increased duration of filtration lines; General improvement in water quality in the different treatment units.	Initial cost for installation is high; High energy cost for ozone generation; It is highly toxic and corrosive; There is no persistent residual production in the water; Ozone concentration rapidly decreases with increasing water pH and temperature; Formation of brominated by-products (when there are bromides in the water), as well as acetones; Biologically activated filters are needed to remove assimilable organic carbon and biodegradable by-products.	DI BERNARDO & DANTAS, 2005.

Ultraviolet (UV) radiation	Effective in inactivating many viruses, spores and cysts; UV disinfection is a physical process, which eliminates the need to generate, handle, transport or store toxic, dangerous and corrosive chemicals; Do not generate residual effects harmful to humans or aquatic life; Disinfection has a shorter contact time when compared to other disinfectants (20-30 sec.); Ease of operation; UV disinfection equipment requires less space than other methods.	Turbidity and total suspended solids in water can impair inactivation efficiency; Microorganisms can sometimes repair and reverse the destructive effects of UV through reactivation or photoreactivation mechanisms, or even in the absence of light; Need for a preventive program to control the formation of biofilms in quartz tubes; Low dosages may not be effective in inactivating some viruses, spores and cysts.	BASTOS, 2007.
Technology	Benefits	Disadvantages	Reference
Zeolites in filter media	Possibility of sizes, shapes and selective loads, thanks to their structures; Abundant synthesis material; Lower cost than other polymeric resins responsible for ion exchange.	-	FUNGARO & SILVA, 2002.
	-	The ionic selectivity, as well as the parameters related to adsorption efficiency and ion exchange capacity, is related to the crystal structure of zeolites, and the chemical characteristics of the ions detected in the solution; Temperature, pH and initial ionic concentration can affect metal removal.	SHINZATO, et al., 2007.
Moringa oil	It costs only a fraction of conventional chemical treatment; Bacteria reduction; The coagulant can be prepared on site, making its use in rural communities advantageous; Efficiency in the treatment of turbidity ranging from 50 to 100 NTU.	There is a need for complementary treatments such as chlorination, slow filtration, solar radiation.	PATERNIANI, et al., 2009.
	Reduces use of alkalizers for pH correction; Forms more erosion-resistant microflakes in the filter interstices; Provides greater ease of treatment and final disposal of the sludge.	It can add organic matter to water, making chlorine disinfection difficult due to the potential for formation of trihalomethanes.	FRANCO, 2015.
Technology	Benefits	Disadvantages	Reference
Slow sand filtration	Low cost; It is easy to install, operate and maintain; Efficiency in removing pathogenic organisms; Absence of toxic residues;	Large area demand; Limitations regarding the characteristics of raw water, especially the concentration of solids; Possibility of using complementary treatments; Clogging of the filter bed;	MURTHA, HELLER & LIBANIO, 1997.

	Efficiency in the order of 90% in the removal of total coliforms, turbidity and apparent color, with the use of slow filtration preceded by pre-filtration.	Use of synthetic blankets to mitigate the effects of seasonal variations due to increased turbidity;	PATERNIANI & CONCEIÇÃO, 2004.
Clay filter with ceramic candles	Efficiency in removing turbidity and E. coli. Simple and low-cost technology; Cultural acceptability.	Periodic maintenance, such as cleaning and filling.	SILVA (2016).
Chlorinator	Simple system, easy to install and cost-effective; Can be mounted by the user; Ease of obtaining the necessary materials; Efficiency in removing germs and microorganisms.	Daily manual addition of 65% calcium hypochlorite by user; Need to check the amount of chlorine in the water;	EMBRAPA, 2014.
	High efficiency; Inactivation of pathogenic microorganisms existing in water; It works in the removal of hydrogen sulphide, iron and manganese; Free residual chlorine;	Calcium hypochlorite must be handled with protective equipment. Do not breathe vapor, avoid contact with eyes, skin and mucous membranes;	FUNASA, 2014.

Source: Authors (2021).

According to the diagnosis carried out in loco, and the comparison of the advantages and disadvantages of the technologies presented in table 6, the joint use of filtration and chlorination in water treatment in the hydrographic microbasin area of the third tributary of the Mato Stream was considered, corroborating with Héller and Pádua (2010), who suggest the combination of filtration and home disinfection.

Simpler, low-cost technologies were chosen, which do not require large areas, but which are also efficient, so that the needs of this population are met.

For filtration, the adoption of a clay filter with ceramic candles is suggested, due to its simplicity and ease of operation and maintenance, as cited by Silva (2016).

For the chlorination of water, the chlorinator is suggested, which is a technology whose treatment principle is chlorination, and has low cost, accessibility, ease of operation, and efficiency in removing pathogens, as shown by studies by Lima et al. , (2012), Druzian et al., (2020), characteristics that make it applicable in the community.

Brito et al., (2015), state that, in water disinfection, chlorine is a practical and effective product in the removal of pathogenic microorganisms, breaking molecular chemical bonds, with oxidation of free oxygen atoms and substitution reactions occurring with chlorine . They emphasize that the effectiveness of disinfection with

chlorine depends on the pH of the water, being more efficient at pH between 5.5 and 7.5.

Furthermore, it acts on most pathogenic microorganisms present in water; not harmful to man at the dosage required for disinfection; it's economical; does not change other water qualities after application; it is relatively easy to apply; it leaves an active residual in the water, that is, its action continues after being applied and is tolerated by the vast majority of the population (BRASIL, 2015).

The EMBRAPA model chlorinator (B) was the alternative considered in the present work for water disinfection. The suggestion of this model was based on the low cost of the system compared to others. To make this comparison, a survey was carried out on the quantity and cost of materials needed to install four different types of chlorinators.

IV. CONCLUSION

The present work made it possible to know the main characteristics of the water supply in the hydrographic microbasin of the third tributary of the Mato Stream, to carry out a diagnosis of it, and in view of the needs, to propose alternative systems for the treatment of water for this rural community.

It was found that the water supply is made up of individual alternative systems, under the responsibility of the user, from the cost of implementation to its maintenance.

It comprises abstraction, adduction of raw water, reservation and distribution to points of use. There is no treatment system, being used in only 5 of the 14 homes, only filtration through a clay filter with a ceramic candle.

A worrying scenario was observed, mainly in relation to the degradation of the contribution basins and the catchment springs, fundamental for the maintenance of the quality and quantity of water for the supply, and that, in accordance with the Brazilian Forest Code, should be preserved.

In this sense, impacts were noted on riparian forests, hilltops and spring recharge areas, especially for the cultivation of coffee. The presence of horses in some springs was also observed, as well as the discharge of domestic and swine effluents. This highlights the possibility of contamination of water supplies by pathogenic organisms such as viruses, bacteria and protozoa, and by chemical residues from agricultural practices; which can compromise the quality of life and health of the population residing there and the health of the environment.

The adoption of alternative water treatment systems in this region is essential, and measures for the recovery and conservation of preservation areas are urgent. This requires an awareness and training work for this population, which can be started in schools attended by residents.

Therefore, it is concluded that this study contributes to the adoption of measures that can bring significant changes in the quality of life of this population, due to the reduction of disease risks, especially of water supply, and to the availability of water for supply in quantity and quality.

REFERENCES

- [1] BASTOS, P. F. **Tratamento de água da chuva através de filtração lenta e desinfecção UV**. Dissertação (Mestrado) - Programa de Pós-graduação em Engenharia Ambiental, Centro Tecnológico, Universidade Federal do Espírito Santo, Vitória, ES, 2007.
- [2] BRASIL. Ministério da Saúde. Fundação Nacional de Saúde. **Manual de saneamento**. Brasília: Ministério da Saúde; Fundação Nacional de Saúde, 4. ed. 2015, 642 p.
- [3] BRASIL. Ministério da Saúde. **Inspeção sanitária em abastecimento de água**. Secretaria de Vigilância em Saúde. Brasília, 2007. 86p.
- [4] BRITO, C. N.; ARAÚJO, E. G.; MARTÍNEZ-HUITLE, C. A. **Aplicação de Métodos Oxidativos Avançados para a Desinfecção de Água**. Revista Virtual de Química, 2015, 1617-1634p.
- [5] CARNEIRO, F. F.; RIGOTTO, R. M.; AUGUSTO, L. G. S.; FRIEDRICH, K.; BÚRIGO, A.C.; **Dossiê ABRASCO: Um alerta sobre os impactos dos agrotóxicos na saúde**. Associação Brasileira de Saúde Coletiva. Fundação Oswaldo Cruz. 2015.
- [6] CASTRO, H.; GIANNASI, F.; NOVELLO, C. **A luta pelo banimento do amianto nas Américas: uma questão de saúde pública**. Revista Ciência & Saúde Coletiva, 2003, 903-911p.
- [7] CHAVES, L. da C. D. **Estudo da cinética de formação de biofilmes em superfícies em contato com água potável**. Dissertação (Mestrado) – Universidade do Minho. Braga, Portugal, 2004.
- [8] DANIEL, L. A. **Processos de Desinfecção e Desinfetantes Alternativos na Produção de Água Potável**. EESC-USP, UFRGS, UnB, Unicamp, UFMG. São Carlos, p. 149 - Publicação do Programa em Saneamento Básico (PROSAB). 2001.
- [9] DE FILIPPO, R. **Impactos Ambientais Sobre os Ecossistemas Aquáticos**. Informe Agropecuário, v. 21, n. 202, p.45-53, 2000.
- [10] DI BERNARDO, L. **Algas e suas Influências na qualidade das águas e nas tecnologias de Tratamento**. Rio de Janeiro: ABES; 1995, 140p.
- [11] DI BERNARDO, L.; DI BERNARDO DANTAS, A. **Métodos e técnicas de tratamento de água**. 2ª. ed. [S.l.]: RIMA, 2005.
- [12] DIAS, G. M. F.; BEVILACQUA, P.D.; BASTOS, R.K.X.; OLIVEIRA, A. A.; CAMPOS, G. M. M. **Giardia spp. e Cryptosporidium spp. em água de manancial superficial de abastecimento contaminada por dejetos humano e animal**. Revista Arq. Bras. Med. Vet. Zootec., v.60, n.6, p.1291-1300, 2008.
- [13] DRUZIAN, M.; BARRETO DRUZIAN, F.; DE OLIVEIRA E SILVA, F.; DA VITÓRIA CALIMAN, M.; PACHECO CASA NOVA, G.; GUIMARAES DA SILVA, M. **A eficiência do uso de um clorador para descontaminação de água de poço**. Anais do Salão Internacional de Ensino, Pesquisa e Extensão, v. 11, n. 2, 03/2020.
- [14] EMBRAPA. **Sistema Brasileiro de Classificação de Solos**. Revista e ampliada. 5ª ed. Brasília, DF, 2018. 356p.
- [15] ESTEVES, F. de A. **Fundamentos de Limnologia**. Rio de Janeiro. Editora Interciência, 1998.
- [16] FRANCO, C. S. **Sistema alternativo de tratamento de água em escala descentralizada**. Dissertação (Doutorado) – Universidade Federal de Lavras, Lavras, MG, 2015.
- [17] FUNASA. Fundação Nacional de Saúde. **Manual de Cloração de Água em Pequenas Comunidades Utilizando o Clorador Simplificado Desenvolvido pela Funasa**. Brasília: Ministério da Saúde; Fundação Nacional de Saúde, 1. ed. rev. 2014, 36 p.
- [18] FUNASA. Fundação Nacional de Saúde. **Manual de saneamento**. Brasília: Ministério da Saúde; Fundação Nacional de Saúde, 4. ed. 2015, 642 p.
- [19] FUNDAÇÃO BIODIVERSITAS. **Plano de manejo da reserva particular do patrimônio natural Mata do Sossego – RPPN Mata do Sossego**. Fundação Biodiversitas, Belo Horizonte, MG. 2011.
- [20] FUNGARO, D. A.; DA SILVA, M. G. **Utilização de zeólita preparada a partir de cinza residuária de carvão como**

- adsorvedor de metais em água.** Revista Química Nova, Vol. 25, n.6, p.1081-1085, São Paulo, SP, 2002.
- [21] GALINDO-LEAL, C.; CÂMARA, I. G. **Mata Atlântica: biodiversidade, ameaças e perspectivas.** Conservação Internacional, Belo Horizonte, MG. 2005.
- [22] GROSSI, C. H. **Diagnóstico e monitoramento ambiental da microbacia hidrográfica do Rio Queima-pé, MT.** Dissertação (Doutorado) -Faculdade de Ciências Agrônômicas. Universidade Estadual Paulista, Botucatu, SP, 2006.
- [23] HELLER, L.; PÁDUA, V. L. **Abastecimento de água para consumo humano.** 2ª Edição. Belo Horizonte: Editora UFMG, 2010.
- [24] HONAIN, C. A. C. **A proibição do amianto no Brasil e os desafios jurídico-ambientais do futuro.** Dissertação (Mestrado). Universidade Católica de Santos, Santos, SP, 2021.
- [25] IBGE – INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. **Minas Gerais, Panorama.** Brasil, 2010. Disponível em: <<https://cidades.ibge.gov.br/brasil/mg/panorama>>. Acesso em 16 de outubro de 2019.
- [26] IBGE – INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. **Pesquisas: Simonésia, Suplemento de Saneamento Básico.** Brasil, 2017. Disponível em: <<https://cidades.ibge.gov.br/brasil/mg/simonesia/pesquisa/10087/76819>>. Acesso em 20 de janeiro de 2021.
- [27] LIBÂNIO, M. **Fundamentos de qualidade e tratamento de água.** 2. ed. Campinas: Átomo, 2008.
- [28] LIMA, L. dos S; CERQUEIRA, C.M.M; ANDRADE, C.F.S. Publicação. **Avaliação de cloradores de água em dois mananciais na vila Oratório, município de Paraty, RJ.** Revista Ciências do Ambiente online. V.8, n°2 -out.2012.
- [29] LOPES, R. P.; ARAÚJO, K. C. S.; LOPES, I. M.; RANGEL, R. P.; SANTOS, N. F. de F.; KAGEYAMA, P. Y. **uma análise das consequências da agricultura convencional e das opções de modelos sustentáveis de produção – agricultura orgânica e agroflorestal.** Revista Espaço de Diálogo e Desconexão, 2. Ed. Araraquara, v.8, n.1. 2014.
- [30] MEDEIROS FILHO. C. F de. **Abastecimento de água.** Notas de aulas. Universidade Federal de Campina Grande. Campina Grande, PB. 2009.
- [31] MURTHA, N. A.; HELLER, L.; LIBÂNIO, M. **A filtração lenta em areia como alternativa tecnológica para o tratamento de águas de abastecimento no Brasil.** Associação Brasileira de Engenharia Sanitária e Ambiental, 19º Congresso Brasileiro de Engenharia Sanitária e Ambiental. p.1542-1556, 1997.
- [32] PATERNIANI, J. E. S.; CONCEIÇÃO, C. H. Z. da. **Eficiência da pré-filtração e filtração lenta no tratamento de água para pequenas comunidades.** Revista de Engenharia Ambiental, Vol. 1, n.1, p.017-024, Espírito Santo do Pinhal, SP, 2004.
- [33] PATERNIANI, J. E. S.; ROSTON, D. M. Tecnologias para tratamento e reuso da água no meio rural. In: HAMADA, E. (Ed.) **Água, agricultura e meio ambiente no Estado de São Paulo:**
- [34] SHINZATO, M. C.; MONTANHEIRO, T. J.; JANASI, V. de A.; ANDRADE, S.; YAMAMOTO, J. K. **Remoção de Pb²⁺ e Cr³⁺ em solução por zeólitas naturais associadas a rochas eruptivas de Formação Serra Geral, Bacia Sedimentar do Paraná.** Revista Química Nova, Vol. 32, n. 8, p.1989-1994, São Paulo, SP, 2009.
- [35] SILVA, A. S. R. **Autogestão de sistemas rurais de abastecimento de água: estudo de caso na comunidade quilombola de Lagedo, São Francisco – MG.** Dissertação (Mestrado) - Programa de Pós-graduação em Saneamento, Meio Ambiente e Recursos Hídricos. Universidade Federal de Minas Gerais, Belo Horizonte, MG, 2016.
- [36] SISTEMA NACIONAL DE INFORMAÇÕES SOBRE SANEAMENTO – SNIS. **Painel do Setor Saneamento.** Site institucional, 2019. Disponível em: <http://snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-setor-saneamento>. Acesso em 2 mar. 2021.
- [37] SNIS – SISTEMA NACIONAL DE INFORMAÇÕES SOBRE SANEAMENTO. **Mapa de Indicadores: Acompanhamento da Coleta.** Brasil, 2019. Disponível em <http://appsnis.mdr.gov.br/indicadores/web/agua_esgoto/map-a-agua>. Acesso em 10 de fevereiro de 2021.
- [38] TUNDISI, J.G.; TUNDISI, T.M. **Impactos potenciais das alterações do Código Florestal nos recursos hídricos.** Biota Neotropica, v. 10, n. 4, p. 67-75. 2010.
- [39] VON SPERLING, M. **Introdução à qualidade das águas e ao tratamento de esgoto.** 3ª ed. Universidade Federal de Minas Gerais. Belo Horizonte, Brasil. p.452. 2005.

Social Isolation as Risk Factor of Stroke: Protocol for Systematic Review

Laura Flavorta Billong, Jiantong Shen, Garba Betchem

School of Nursing sciences, Huzhou University, Huzhou, China.

Received: 30 Sept 2021,

Received in revised form: 09 Nov 2021,

Accepted: 22 Nov 2021,

Available online: 30 Nov 2021

©2021 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— social isolation, social,
deprivation, stroke.

PROSPERO registration number:
CRD42021254102

Abstract— Introduction: The purpose of this study protocol is to provide the methodology of the review and to estimate the influence of social isolation on stroke incidence. The negative influence of psycho-social factors on the health of individuals has been discussed in several literatures⁷⁻¹³ but the mechanism of social isolation on stroke occurrence has been not clearly explained in the previous studies as a very high risk factor to fear. It's that why is very important to plan this systematic review in view to have a good understanding about the relationship existing between isolation and stroke occurs to have a good follow-up of this disease.

Methodology: A complete search of published studies will be conduct until May, 2021 using MEDLINE, Embase, PubMed, Science Direct and Springer. Prospective and retrospective studies to evaluate the influence of social isolation on stroke incidence. After eliminating copies, the eligible articles will be screened by researchers then extraction and evaluation of the quality data will be done independently. Any disputes will be solved by discussion or the arbitration of a third author.

Ethics: Moral consent is not intended for the study, as we will only collect data from published available articles. This paper will be conducted to a peer journal for publication after completion.

I. INTRODUCTION

Stroke also known as a cerebrovascular accident that occurs when the supply of blood to the brain is reduced or blocked completely. This chronic disability has a significant emotional and socio economic repercussion in the world^[12,3]. Moreover, it is also one of the main causes of death in China^[4]. Consequently stroke constitutes and remains a major public health issue, especially due the significant costs it generates for example in United States, every 30 seconds we have a new stroke, and every 5 minutes we record one death from stroke; the estimated cost of stroke in the United States is \$33 billion^[5]. Stroke affects the physical, cognitive and social functioning of humans^[6]. The primary prevention of this pathology in most cases is to

resumed lifestyle habits such as not smoking, eating a healthy diet, regularly physical activities. Social isolation is an irregularity of social support can be cause by health issues or loss of mobility.

The physical and mental health are linked and the negative health effects of social isolation range from insomnia to reduced immune function. Isolation is linked to very high rates of depression, suicide and anxiety. It is also associated with poor cognitive function. Nevertheless the poor influence of psycho-social factors on the health of individuals has been discussed in several literature^[7-13] and social isolation in particular has been demonstrated as a very high risk factor of stroke with a global rate of about 48% of cases and an underappreciated determinant of physical

health^[14-19]. Therefore, this factor should be given careful consideration and should be regarded the same way as other risk factors of stroke cited by WHO, 2011 (alcoholism, hypertension, hypercholesterolemia, diabetes, lack physical exercise, smoking).

Problem research: Current studies comprising of more than 600,000 participants established that socially isolated people have a 70% chance of being exposed to risk factors of stroke than people who have high levels of social support²⁰. Therefore social isolation contributes to the overall process of stroke in humans^[21]. Nonetheless, the underlying mechanisms in this regard are still unknown^[22]. Moreover, it is important to note that the harmful effects of social isolation can be modeled in humans and given that many "isolated" people are unidentified until they come to medical attention when a stroke occurs. Therefore, assessing the effects of social isolation on the occurrence of stroke is essential in translating efforts done in targeting social factors in stroke.

Seen from this perspective, the purpose of our study is to evaluate the link between social isolation and the incidence of stroke, which is recognized as one of the most frequent reasons of death in the world. We therefore showed a systematic analysis to answer the main **question**: what is the impact of the absence of social contact on the occurrence of strokes in the world?

The second goal is to identify the relationship between the absence of social interactions and the incidence of stroke and whether it varies by age, socioeconomic status and sex.

Why this review is important

The purpose of this study is to comprehensively examine social isolation as a potential risk factor of stroke. Identifying and understanding social isolation relation to stroke could allow future research to address specific risks and update potential studies to target stroke prevalence. Thus, this review not only takes a dimensional approach to include social isolation as a risk factor of stroke, but also includes age and gender difference.

Objectives

The primary aim of the systematic review is to determine whether people with socially isolated are at greater risk of a subsequent cerebrovascular event (stroke) than those socially active.

1. To examine risk factors linked to social isolation and incidence of stroke
2. To examine whether there is a significant effect of age, sex difference between social deprivation and incidence of stroke.

II. MATERIAL AND STATISTICAL ANALYSIS METHODS

2.1 Search Strategy

We will identify studies published through the articles of MEDLINE, Embase, PubMed, Science Direct and Springer (from the databases' until May, 2021). To capture relevant articles, the multiple search terms will be use, including: "lack of social relationship", "social skills", "social contact deprivation", "living alone", "social isolation" which will be cross with the terms such as "transient ischemic stroke", "cerebrovascular disease", "cardiovascular event", "intracranial hemorrhage", "isolation" "stroke", And we will use the following search strategy: (((((deprivation[Title/Abstract]) OR isolation[Title/Abstract]) OR exclusion[Title/Abstract])) OR lack of[Title/Abstract])) AND (((social support [Title/Abstract]) OR social contact [Title/Abstract] OR social interaction[Title/Abstract]) OR social intercourse[Title/Abstract]) OR social communication[Title/Abstract]) OR social skills[Title/Abstract])))) AND (((ischemic stroke[Title/Abstract] OR hemorrhagic stroke[Title/Abstract] OR all strokes[Title/Abstract] OR transient ischemic attack[Title/Abstract]) OR intracranial hemorrhage[Title/Abstract]) cardiovascular event OR cerebrovascular disease[Title/Abstract])))). In addition to this search approach, reference lists of all important analyses will be explored, and a reference search cited will be conducted using the Institute of Scientific Information's Web of Science. The search strategy will be developed after discussion among reviewers, according to the guidance of the Cochrane handbook. The indexes of all retrieved and relevant publications identified by the above strategies will be searched for further studies. To minimize accidental omissions, we will perform two searches of each database, with searches ending in May 2021. Second, we will look the references of previous reviews and studies that meet the inclusion criteria to find articles.

2.2. Selection criteria

Inclusion criteria: articles that studied the influence of social isolation in situations where people lived alone with a few group activity circle and/or a few physical contacts (structural isolation) or they were not interacting with the others by phone, internet as no call, no message, no email (functional isolation), presenting an incident of stroke as a result and had reported either odds ratios, relative risk or risk ratios with 95% of CIs. Case controlled studies, cohort studies, randomized controlled studies and controlled studies, correspondence with relevant clinical data, will be included for further review.

Exclusion criteria: ineligible studies will not be reported and the motives for exclusion will be documented. Additionally, repeated publications on the same subjects will also be excluded.

2.3. Study Selection and Data Extraction

We will import our search results into Mendley software before selecting. We will screen through two processes. In the primary phase, two investigators will independently browse identified articles' titles or abstracts or both, and full text to identify the potentially eligible ones. In the second phase, a third investigator will resolve any discrepancies till an eventual consensus is reached. This will be done according to the Cochrane book methods for Reviews²³, the extraction sheet will include information such as study design, interventions, method, conclusions, participants, sources of bias and outcomes. The PRISMA flow diagram will be shown in a flowchart (figure 1).

We will construct extraction tables in Microsoft software. Data from included papers will be drawn by two authors. Disputes will be decided by discussion with a third author. The data will be drawn according the categories: study designs, Main population, control/ comparator groups, and the investigated clinical outcomes. The liaison between social isolation and stroke incidence will be also included, measuring as odd ratio (OR) or hazard ratios (HRs).

Participant(s): Patients who have all kind of stroke (men or women) no sex restriction.

Investigation(s): Social isolation is a state when people withdraw and become disconnected from family, friends and community.

Control/Comparator(s): No restrictions will be made on the comparisons and/or control group

Outcome(s): The key outcome of the review is to identify published article describing indicators relevant to incidence of stroke.

Other important outcomes include stroke mortality and social isolation risks factors, as well as all other unintended effects of the stroke. We will prioritize those studies with a longitudinal study design that calculate effect estimates as either HRs or incidence rate ratios, but will also consider those studies that report ORs if it can be determined that subjects had not had a stroke event preceding the starting of study period.

2.4. Bias risk assessment

The bias risk assessment tool revised by the Cochrane Effective Practice and Organization of Care (EPOC) Group^[24]. Authors will independently assess the risk of bias in the included studies. Any discrepancies will be fixed through discussion or in consultation with a third reviewer.

We will evaluate individual studies to have 'low', 'unclear' or 'high' risk of bias. Low risk of bias is plausible bias unlikely to alter results, unclear risk of bias is plausible bias that raises some doubt about the results and high risk of bias is plausible bias that seriously weakens confidence in results.

For non-randomized controlled studies, we will judge the risk bias from seven aspects, and distinguish confusion bias, study participants, intervention classification, expected intervention bias and missing data. We summarize the overall deviation as "low", "medium" or "critical". We summarize the risks of bias in two tables to illustrate these findings. Differences will be resolved through discussions between authors or with third-party authors until consensus is reached.

2.5. Data synthesis

The effect of social isolation on the incidence of stroke will be included as relative risk (RR) without tuning of initial variables. If adjustments are made, we will use risk ratios (SSR) taking account the basic differences in the relevant prognostic variables. More specifically, these HRs will represent the pure effect of social isolation on morbidity or mortality. For both measurements, corresponding confidence intervals (CI) will be used to calculate the accuracy of the effect. The final results will appear in a table two by two, we will calculate the RR values separately. As a result, all odds ratios will be converted to RRs according to Yu & Wang approach²⁵. All analysis will be conducted using StataSE^[26], and the reported summary statistics will be calculated as random effect models based on the idea of heterogeneity between studies. The ICR will represent 95% ranges, which will indicate a significant effect when the values of 1.0 are excluded from the RR or HR values. HR or RR 1.0 values will indicate a social isolation effect on stroke development.

Heterogeneity between studies will be assessed by examining forest plots of study, calculating a chi² heterogeneity test, and statistics I²³. The chi² test value between studies will be heterogeneous if exists a statistically significance. In addition, higher I² values will indicate greater variability between studies which might be expected, due to the random threshold (0% to 100%)^[27] Proposed indicators of low-slung, moderate or high I² values of 20%, 40% and 70% heterogeneity. If possible, we will also perform a subgroup analyses for age, gender and social activity. The results of selected studies will be presented in tabular form, and the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach will be used to evaluate the quality of evidence^[28].

2.6. Subgroup and sensitivity analysis

If there is ample data available, subgroups analyses will be performed. These analyses will assess Age, sex, between the patients, stroke risk factors (obesity or overweight, physical inactivity, dietary factors), quality and risk of bias. We will also conduct a sensitivity analysis to determine the effect of

various factors, where applicable, and the degree of the effect. We will stratify analyses per journal status and level of risk of bias to decide if studies with high risk of bias affects the results.

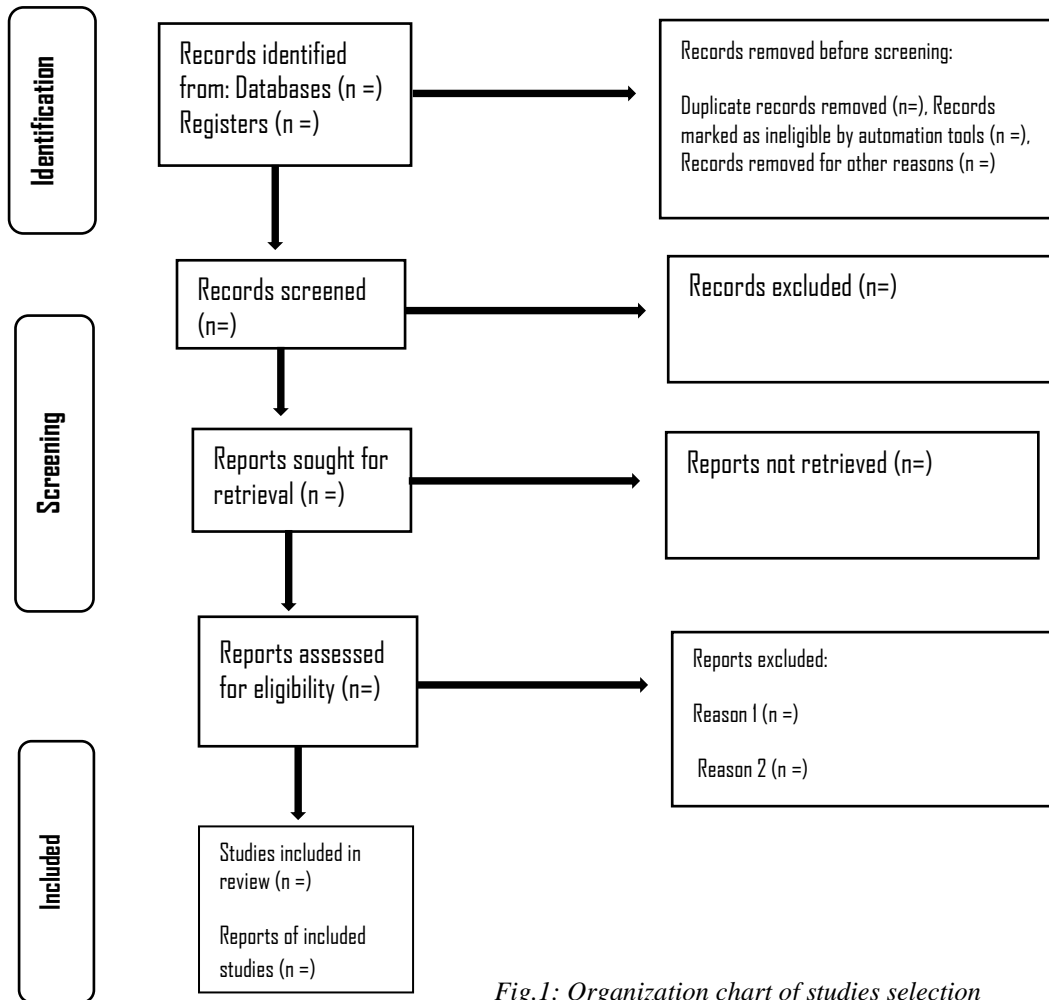


Fig.1: Organization chart of studies selection

Evaluating reporting bias

Given sufficient numbers of papers (more than 10), the funnel plots will be used to measure the probability of outcome reporting bias (publication) and a Begg's test for asymmetric tests. If, however this is not possible we will discuss the able bias sources across studies and bear this limitation in mind when drawing our conclusions.

Patient involvement

No patient is involved in the development of the plans for the project and the implementation of this study. They are not invited to give advice on reading the results. The final results will be disclosed through the author's publications.

III. DISCUSSION

The findings of this systematic review may influence future health policies for stroke prevention and management. By understanding all the risk factors that can contribute to the incidence of stroke worldwide, psychosocial factors such as social isolation could be re-examined and taken into account as one of the silent factors with serious consequences in order to increase relevance for better follow-up. As noted in the approach, most reviews of stroke risk factors were limited to factors such as: hypertension, obesity, chronic stress, poor diet, alcoholism, smoking, physical inactivity. Although these factors are recognized globally, this study will aim to capture data demonstrating the impact of social isolation in stroke occurrence.

However, there is still ambiguity about the implication of social isolation in the occurrence of strokes, as others have

presented it as one of the methods of post-stroke recovery. In view of this, despite the relevance of the strong evidence that positively associates it with the risk of many non-communicable diseases, it would be difficult to judge the role that social isolation plays on the incidence of stroke. It remains to be seen whether social isolation is really a factor in promoting stroke, but so far the answer is still controversial because there is not enough meta-analysis to discuss the questioning.

The study eligibility criteria included for this systematic review will ensure that global data on social isolation and stroke are captured. Currently, psychosocial factors and stroke prognosis are misunderstood, which may partly explain why interventions at this level are neglected. Clinicians tend to focus on education and communication interventions related to lifestyle (food hygiene, physical activities) public awareness campaigns. Current data on the psycho-social factor associated with stroke in this study may be of future input into evidence-based health policies. Therefore, it is very important to conduct this systematic review to shed light on the impact of social isolation on stroke development. Nevertheless, this systematic review will have some limitations. The medical databases in other languages (e.g., Dutch, Spanish, Korean and Japanese) will not be covered because of language barriers, so a language bias may exist. However, our goal is to summarize the published direct evidence and provide evidence-based suggestions for clinical use in stroke prevention.

AUTHOR CONTRIBUTIONS

BLF and JS carried on the conception and construction of this protocol. BLF developed the search strategy and wrote the protocol. BG added conceptual clarification. All authors read and approved the final manuscript.

IV. INSTITUTIONAL REVIEW BOARD STATEMENT

This study was conducted according to the guidelines of the Declaration of Huzhou University, and approved by the Institutional Review Board of PROSPERO (registration number: **CRD42021254102**, approved on 10 September 2021)

ACKNOWLEDGEMENTS

we acknowledge the support given by Huzhou University and Huzhou First Central Hospital for the writing of this work.

REFERENCES

- [1] Chtaou N, Bouchal S, Midaoui AE I., Souirti Z, Tachfouti N, Belahsen MF. Stroke Mimics: Experience of a Moroccan Stroke Unit. *J Stroke Cerebrovasc Dis.* February 2020;104651. doi:10.1016/J.JSTROKECEREBROVADIS.2020.104651
- [2] Savard J, Ouellet M-CBT-H of SD in MC, eds. Front-matter. In: Academic Press; 2019:i-iii. doi:https://doi.org/10.1016/B978-0-12-813014-8.00020-2
- [3] Sterr A, Ebajemito J. Stroke. *Handb Sleep Disord Med Cond.* January 2019;277-291. doi:10.1016/B978-0-12-813014-8.00012-3
- [4] Wang Y, Zhou L, Guo J, et al. Secular trends of stroke incidence and mortality in China, 1990 to 2016: The Global Burden of Disease Study 2016. *J Stroke Cerebrovasc Dis.* 2020;29(8):104959. doi:https://doi.org/10.1016/j.jstrokecerebrovasdis.2020.104959
- [5] Bresette LM. What Is Stroke Certification and Does It Matter? *Crit Care Nurs Clin North Am.* 2020;32(1):109-119. doi:10.1016/J.CNC.2019.11.002
- [6] Friedler B, Crapser J, McCullough L. One is the deadliest number: the detrimental effects of social isolation on cerebrovascular diseases and cognition. *Acta Neuropathol.* 2015;129(4):493-509. doi:10.1007/s00401-014-1377-9
- [7] Warren N, Ayton D. Loneliness as Social Suffering: Social Participation, Quality of Life, and Chronic Stroke BT - World Suffering and Quality of Life. In: Anderson RE, ed. Dordrecht: Springer Netherlands; 2015:159-170. doi:10.1007/978-94-017-9670-5_13
- [8] Leigh-Hunt N, Bagguley D, Bash K, et al. An overview of systematic reviews on the public health consequences of social isolation and loneliness. *Public Health.* 2017;152:157-171. doi:https://doi.org/10.1016/j.puhe.2017.07.035
- [9] Forsberg P-O, Ohlsson H, Sundquist K. Causal nature of neighborhood deprivation on individual risk of coronary heart disease or ischemic stroke: A prospective national Swedish co-relative control study in men and women. *Health Place.* 2018;50:1-5. doi:10.1016/J.HEALTHPLACE.2017.12.006
- [10] Mayor S. Insomnia may raise risk of MI and stroke, review finds. *BMJ.* 2017;357:j1647. doi:10.1136/bmj.j1647
- [11] Heidari Gorji MA, Fatahian A, Farsavian A. The impact of perceived and objective social isolation on hospital readmission in patients with heart failure: A systematic review and meta-analysis of observational studies. *Gen Hosp Psychiatry.* 2019;60:27-36. doi:10.1016/J.GENHOSPPSYCH.2019.07.002
- [12] Kim ES, Park N, Peterson C. Perceived neighborhood social cohesion and stroke. *Soc Sci Med.* 2013;97:49-55. doi:10.1016/J.SOCSCIMED.2013.08.001
- [13] Valtorta NK, Kanaan M, Gilbody S, Ronzi S, Hanratty B. Loneliness and social isolation as risk factors for coronary heart disease and stroke: systematic review and meta-analysis of longitudinal observational studies. *Heart.* 2016;102(13):1009 LP - 1016. doi:10.1136/heartjnl-2015-308790
- [14] Madsen TE, Roberts ET, Kuczynski H, Goldmann E, Parikh NS, Boden-Albala B. Gender, Social Networks, and Stroke Preparedness in the Stroke Warning Information and Faster

- Treatment Study. *J Stroke Cerebrovasc Dis.* 2017;26(12):2734-2741.
doi:10.1016/J.JSTROKECEREBROVASDIS.2017.06.046
- [15] Salinas J, Beiser A, Himali JJ, et al. Associations between social relationship measures, serum brain-derived neurotrophic factor, and risk of stroke and dementia. *Alzheimer's Dement Transl Res Clin Interv.* 2017;3(2):229-237. doi:10.1016/J.TRCL.2017.03.001
- [16] Uchino BN, Cronan S, Scott E, Landvatter J, Papadakis M. Social support and stress, depression, and cardiovascular disease. *Cardiovasc Implic Stress Depress.* January 2020:211-223. doi:10.1016/B978-0-12-815015-3.00009-X
- [17] Wise FM, Harris DW, Olver JH, Davis SM, Disler PB. Acute Predictors of Social Integration Following Mild Stroke. *J Stroke Cerebrovasc Dis.* 2018;27(4):1025-1032. doi:10.1016/J.JSTROKECEREBROVASDIS.2017.11.011
- [18] Bu F, Steptoe A, Fancourt D. Relationship between loneliness, social isolation and modifiable risk factors for cardiovascular disease: a latent class analysis. *J Epidemiol Community Health.* January 2021:jech-2020-215539. doi:10.1136/jech-2020-215539
- [19] Holt-Lunstad J, Steptoe A. Social Isolation: An Underappreciated Determinant of Physical Health. *Curr Opin Psychol.* 2021. doi:https://doi.org/10.1016/j.copsyc.2021.07.012
- [20] Stuller KA, Jarrett B, DeVries AC. Stress and social isolation increase vulnerability to stroke. *Exp Neurol.* 2012;233(1):3339. doi:10.1016/J.EXPNEUROL.2011.01.016
- [21] White CN, VanderDrift LE, Heffernan KS. Social isolation, cognitive decline, and cardiovascular disease risk. *Curr Opin Psychol.* 2015;5:18-23. doi:10.1016/J.COPSYC.2015.03.005
- [22] Venna VR, McCullough LD. Role of social factors on cell death, cerebral plasticity and recovery after stroke. *Metab Brain Dis.* 2015;30(2):497-506. doi:10.1007/s11011-014-9544-1
- [23] JPT H, Green S. *Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [Updated March 2011]*. The Cochrane Collaboration, 2011; 2011.
- [24] Timpel P, Oswald S, Schwarz PEH, Harst L. Mapping the Evidence on the Effectiveness of Telemedicine Interventions in Diabetes, Dyslipidemia, and Hypertension: An Umbrella Review of Systematic Reviews and Meta-Analyses. *J Med Internet Res.* 2020;22(3):e16791-e16791. doi:10.2196/16791
- [25] Yu B, Wang Z. Estimating relative risks for common outcome using PROC NLP. *Comput Methods Programs Biomed.* 2008;90(2):179-186. doi:https://doi.org/10.1016/j.cmpb.2007.12.010
- [26] Darren George, Mallery P. *IBM SPSS Statistics 25 Step by Step: A Simple Guide and Reference.* 15th ed.; 2018.
- [27] Shvedko A, Whittaker AC, Thompson JL, Greig CA. Physical activity interventions for treatment of social isolation, loneliness or low social support in older adults: A systematic review and meta-analysis of randomised controlled trials. *Psychol Sport Exerc.* 2018;34:128-137. doi:https://doi.org/10.1016/j.psychsport.2017.10.003
- [28] Group Grade Working. Grading of Recommendations Assessment, Development and Evaluation. Grade Working Group.

Statistics Education - Teacher Training in Investigative Classes

Angelo Ricardo Balduino¹, Albano Dias Pereira Filho¹, Cláudio de Sousa Galvão¹,
Cynthia Souza Oliveira², Raphael Fontes Cloux²

¹Department of Educational Sciences, Interamerican University, Paraguay

²Department of Mathematics Education, Federal Institute of Education, Science and Technology of Tocantins, Brazil

Received: 30 Sept 2021,

Received in revised form: 09 Nov 2021,

Accepted: 22 Nov 2021,

Available online: 30 Nov 2021

©2021 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— Continuing Education;
Statistical Education; Games; Investigative
activity.**

Abstract— This article is an experience report. The theoretical referential involves assumptions of Zeichner's (1993) and Imberón's (2004) continuing education, Schön's (1983) concepts of reflection and Shulman's professional knowledge, besides Ball, Phelps and Thames (2008) regarding the necessary knowledge for teaching in mathematics. The research, using a qualitative Design Research methodology, according to Cobb et al (2003), examines the contributions of a training to teacher professional development. The training was undertaken by us and focused on the teaching of probabilities through investigative lessons. The methodological procedures of data collection during the training, were by observations data production occurred from the interaction with the participants through the Classroom (<https://meet.google.com>), where we built graphs (histogram and the normal curve) in Excel spreadsheet, from the results of the sample space coming from <https://www.dados-online.pt/>. The collected data were analyzed by the content analysis method, according to Bardin (1979), considering the steps: pre-analysis, material exploration and treatment of results. Under the view of teaching by investigative activities, mathematics teachers participating in the formative process, reflected collectively on this methodology and discussed taking investigatively the concepts of sample space, randomness, probability definition, frequency distribution and Law of Large Numbers. This activity was entitled "PLAYING WITH THREE DATES".

I. INTRODUCTION

Teaching statistics through games, in a dynamic way, should be seen as a potential methodology, since students in basic education tend to disperse very easily, thus, games and play can help in this process, being initially attracted by the ludic activities.

The use of educational resources in teaching, if well used, emerges as an important tool in breaking the traditional model, since according to the National Curriculum Parameters (PCN), such resources serve to enrich the educational environment, providing an active,

critical and creative construction of knowledge by students and teachers. (BRASIL, 1998).

In this perspective, this research is configured as an investigation in Mathematics Education, particularly on aspects related to the use of games in the processes of teaching and learning statistics in Basic Education.

We understand that the action of investigating means to understand and seek solutions to the proposed problems and thus seek relationships, always trying to justify them.

We chose to work by means of teaching through investigative lessons, because we understand that it

enables the construction of concepts and knowledge to the learner, in order to lead him to, presume, experiment, prove, evaluate and present the results found.

For Fiorentini and Lorenzato (2006) the investigative lessons are those that mobilize and trigger, in classroom, tasks and open, exploratory and non-directive activities of the student's thought and that present multiple possibilities of alternative treatment and meaning.

Bona and Souza, (2015) highlight that the use of investigative class in teaching generates a so-called imbalance that is necessary to instigate the reasoning of the student, this imbalance occurs when the student is removed from the passivity of the classic classroom classes and becomes part of the action on the environment, on the objects, on the ideas with colleagues, and also experimentation, creation and solution of problems, observations, tests and research.

This paper seeks to highlight the importance of the participation of 20 mathematics teachers in a training course regarding their perceptions about their preparation to teach statistics in their classes.

In this sense, we sought with the development of online activities with the use of Excel spreadsheet, three data and a fictitious ballot, where they discussed the teaching of statistics with a proposal for an investigative class and created activities to lead students to build the concepts of mode, mean, median, average deviation and measures of dispersion.

Therefore, this is an experience report in which we reflect on the possibilities for teaching statistics in Basic Education through the game of dice and fictitious ballots, in an experience with 20 mathematics teachers inserted in a formative process.

The objective of the game was to enable the expansion of the professional knowledge of participating teachers about statistics in Basic Education, through games, as well as discuss and create essential activities according to the BNCC (2017) guidelines.

II. MATERIAL AND METHODS

The major research that subsidizes this article was developed with qualitative methodology of the Design Based Research type, according to Cobb et al (2003). This methodology is characterized by flexibility, for allowing modifications along the research route, based on feedback received from each teaching experiment developed, they are the re-designs, which allow correcting directions along the continuing education and research. The contributions of continuing education to the professional knowledge of teachers were analysed. The training

focused on the teaching of probabilities by investigative classes. The methodological procedures of data collection during training, were by observations data production occurred from the interaction with participants through the Classroom (<https://meet.google.com>), where we build graphs (histogram and normal curve) in Excel spreadsheet, from the results of the sample space coming from <https://www.dados-online.pt/>. The data collected were analyzed using the content analysis method, according to Bardin (1979), considering the stages: pre-analysis, material exploration and treatment of results.

The present investigation was developed with a group of 20 mathematics teachers of basic education. It is of a basic nature, with a qualitative approach. From the point of view of the objectives, it is an exploratory research.

According to Kauark, Manhães, & Medeiros (2010) basic research aims to generate new knowledge, useful for the advancement of science without expected practical application.

We classified this research as to its approach and objectives, according to Gil (2010), as qualitative of exploratory nature, the author states that exploratory research enables: approach the researcher to the subject and object of study; build important questions for the research; provide an overview about a certain fact or problem; deepen preliminary concepts on a given subject; identify a new aspect on the subject researched.

2.1 - The Activity: Three Dice and Dummy Ballots

The following is an account of the episode with the teachers in which the activity was discussed.

We asked the participants to play on the <https://www.dados-online.pt/> page and let us know the results of the sum of the three dice. We entered the results into a frequency distribution table in an Excel spreadsheet.

We showed them that the game can be adapted for face-to-face activities, so that it can be divided into teams, each of them with sets A or B, made up of the numbers $A = \{2, 4, 5, 8, 10, 11\}$, $B = \{1, 3, 6, 7, 9, 12\}$. If it is two dice and if it is a game with three dice, the sets must be evaluated in order to evaluate the number of possibilities of sum.

We explain the notes of a dummy coin (relas), according to the model in figure 1, with notes from 2 to 18. The banknotes are optional, but they add dynamics to the game and can be adapted for primary schools activities, since they allow the four operations to be worked on, among others.



Fig. 1: Some of the dummy banknotes and activity data.

We explained that the numbers within the sets were the possibilities of the results of the sums of the dice rolled from 1 to 6.

We explained that, in each round of the game, the team would be considered the winner if the sum of the dice equaled any of the numbers in its respective set. The team that wins the round keeps the ballot with the corresponding value in its bank. For example: If I choose set B and in a certain round, one dice shows the number 3 and the other the number 6, their sum is 9.

Although we knew that we would never have sums greater than 12 on the roll of two dice, the notes were purposely made from 2 to 18, so that notes 2 to 12 could be distributed to groups, and so that at some point one of them would be missing from the groups. Grades 2 to 18 were discussed later in the three-dice game we will present.

The results of the sums were fed into an Excel spreadsheet, and a histogram with their respective frequencies appeared on the board. Thus, we started with the teachers a moment of reflection with fictitious ballots about which contents of statistics and which grades could be worked on.

III. RESULTS AND DISCUSSION

In this episode, through the experience of the investigative activity of the game of three dice, the teachers participating in the training process had the opportunity to develop an experiment that caused an unbalanced situation regarding the expectation of results.

We presented to the participants the possibilities of the sum of three dice observing the regularity of table 1. The numbers 1, 2,...6 in row 1 are the faces of the dice and then the possibilities that they have in the roll of three dice.

Soma	1	2	3	4	5	6	Possibilidades
3	1						1
4	2	1					3
5	3	2	1				6
6	4	3	2	1			10
7	5	4	3	2	1		15
8	6	5	4	3	2	1	21
9	5	6	5	4	3	2	25
10	4	5	6	5	4	3	27
11	3	4	5	6	5	4	27
12	2	3	4	5	6	5	25
13	1	2	3	4	5	6	21
14		1	2	3	4	5	15
15			1	2	3	4	10
16				1	2	3	6
17					1	2	3
18						1	1

Table 1 - Regularity of posting possibility.

Figure 2 shows the results of 500 throws of three dice, carried out using <https://www.dados-online.pt/>. The sums 10 and 11, had a higher frequency and the extremities with much lower frequencies, although they are random events, these results, receive influence by the smaller possibilities.

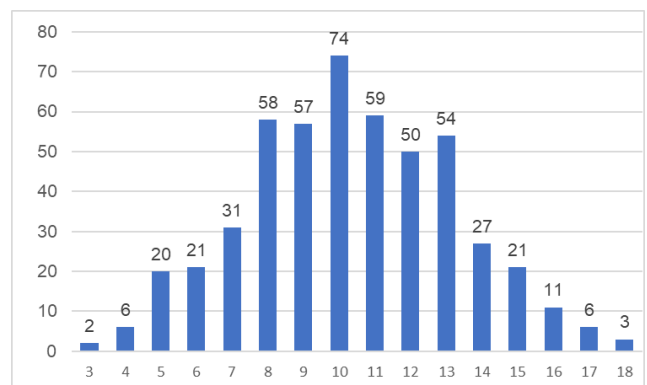


Fig. 2: Result of 500 throws of three dice.

We present in table 1 below the result of 1000 entries.

Lances	Dado 1	Dado 2	Dado 3	Soma	Soma	F	%
1	4	4	4	12	3	1	0,1
2	5	1	6	12	4	15	1,5
3	1	3	3	7	5	37	3,7
4	2	4	3	9	6	41	4,1
5	4	4	4	12	7	66	6,6
6	6	1	2	9	8	99	9,9
7	4	6	6	16	9	116	11,6
8	1	3	4	8	10	130	13
9	4	6	3	13	11	135	13,5
10	4	5	1	10	12	107	10,7
11	4	2	1	7	13	109	10,9
12	6	5	1	12	14	58	5,8
13	6	3	5	14	15	46	4,6
14	5	2	6	13	16	25	2,5
15	6	4	6	16	17	13	1,3
16	1	3	3	7	18	2	0,2
17	1	1	3	5	Total	1000	100
18	6	6	1	13			
19	6	6	5	17			

Table 2 - Result of 1000 throws of three dice.

We can observe in figure 3 that the central part has close frequencies, we explain that this phenomenon should be used to address the law of large numbers. The extremities continue with a lower frequency, even with the increase of launches, the sums 10 and 11 that are part of the central position and have a high number of possibilities, continue with a relatively high frequency.

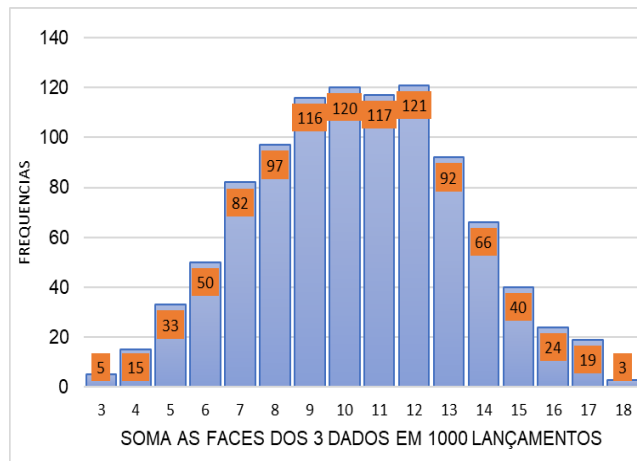


Fig. 3: Sum of the faces of 3 dice in 1000 throws.

In figure 4, we take the opportunity to address concepts of the normal distribution, including the possibility of discussing this subject with high school students.

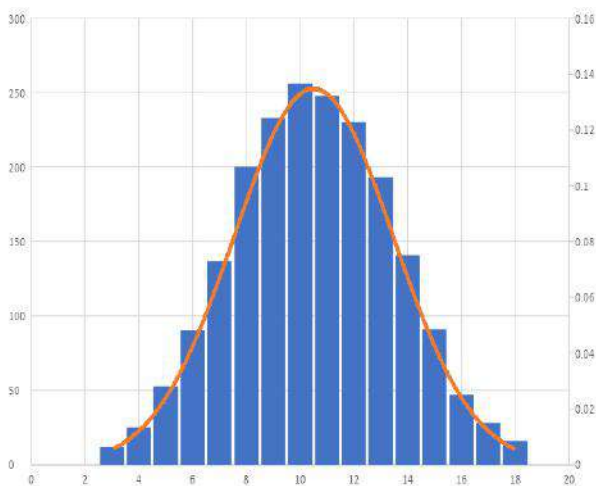


Fig. 4: Normal Distribution

We consider that the proposed activity provided the production of meanings about investigative activities, promoted reflections on aspects inherent to teamwork, also on the importance of continuing education, as well as on methodology for statistics teaching. The reflections were focused on the importance of teaching focused on the participation of students as active agents in the construction of concepts and appropriation of definitions.

IV. CONCLUSION

At the end of the meeting, it was evident that participation in the training could expand the teachers' professional knowledge about statistics, as well as an opportunity for reflection on their practices (didactics) in class, providing the opportunity to insert investigative lessons to address the concepts of statistics.

Teachers pointed out that it could be worked in a way to adapt games, but with respect to statics, we could work in Basic Education:

- Identify, in familiar random events, all possible outcomes, estimating those with higher or lower chances of occurrence;
- Promote the understanding that not all phenomena are deterministic;
- Organise the data collected using lists, simple tables;
- Counting;
- Luck x chance (Probability);
- Measures of central tendency and dispersion.

REFERENCES

- [1] Bardin, L. (1979), Content analysis, 1st ed, vol. 1. Lisboa: Edition 70, pp.262-288.
- [2] Bona, A. S., & Souza, M. T. (2015). Investigative classes and the construction of mathematics concepts: a study based on Piaget's theory. Psychology USP, São Paulo, SP.
- [3] BRASIL (11 May 2018). Base Nacional Comum Curricular (BNCC). Education is the Base. Brasília, DF. Brazil. Accessed on 28 October 2021, available at: http://basenacionalcomum.mec.gov.br/images/BNCC_EI_E_F_110518_versaofinal_site.pdf.
- [4] BRASIL (15 Jun 1988). Parecer n° 15 de 2 de Junho de 1998. National Curricular Guidelines for Secondary Education. Diário Oficial da União, 26 jun. 1998. Brasília, DF. BRAZIL. Accessed on 30 October 2021, available at: <http://www.educacao.go.gov.br/educacao/ensino/medio/documentos/15.pdf>.
- [5] Cobb, P. Confrey, J. Disessa, A. Lehrer, R. Schauble, L (2003). Design Experiment in education research. Educational Researcher, v.32, n.1, pp. 9-13.
- [6] D'ambrosio, U (1998). Mathematics and mathematical Education: The Problem of Convergence IV Mathematics Education Meeting / SBEM-ES, Vitória, ES. Brazil. November 21, 1998. Available at: <http://sites.uol.com.br/vello/ubi.htm>
- [7] Fiorentini, D. Lorenzato, S. A. (2006). Research in mathematics education: theoretical and methodological paths. Campinas, SP. Brazil: Associated Authors.
- [8] Gil, A. C (2010). How to design research projects. 5rd. São Paulo, SP. Atlas.
- [9] Kauark, F. Manhães, F. C. Medeiros, C. H (2010). Research methodology: a practical guide. Itabuna. Ed. Via Litterarum.

The essence of the world as an experience of aesthetic contemplation in Arthur Schopenhauer

Luciano da Silva Façanha¹, Klisman Lucas de Sousa Castro²

¹Professor Doutor do Programa de Pós-Graduação em Cultura e Sociedade e do Departamento de Filçsofia da Universidade Federal do Maranhão. São Luís – MA, Brasil.

²Professor de Filosofia. Mestre em Cultura e Sociedade pelo Programa de Pós-Graduação em Cultura e Sociedade da Universidade Federal do Maranhão. Membro do GEPI Rousseau UFMA/FAPEMA/CNPq. São Luís – MA, Brasil.

Received: 29 Sept 2021,

Received in revised form: 06 Nov 2021,

Accepted: 21 Nov 2021,

Available online: 30 Nov 2021

©2021 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— Schopenhauer, Will,
Impersonation, Aesthetics, Idea.

Abstract— This article analyzes the constitution of the metaphysics of the beautiful in the philosophy of Arthur Schopenhauer present in the book *The world as will and as representation*. Therefore, an exposition of the theoretical foundations of the metaphysics of the Will is made, and then the steps that comprise all the pessimism characteristic of the author's thought are examined, and thus understand how these contribute to the composition of aesthetic contemplation. Thus, a bibliographical research on the theme will be carried out, aiming to understand how these conceptions contribute to the aesthetic experience, analyzing the main concepts and particularities of the ideas of the German philosopher.

I. INTRODUCTION

Aesthetics is the area of philosophy that develops appreciation for beauty and how we perceive it. Historically, we see that in the eighteenth century was introduced into philosophy by Alexander Gottlieb Baumgarten as a discipline. In the previous sense, it is possible to observe that works such as Cicero's *Rhetoric*, Horace's *Poetic Art* and Aristotle's *Poetics* are inscribed in the field of aesthetics even before the word, because they set rules of production. In the nineteenth century, under the voice of Arthur Schopenhauer's philosophy, the meaning of the discipline gains another contour and as a definition, escapes any determined effect, refusing any idea of duty. This conception is founded by the *Will*, the essence of the world. In other words, the problem of aesthetics in the nineteenth century, being deciphered by the German philosopher consists in the definition that the beautiful depends on the certainty of a knowledge, being intuitive and that it can not be satisfied with the concept of perfection.

Thus, the problem of the foundation of Schopenhauerian aesthetics in this study will deal with the meaning mentioned above: the definition of *Will*, on the one hand, to understand which aspect of the essential nature of the world comes from the pain and suffering inherent to the subject. And in another perspective, understand what motivates us to act to escape such a condition and to what theoretical alternative we can turn. These two references are gathered in Schopenhauer's approach, located in his work par excellence *The world as will and as a representation* of 1819. Most of our interest will be focused on the debate between the *Will* as the essence of the world and art as a temporary satisfaction of man's suffering, which is influenced by platonic *ideas* in contemplative aesthetics. Thus, the knowledge of its metaphysical system is assumed. Therefore, we will refer, whenever necessary, to Schopenhauer's epistemic and metaphysical ideas that will be useful for understanding the metaphysics of the beautiful.

The presentation dedicated to the exposure of Schopenhauer's aesthetic thought was developed taking

into account some methodological assumptions that should be noted. The understanding of the meaning of the metaphysics of beauty cannot be obtained without the recognition of the metaphysics of the *Will*, that is, the proposal of contemplation of art is based on the unique and true essence present in all its philosophy. Our reading of the introduction of the metaphysics of the beautiful will seek to follow this methodological orientation of taking art as part of a broader system.

Moreover, it is important that we recognize that platonic *ideas* serve as a backdrop for the foundation of Schopenhauer's aesthetic theory, elevated to a state of knowledge of the world that from the philosopher's perspective competed with the sciences and surpassed them, taking into account satisfaction, as well as the metaphysical joy it provides. Finally, the objectification of the *Will* as a means of pure intuition for the fine arts and their various degrees of knowledge, accentuating music as independent art and having immediate access to this principle, not making concessions to *idea* for this. Therefore, the focus of this research is on Schopenhauer's aesthetic contemplation, because with this establishes another form of world knowledge, in addition to what was established by the philosophical tradition, always emphasizing the true essence of life, the *Will*.

II. THE METAPHYSICS OF THE WILL

To talk about Schopenhauer's aesthetics, we must first address the main concepts developed by the philosopher in his main work: *The world as a will and as a representation*. Published in 1819, the production has as its greatest merit to spark a discussion about the irrational and unconscious. A clear answer is the rationalist tradition of Western philosophy, which gained strength in the eighteenth century with the Transcendental Idealism of Immanuel Kant and with the advent of German Idealism¹, under the voice of the ideas of so-called systematic idealistic philosophers: Fichte, Schelling and Hegel. As Lefranc (2005, p. 20) points out, "Schopenhauer's philosophy is consciously and explicitly a philosophy of artist, writer, a philosophy that seeks to break with the specialized language of the great teachers of idealism". That said, it is important to emphasize that the background of the philosophy of the author of Dantzig is metaphysical pessimism, and from this understanding we will observe a distinct direction throughout his line of thought.

¹ German Idealism arose from Romanticism, which raised the overcoming of the Enlightenment. In addition, originated in the post-Kantian period in Fichte, Schelling and had its continuity with Hegel. Such a philosophy was a transcendental, subjective and absolute denomination.

In the first tome of the book *The world as a will and as a representation*, Schopenhauer presents bluntly the maxim that will characterize his entire philosophy, as we see in the following passage:

'The world is my representation': - this is a truth that is valid in relation to every being who lives and knows, although only the human being can bring it to the reflected and abstract consciousness: and indeed it does, then philosophical clairvoyance arises in it. It becomes clear and certain to him that he knows no sun or any Earth, but always only an eye that sees a Sun, a hand that touches the earth; that the world around him exists only as a representation, that is, only in relation to others, the one who represents himself (SCHOPENHAUER, 2015, p. 3).

A priori, it is emphasized that representation indicates something placed (*Stellung*) before (*Vor*). This presupposes a subject who intuit. We can understand, then, what representation is the world, the starting point of our perceptual acts. It is corresponding to the Kantian phenomenon, being subjected to three conditions: space, time and causality. All dependent on understanding and grouped from the *principle of sufficient reason*. Thus, "[...] what exists for knowledge, therefore for the whole world, is only an object in relation to the subject, intuition of those who intuit, in a word, representation" (SCHOPENHAUER, 2015, p.3). As Barboza (2003, p. 10) approaches, "from data from abroad, understanding, so to speak, manufactures objects, as if it were a craftsman, when considering this data an effect, from which it seeks its cause and, in it, places it in space as a figure". In this sense, the consideration developed by Schopenhauer is that all existing objects even the body itself are representations.

On the other hand, to clarify what abstraction is, Schopenhauer complements the world as a representation through the *Will*, which corresponds to another prism of his philosophy. According to his words: "[...] what is exposed as representation both in their actions and in their permanent substrate, the body, is the Will, which constitutes the most immediate of our consciousness" (SCHOPENHAUER, 2015, p.128). Of course, we are dealing with what Kant called *thin-in-itself*, and precisely by this circumstance that led Schopenhauer to call himself the continuer of his work².

² In his main appendix, in the appendix dedicated to the critique of Kantian philosophy, Schopenhauer says: "People begin to realize that true and serious philosophy is still there where Kant left it. In any case, I do not recognize that something has happened in philosophy between him and me: therefore, I immediately connect with him" (SCHOPENHAUER, 2015, p. 483).

That said, it is understood that the *Will* is the fundamental instance of Schopenhauer's thought, as we will see in the following excerpt, it establishes a legitimate role of protagonism to the concept, envisioning it in all aspects of life:

You will recognize the same will as the most intimate essence not only of appearances entirely similar to yours, that is, humans and animals, but continued reflection will lead you to recognize that also the force that vegetate and guess in the plant, yes, the force that forms the crystal, which rotates the magnetic needle to the north pole, which erupts from the shock of two heterogeneous metals, which appears in the elective affinities of materials such as attraction and repulsion, yes, the very gravity that acts powerfully in all matter, attracting the stone to the earth and the Earth to the Sun, - all this is different only in appearance, but according to its essence itself and to recognize itself as it known immediately in such an intimate and better way than anything else and that, where it appears more clearly, it's called Will. (SCHOPENHAUER, 2015, p. 128).

Thus, the author's demonstration illustrates the strength that the concept holds within in the nature of life. In view of this, it is important to emphasize that appearance is representation, whatever, on the other hand, the Kantian concept called *thing-in-itself* is the *Will*, the core of each particular, as well as of the whole, and that is exactly why it acquires a cosmological status. This is because it appears in every force of nature that takes effect blindly, in this regard Safransky (2012) comments that the Being that Schopenhauer discovered was a (*Blinder Wille*), vital and opaque, and did not nod to common sense, much less presented the slightest design, the Being simply is. With the *Will*, Schopenhauer surpassed the figures of the ancient metaphysics, because it goes in opposition to the philosophical tradition from Plato to Descartes, who intended to achieve a transcendent reality through a cognitive instance. The Schopenhauerian metaphysics, on the contrary, penetrates into the heart of the experience to reach its innermost core, because it is necessary to understand the knowledge that each has of his or her will. Finally, we can understand that the *Will* has a status as the central nucleus of life, is the essence of the world and has three fundamental characteristics: unity, ungroundability and unknowability.

In view of this, we will see how in particular aspects in schopenhauerian aesthetics the *Will* takes the path of pessimism coming from wanting to live present in ideas.

III. METAPHYSICAL PESSIMISMO

In the previous section, we indicate the main concepts worked by Schopenhauer in his main work, and which, as we know, guide all his thinking throughout his life. From this, we need to present ideas that are fundamental to his aesthetic theory. It is worth mentioning that the *Will* and Representation as we have seen has its own characteristics, the first because it is entirely free, and the second in turn is governed by necessity, that is, each object presented as a phenomenon is absolutely necessary, rejecting the possibility of freedom in the field of representation. Of this, the particular pessimism of the German philosopher is the starting point for understanding that the metaphysical dimension is directed by ends, producing a series of objects of desire and needs. As Dalcol (2014, p.31) points out, "Thus, we are inserted in this mode of existence, marked daily by the search and satisfaction of our desires". This is determined by the lack, that is, lack. In this regard Jair Barboza, comments that:

[...] even if the desires being satisfied, against each one who was there are at least ten who are not: when a desire is satisfied, soon a new one takes its place. Satisfied desire is a known error and the new, an error still unknown. There is no lasting satisfaction, but each resembles the alms giving that is given today to the beggar, making his life less miserable, yet prologando his torment tomorrow. Nothing makes the person effectively happy. Pleasure is only a momentary end of pain (BARBOZA, 2003, p.14).

Taking these aspects into account, we can affirm that selfishness is inherent to the *Will*, conditioned by wanting to live, and feeds the ends to be pursued. According to Redyson (2009, p.50), "Schopenhauer's concept of "want-to-live" seems to fit into an "ontology of annihilation" of beings. According to these indications, it would be to consider a counterposition between metaphysics and human finitude that would actually be found". Thus, if desires are not satisfied, boredom arises, if they take time, the distressing need follows. There is no state of perfection or stillness. The *Will* being insatiable, presents a movement of infinity, suffering, thus, is continuous. It is also subordinated to selfishness personified by individualism. Therefore, we can understand that our receptivity to pain is almost infinite, but it does not occur the same with our openness to pleasure, because the subject is surrounded by a mesh of limits. Thus, we see that schopenhauerian philosophy is

drawn by a metaphysic pessimism³, based on the will of the *Will*, being immanent.

However, dantzig's thinker in search of a state that could achieve momentary satisfaction and move away from the pain caused by incessant wanting, resorts to aesthetic contemplation, since such a state is defined as that of intuition of undying archetypes of things, the same *Ideas* exposed in nature as a species. Given the above, we will highlight the particular aspects of the metaphysics of the beautiful in the following topic.

IV. METAPHYSICS OF THE BEAUTIFUL

As discussed earlier, Schopenhauer's entire philosophy is developed based on the work *The world as will and as representation*. Taking into account this aspect, the metaphysics of the beautiful, in the III book of this manuscript, characterizes aesthetic contemplation as a high state of knowledge of the world, which overcomes and competes with the sciences, taking into account the satisfaction and metaphysical joy. That said, we can say that schopenhauerian aesthetics has an emphasis on contemplating *Ideas*⁴ as a fundamental condition of artistic activity. It is worth mentioning that in this instance the objectification of the Will is important, as the German philosopher comments: "[...] we name the world seen as a representation, both in its whole and in its parts, OBJECTIVITY OF THE WILL, that is, the will that became an object, that is, that became representation" (SCHOPENHAUER, 2015, p. 195). When analyzing this instance, we see that the objectification of the Will has specific degrees and in essence appears in the representation, with clarity and perfection, and exposes itself as an object.

It can be affirmed that because of this, the object occurs in itself and by itself as an objectified *Will*, being this natural or made by the human hand. According to Lefranc (2005), in the experience of beauty, it is so much said that the object is seized as an idea or that it exists freely in itself. On the other hand, we see Plato's influence on Schopenhauer's aesthetic conception, because when it comes to the degrees of objectification these are given through the *Idea*, due to the immutability, forms and properties originating from both organic and inorganic

bodies. Thus, in line with what the philosopher of antiquity conceived, it is understood that in all Ideas there are countless individuals and singular appearances, reproduced as copies, simulacrum present in the sensitive world. It is also pertinent to comment that the plurality of these individuals can only be represented through time, space and causality, contained in the principle of reason. But it is worth mentioning that "[...] the Idea, on the contrary, does not submit to this principle, therefore it does not fit plurality or change" (SCHOPENHAUER, 2015, p. 196). Therefore, it remains unchanged, and resides completely outside the sphere of knowledge of the individual, is unique. What is unique, and it is up to the subject belongs to the *principle of individuation*, which comprises two thirds of the *principle of sufficient reason*, that is, time and space. That is exactly why, what is one and similar in essence and in its concept appears to us as different, both in coexistence and in succession.

Art is a mode of knowledge that considers the essential and remains in the world, is independent and external to any relationship. Therefore, it is the true content of phenomena not subjected to change, known through *Ideas*, objectified and immediate of the *thing-in-itself*, that is, the *Will*, is the work of genius. In addition to this aspect, it reproduces the Ideas conceived by pure contemplation, and going according to this matter of reproduction can be plastic art, poetry or music. For this reason, Schopenhauer comments that in this contrary to science there is a pure satisfaction, as we see in the following passage:

Science follows the endless and unceasing torrent of the various forms of foundation and consequence: with each end achieved it is again thrown further, never being able to find an end goal or a complete satisfaction, in the same way as one cannot, running, // reach the point where the clouds touch the horizon line; art, on the contrary, finds everywhere its end (SCHOPENHAUER, 2015, p. 213).

From this consideration we can understand that the *Idea* is independent of the *principle of reason*. Thus, the brilliant mode of consideration for its characteristic of pure contemplation escapes this principle, is what is worth and helps in art. It should also be noted that the essence of genius consists in the outstanding capacity for such artistic abstraction. The justification for this lies in the fact that only he is capable of a complete forgetfulness of the person himself and his relationships. This means that genius is more perfect objectivity, ability to proceed in a purely intuitive way, while being lost in intuition, leaves aside one's own interest, want and ends, that is, leaves knowledge originated by the *Will*.

³ Thomas Mann, a German novelist, argues that Schopenhauer was at the same time the philosopher of will and pessimism, for the two things are one, so he says: "If we see it as the opposite of beata satisfaction, the will is in itself a fundamental unhappiness: it is dissatisfaction, effort in view of something, intelligence, burning sea, greed, desire, *suffering*, and a world of will can be nothing but the world of suffering" (MANN, 2015, p. 8).

⁴ Schopenhauer's thesis aims to bring together the Platonic Idea and the Kantian thing-in-si.

As a result, the personality moves away for a while, leaving only the pure subject he knows. According to Barboza (1997), for genius to enter the scene in an individual a degree of faculty of knowledge goes beyond the servitude of the *Will*, becoming free. Therefore, the subject becomes a purification of the *Will*, mirror of the essence of the world. Thus, we see that the theory of genius in Schopenhauer is the means by which art receives its metaphysical meaning beyond the satisfaction of desires. All men, to some degree, are able to recognize their *Ideas* in things, and thereby renounce their personality for a moment. Genius, therefore, has the advantage of the much higher degree and the longer duration of that way of knowledge, has the ability to reproduce and as we note the art is in definition the ability to reproduce.

Because of this aspect, we can approach the hierarchies of art. For, when remembering aesthetic intuition, that is, when genius produces a work, it does so through the *Idea*. And as we know, art is an exhibition of *Ideas*, a reminder of what exists in the intelligible world. This means that "[...] this exhibition implies reference to the degrees of objectification of the will, there is a hierarchy of arts corresponding to the hierarchy of Ideas" (BARBOZA, 2003, p. 15). Therefore, it should be emphasized that this order does not concern the same arts, but rather the theme they present. Given this, we will see how they rank.

The architecture corresponds to gravity, cohesion, resistance, hardness of materials, reaction against light, and is incorporated in schopenhauerian aesthetics because it presents in the constructions the most elementary ideas of objectification of the *Will*. Then we have gardening and landscape painting, both working with *ideas* in the plant kingdom. Later comes the sculpture and painting of animals, thus being surpassed by the sculptures and paintings of men. Of this, in a privileged place is poetry, because it comprises the exhibition of the *Idea* in which the *Will* reaches its highest objectification. As the German philosopher describes in the following passage:

Ideas are essentially intuitive: if, however, in poetry only abstract concepts are communicated immediately by words, it is, however, clear that the intention is, through the representatives of these concepts, to allow the listener to intuit the Ideas of life, which is only possible with the help of fantasy itself (SCHOPENHAUER, 2015, p. 280).

Poetry is thus the art that allows the materialization of imagination through the word. It is the manifestation of the *Idea* corresponding to the higher degree of objectivity of the *Will*, the exposure of human beings in the concatenated series of their efforts and actions. Still in this

sense, it is worth mentioning that Schopenhauer gives the genre of tragedy⁵ the privilege of being the most perfect and rich art, since it presents an element of existential pessimism, that is, it approaches what it means by *Will*. This aspect is corroborated in the following passage: "The only essence of tragedy is the exposition of great unhappiness" (SCHOPENHAUER, 2015, p. 294). Given the above, we will then approach music, which occupies a privileged place among all fine arts.

V. MUSIC: ART PAR EXCELLENCE

Arthur Schopenhauer separates the music of the other arts, the reason for this is due to the fact that in it we do not find copy or repetition of some *Idea* of beings in the world. It conceives it, thus, as high and majestic art. Which leads him to argue that this is capable of making the most powerful aesthetic effect on the most intimate of the human being. So, that considers it as a universal language, whose clarity surpasses even the intuitive world. Jair Barboza (2003) comments that music produces all degrees of objectification of the *Will*, and that is exactly why Schopenhauer deals with the effect it is producing in a serious and profound way. For, musical art has the intimate essence of the world and of ourselves. Thus, as the German thinker establishes:

From the analogy with the other arts we can conclude that music, in a way, has to be for the world as the exhibition for the above, the copy to the model, because its effect is in the whole similar to that of the other arts, but more vigorous, faster, more necessary and infallible. Also its copying relationship with the world has to be quite intimate, infinitely true and precise, since it is understood instantly by anyone and makes known a certain infallibility in the fact that its form is subject to certain rules expressed in numbers, from which it can not deviate completely from being music (SCHOPENHAUER, 2015, 297).

Thus, Schopenhauer's understanding of music is an art that has the privilege of overcoming Ideas, it is completely independent of the apparent world, for this reason it understands that "[...] it could to some extent

⁵ Schopenhauer three genres of tragedy employed by the poet: what occurs through extraordinary wickedness that touches the extreme limits of possibility, attributed to a single being, examples: Richard III, Iago in Othello, Shylok in the Marker of Venice, Fedra of Euripides, Creon in Antigone. The unhappiness produced by blind destiny, that is, chance and error, for example: Oedipus King of Sophocles, between the modern Romeo and Juliet, Tancredo de Voltaire. And finally, the mere mutual disposition of people, by the combination of their reciprocal relations. That is, it originates easily and by itself from human actions and characters.

exist even if the world did not exist – something it could not say of other arts" (SCHOPENHAUER, 2015, p. 298). In understanding this conception, the important thing to fix is that such art is an immediate objectification and copy of all *will*, mirroring the world as it is, as well as ideas. Therefore, music is a copy of the *Will*, because of this, the effect it has is more powerful and penetrating, because it speaks of the essence of the world.

It is of fundamental importance to understand the reference of music as the true essence of things because the melody refers to an action, event and environment. And this means that, it reveals to us the most secret meaning of ourselves, directly affects the inner life. Thus, it transports us to a level of immersion in which we see in front of us all the possible events of life and the world, because it exposes to every physicist the metaphysical, for all appearance the *thing-in-itself*. In this way, it is through music that we see the intimate essence, the in itself of every appearance, the *Will* as it is. This aspect is pertinent to Schopenhauer, because musical art does not express this or that particular feeling, but the feelings themselves, as highlighted in the following passage:

Music expresses, therefore, // is not either that particular and determined joy, this or that affliction, or pain, or astonishment, or rejoicing, or rejoicing, or tranquility of spirit, but themselves, that is, joy, affliction, pain, astonishment, joy, rejoicing, tranquility of spirit, to some extent in abstract, the essential of them, without accessories, so also without your motives. And yet we fully understand it in this purified quintessence (SCHOPENHAUER, 2015, p. 302).

For this reason, the art of tones raises and awakens fantasy so easily. On another circumstance, we see that Schopenhauer confers the symphony a more dignified expression than that of the opera, because it makes music a mere means of the expression of words, whereas because it is instrumental, as well as the concert and sonatas, the symphony occupies an essentially intimate and free space in the world. Only a few geniuses, such as Mozart and Rossini, succeeded in the German thinker's vision to overcome obstacles imposed by the other arts in music, not to sing were his preferences in the art of melody. Therefore, from what had been exposed, we see that aesthetic knowledge is intuitive when it comes to *Ideas*, and non-intuitive immediacy when it comes to music, in other words, provides a disinterested pleasure and maintains with the world a relationship of representation.

However, it is important to mention that this knowledge of aesthetic life, does not provide the pain relief inherent in our reality, it is an occasional consolation. Moreover, according to Schopenhauer, ethical

life is clarified by compassion and quietism, recurrent from the influence of Eastern philosophy, are steps where the individual can eliminate the *will's* desire altogether by reaching the stage of nirvana.

VI. CONCLUSION

As can be seen, in the eighteenth century we owe the invention of Aesthetics as a recognized and autonomous philosophical discipline. As Matos (2001, p. 66) states, "Until then, poetry, painting, sculpture, music were thought of in different domains of knowledge, but from that moment on, all arts began to be examined from a synthetic perspective". Thus, these were incorporated into the same principle. And in the case of Schopenhauerian thought, built on the metaphysics of the *Will*.

Thus, we begin this work by presenting the foundation of the metaphysics of Arthur Schopenhauer's *Will*. This demonstration, as we affirm, involves the author's entire thought structure and how we expose it, directly linked to metaphysical pessimism. He states that, from the point of view of nature, aesthetics is linked to the eternal *Ideas* present in the essence of the world, and as copies, are exposed as phenomena. In other words, they are subjected to the objectification of the *Will*, a condition that comes from the *principle of sufficient reason*. In the author's opinion, aesthetics is not a set of school precepts, nor even a prescriptive discipline. It is, first of all, an understanding that the beautiful expresses through the Platonic *Idea* and that through art, it frees the individual, even momentarily from the pain caused by the incessant want-to-live. In this sense, the particular assumptions of aesthetic understanding were highlighted, such as wanting, satisfaction and boredom. Founding cycle for suffering in the world, and cause of constant human pain.

We tried, by exposing this path, to describe the particularity inherent to genius, which, unlike other men, reaches high levels of aesthetic contemplation and in the production of art, which are reproduction of the *ideas* or immediate objectivity of the *Will*. This theory was formulated to understand what Schopenhauer understands by fine arts: architecture, gardening, sculpture, painting, poetry and music. All thought from particular conceptions of the concept of *Idea*. However, a particular art occupies a privileged place in the aesthetic philosophical thought of the author: music.

He conceives it through direct communication with the essence of the world, to know, at *Will*. The clarity of this point takes the approach of the aesthetics of melody as a universal and completely independent language, so its effect is more powerful and penetrating. It is also worth mentioning that the art in Schopenhauer's thought reaches temporary levels of pain suspension, and it is still

necessary to ascend ethical life, by the path of compassion by placing oneself in the place of the other, valuing the direction of experience and finally, that of ascesis, where the individual would reach a level for complete denial of the *Will*, idea influenced by Eastern philosophy.

Therefore, we intend to show in the development of this work the elements in favor of Schopenhauer's proposal in defense of the aesthetic foundation based on the metaphysic pessimism of his philosophy of the *Will*. It involves on the one hand the escape from the pain caused by want-to-live and on the other, the contemplation of the beautiful in art. Finally, we show that Schopenhauer's aesthetic is grounded by his entire structure of thought, which he kept faithful throughout his life, and that together the Platonic *Idea* found space to develop a unique aesthetic theoretical field.

ACKNOWLEDGEMENTS

Luciano da Silva Façanha and other authors would like to thank the Coordination for the Improvement of Higher Education Personnel - thanks to CAPES (Finance code 001).

REFERENCES

- [1] BARBOZA, Jair. **Schopenhauer: a decifração do enigma do mundo**. Jair Barboza. – São Paulo: Moderna, 1997. – (Coleção logos).
- [2] BARBOZA, Jair. **Schopenhauer: Filosofia Passo-a-Passo** 16. RJ: Zahar, 2003.
- [3] DALCOL, Mônica Saldanha et al. **A COMPAIXÃO COMO FUNDAMENTO DA MORAL EM SCHOPENHAUER**. 2014. Disponível em: <https://repositorio.ufsm.br/handle/1/9134>
- [4] LEFRANC, Jean. **Compreender Schopenhauer**. Tradução de Ephraim Ferreira Alves, - Petrópolis, RJ: Vozes, 2005.
- [5] MANN, Thomas. **Pensadores Modernos: Freud, Nietzsche, Wagner e Schopenhauer**. São Paulo: Ed Zahar, 2015.
- [6] MATOS, Franklin de. **O Filósofo e o comediante: Ensaio sobre literatura e filosofia na ilustração**. Belo Horizonte: UFMG, 2001.
- [7] REDYSON, Deyve. **Dossiê Schopenhauer**. São Paulo: Universo dos Livros, 2009.
- [8] ROGER, Alain. **Vocabulário de Schopenhauer**. Tradução de Cláudia Berliner. São Paulo: Editora Martins Fontes, 2013.
- [9] SAFRANSKY, Rüdiger. **Schopenhauer e os anos mais selvagens da filosofia: uma biografia**. Tradução William Lagos. – São Paulo: Geração Editorial, 2011.
- [10] SCHOPENHAUER, Arthur. **O Mundo como Vontade e como Representação**. 1º Tomo. Trad. Jair Barbosa. 2ed. - São Paulo: Editora da Unesp, 2015.

Risk of withdrawal of foot-and-mouth disease vaccine in Mato Grosso do Sul and consequent loss of herd immunity for reintroduction of foot-and-mouth disease virus in the State

Cristiano Moreira de Oliveira^{1,*}, Viviane Lima Catelan Moreira¹, Amanda Serrado de Almeida¹, Marcela Barros de Queiróz¹, Andressa Rossetto¹, Rita Jusceline Lopes de Goes¹, Abner Júlia Savieto¹, Samuel Carvalho de Aragão², Jorge Granja de Oliveira Junior¹, Márcio Teixeira Oliveira³, Suellen Moreira de Oliveira³, Geraldo Marcos de Moraes⁴, Paulo Eduardo Ferlini Teixeira⁵, Jefferson Pinto de Oliveira⁶, Agnaldo Reis Pontes⁷

¹State Agency for Animal and Plant Sanitary Defense - IAGRO, Campo Grande-MS, Brazil

²Federal Institute of Education, Science and Technology of Mato Grosso do Sul -IFMS, Campus Naviraí-MS, Brazil

³Federal Institute of Education, Science and Technology of Mato Grosso do Sul -IFMS, Campus Três Lagoas-MS, Brazil

⁴Ministry of Agriculture, Cattle and Supplying- MAPA, Department of Animal Health-DSA, Brasília-DF, Brazil

⁵Federal Institute of Education, Science and Technology of Mato Grosso do Sul -IFMS, Campus Nova Andradina-MS, Brazil

⁶Agricultural Defense Agency of the State of Pará -ADEPARA, Belém-PA, Brazil

⁷Federal Institute of Education, Science and Technology of Pará -IFPA, Campus Paragominas-PA, Brazil

Corresponding author*

Received: 01 Oct 2021,

Received in revised form: 10 Nov 2021,

Accepted: 20 Nov 2021,

Available online: 30 Nov 2021

©2021 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—Vaccine withdrawal, foot and mouth disease, Mato Grosso do Sul, IAGRO.

Abstract— The state of Mato Grosso do Sul - MS, has one of the largest cattle herds in the country, and the state is known nationally for the quality of bovine genetics, because the productive system is highly technical, where it seeks the precocity and high quality of pastures provided to animals. Because it is an organized productive sector, it has the longing to have its bovine herd free of foot-and-mouth disease without vaccination, which is already occurring in several states of the federation. However, a long way is already being traveled in order for this dream to come true for the entire beef chain of the state. In view of this situation, the objective of this study is to conduct a study on the sanitary measures adopted, with the objective of removing the vaccine against aphthous from the cattle herd of the state of Mato Grosso do Sul and possible impacts. For this, the State Agency for Animal and Plant Sanitary Defense - IAGRO has not measured efforts with its entire technical team to achieve this goal. With this, it has enhanced its actions in traffic control, in the technical training of its employees, in health education activities, successes in the coverage of all its vaccination campaigns against foot-and-mouth disease and in the results of serological surveys, restructuring of the defense service, as well as

animal health legislation and active surveillance for the early detection of foot-and-mouth disease virus infection. In addition, it is worth mentioning that IAGRO has been available to comply with all the determinations established by the Ministry of Livestock Agriculture and Supply - MAPA, so that the status of an area free of foot-and-mouth disease without vaccination can be implemented in the state of Mato Grosso do Sul, which validates the work of this agency before MAPA and meet the demand of the productive sector of the state that yearlike this election.

I. INTRODUCTION

Restrictions on trade in animal products and by-products used by some countries is based on the health status of the exporting country, status of foot-and-mouth disease free with vaccination is vetoed by countries that pay better for meat, and by important countries both by high consumption power, as well as by purchasing power, such as countries in Europe, Japan, Canada and the USA, countries that have long eradicated foot-and-mouth disease.

Based on the opening of new markets, the private sector makes a great strength with the agencies responsible for the Brazilian States to advance in the conquest of a new health status, so that they can drain their production to new countries and with greater added value.

By the end of the 2011-2020 Action Plan, the territory of South America with official recognition of foot-and-mouth disease-free status had increased from 67.6% in 2010 to 94.7% at the end of 2019. The herds free of foot-and-mouth disease, which at the beginning of the current action plan represented 63.7%, increased to 97.4%, and the population of free cattle and buffaloes went from 84.4% to 95.4%. Approximately 5% of the territory, herds and bovine population of South America, remains without health recognition at the end of 2020, and comprises the entire territory of Venezuela, which constitutes a significant achievement of national programs and the PHEFA Action Plan 2011-2020 [1].

The improvement in the defense service, traffic control and systematic vaccination, and control programs, led these countries to demonstrate the absence of viral circulation and infection in their territories, which in the 1980s was endemic and in the last decade in isolated cases, today the picture is of absence of both the disease and the presence of the virus.

In 2018, Moraes (2018), points out that in cases of countries or zones free of foot-and-mouth disease where vaccination is applied, the recognition of disease-free status has always been a major challenge for the official veterinary service, when compared to areas where

vaccination is not performed. This is partly due to the difficulties of demonstrating the absence of the viral agent in herds submitted to massive and systematic vaccination[2].

"In addition to the general conditions, a Member State applying for recognition of the status of a foot-and-mouth disease-free country or zone with vaccination shall provide evidence of the existence of an effective clinical disease surveillance programme and demonstrate that foot-and-mouth disease has not been present in the country or area for at least the last 2 years. In addition, surveillance of foot-and-mouth disease virus infection should show that the virus has not circulated in the vaccinated population in the last 12 months. For this purpose, serological surveillance will be necessary that includes evidence capable of detecting the presence of antibodies against PNEs, as described in these guidelines. It is recommended to provide evidence of the effectiveness of the vaccination program" [2][3].

According to the Panaftosareport, in 2017, the maintenance of immunization programs as a risk mitigation measure is only justified when there is somewhat significant evidence or probability of transmission or introduction of foot-and-mouth disease virus [4].

Therefore, this study aims to conduct a study on sanitary measures with the objective of withdrawal of the vaccine against aphthous from the cattle herd of the state of Mato Grosso do Sul and possible impacts.

a) Survey at Latin American level of vaccine withdrawal and risk of reintroduction of foot-and-mouth disease virus

Only three Latin American countries are considered totally free of foot-and-mouth disease without the need for vaccination, Chile, Guyana and Peru. In addition to these, there are disease-free zones without vaccination in portions of Argentina, Bolivia, Ecuador and Colombia (fig. 1).

In Brazil, the states of Santa Catarina, Paraná, Rio Grande do Sul, Acre, Rondônia and part of Amazonas and

Mato Grosso are recognized as free without vaccination by the OIE.

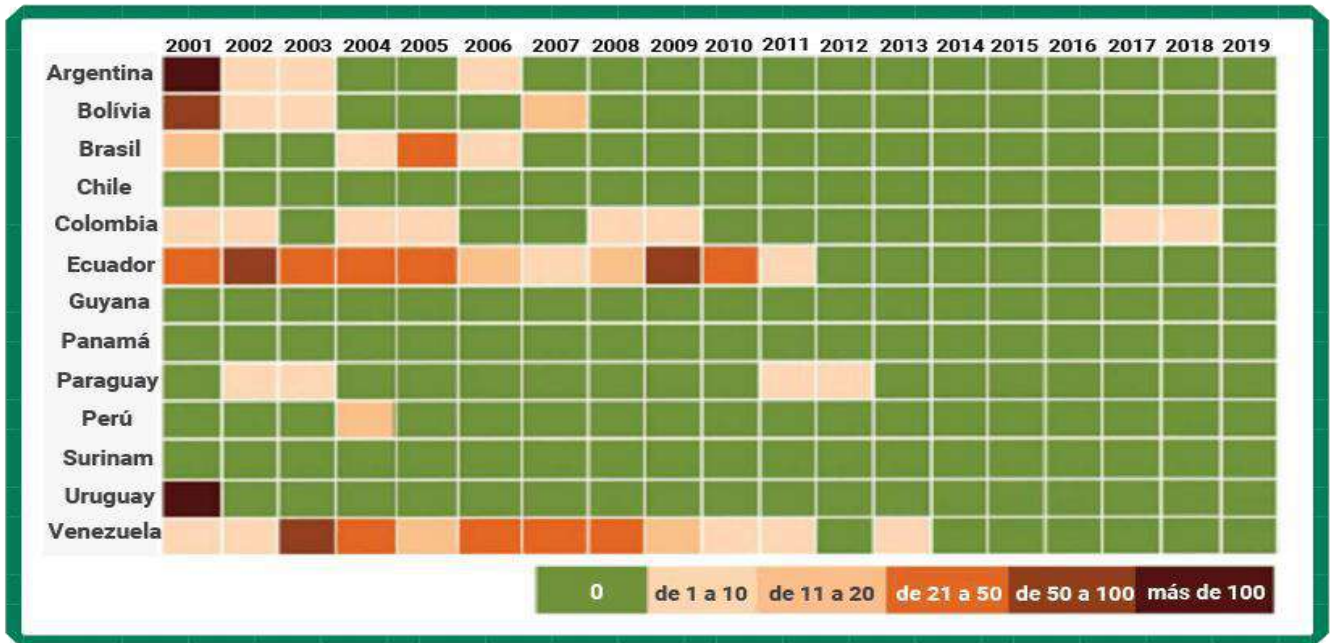


Fig. 1: Geographical distribution of historical risk of foot-and-mouth disease incidence in South America

Source: Cosalfa, 2020

The main risks for the reintroduction of foot-and-mouth disease in these countries are control of income from regions of different status, control of the risk of introduction associated with formal and formal livestock practices in communities and livestock farms that share an administrative border [4].

Dutra et. al. (2006), carried out a study seeking information to assist health actions involving the prevention of the entry of the Foot-and-Mouth Disease virus into the gaúcho herd. Rural properties with high movement of bovínos, located in border regions, close to dairy products or slaughterhouses of animals are classified as high-risk properties for the introduction of foot-and-mouth disease virus. In the second half of 2006, under the coordination of veterinarians of the Department of Animal Production of the Department of Agriculture and Supply of Rio Grande do Sul, a study was conducted on rural properties in the state, finding that 0.88% are classified as high risk to the introduction of foot-and-mouth disease virus. With integrated work among rural producers, plus active surveillance by DPA/SAA employees, in high-risk properties to the introduction of the virus, the probability of introducing this virus into RS is quite low, allowing the state to maintain its health status free of foot-and-mouth disease with vaccination [5].

The most recent work found was by Gavião (2017), who reports on "RISK PERCEPTION OF THE DIFFERENT ACTORS INVOLVED IN THE CONTROL OF FOOT-AND-MOUTH FEVER ON THE WESTERN BORDER OF RIO GRANDE DO SUL". In this work, the placement of Gavião (2017) was clear, where he concludes that it is extremely important for the SVO to mitigate the risk of foot-and-mouth disease, not only in the supervision of vaccination and other control activities performed, but also through health education actions that lead to the breaking of the paradigm that surveillance should be exercised exclusively by government inspection agencies. As well as, intensify the surveillance of the transit of animals and products of animal origin and surveillance activities on the properties identifying animals introduced illegally [6].

b) History of foot-and-mouth disease vaccination in Brazil and the state of Mato Grosso do Sul

In Brazil, a milestone in the institutionalized struggle against the disease was the promulgation of Decree 52,344 of August 9, 1963, with the institutionalization of the Campaign Against Foot-and-Mouth Disease (CCFA). At that time, the activities were basically summing up in the action in foci and vaccination against foot-and-mouth disease. At the same time, during the 1960s, laboratory

infrastructure, personnel training and producer awareness occurred, initiating systematic control of the disease with vaccine production, notification of outbreaks and diagnosis of the disease [1].

Animal health systems and state veterinary services were established one by one, improving surveillance, inspection and coordination, and the private sector participated in actions against the disease, especially vaccination. Strategies to combat foot-and-mouth disease were limited to vaccination campaigns; registration of holdings with susceptible animals; identification and prohibition of transit from holdings with sick animals (where the ban lasted up to two incubation periods from the cure of the last sick animal); and the control of the movements of susceptible animals [1].

Another important milestone in the 1970s was the implementation of vaccine quality control and the identification of problem areas through the study of animal transit and its comparison with the occurrence of the disease.

A sharp drop in the number of outbreaks was observed from 1980, when vaccination campaigns were expanded and control activities carried out by the Official Veterinary Service (SVO) were strengthened [1].

In Brazilian cattle, vaccination against foot-and-mouth disease (AF) virus is fundamental for the initial phase of eradication of the disease. Even with the quality of the vaccine having strict control made by the official agencies, technical variables still not monitored such as manipulation, transportation and conservation by the consumer, dose, place and form of application that interfere in the immune response [7].

The use of mandatory preventive vaccination only in cattle and buffaloes in the areas free of foot-and-mouth disease with vaccination. At the discretion of the Ministry of Agriculture, Livestock and Supply, emergency vaccination can be used as part of strategies to contain outbreaks of foot-and-mouth disease in the country, as provided for in manuals and plans made available by the Department of Animal Health (Article 19 of IN 48/2020). [8].

In Brazil, only cattle and buffaloes are vaccinated, because these species are considered important in the manifestation of foot-and-mouth disease virus in nature, because they develop persistent infections. Therefore, if the spread of the virus is controlled in these species, sheep, goats and pigs and also wild animals will not have anywhere to contract the disease [9].

c) History of serology in Mato Grosso do Sul

Seroepidemiological studies aim to support the certification of no transmission of foot-and-mouth disease virus and are carried out in addition to other components of the surveillance system implanted in the areas under evaluation. In this context, seroepidemiological studies, especially in herds submitted to massive and systematic vaccination, involve the detection of animals in the serological population compatible with foot-and-mouth disease virus infection and require the use of laboratory tests to identify the presence of antibodies against non-structural proteins – PNEs [2]

In the period of 1995 and 1996, in order to evaluate whether the actions to combat foot-and-mouth disease, especially the annual vaccination strategy with oily vaccine, were sufficient to cut the cycle of endemic transmission of the viral agent, Moraes et al. (1996-1997) conducted a serological study in the Pantanal region of Mato Grosso. The study involved 311 rural properties, randomly selected in a universe of 2,183 herds, and the collection of 3,885 blood serum samples in cattle aged 6 to 24 months. The samples were evaluated by PANAFTOSA, using viaa-idga test as screening test and as confirmatory test the EITB (enzyme-linked immunoelectrotransfer blot). In general, 0.30% (6/1,972) of seropositive cattle aged 6 to 12 months and 0.31% (6/1,913) were identified at 13 to 24 months of age. The results were incompatible with viral agent transmission and motivated local health authorities to follow the objective of eradication of the disease in the State, maintaining the annual vaccination strategy in the cattle herd and buffalo located in the Pantanal of Mato Grosso [2].

From the adoption by the OIE of the concept of zonation, epidemiological studies to support the certification of absence of foot-and-mouth disease virus transmission have been incorporated into the surveillance system for the disease in South American countries. In Brazil, several studies were conducted from 1996 to 2017, with the objective of implantation or recovery of the zoosanitary condition of foot-and-mouth disease free. Complementary work was also carried out to maintain free zones or to meet the demands of importing markets, highlighting: in 2008, serological surveillance at international borders with the states of Mato Grosso do Sul, Mato Grosso, Rondônia and Acre; in 2009, serological study in the Amazon River, Amazonas State, and in the State of Acre (repeated studies in 2010 and 2011); in 2010, serological and clinical surveillance in the State of Santa Catarina (foot-and-mouth disease-free zone without vaccination) and in the foot-and-mouth disease-free zone with vaccination, and a longitudinal study in the high surveillance zone established in the State of Mato

Grosso do Sul; in 2012, a new longitudinal study in the high surveillance zone established in the State of Mato Grosso do Sul; in 2014, serological and clinical surveillance in the foot-and-mouth disease-free zone with vaccination; and in 2016 and 2017, the implementation of longitudinal studies in the State of Santa Catarina [2].

In 2018, surveillance activities were conducted in 5 Brazilian states (Rio Grande do Sul, Paraná, Mato Grosso do Sul, Mato Grosso and Roraima) in the region bordering Uruguay, Argentina, Paraguay, Bolivia and Venezuela. (MAP, 2018) In August 2019 and March 2020, serological surveillance was carried out in the zones free of foot-and-mouth disease with vaccination, where the border regions with Argentina, Bolivia, Paraguay, Uruguay, Peru and Venezuela were carried out, involving the states of Rio grande do Sul, Paraná, Mato Grosso do Sul, Mato Grosso, Rondônia, Acre and Roraima, and each of these regions involved has their particularities [10].

The current epidemiological scenario of the Continent is favorable to the maintenance of free zones with vaccination and the expansion of free zones without vaccination, despite the critical situation of Venezuela and the occurrences in Colombia in 2017 and 2018. In this context, countries should mainly strengthen the surveillance system for early detection of the viral agent and to prevent reintroduction of the disease. However, there is also a need to maintain mechanisms for certification of the absence of viral transmission in the region, mainly to meet OIE standards, to confirm the annual health status and to present the requirements of commercial partners. (MAPA, 2018a)

Serology has a limiting factor, because the program for eradication and prevention of foot-and-mouth disease in Brazil uses the vaccination of box. The EITB test is able to differentiate vaccine antibodies from those produced in natural infection, however, in some cases, non-structural proteins, present in vaccines and that have not been eliminated during filtration, can provoke false-positive reactions Thus, vaccinated animals with suspected foot-and-mouth disease, which react positively to The EITB, should be tested in the "probang" test and, therefore, to be considered negative, the virus cannot be isolated in 3 consecutive tests with an interval of 30 days [9].

Sheep, goats, pigs and wild animals can be used in seroepidemiological surveillance programs to detect viral activity [9].

d) Health defense activities developed by the Agency for Animal and Plant Sanitary Defense - IAGRO

Registration of rural properties; Promotion and supervision of vaccination of cattle and buffaloes; Supervision of vaccination in hazardous areas or

properties; Serology; Control of the transit of animals and their products and by-products (intra and interstate); monitoring the distribution and trade of vaccines against foot-and-mouth disease; Attendance to outbreaks of the disease, as well as notifications of suspected vesicular disease and eradication of foci; Health education, organization and encouragement to community participation; Development of the animal health information and surveillance system at the state level; Supervision of livestock events (fairs, exhibitions, auctions and other agglomerations); Inspection of animals and their products and by-products and human resources training [11].

e) Health defense measures adopted by countries bordering Brazil

In 2012, the member countries of the World Organization for Animal Health (OIE) approved a global strategy for the control of foot-and-mouth disease, led by this body together with the Food and Agriculture Organization of the United Nations (FAO), which recognized the Hemispheric Program for the Eradication of Foot-and-Mouth Disease (PHEFA) as a guideline for the control and eradication of the disease on the American continent. Which is conducted by the Hemispheric Committee for the Eradication of Foot-and-Mouth Disease (COHEFA) and the South American Commission to Combat Foot-and-Mouth Disease (COSALFA), and coordinated by the Pan American Foot-and-Mouth Disease Center of the Pan American Health Organization [12].

The last PHEFA Action Plan that was in force during the period 2011 to 2020 allowed 94.7% of the territory of South America to achieve the recognition of official status of foot-and-mouth disease free in 2019, with approximately 97% of its cattle and buffalo herds free of foot-and-mouth disease with or without vaccination. However, Venezuela was the only country that remained without health recognition until the end of 2020, according to Fig. 2, generating a risk to the north of the Andean region and being responsible for the focus that occurred in Colombia during the years 2017 and 2018 [12].



Fig. 2: Official status of Foot-and-mouth Disease in South America.

Source: <https://bit.ly/3xsDN2Q>

- Members and recognised areas free of foot-and-mouth disease without vaccination.
- Members and recognised areas free of foot-and-mouth disease with vaccination.
- Country and zone without official OIE recognition for foot-and-mouth disease

The PHEFA's 2011-2020 Action Plan has enabled an advance in out-of-date health programs since 2010 and the preservation of status in the free countries of the Southern Cone, i.e., Argentina, Bolivia, Brazil, Chile, Paraguay and Uruguay, where there were sporadic outbreaks in vaccinated populations. However, most free countries with vaccination did not advance to free status without vaccination, as had been proposed [12]

Therefore, the current Action Plan 2021-2025, approved in 2020 by the Hemispheric Committee for the Eradication of Foot-and-Mouth Disease (COHEFA), is responsible for this eradication throughout the American continent by 2025, which also provides for the strengthening of official surveillance services. Its guidelines include: the eradication of the virus active in Venezuela, in order to mitigate the risk to the Northern Andean region; change the official status of free countries with vaccination to without vaccination; and preserve the health status of foot-and-mouth disease-free territories without vaccination [4][12].

In this article, we will emphasize the countries bordering the state of Mato Grosso do Sul, that is, we will discuss the sanitary measures adopted by Bolivia and Paraguay.

Historically, in Bolivia, the Cochabamba region has been affected by outbreaks of the disease with high morbidity, mainly involving type O and A viruses, including having affected vaccinated herds, during the years 1968 to 1969. In the following year, another outbreak with type A virus (provisionally called A/Bolivia/70) affected this region and santacruz, as well as numerous outbreaks caused by the Type O1 virus also in Cochabamba. In 1971, type A and C viruses were typified and the disease manifested itself in seven of the nine departments of the country [13].

Law No. 2061 of 16/03/2000 established the National Service of Health and Agri-Food Quality - SENASAG, as an operational structure of the Ministry of Agriculture, Livestock and Rural Development of the country, responsible for agricultural health and food safety in Bolivia, and in 2001 the National Program for the Eradication of Foot-and-Mouth Disease - PRONEFA was implemented [14].

According to Fig. 3, the country currently has international OIE recognition of three zones free of foot-and-mouth disease with and without vaccination: Chiquitania (with 10 municipalities in 2003), Altiplano (with 58 municipalities in 2012) and Chaco and Valles (with 50 municipalities in 2013). The last record of the disease in this country occurred in the region of Santa Cruz between January and February 2007 [14].

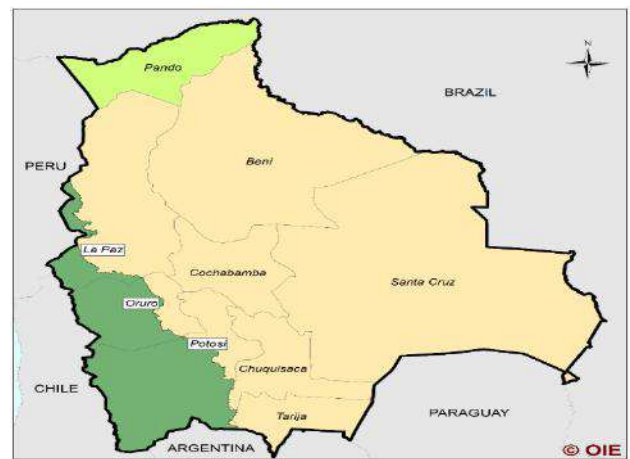


Fig. 3: Official status

Source: World Animal Health Organization - OIE

- Foot-and-mouth disease-free zone without vaccination (part of the Altiplano region).
- Foot-and-mouth disease-free zone without vaccination (Department of Pando).
- Zone free of foot-and-mouth disease with vaccination (chaco, valles and part of Amazonas and Altiplano).

Through senasag's 2014-2018 Institutional Strategic Plan, it was possible: the strategic vaccination of the herd, carried out every six months, with minimum vaccination coverage of 90%, preserving the High Surveillance Zone as an area free of foot-and-mouth disease; the analysis of corrective actions for the non-conformities pointed out by the Process for the Performance of Veterinary Services - PVS/OIE; the technical and structural improvement of the official laboratories and operational capacity of SENASAG through economic support to PRONEFA by the Foot-and-Mouth Disease Free Action Plan – PAMA/MERCOSUR; the computerization and registration of agricultural data through the implementation of the Gran Paititi Software in order to facilitate sanitary management by SENASAG; the implementation of the National Registration and Identification System of the Cattle Herd - SIRINGA; the accreditation of competent professionals responsible for animal health; the registration update of rural properties; updating the list of diseases of mandatory notification with the manual of the National Epidemiological Surveillance System - SINAVE; seroepidemiological studies of the viral circulation of foot-and-mouth disease in the country; the implementation of the National Council of Pork (CONAPOR) to approach swine health and approval of the National Swine Health Regulation; the installation of incinerators at international airports; strengthening the National Herbivorous Rabies Control Program together with Peru, Guatemala and Honduras, as well as the Surveillance Plan against Bovine Spongiform Encephalopathy – BSE; the registration and control of refrigerators and industries in the food industry; the intensification of supervision and the health registry of companies in the food sector; the regulation of inspection and certification for the import and export of food; the control of organic production; technical training of personnel; the implementation of the Bolivian Cattle Traceability System; and technical training in relation to Good Agricultural Practices through the Safety Assurance Program – PAI [14].

In Paraguay, SENACSA is the national body responsible for the preparation, regulation, coordination, implementation and supervision of national policy and management of quality and animal health. In this context, it uses the National Program for the Eradication of Foot-and-Mouth Disease, which has the legal support of Law 808/96, and has as its main objective to keep the national territory free of foot-and-mouth disease virus (FMD) [15].

The strategy consists of carrying out actions to maintain a high level of immunity in the bovine population, through systematic and massive vaccination campaigns, procedures for the care of suspected diseases (interdictions, movement control, strategic vaccinations,

etc.), detection of compatible clinical cases and in case of possible outbreak of foot-and-mouth disease, eliminate the sources of infection, through the eradication of sick animals and contacts, disinfection and other tasks [15].

The objective of the National Program for the Eradication of Foot-and-Mouth Disease is to control, eradicate and prevent the re-entry of the disease, in a sustainable way, throughout the territory and in the population of species susceptible to it [15].

The central strategic axes of combating the disease are based on:

- *The drastic decrease in the susceptibility of the bovine population (a single species that gives conditions to sustain endemicity), through systematic and mandatory vaccination campaigns to interrupt the process of transmission of the infection,*
- *A very strict control of disease outbreaks supported by a well-structured surveillance system, timely detection and rapid emergency response. With the support of a very efficient cattle handling control system, based on a very well structured information system (SIGOR and SISA).*
- *A very robust diagnostic system that includes a maximum safety laboratory, and diagnostic regimens capable of detecting infection through serology in vaccination environments, and determine with high efficiency the level of immune coverage and the quality of vaccines used in the program.*
- *A robust public-private alliance to carry out the program's actions in a delegated manner.*

Systematic vaccination campaigns, surveillance of vaccinated cattle and capture of herd registration data [15].

This study aims to conduct a study on sanitary measures to remove the anti-foot-and-mouth vaccine from the cattle herd of the state of Mato Grosso do Sul and possible impacts.

II. METHODOLOGY

a) Research design

This work regarding its nature is applied research, because once it is intended to conduct a survey of sanitary measures that have been carried out over the last 3 years by the Agency for animal and plant health defense IAGRO do Mato Grosso do Sul, among them an analysis of the latest seroepidemiological studies carried out, with the objective of the withdrawal of the vaccine against aphthous in the cattle herd.

The research is characterized as exploratory and explanatory, since a bibliographic survey will be conducted on information on the subject, providing greater familiarity with the problem and identifying the factors that determine or contribute to the occurrence of phenomena [16].

The scientific basis, makes it necessary since in Brazil other states of the federation that have already gone through the process of withdrawal of the vaccine from their cattle herd, and this process, has not yet occurred with the state of Mato Grosso do Sul, causing a program of measures that are being implemented to achieve this objective.

b) Animal and Vegetable Sanitary Defense Agency of Mato Grosso do Sul IAGRO

The State Agency for Animal and Plant Sanitary Defense of the State of Mato Grosso do Sul - IAGRO, was created by Decree-Law No. 9, of January 1, 1979. Linked to the State Secretariat for The Production of Agrarian Development, Industry, Trade and Tourism [17].

IAGRO, through the delegation of the Ministry of Agriculture Livestock and Supply, implements the **actions of the Animal and Plant Health Programs** that aims to: implement public policies of education, health, inspection and inspection in order to promote, maintain and recover animal and plant health, the quality of its products and by-products through health defense, control, inspection and inspection of products and by-products of agricultural origin, inspection of agricultural inums and biosafety activities to ensure human health. Comply with and enforce the operational obligations delegated by the Executive Branch, which deals with legislation on the protection of animal and plant health and the control and inspection of agricultural products, goods and services, processes and technologies achieved by the agricultural health care system [18].

c) Collection standards for serology

In 2018, the seroepidemiological study was directed to the border region with the following countries: Uruguay, Argentina, Paraguay, Bolivia, and Venezuela, and had the involvement of 5 Brazilian states (RS, PR, MS, MT, RR). According to MAPA, 2018 for the selection of properties that participated in the studies were considered the following indicators: presence of cows (properties with more than 30 cows); Steer/Cow ratio (Males from 25 to 36 months/Total females older than 36 months greater than 0.7); Total cattle (properties with more than 100 cattle). Within the cattle herd the target population were animals from 6 to 24 months of age, this choice was due to the history of lower doses of vaccines applied in these animals as well as the higher frequency of movement between rural

properties. For the study, 100 properties were selected among the states mentioned, as described in Table 1 [19].

Another seroepidemiological study to verify viral transmission was conducted between August 2019 and March 2020, was also a study directed to the border zone and had the participation of 7 Brazilian states (RS, PR, MS, MT, RO, AC and RR). According to MAPA, 2020, a 15 km border strip that is usually used to define the area of protection and surveillance delimited the target population in the study, as illustrated in Fig. 4. Because they presented lower immunity results and because they are more susceptible in the transmission of the virus, the bovine population selected for the study were young animals, preferably up to 12 months of age [20].



Fig. 4: Map of the study area, highlighting the region involved and the distribution of the sampled properties.

Source: Ministry of Agriculture, Livestock and Supply - MAPA

III. ANALYSIS AND INTERPRETATION OF DATA

In the serological study conducted in 2018 by MAPA, the properties were distributed according to the border range and the Zones of High Surveillance of the selected States, according to Table 1 [21].

Table 1: Information on total properties in border municipalities and those selected for monitoring in border regions [21].

State	Establishments in border municipalities		Properties chosen for monitoring
	Properties	Cattle	Total
PR	12.108	275.319	15
MS	18.286	7.100.358	20
MT	4.553	1.479.816	15
RR (Pacaraima)	73	20.556	20
RS	33.875	2.830.983	30
Total	68.895	11.707.032	100

Already in the Fig. 5, allows you to visualize the spatial distribution of properties in Mato Grosso do Sul state.

Table 2 shows the information on the number of animals collected in each zone, as well as the laboratory results found in the study conducted in 2018 [21].

Table 2: Number of animals collected and laboratory results, per zone, in thesepidemiological study for foot-and-mouth disease in the border region [21].

Zone	Participating States	Number of cattle selected for monitoring	Number of reagent cattle in the first serology	Number of cattle selected for the second serology	Number of reagent cattle in the first serology	Cattle that had LEF samples collected in a paired fashion with a "Not Detected" result for FA
2	RS	1.619	43	980	28	27
3	MT,RR,PR e parte do MS	2.739	91	2.019	64	61
4	Parte do MS	578	27	351	8	8
Total	RS, MT, RR, PR e MS	4.936	161	3.350	100	96

Table 3 shows the final data of the first serology of the study conducted in the years 2019 and 2020 of the animals of the study, with the indication of the number of

properties, number of animals collected and laboratory results per zone [21].

Table 3: Number of properties, collected animals and laboratory results, per zone, in the first serology of the seroepidemiological study for foot-and-mouth disease in the border region conducted in 2019, where R= Reactive and I= Undetermined [21].

General data			ELISA 3ABC/EITB (1° sorology)						
UF	Zone	N° of properties	Samples	Negative Sample (N)	Relative Frequency	Reactive Sample (R)	Reactive frequency (R)	Samples indeterminate (I)	Relative Frequency (I)
RS	2	97	4.714	4.666	98.98%	28	0.59%	20	0.42%
RR	3	12	230	224	97.39%	4	1.74%	2	0.87%
RO	3	34	1.798	1.787	99.39%	7	0.39%	4	0.22%
PR	3	17	269	261	97.03%	1	0.37%	7	2.60%
MS	3 e 4	62	3.360	3.314	98.63%	14	0.42%	32	0.95%
MT	3	54	3.359	3.302	98.30%	22	0.65%	35	1.04%
AC	3	66	3.180	3.160	99.37%	8	0.25%	12	0.38%
Total		342	16.910	16.714	98.84%	84	0.50%	112	0.66%

Already in the Fig. 6, it shows a spatial distribution of the properties studied in Mato Grosso do Sul, in the years 2019 and 2020[10].

Table 4: Number of animals collected and laboratory results, per zone, in the second serology of the seroepidemiological study for foot-and-mouth disease in the border region conducted in 2019, where R= Reactive and I= Undetermined [20].

General Data					ELISA 3ABC/EITB (1° sorology)					
UF	Zone	Predicted sample	Animals sampled	% of recuperation	Reactive Sample (R)	Relative frequency (R)	Samples indeterminate (I)	Relative Frequency (I)	Properties sampled	Properties with R or I
RS	2	1956	1884	96.32%	4	0.21%	14	0.74%	37	13
RR	3	150	141	94.00%	1	0.71%	1	0.71%	4	1
RO	3	404	394	97.52%	0	0.00%	7	1.78%	8	5
PR	3	105	85	80.95%	0	0.00%	0	0.00%	6	0
MS	3 e 4	1870	1824	97.54%	3	0.16%	23	1.26%	30	15
MT	3	2094	2045	97.66%	6	0.29%	22	1.08%	34	16
AC	3	941	927	98.51%	2	0.22%	9	0.97%	18	8
Total		7520	7300	97.07%	16	0.22%	76	1.04%	137	58

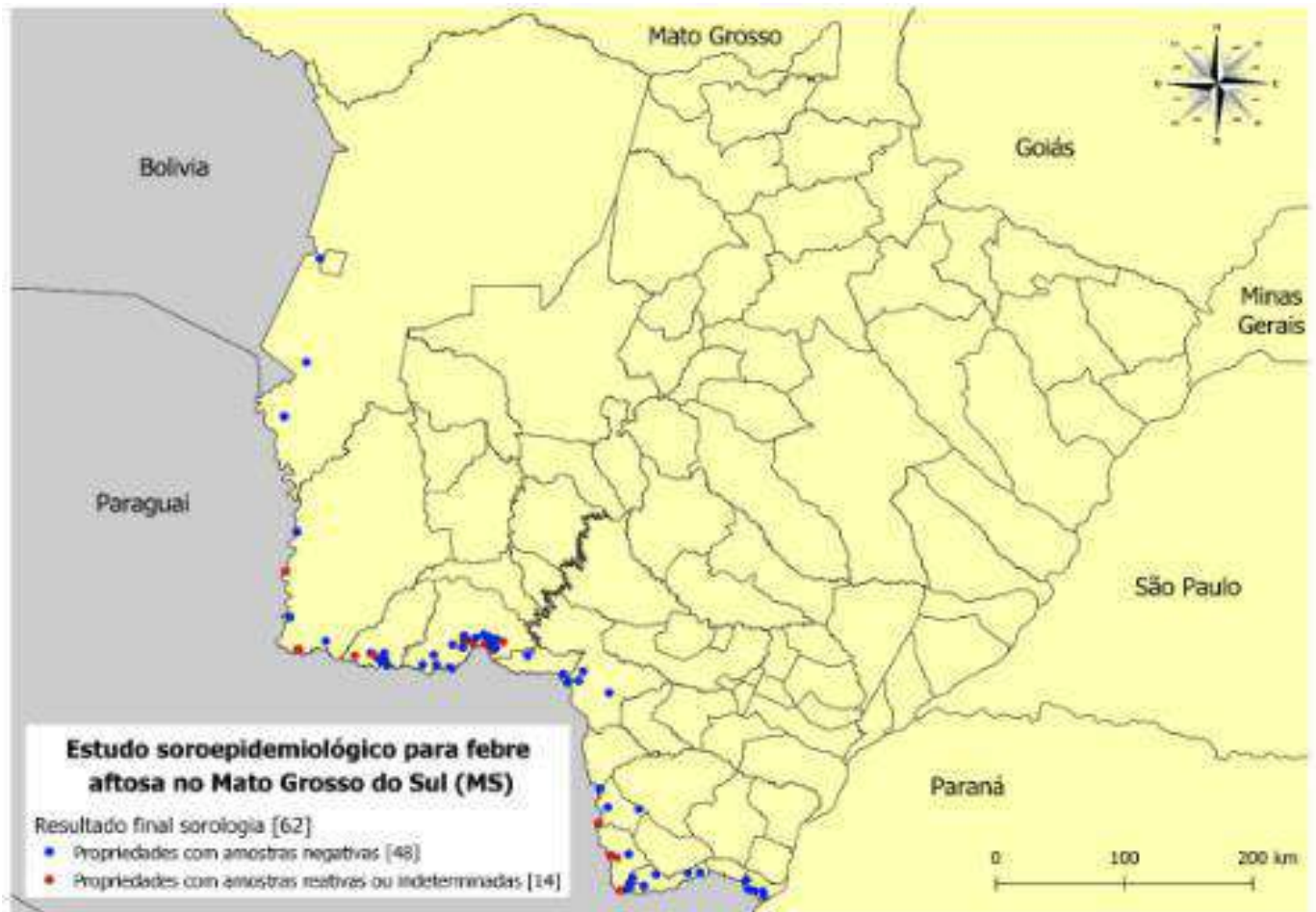


Fig. 6 - Distribution of properties and final results in serology - Mato Grosso do Sul

As foreseen in the study design, a second serology of all animals sampled on properties that had at least one reactive or indeterminate animal in the first serology was performed. With results described in Table 4 and Table 5[20].

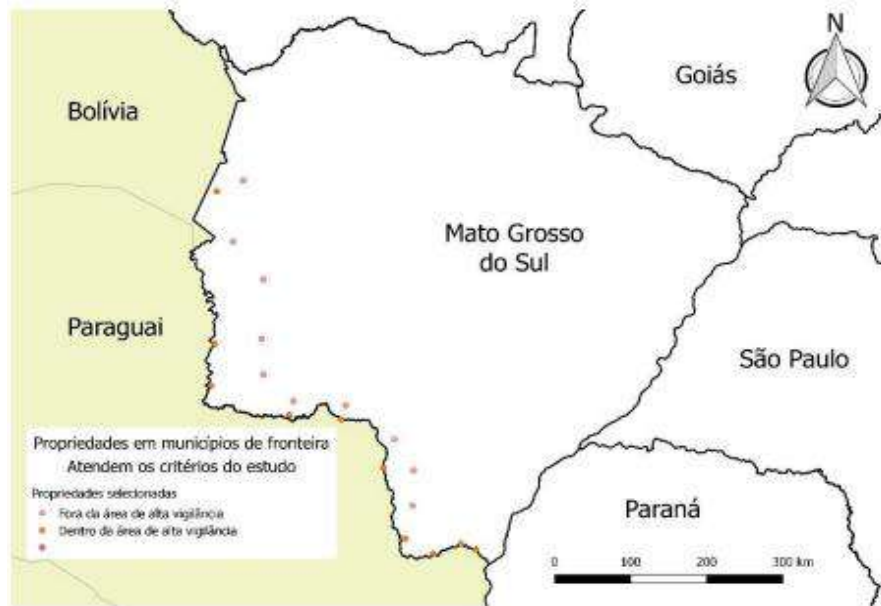


Fig. 5: Border region of Mato Grosso do Sul [21].

It was observed that there was no significant increase in the total number of positive animals, already allowing the discarding of viral transmission. However, to obtain greater safety, samples of esophageal-pharyngeal fluid (LEF) were collected from all animals with a positive result of the second serology, where the presence of foot-and-mouth disease virus was not detected, ending studies in these years [10]

IV. RESULTS AND DISCUSSION

a) Measures implemented by IAGRO to obtain the withdrawal of the vaccine

According to the Technical Guide to the Last Stage of the Hemispherical Foot-and-Mouth Disease Eradication Program 2017, Risk Management should consider three levels of action in a free zone without vaccination to mitigate the impact of a possible outbreak of foot-and-mouth disease.

First level of Action: Prevention against the introduction of foot-and-mouth disease virus, objective is an effective separation of the population with the free status without vaccination of other animal populations with a different health status, as well as an effective control of the entry of animals and livestock goods for control by the health authority.

At the second level of action would be risk management measures aimed at reducing the exposure of an animal population to foot-and-mouth disease virus would be associated with a particular route, whereby a commodity contaminated by foot-and-mouth disease virus

can enter free territory and reach a susceptible animal, such as feeding pigs with remains of animal origin.

At the third level of action are management measures leading to rapid detection and rapid response in the event of an incursion of foot-and-mouth disease virus into an animal population. These measures aim to limit the spread of a focus and reduce its impact.

Considering the State of MS, where we have borders with 2 countries (Bolivia and Paraguay) where they are free with vaccination, and with the States of MT, GO, MG and SP that also has free status with vaccination, it is essential to effectively control traffic in these borders in case of suspending the vaccine in the south-matogrossense territory, and the withdrawal of the vaccine in block would be a valuable strategy for these states.

In the process of transition to free status without vaccination, the state veterinary service should strengthen prevention, detection and early response measures. Among the measures implemented by IAGRO we can mention: traffic control, restructuring of the defense service, as well as animal health legislation, health education, serology and active surveillance for the early detection of AF virus infection.

Vaccination against foot-and-mouth disease of cattle and buffaloes is the responsibility of producers, and IAGRO is responsible for regulating, disseminating, health education and supervising the activity. In recent years, the State of Mato Grosso do Sul (MS) has achieved excellent vaccination rates of animals against foot-and-mouth disease above 99% (data referring to the stages of May of each year), which demonstrates the commitment of the

entire producing class in the execution of activities, as shown in Fig. 7.



Fig. 7: Animal vaccination rates (%) against foot-and-mouth disease in the State of Mato Grosso do Sul in the years 2017 to 2021 (data referring to the stages of May of each year).

Since 2005, the State Veterinary Services (SVEs), coordinated by the Department of Animal Health of the Ministry of Agriculture, Livestock and Supply (MAPA), conduct seroepidemiological studies, with the objective of estimating the percentage of immune coverage of the bovine population achieved by vaccination campaigns against foot-and-mouth disease. In 2020, a study was

conducted to the Federation Units (UFs) qualified for the export of fresh beef to the European Union (EU), covering part of the foot-and-mouth disease-free zone with vaccination (Minas Gerais, Espírito Santo, São Paulo, Mato Grosso do Sul, Mato Grosso and Goiás), in order to meet the certification commitment signed with that economic bloc (Fig. 8).



Fig. 8. Distribution of corrected prevalence of cattle immunized by federative unit

b) Serology

In order to meet the OIE standards, for the annual confirmation of health status and to present the requirements of commercial partners, there is a need to maintain mechanisms for certification of absence of viral circulation in the State, therefore, the epidemiological

study was structured to detect, through sampling, the presence of AF virus transmission [8], therefore serology and the evaluation of the quality of the official veterinary service (QUALISV), are the main control tools for the conquest and maintenance of health status.

Table 5: List of the main epidemiological studies conducted with the objective of supporting the claims to recognize the condition of foot-and-mouth disease-free zone with the OIE, 1997 to 2017, Brazil.

ID	Goal	Year		Location involved	Subpopulations considered in the design	UPA ¹	Prop ²	Esp ³	age group (months)	Samples ⁴			Laboratory tests used ⁵
		Study conducted	Recognition or restitution							Total	Positives	%	
1	Recognition	1996/1997	1998	RS e SC	7	780	Cattle	PR	>6	8.326	9	0.11 %	VIAA-IDGA/EITB
									>3	1.993	2	0.10 %	VIAA-IDGA
2	Recognition	1999	2000	PR, SP, GO, MT, DF and part of MG	3	1.053	2.312	Cattle	6 a 24	35.410	420	1.19 %	ELISA/EITB
3	Recognition	2000	2001	MS, TO, BA, SE, ES, RJ and part of GO, MG, MT and SP	6	1.280		Cattle	6 a 24	35.410	420	1.19 %	ELISA/EITB
4	Restitution	2001	2002	Região norte RS and frontier SC/Argentina	2	167		Cattle	6 a 24	1.899	0	0.00 %	ELISA/EITB
5	Restitution	2002	2002	RS E SC	3	381	716	Cattle	6 a 24	4.353	20	0.46 %	ELISA/EITB
								PR	> 3	1.343	0	0.00 %	VIAA-IDGA
6	Recognition	2002	2003	RO	1	344	709	Cattle	6 a 24	8.918	142	1.59 %	ELISA/EITB
7	Recognition	2003/2004	2005	AC and part of AM	1	335	448	Cattle	6 a 24	15.598	71	0.46 %	ELISA/EITB
8	Recognition	2003/2004	2007	South-central region of PA	2	649	941	Cattle	6 a 24	32.078	88	0.27 %	ELISA/EITB
9	Recognition	2005	2007	South-central region of PA	2	650	1.101	Cattle	6 a 24	30.137	678	2.25 %	ELISA/EITB
10	Recognition	2006/2007	2007	SC (free without vaccination)	3	468	1.347	Cattle	6 a 36	11.059	48	0.43 %	ELISA/EITB
11	Restitution	2006	2008	forbidden area MS	1	382		Cattle	6 a 24	7.458	214	2.87 %	ELISA/EITB

e													
1 2	Restituição	2006	2008	forbidden area PR	1	576		Cattle	6 a 24	9.826	34	0.35 %	ELISA/EIT B
1 3	Restituição	2006	2008	Area not forbidden MS	1	483		Cattle	6 a 12	11.568	26	0.22 %	ELISA/EIT B
1 4	Restituição	2006	2008	Area not forbidden PR	1	932		Cattle	6 a 12	7.797	24	0.31 %	ELISA/EIT B
1 5	Restituição	2006	2008	SP	1	455		Cattle	6 a 12	9.100	3	0.03 %	ELISA/EIT B
1 6	Restituição	2006/2007	2008	Áreainterditada MS	1	444		Cattle	6 a 12	7.986	219	2.74 %	ELISA/EIT B
1 7	Restituição	2007	2008	Áreainterditada MS	1	245	611	Cattle	6 a 12	5.681	168	2.96 %	ELISA/EIT B
1 8	Restituição	2007	2008	Pantanal	1	300	482	Cattle	6 a 12	11.537	133	1.15 %	ELISA/EIT B
1 9	Restituição	2007	2008	Planalto	1	307	452	Cattle	6 a 12	8.846	251	2.84 %	ELISA/EIT B
2 0	Restituição	2007*	2011	Fronteira MS e Paraguai (zona de alta vigilância)	1	298	501	Cattle	6 a 12	8.635	283	3.28 %	ELISA/EIT B
2 1	Reconhecimento	2010	2011	Zona proteção BA	1	294		Cattle	6 a 12	3.804	6	0.16 %	ELISA/EIT B
								PR	> 3	1.433	0	0.00 %	VIAA-IDGA
2 2	Reconhecimento	2010	2011	Zona proteção TO	1	289		Cattle	6 a 12	3.322	1	0.03 %	ELISA/EIT B
2 3	Reconhecimento	2010	2011	Zona proteção RO	1	58		Cattle	6 a 12	1.257	1	0.08 %	ELISA/EIT B
2 4	Reconhecimento	2012/2013	2014	AL, CE, MA, PB, PE, PI, RN e parte do PA	5	1.756	1.942	Cattle	6 a 24	48.840	27	0.06 %	ELISA/EIT B
								PR	>3	9.888	103	1.04 %	ELISA
2 5	Reconhecimento	2014/2015	2018	RR, AP, AM e partes do PA	3	910	1.103	Cattle	6 a 24	19.225	67	0.35 %	ELISA/EIT B
2 6	Reconhecimento	2017			5	162	162	Cattle	6 a 24	3.982	9	0.23 %	ELISA/EIT B

Source: Moraes, 2018

*Na fronteira do MS com o Paraguai, além do estudo realizado em 2007, foram realizados estudos longitudinais na zona de alta vigilância em 2008 e 2009

1. UPA = unidade primária de amostragem; 2. Prop. = propriedade rural; 3. Esp. = espécie (Bov=bovinos/bubalinos, PR=Pequenos

ruminantes) 4. Amostras referentes à primeira coleta (não estão incluídas amostras referente às investigações complementares desencadeadas nas UPAs com pelo menos um animal soropositivo)

5. Testes sorológicos para detecção de anticorpos contra PNEs. Dependendo de cada estudo, foram utilizados

outros testes laboratoriais complementares, como teste de reação em cadeia da polimerase de transcrição inversa, em tempo real – RT-PCR, para amostras de líquido esofágico-faríngeo, ou teste de ELISA CFL

c) Measures implemented by IAGRO to obtain the withdrawal of the vaccine

The strengthening of the traffic control of animals within an area free of aphthous without vaccination, is a very important factor for the claim of the new health status. IAGRO - State Agency of animal and plant health defense of MS, created a new management, specific to the issue of Traffic control, made investments in structure and mainly uses artificial intelligence for analysis of intrastate and interstate traffic, created a situation room that monitors all animal traffic in the State (fig. 9 and 11), has in real time, the location of Iagro's teams, and attendance of anomalies within the E-Saniagro system, has in the implementation phase the control through application of the transport of animals, registering the carrier and linking the trip to the GTA's (fig. 10), thus allowing the visualization of the point of embarkation and landing of the animals, the flyunits are guided through these analyses in which area they will act, and in which fixed posts will be activated, always with teams formed by employee of the agency, as employee of public security agencies.

(competição em fase líquida) para detecção de anticorpos estruturais em animais não vacinados.

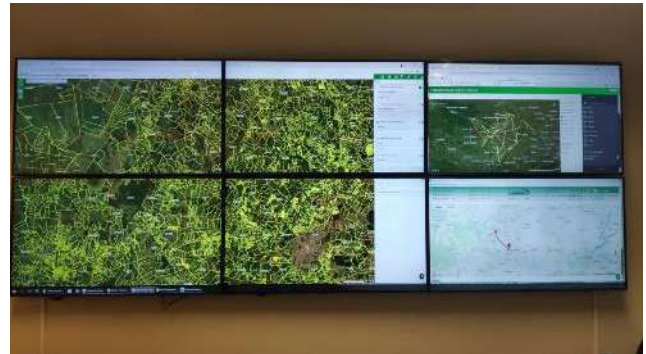


Fig. 9: Geographical Viewing Panel through Business Intelligence

An unprecedented cooperation agreement has been signed in the country, an agreement for the exchange of information and joint actions with the Paraguayan defense service SENACSA, an example is the sharing of the bank of brands of the institutions, thus enabling the identification of the origin of the animals.



Fig. 10: Bovine Movement Network from the state of Mato Grosso do Sul to other states.

fixed and mobile posts throughout the state, health surveillance actions throughout the border region, the restructuring of the agency, the implementation and updating of legislation and health education actions, among other activities has given subsidy for the request for the election.

Moreover, the responsibility for the quality of the service already performed, as well as the commitment to meet all the demands of the Ministry of Agriculture Livestock and supply with regard to having the state as an area free of foot-and-mouth disease without vaccination, are commitments that will be assumed before mapá and society south matogrossense in the face of this great victory for the state.

Despite all the weather, such as the pandemic, the difficulty of investments and the global crisis, the State of Mato Grosso do Sul, through the Agency for Animal Sanitary Defense and - Vegetal de MS- IAGRO, has been galloping in strides to obtain the status of free zone without vaccination. There have been several achievements, such as the creation of funds and applied technological innovation, which enables the analysis of information in real time through applications used in the field and transport, very important for quick decision making and for an immediate response to any notifications.

The challenges are enormous, mainly due to the geographical location of the State of MS in the face of the extension of international currencies, making traffic control a critical point. However, this challenge must have numerous partners, such as MAPA, public security agencies and, mainly, rural producers. Another limiting factor of this journey, as in other States, is still the structuring of personnel, which should be saneada with tender scheduled for the beginning of 2022.

ACKNOWLEDGEMENTS

We are grateful to IAGRO for providing the information for the production of this paper, together with the IFMS for providing this moment of learning.

REFERENCES

- [1] ENAGRO. (2021). Foot-and-mouth disease: Surveillance and Procedures in the Investigation of Vesicular Disease.
- [2] MORAES, G. M. (2018). Epidemiological studies to support the implementation of foot-and-mouth disease-free zones in Brazil.
- [3] OIE. (2021). World Organisation for Animal Health 2021. Retrieved August 1, 2021, from <https://www.oie.int/en/disease/foot-and-mouth-disease/#ui-id-2>
- [4] PANAFTOSA. (2017). Working Technical Guide for the Last Stage of the Hemispherical Program for the Eradication of Foot-and-Mouth Disease - PHEFA (2). World Health Organization
- [5] DUTRA, M. G. B., SANTOS, D. V., & GROFF, F. H. S. (2006). Characterization of rural properties for the risk of the introduction of foot-and-mouth disease virus in the gaúcho herd.
- [6] GAVIÃO, A. A. (2017). Percepção de risco dos diferentes atores envolvidos no controle da febre aftosa na fronteira oeste do Rio Grande do Sul [Master's dissertation, Universidade Federal do Pampa]. https://www.lareferencia.info/vufind/Record/BR_e583aee1130f6188e29ab4e1f352ba8f
- [7] LYRA, T. M. P., & SILVA, J. A. (2004). Foot-and-mouth disease in Brazil, 1960-2002. *Brazilian Archive of Veterinary Medicine and Animal Science*, 56(5), 565-576. <https://doi.org/10.1590/S0102-09352004000500001>
- [8] MAPA. (2020a). Brasil Livre da Aftosa is a milestone in the history of livestock. Ministry of Agriculture Livestock and Supply. https://www.gov.br/agricultura/pt-br/assuntos/sanidade-animal-e-vegetal/saudeanimal/programas-de-saude-animal/febre-aftosa/brasil-livre-daaftosa/copy_of_FichaTcnica_FebreAftosa_ago20.pdf
- [9] LEMOS, R. A. (2008). Diseases of economic impact in beef cattle., 105-157.
- [10] MAPA. (2019). Final report of serological surveillance in foot-and-mouth disease-free zones with vaccination in Brazil in 2019.
- [11] IAGRO. (2019). Shared Responsibilities. http://www.iagro.ms.gov.br/wp-content/uploads/2019/07/PNEFA_ResponsabilidadesCompartilhadas.pdf
- [12] PANAFTOSA. (2011). Hemispheric Program for the Eradication of Foot-and-Mouth Disease: Action Plan 2011-2020. <https://iris.paho.org/%20handle/10665.2/49641>
- [13] GUTIÉRREZ, H. O. D. (2007). Forms of livestock production and foot-and-mouth disease distribution in the department of Santa Cruz [Doctoral thesis, Universidade Federal de Minas Gerais].
- [14] SENASAG. (2021). Annual Operating Program. <https://www.senasag.gob.bo/index.php/transparencia/programa-operativo-anual>
- [15] SENACSA. (2021). Sanitary programs. <https://www.senacsa.gov.py/index.php/Temas-pecuarios/sanidad-animal/programas-sanitarios>
- [16] GIL, A. C. (2008). How to develop research projects (4th ed.). Atlas.
- [17] MAPA. (2018a). Annual report of Brazil for 46th COSALFA. <https://www.gov.br/agricultura/pt-br/assuntos/sanidade-animal-e-vegetal/saude-animal/programas-de-saude-animal/febre-aftosa/arquivos/PNEFA2018.pdf>
- [18] MATO GROSSO DO SUL. (2021). Mato Grosso do Sul 43 years: 24 cities that were born after the division and its potentialities. Portal of the Government of Mato Grosso do Sul. Retrieved August 1, 2021, from

<http://www.ms.gov.br/ms-43-anos-24-cidades-que-nasceram-depois-da-divisao-e-suas-potencialidades/>

- [19] MAPA. (2018b). Annual report of Brazil for 47th COSALFA. https://www.gov.br/agricultura/pt-br/assuntos/sanidade-animal-e-vegetal/saude-animal/programas-de-saude-animal/febre-aftosa/arquivos/Texto_COSALFA_2019_ano_base_201803_2020.pdf
- [20] MAPA. (2020b). Annual report of Brazil to 47th COSALFA. https://www.gov.br/agricultura/pt-br/assuntos/sanidade-animal-e-vegetal/saude-animal/programas-de-saude-animal/febre-aftosa/arquivos/Texto_COSALFA_2019_ano_base_201803_2020.pdf
- [21] MAPA. (2018b). Guide to the implementation of foot-and-mouth disease surveillance activities in international border regions.

Laboratory study of stone matrix asphalt by using bamboo fibre

Mr Rishi Dubey, Mr. Tarun Kumar Narnaure

Department of Civil Engineering and Applied Mechanics, Shri G.S. Institute of Technology and Science, Indore, Madhya Pradesh, India

Received: 20 Sep 2021,

Received in revised form: 07 Nov 2021,

Accepted: 18 Nov 2021,

Available online: 30 Nov 2021

©2021 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— *Bamboo Fibre, Drain Down Test, Marshall Stability Test, Optimum Fibre Content, Optimum Binder Content, Stone Matrix Asphalt.*

Abstract— *This study has been undertaken to investigate the modification of Stone Matrix Asphalt by using Bamboo Fibre. Now a days with increased traffic and maintenance costs there is need of construction of better long lasting roads that avoid pavement damage. Because of the presence of water in rainy season most common pavement damage starts. Moisture induced damages are a major source of concern on Indian roads. Stone Matrix Asphalt has a higher percentage of coarse aggregates and mineral filler and a low amount of fine aggregates. It also has a macro texture, low air voids, and high binder content, result in waterproof and good surface drainage. Stone Matrix Asphalt Mixture include a higher amount of coarse aggregate and a higher percentage of bitumen binder than standard Hot Mix Asphalt mixtures which consist of homogeneous aggregate and less bitumen binder. The Stone Matrix Asphalt mixes offer a long lasting surface. In India the idea of stone matrix asphalt is not well known because of lack of suitable standards. For the past few decades researchers have been focusing their efforts on developing stabilized mixes for enhanced pavement efficiency all over the world. Many attempts have been done to modified SMA mixes using Synthetic Fibres and polymers. Natural Fibres as Bamboo Fibre are being used to replace Synthetic Fibres and polymer as additives. India is a one of the world largest agricultural economy, generates a large amount of Natural Fibres. In according to this idea the focus of this study is on using Bamboo Fibre as additives to increase Stone Matrix Asphalt performance. The main object of this work is to find the effects of Bamboo fiber on the properties of SMA mixes. Stone Matrix Asphalt mix is prepared by varying bitumen content from 5.5% to 6.5% to obtain optimum bitumen content after that Bamboo Fibre is added during preparation of mix at varying content of 0.1% to 0.4% , then Marshall Stability Test and Drain Down Test are conducted to find Optimum Fibre content. All of these data back up the idea that Bamboo Fibre as additives in Stone Matrix Asphalt mixes have an impact. On the basis of volumetric, mechanical, and drain down properties of the various modified mixes, optimal Fibre content for Bamboo Fibre mixtures is 0.3 percent by weight of mix, which lead to rise in Marshall Stability value and fall in Flow Value when compared to traditional SMA mix.*

I. INTRODUCTION

India road infrastructure is rapidly expanding the increase in traffic and vehicle loads reduces the life of roads constructed with traditional bituminous mixtures. There is a lot of study going on in country to overcome the difficulties with pavements. The Stone Matrix Asphalt combination has been found to be an excellent choice for long lasting Indian highways. Bituminous paving mixtures that meet MoRTH criteria (MoRTH, 2001) are widely employed. Overloading is a big worry in India unlike most developed countries. Axle loads are heavy and speeds are low with many stop and start conditions resulting in deformation of the currently employed bituminous mixture. Permanent deformation in flexible pavement is often limited in the range of 10 to 15 cm from top of the flexible pavement according to several studies. Stone Matrix Asphalt mix is recommended for severe traffic loads and high tyre pressures. Because of stone on stone contact the weight is carried directly by the coarse aggregate. Bitumen modification and strengthening have played a vital role in improve the performance of flexible pavements. The transportation industry developed this technology in response to the poor functioning of road materials when subjected to significant change in traffic patterns. Natural Fibres are used as additives to stiffen the mastic during manufacture and application at high temperatures as well as to achieve even greater binder content for enhanced durability there is the increasing demand of various natural Fibre in various part of country for various purpose because these natural Fibre are environmental friendly. Stone matrix asphalt is made up of coarse and fine aggregates (70% to 80%), filler (10%), bitumen (min 6%) and stabilizer. When Stone Matrix Asphalt mixture is compacted a stone skeleton combination forms from a gap graded aggregate that can withstand severe load, avoid deformation, and ensure durability. Cement as filler, sand and bitumen form glue that holds the stone network together and makes the material cohesive. Stabilizer like Fibres added to keep the mastic in place. The mastic fills the gaps, holds the aggregate in place and provides further stabilization while also reducing air voids resulting in extremely durable bitumen. Mineral fillers and additions help to reduce binder drain down and increase the quantity of binder. Due to high percentage of coarse aggregate concentration stone to stone contact occurs resulting in a combination that is extremely resistant to deformation. The void free, binder rich mastic will give excellent durability and fracture resistance. The high concentration of big stones which is 3–4 more times traditional dense graded mixture will provide excellent

wear resistance. The rough surface roughness will provide better skid resistance.

II. RESEARCH OBJECTIVES

Main object is to provide long lasting surface of pavement by using bamboo fibre as additives in stone matrix asphalt this will provide a environmentally friendly surface.

1. To find out the volumetric parameter of traditional stone matrix asphalt mix by varying bitumen percentage content in order to find out optimum bitumen content.
2. To find out the effect of varying bamboo fibre content at optimum bitumen content in stone matrix asphalt.
3. Effect of varying bamboo fibre content is measured by Marshall Stability Test and flow value.
4. To find optimum fibre content using drain down test by varying bamboo fibre content in a mix.
5. To draw various graph on volumetric parameter, Marshall Stability Test and provide proper results and conclusion.

III. RESEARCH METHODOLOGY

In the way of obtaining the object of this study, Methodology has been used and present in a form of flow chart. First off all material use in experiment are tested to obtain their material characteristic, material testing include bitumen test, aggregate test are done, after the basic testing of material, specimen is prepared from stone matrix asphalt mix. Marshall Stability Test is conducted for specimens of varying percentage of bitumen content to obtain optimum bitumen content, after that optimum Fibre content is obtained by varying the percentage of Fibre content in a Stone Matrix Asphalt mix of optimum bitumen content by conducting Marshall test and drain down test. Volumetric characteristic such as air void, Voids in Mineral Aggregate(VMA), Voids Filled with Bitumen(VFB) and bulk specific gravity are calculated during testing of specimen. Now modified Stone Matrix Asphalt specimen is prepared by using varying percentage of Bamboo Fibre as additives and Marshall Stability Test and Drain Down Test is performed to obtain stability and flow value. After this result of both control Stone Matrix Asphalt sample and modified Stone Matrix Asphalt sample is compare and conclusion.

IV. MATERIALS

The type and quantity of materials used in flexible pavement surface have a significant impact on its performance. Aggregates, Bituminous, Cement, and Bamboo Fibre are all required for the creation of Stone Matrix Asphalt mixes.

4.1 Aggregate

Aggregates are the most common type of material used in road building. They must withstand heavy traffic, deterioration and sufficient stability. The Techniques of testing for aggregates in road building are outlined in IS 2386-1963. In this study, 20mm and 10mm aggregates, as well as stone dust. Table No. 4.1 Property of aggregate shows the results obtained for various aggregate characteristics.

Table 4.1 Property of Aggregate

Property	Value Obtain from Tests	Standards
Impact value	14.3	IS:2386 Part 4
Combined Elongation & Flakiness Index	23.828	IS:2386 Part 1
Specific Gravity	2.9	IS:2386 Part 3
Water Absorption%	0.133%	IS:2386 Part 3

4.2 Cement

The main aim of cement as Mineral Filler material is to make the bitumen binder stiff in the mix. Cement, bitumen binder and stabilizing ingredient is used to fill gaps and produce strong mastic. It improves the mix cohesiveness. As the filler increases stiffen of the mix increases, making it harder to compress and perhaps resulting in a crack composition. The quantity of material that passes from 0.075 mm sieve accounts for 10% of the aggregate in the mix, Ordinary Portland Cement 43 grade as mineral fillers is used. This investigation utilized cement, which has a stronger binding with aggregate, bitumen, and Bamboo Fibre as additive. Table No. 4.2 Property of cement shows the physical characteristics of the filler utilized.

Table 4.2 Property of Cement

Property	Values Obtain from Tests
Specific Gravity	3.11
% Passing 0.075 mm sieve	78

4.3 Stabilizing Additive

During mixing, shipping, and placement processes a stabilizing ingredient is added to retain the binder in a Stone Matrix Asphalt mixture consists of high binder content. Bamboo Fibres can be added to the mixture as stabilizing additives to avoid the undesirable drain down. Bamboo Fibre employed as stabilizing additives in this investigation.

4.4.1 Bamboo Fibre

India having large supply of Natural Fibres such as jute, Bamboo, Banana Fibre, Sisal Fibre, Coconut Fibre and many other which may be utilized for construction projects. Fibres used as a stabilizing agent, during the mixing process have numerous benefits such as improved binder content, thick film and mixture stability. Bamboo Fibre is utilized in this investigation at varying percentages to obtain Optimum Fibre content. Bamboo Fibre is shown in Fig.4.1. Bamboo Fibre is use because it is easily available in all parts of India, Bamboo is the only plant which grows fast in a single day at the rate of 40 mm per hour, Bamboo grow in forest of central part of India. They mainly grow in Madhya Pradesh, Maharashtra, Chattisgad and Odisha. Bamboo Fibre is obtained from natural Bamboo stem.



Fig. 4.1: Bamboo Fibre

4.4.2 Bitumen

The binder in Stone Matrix Asphalt mixture is bitumen. In different mixtures such as hot-mix and gap graded mix different grades of bitumen are employed. In the production of SMA mix samples VG30 grade bitumen is utilized. The physical characteristics of bitumen have

been discovered and bitumen property is shown in Table No. 4.3 Property of bitumen.

Table 4.3 Property of Bitumen

Property	Value Obtain Tests	Specification
Softening point °C	49	IS:1205-1978
Flash & fire point	230 260	IS:1209-1978
Specific gravity	1	IS:1202-1978
Ductility at 27°C (cm)	74	IS1208-1978
Penetration at 25°C	65	IS:1203-1978

V. TESTS

5.1 Marshall Stability Test

A total 1200gm weight of aggregates and mineral filler are heated together at a temperature of 150-160°C . Bitumen is heated at a temperature of 150°C. After heating aggregates and bitumen they are completely blended at temperature ranging from 150 to 160°C . To create laboratory sample of hight 63.5mm mix is filled in a mould which is preheated and compacted by a hammer of weight 4.5 kg and free fall is allowed at the hight of 45.8 cm by providing 50 blows of hammer on each side as per NCHRP Report 425. 75 blows were not provided as they were provided in dense graded bituminous mixes because 75 blows will break down the aggregate more in the gap graded mixes. The effort required to compact Stone Matrix Asphalt mixes to the necessary density on the highway was less than that required for standard Hot Mix Asphalt combinations. All of the samples in this study were compacted with 50 Marshall Hammer blows on each side. Marshall Stability test is performed on stable Stone Matrix Asphalt sample as shown in Figure 5.1 and 5.2 having a diameter of 100 mm and height of 63.50 mm, using 50 blows on each face. Bituminous mixtures are made by combining aggregates with bitumen and additives. In this study, the Bamboo Fibre content was changed between 0.1%, 0.2%, 0.3%, and 0.4% by weight of the mix. The Marshall Stability Test Sample is made in the same way as control mixture with the exception that the additives as Bamboo Fibre are added to bitumen during initial stage of heating .The Fibre length is a constant value of 6 mm which is used in a mix.



Fig. 5.1: SMA Mix Sample Specimen

The sample height is measured and the sample is submerged at 60°C water bath for 30minutes. The samples are immediately withdrawn from the bath tub filled with water and loaded into the Marshall loading head.



Fig 5.2: Marshall Test

Sample is applied with the compressive load at the rate of 50.80 mm per min. Sample before getting failure is used to obtain the values of Marshall Stability and Flow Value, when the maximum load is applied to it.

5.2 Drain Down Test

The Drain Down of SMA mixes produced at optimal binder concentration is evaluated, As per NCHRP Report 425 in this test bituminous mix is prepared after that it is weighted and place it in a wire basket in loose condition without compaction before placing wire basket in pan weight of pan is taken and then kept in oven for 1 hour at temperature of 170 after that pan is taken out along with wire basket then final

weight if pan is taken and drain down is calculated as below.

$$\text{Drain down}(\%) = (C-B)/A * 100 \quad (1)$$

Where, A = Mass of initial total sample (g)

B = Mass of initial pan (g)

C = Mass of final pan (g)

VI. RESULTS AND DISCUSSION

6.1 Marshall Stability Test

6.1.1 Marshall Stability and Flow Value

The addition of Bamboo Fibre in Stone Matrix Asphalt mixes efficiently increases stability values,

resulting in an increase in mixture toughness, as shown in Table 6.1. This suggests that the Fibre-based combination would perform better than the control. Figures show the variation in Marshall Stability and flow value of Bamboo Fibre content.

As shown in Figure 5.1 & 5.2 the stability of Bamboo Fibre stabilized mixes rises at first then reach a maximum value and subsequently declines as the Bamboo Fibre concentration increases. Bituminous mixture is a combination of aggregates and bitumen that is inconsistent, non-uniform, and multi phased. Excess Bamboo Fibres may not distribute evenly, coagulating together to produce weak spots within the mixture. As a result when Bamboo Fibre content is high, stability suffers.

Table 6.1 Marshall Stability Properties

Additive	Bamboo Fibre (%)	Marshall Stability (kN)	Flow value (mm)	Marshall Quotient (kN/mm)	Air Void (%)	Bulk Specific Gravity	VMA (%)	VFB (%)
Nil	0	7.852	3.81	2.060	3.984	2.506	19.057	79.094
Bamboo Fibre	0.1	8.213	3.64	2.256	4.09	2.503	19.154	78.599
	0.2	9.835	3.61	2.724	4.29	2.498	19.316	77.78
	0.3	11.671	3.56	3.278	4.40	2.495	19.413	77.303
	0.4	8.311	3.50	2.374	4.63	2.489	19.607	76.355

It should be highlighted that at 0.3% Bamboo Fibre content, Bamboo Fibre modified mixes have the Marshall Stability of (11.671 KN) suggesting that they had greater rutting resistance. When bitumen mixture crack Bamboo Fibre acts as a bridge preventing crack from spreading farther. Bamboo Fibre also enhances the viscosity and stiffness of bitumen by absorbing light components.

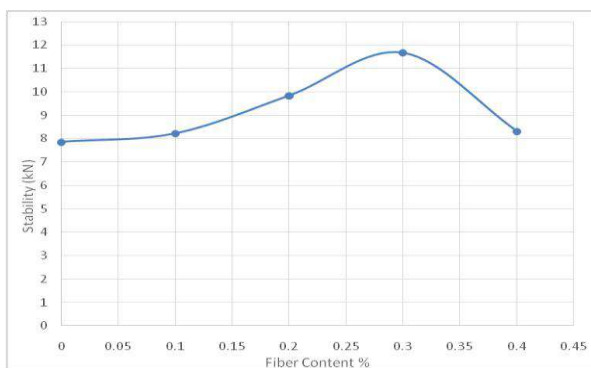


Fig 6.1: Stability v/s Fibre Content (%)

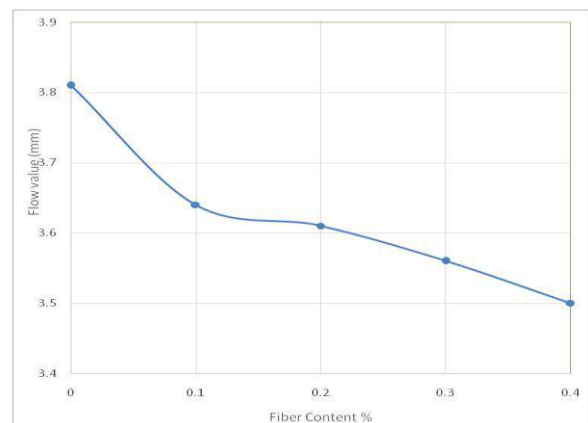


Fig. 6.2: Flow Value v/s Fibre Content (%)

6.1.2 Bulk Specific Gravity

The elastic behaviour of the mix improves as the Bamboo Fibre concentration rises because of elastic behaviour of Bamboo fiber. As Bamboo fiber content increases in the stone matrix asphalt mix specific gravity decreases as shown in Fig. 6.3.

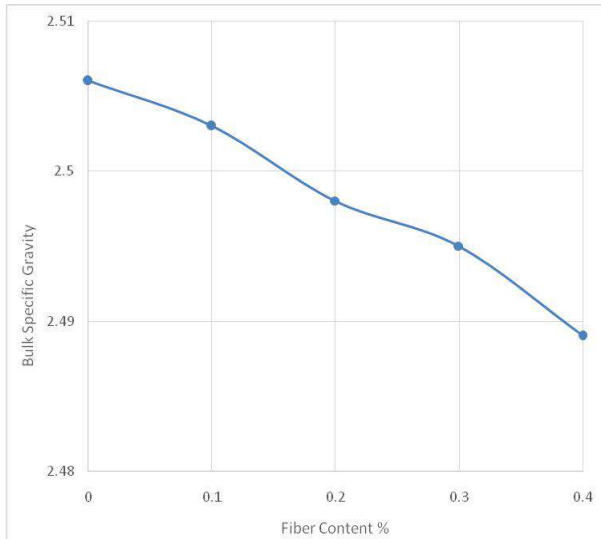


Fig 6.3: Bulk Specific Gravity v/s Fibre Content (%)

6.1.3 Air void, Voids in Mineral Aggregate and Voids mFilled with Bitumen

With increasing air gaps in the mix it will cause crack because there will be less bitumen binders to provide proper coating to the aggregates surface whereas little air void will cause greater plastic flow and bleeding problem of bitumen. The test findings Figure.5.4, 5.5 & 5.6 demonstrate that adding Bamboo Fibres to bituminous mixes increases the air void. However, the air spaces in mixes are in the limit of 3% to 5% indicating that Bamboo fiber can be used as additives.

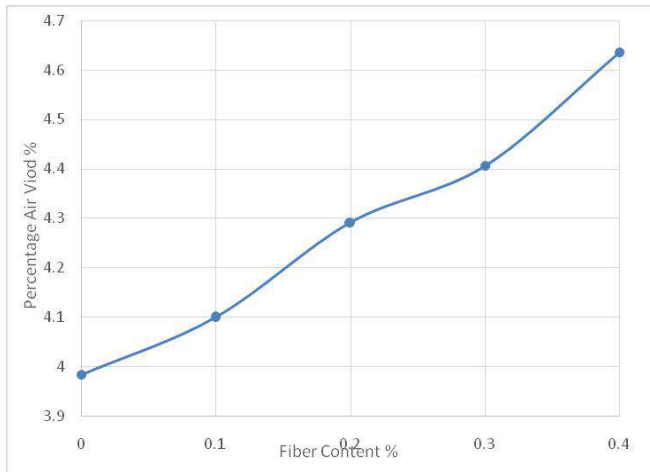


Fig.6.4: Air Void v/s Fibre Content (%)

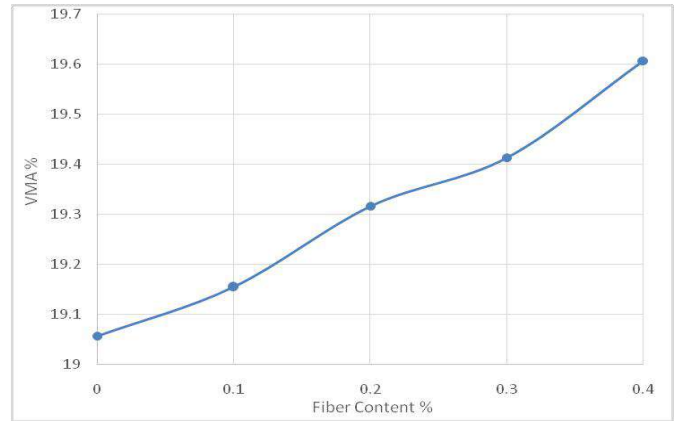


Fig.6.5 Voids in Mineral Aggregate v/s Fibre Content (%)

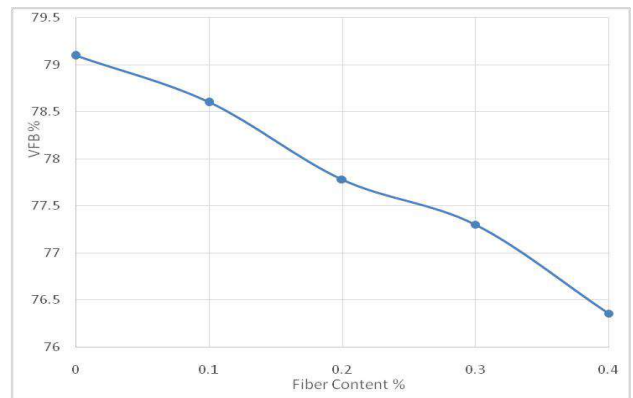


Fig.6.6 Voids Filled with Bitumen v/s Fibre Content (%)

6.2 Drain Down Test

Bamboo fiber additions significantly stabilize the combination when compared to the control mixture. According to AASHTO T305 the drain down of the traditional mixture is 6.658% which is well above the allowed limitations which is 0.3% of weight of mix. The values of drain down in all stabilized stone matrix asphalt mixes shown in Table 6.1 drop significantly with increasing Bamboo fiber concentration as shown in Figure No.6.2 and approach the permissible limit at 0.3% Fibre content. The possible benefit of adding Bamboo Fibre as additives to SMA Mixes is to reduce drain down and bleeding problem of SMA mix. As a stabilizing agent Bamboo Fibre additive can be used successfully.



Fig. 6.1: Drain Down Apparatus

Table 6.1 Drain Down Value

Bamboo Fibre (%)	Drain Down (%)
0	6.658
0.1	2.895
0.2	0.547
0.3	0.234
0.4	0.156

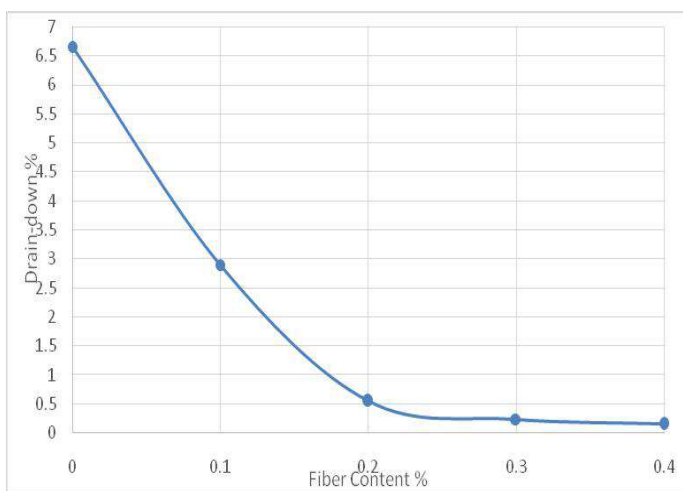


Fig. 6.2: Drain Down v/s Fiber Content

VII. CONCLUSION

1. It is noted that as the amount of Bamboo Fibre in Stone Matrix Asphalt increases with increase in the value of stability and Marshall Quotient, maximum value is obtained at 0.3% Bamboo Fibre content.

2. The highest values of Marshall Stability of stone matrix asphalt mixes are attained at 0.3 % Fibre content.
3. Bamboo Fibre has the highest stability (11.671 kN), indicating that it is more resistant to rutting.
4. Bamboo Fibre as additives utilised in the Stone Matrix Asphalt mixture for this study function of Bamboo fiber is to be an effective stabilizing agents and give considerable stability to the mixture.
5. The conventional mixture is exposed to significant drain down of 6.658%, which is over 0.3 percent by weight of mix because of stone to stone contact and rich binder concentration in Stone Matrix Asphalt. The addition of additives in the Stone Matrix Asphalt mix reduces Drain Down to the required level.

REFERENCES

- [1] Bindu C.S , Beena K.S Study on Influence of additives on the drain down characteristics of stone matrix asphalt mixtures. (2014)IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308
- [2] Siva Gowri Prasad S Study on An Experimental Investigation On Stone Matrix Asphalt By Using Coconut And Banana Fibres. (2018)International Journal of Civil Engineering and Technology (IJCIET) Volume 9, Issue 8, August 2018, pp. 964–973, Article ID: IJCIET_09_08_097
- [3] Prashanth M D , Divyesh study on Utilization of Waste Plastic and fibres In Stone Mastic Asphalt. (2018)INTERNATIONAL JOURNAL OF SCIENTIFIC PROGRESS AND RESEARCH (IJSPR) ISSN: 2349-4689
- [4] RAJENDRA SOREN study on Laboratory Investigation Of Stone Matrix Asphalt Using Bagasse. (2012)
- [5] Naveen Kumar R , V Sunitha study on Experimental Investigation of Stone Mastic Asphalt with Sisal Fibre. (2016)International Journal of Engineering Research & Technology (IJERT)ISSN: 2278-0181 IJERTV5IS110309 Vol. 5 Issue 11, November-2016
- [6] Sambhav Jain, Harpreet Singh, Tanuj Chopra study on Laboratory investigations and performance evaluation of stone matrix asphalt as a wearing course using three different fibres. (2017)International Journal of Applied Science and EngineeringISSN: 1727-2394
- [7] Mustafa Musleh Razahi1, Avani Chopra study on a review of using sisal fibre and coir fibre as additives in stone matrix asphalt. (2020)International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 07 Issue: 02 | Feb 2020
- [8] Uma Maruthi Venkatesh V , Siva Gowri Prasad S study ON a review on stone matrix asphalt by using stabilizing additives. (2018)International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES) Impact Factor: 5.22 (SJIF-2017), e-ISSN: 2455-2585 Volume 4, Issue 8, August-2018

- [9] Pragnya Parimita study on Influence of Natural Fibres as Additive on Characteristics of Stone Mastic Asphalt. (2020) IOP Conf. Series: Materials Science and Engineering 970 (2020)
- [10] Piyush Prakash, Rajat Palya STUDY on utilization of bamboo fibre in improving the properties of stone matrix asphalt mixes. (2017)International Journal of Mechanical And Production Engineering, ISSN: 2320-2092, Volume- 5, Issue-11, Nov.-2017
- [11] N.L.N Kiran Kumar , A. Ravitheja Study on Characteristics of stone matrix asphalt by using natural fibres as additives. (2019)ASCElibrary
- [12] K. Shravan , K.B.R. Prasad Reddy study on A COMPARATIVE STUDY ON PERFORMANCE OF STONE MATRIX ASPHALT WITH CELLULOSE AND COIR FIBERIJARIE-ISSN(O)-2395-4396 , Vol-3 Issue-6, 2017
- [13] K. Karunakar study on Properties of Stone Matrix Asphalt Using Carbon Fiber and Glass Fiber International Journal of Engineering Science Invention (IJESI) ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726 , Volume 7 Issue 6 , June 2018, PP 45-52 (2018)
- [14] Shaik. Dilkusha, K.V. Manikanta study on Laboratory Investigations of Stone Matrix Asphalt ByUsing Natural Fibres ISSN [ONLINE]: 2395-1052 IJSART - Volume 4 Issue 8–AUGUST 2018
- [15] Rose Mary Xavier study on A Review on Fiber Modified Stone Matrix Asphalt e-ISSN: 2395-0056 Volume: 05 Issue: 03, Mar-2018
- [16] National Cooperation Highway Research Program Report 425
- [17] IS:2386(I,III&IV)
- [18] IS:1202-1978
- [19] IS1205-1978
- [20] IS1203-1978
- [21] IS1208-1978
- [22] IS1209-1278

Stories of narrations, actions and facts related to the control and eradication of foot-and-mouth disease in the state of Mato Grosso do Sul.

Angela Nunes Boni¹, Claudio Di Martino¹, Graziela Picoloto¹, Rodrigo Cantero Dorsa¹, Graziela Picoloto¹, Viviane Müller Dantas¹, Luciano Fabrício Bariani José de Oliveira¹, Cynthia Nakaya Kinoshita Centurion¹, Odete Aparecida Pereira¹, Samuel Carvalhode Aragão², Jorge Granja de Oliveira Junior¹, Márcio Teixeira Oliveira³, Geraldo Marcos de Moraes⁴, Paulo Eduardo Ferlini Teixeira⁵, Jefferson Pintode Oliveira⁶, Renno de Abreu Araújo⁷, Agnaldo Reis Pontes⁷

¹State Agency for Animal and Plant Sanitary Defense - IAGRO, Campo Grande-MS, Brazil

²Federal Institute of Education, Science and Technology of Mato Grosso do Sul - IFMS, Campus Naviraí-MS, Brazil

³Federal Institute of Education, Science and Technology of Mato Grosso do Sul - IFMS, Campus Três Lagoas-MS, Brazil

⁴Ministry of Agriculture, Cattle and Supplying- MAPA, Department of Animal Health -DSA, Brasília-DF, Brazil

⁵Federal Institute of Education, Science and Technology of Mato Grosso do Sul - IFMS, Campus Nova Andradina-MS, Brazil

⁶Agricultural Defense Agency of the State of Pará- ADEPARA, Belém-PA, Brazil

⁷Federal Institute of Education, Science and Technology of Pará-IFPA, Campus Paragominas-PA, Brazil

Corresponding author: Email: anbvvet@hotmail.com

Received: 19 Sep 2021,

Received in revised form: 13 Nov 2021,

Accepted: 19 Nov 2021,

Available online: 30 Nov 2021

©2021 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— *Stories of Narrations, Actions, Facts, control, eradication of foot-and-mouth disease.*

Abstract— *In the year that the state of Mato Grosso do Sul celebrates its 44th anniversary, the State Agency for Animal and Plant Sanitary Defense - IAGRO celebrates its 42 years of work and dedication in favor of agriculture and livestock in the state. IAGRO in this period underwent the formation of its technical and structural staff so that the operability of the work would happen in an integral way in the state as it is today. Throughout this period, we are aware of the history of narratives, actions and facts related to the good work performed by active, inactive, concursus's and hired public service person, who contributed to IAGRO today being for Brazil, a reference in animal and plant health defense work, a work with international recognition. These stories, actions and facts culminate in the main objective today of IAGRO, which is the main demand of this agency and the productive sector of the entire Mato Grosso do Sul, that is, the withdrawal of the vaccine against foot-and-mouth disease throughout the state's cattle herd. Thus, this work aimed to narrate the history, actions and facts related to the control and eradication of foot-and-mouth disease in Mato Grosso do Sul over these 42 years of this young agency. The result of this work allowed the employees, especially the younger ones, to make a trip to the history of the institution, to be moved by stories lived by colleagues of service, to have a knowledge of*

actions and remarkable facts, which made the history of this agency, leaving the challenge of continuing to write, experience and mark as a new protagonist of the work of animal and plant sanitary defense of the state of Mato Grosso do Sul.

I. INTRODUCTION

Since the creation of Mato Grosso do Sul in 1977, its economy has always been focused largely on agriculture. In 1979, IAGRO, the State Agency for Animal and Plant Sanitary Defense, was created, which has always contributed to the sector, guiding, supervising, thus ensuring the improvement of animal and plant health in the State.

Over the years, one of the strengths of the institution has become the fight against foot-and-mouth disease. Since the 1980s, there has been a reduction in outbreaks of foot-and-mouth disease and policies have been implemented aimed at reducing outbreaks and mandatory vaccination. At the beginning of that same decade, there was a large number of outbreaks. Mato Grosso do Sul recorded 100 cases annually, until vaccination became mandatory in the state.

The last outbreaks were recorded in 2006, in the municipalities of Japorã, Eldorado and Mundo Novo and ended with the formation of Zav (Zone of High Surveillance), which acted as a buffer zone, with 15 km of extension of the international line, where the bovÍdeos and other ruminants were identified individually, the georeferenced properties, the two annual vaccinations for foot-and-mouth disease were carried out by the state official service, the properties were often inspected by veterinary medical inspectors and each local office had two veterinary medical inspectors.

This condition was only amended in 2019, after a recommendation from the OIE for ZAV to become a single vaccination-free area in Mato Grosso do Sul, and its approval was ratified at the Panaftosa General Assembly 88, in May 2020, Resolution N° 7.

To achieve this status, intense work was carried out, with surveillance on properties, traffic control, animal serology, health education, public service person training.

In 2021, the State of Mato Grosso do Sul aims one more step: foot-and-mouth disease-free area without vaccination from 2022. For this, efforts are focused on improving the capacity of animal health defense as a whole. Personal, structural, health education and communication, financial resources.

This article aims to tell a little of the history of Mato Grosso do Sul and IAGRO allied to the fight of Foot-and-Mouth Disease throughout its existence.

a) The history of the division of Mato Grosso do Sul

Due to the great debate that had been taking place for decades among the population of Mato Grosso, political, economic, cultural issues, among others, where it was already clear and notorious the discontent and anxiety of the matogrossense people, so that the federal government would carry out the division of the state, with the objective of mainly enabling the governance of the then great state[1].

All this movement culminated in the creation of the state of Mato Grosso do Sul, through the publication of Complementary Law N° 31, of October 11, 1977, and the implementation of the state in 1979. At the time, the state after being implemented consisted of 55 municipalities, with 453.000 inhabitants in the urban area and 547.000 in the rural area, with an area of 350,549 square kilometers having as first governor Dr. Harry Amorim Costa [1][2].

And over 44 years of history, another 24 municipalities were created, totaling 79 in 2021, with an estimated population of 2,8 million people [3]. And the main base of the economy is agribusiness, but it also stands out worldwide for its natural beauties [4]. In the division of states, Mato Grosso do Sul had all the existing research structure at the time [5].

The then created state of Mato Grosso do Sul, is located in the central west region of Brazil, bordering the following countries Paraguay and Bolivia (1103 km) and with the following Brazilian states: Mato Grosso, Goiás, Minas Gerais, Paraná and São Paulo [2].

An Adjustment Term was signed on February 8, 1979, where it aimed to establish an administrative coexistence, seeking to expedite economic development activities through assistance between the parties for the transfer of existing assets and documentary collection that was already belonging to the territory of Mato Grosso do Sul [6].

After 44 years of implementation in the state of Mato Grosso do Sul, the then young Brazilian state, became one of the largest grain producing states in the country, being the 5th largest cattle herd, having national prominence in the breeding of pigs, poultry, fish, in the production of honey, cellulose, ethanol, among other agribusiness activities [2] [2][3].

b) Creation of the State Agency for Animal and Plant Health Defense -IAGRO

On January 1, 1979, the governor of Mato Grosso do Sul, Dr. Harry Amorim Costa, according to Decree Law Nº. 9 of January 1, 1979 created IAGRO under the name of Department of Agricultural Inspection and Defense of Mato Grosso do Sul –IAGRO [4].

In 2000, IAGRO, by Law Nº 2,152, received the current name: State Agency for Animal and Plant Sanitary Defense. In this fact, there was a curious moment, where IAGRO's public service person participated in the choice of the agency's new slogan. Since December 2014 it is linked to the Secretariat of State and Production of Agrarian Development, Industry and Tourism - SEMAGRO[7].

Its attributions are the execution of agricultural inspection and defense policies, mainly in the actions of national animal health programs, animal disease diagnosis, inspection of animal products, plant health diagnoses, soil and seed analysis, sanitary education, trade in agricultural insums, traffic controls and information systems[8].

Formed by a total effective public service person board of 455 people, and 78 non-effective active public service person (assigned from other agencies or commissioned). Hierarchically divided into Board of Directors, Direct superior advisory that has four coordinators in its formation, five senior management sits under their tutelage 16 divisions with various planning and execution obligations within the agency[8].

The operational structure is divided into 11 Regional Units (Fig. 1), being distributed throughout the territory of MS and strategic points. They are: Amambai, Aquidauana, Campo Grande, Costa Rica, Coxim, Dourados, Jardim, Naviraí, Nova Andradina, Ponta Porã and Três Lagoas. And they are composed of 78 Local Units (with the exception of the municipality of Ladário that is linked to the corumbá office). who have a technical team composed of veterinarians, agronomists, chemists, chemical engineers, agricultural technicians, field and administrative assistants, trained and trained to give full support in the activities to be performed daily[8].



Fig. 1: Geographical distribution of IAGRO's regional offices

Source: IAGRO, 2021

Health Education began before the division with the advent of CACOFA in the eastern region of the state, where veterinarians participated in an exhibition where they presented photos and drawing of animals with symptoms of foot-and-mouth guiding the population on the disease and the importance of herd vaccination to decrease the progress of the disease in the state[9].

In the division of the state, nine regions were created, most of the municipalities had a veterinarian, who after training in TrêsLagoas, implemented registration, orientation lectures and vaccination of herds. There was an amateur radio system (in Campo Grande) in which the information was passed on to the regional ones and the educational material was produced in the existing printing plant at IAGRO[9].

IAGRO also carries out surveillance, defense and health surveillance activities through fixed inspection posts in the border areas of Bolivia and Paraguay, as well as with all states of the federation that border Mato Grosso do Sul[8].

The creation of these fixed posts in the border region emerged as a measure to contain the entry of citrus cancer into the country [9]. There are currently six fixed posts in operation, one in Guia Lopes da Laguna (Laguna), two in Ponta Porã (CopoSujo and Pacuri), one in Bataguassu (Porto XV) and one in TrêsLagoas (Jupiá), as illustrated in the fig.2[8]

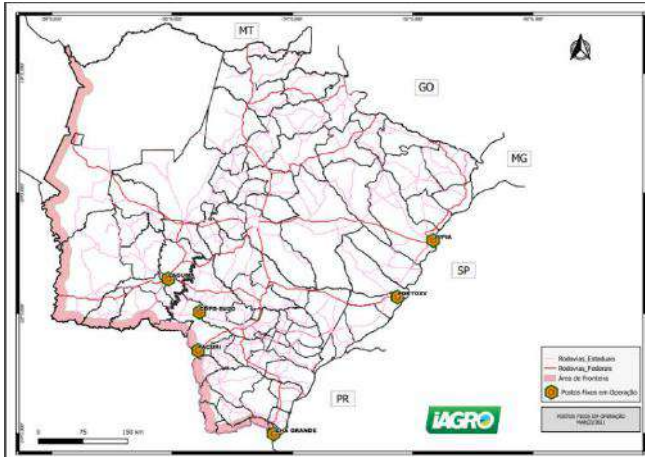


Fig. 2: Active fixed posts in the state of Mato Grosso do Sul

Source: IAGRO 2021

c) Chronology of foci of foot-and-mouth disease in the states of Mato Grosso and Mato Grosso do Sul

In the mid-1950s, there was practically foot-and-mouth disease in all south American countries, with this was created the Organization of American States (OAS), in the city of Rio de Janeiro, in 1951 [10]. According to Federal Decree No. 52.344 of August 9, 1963, the institutionalization of the campaign to combat foot-and-mouth disease began:

art.1º It is instituted in the Ministry of Agriculture, linked to the Secretary General of Agriculture, the "Campaign Against Foot-and-Mouth Disease" (C.C.F.A.), with the task of mobilizing all government resources and tracing the norms of the policy of research and combating foot-and-mouth disease, as well as adopting technical and administrative measures necessary for the implementation and development of the anti-aftosa campaign, throughout the national territory (Federal Decree 52.344/1963).

This led to the implementation of laboratory infrastructure, personnel training and awareness of producers, initiating the control and diagnosis of the disease[11]. In 1968, he began to think about financing by a quota system of PAHO (Pan American Health Organization) member countries [12].

In the 1970s, the information system was implemented, which, due to surveillance and more accurate identification capacity, revealed the largest number of outbreaks, along with the implementation of vaccine quality control, the identification of problem areas through the study of animal transit and its comparison with the occurrence of the disease[11]. (Lyra and Silva, 2004).

In the early 1980s, the entire Midwest region of Brazil had a high rate of outbreaks of foot-and-mouth disease. The State of Mato Grosso do Sul recorded more than 100 outbreaks annually, reaching a total of 552 investigations by the 1990s[12].

In the 1990s, there was the publication of State Law 1.045, of May 23, 1990, which made vaccination in the State mandatory. And there was also the implementation of the eradication policy with the regionalization of actions and the free country goal, which should occur in 2005, and this goal was compromised due to the last outbreaks and the Hemispheric Plan for the Eradication of Foot-and-Mouth Disease to predict eradication in the South American continent in 2009[12].

In 1998, after a period of 38 months without occurrences of Foot-and-Mouth Disease, the disease was diagnosed in Porto Murtinho (Fig. 3-6), by a team from the then Department of Agricultural Inspection and Defense of Mato Grosso do Sul - IAGRO, meeting the anonymous complaint of two properties involved and a total of 3039 sacrificed animals (Fig.4) [13].



Fig. 3: Foot-and-mouth disease lesions in an inspected animal



Fig. 4: Sacrificed animals already placed in the ditch of destruction.



Fig. 5: Animals sacrificed in the ditch of destruction. public service person opening the housings.



Fig. 6: Work of opening animal carcasses inside the ditch to prevent gas build-up.

After clinical findings, sanitation actions were triggered that lasted about 106 days. With the support of the Ministry of Agriculture, there was the option of using a sanitary rifle with compensation from the owners, an option that served as a reference framework for the state, being definitively established as an action to eradicate the total foot-and-mouth disease of 3039 sacrificed animals [13].

At that time, the vaccination schedule took place through the stages of February (including animals under 12 months old), May (for animals aged up to 24 months) and November (total herd vaccination). Porto Murtinho because it had part of its territory considered Pantanal, still had a campaign stage per year and performed vaccination of total herd (only for pantanal properties with campaign option in May or November)[13].

In 1999, there was a new reintroduction of the Foot-and-Mouth Disease virus, there were outbreaks in the municipality of Naviraí, there were three properties involved and 1740 animals sacrificed and five more properties with animals destined for sanitary slaughter totaling 6592 slaughtered animals, whose working period lasted until May 2000[13].

The suspicion originated in pigs and sheep that appeared to be sick. Because they are compatible symptoms, it was decided to immediately ban the property, from the municipality of Naviraí (Fig. 7), parts of the municipality of Juti and Jateí for the transit of animals susceptible to Foot-and-mouth disease as well as its products and by-products [13].



Fig.7: Foot-and-mouth disease injury in an animal from the naviraí outbreak.

The diagnostic methods at the time for unvaccinated animals was Immunodiffusion in Agar Gel with VIA antigen (IDGA-VIA) and for vaccinated the Immunoenzymatic Assay by Electrotransference Test [13]was already used.

And in 2005, more precisely on September 30, the Veterinarian of the property FazVezozzo, sought the Local Unit to report the possibility of vesicular disease in cattle and horses. At that time, vaccination stages were changed, with the February stage being removed that included calves up to 12 months old [15].

The harvests (Fig. 8-9) of this occurrence were carried out on October 1 and the confirmatory result came out on October 8. The municipalities of Eldorado, Itaquiraí, Iguatemi, Mundo Novo and Japorã were banned, in several properties as an area of health risk. 77628 animals susceptible to foot-and-mouth disease were subjected to slaughter or sacrifice [15].



Fig.8: Harvesting of gallbladder fluid oot-and-mouth disease injury)

The diagnostic tests used in this occurrence were the Immunoenzymatic Assay test using 3ABC protein (ELISA-3ABC) that protein is present at high levels in the serum of infected animals and the EITB test. The actions lasted until 2006[15].



Fig. 9: Esophageal Liquid (LEF) harvest for diagnosis of Foot-and-mouth disease

The sanitary status "free with vaccination" was only recovered after several actions to meet health requirements, including the creation of the High Surveillance Zone (ZAV) in the State of Mato Grosso do Sul. Zav, created on January 21, 2008, according to ORDINANCE/IAGRO/MS N° 1.420, covering an area of sanitary protection formed by the municipalities and/or part of the municipalities that make up the state's borders with Paraguay and Bolivia [16](IAGRO, 2008).

According to Normative Instruction N° 44, of the Ministry of Agriculture, Livestock and Supply, of October 3, 2007, "the transit of animals, their products and by-products, between the properties and municipalities that make up ZAV or destined for the other regions of the State and the country".

In February 2011, the Scientific Commission of the World Organization for Animal Health (OIE) recognized the High Surveillance Zone (ZAV) of Mato Grosso do Sul as "free of foot-and-mouth disease with vaccination". With the publication of Normative Instruction No. 13, of March 22, 2011, the guidelines for the implementation of the veterinary surveillance system at ZAV[17] were redefined.

The official veterinary service established that in each local unit of the municipalities of the border region, there were at least two veterinarians, in addition to fixed posts and mobile inspection teams acting permanently. Another initiative was the implementation of the georeferenced register of properties, followed by a specific plan of monitoring and veterinary surveillance, including, as a priority, inspections in properties and risk areas and inspection of the transit of animals[16].

In 2019, the municipalities that formed ZAV began to have the same health status as the rest of the state, considered as an area free of foot-and-mouth disease with vaccination.

d) Actions and facts related to the control of foot-and-mouth disease in Mato Grosso do Sul

An agreement between the OAS, the Pan American Sanitary Workshop and the Brazilian government on August 25, 1951, panafosa was created. With the objective of being the first center specialized in Foot-and-mouth disease in the Americas, with the mission of cooperating with the countries of the region in the organization, development and strengthening of national programs for the prevention, control and eradication of the disease. Originally, it was dedicated exclusively to the fight against Foot-and-mouth Disease, today it also acts in technical cooperation fighting zoonoses and food safety. In 1952, the training program for veterinarians of the national official services for the prevention, control and eradication of foot-and-mouth disease [18] was initiated

It was created in 1972 during the 5th. Inter-American Meeting on The Control of Foot-and-Mouth Disease and Other Zoonoses (RICAZV), the South American Commission for the Fight against Foot-and-Mouth Disease (COSALFA), which published Resolution VIII, which calls for this Pan American Health Organization (PAHO) to create, coordinate and promote the commission instituted[19].

The creation of this commission was mainly recommended at the XXIX Seminar organized by the Pan American Center for Foot-and-Mouth Disease (CPFA), held in Rio de Janeiro, Brazil, in December 11971, with the participation of the directors of Disease Control Programs of South America, in which the need to have an interregional cooperation mechanism for the purpose of

studying was justified, coordinate and evaluate the activities carried out at continental level for the control and eradication of foot-and-mouth disease. The first meeting took place in February 1973[19].

The committee meetings are governed by a statute establishing as main members the directors of Animal Health of the Foot-and-Mouth Disease Programs of Argentina, Bolivia, Brazil, Colombia, Chile, Ecuador, Guyana, Paraguay, Peru, Uruguay and Venezuela. At the request of these countries, the CPFA acts as secretariat ex officio in common agreement and accepts other countries and international organizations as observers [19].

In view of the need to evaluate, analyze, and exchange information on the main technical aspects of foot-and-mouth disease control and eradication, the committee has asked PAHO to hold seminars that precede ordinary meetings and whose conclusions and recommendations are adapted by the Commission. The themes chosen include areas of epidemiology, administration, planning, communication and health education and immunization programs against foot-and-mouth disease [19].

In 1973, it was requested to include in the next meeting as the theme a study on "Free and controlled areas". Already in 1974, the 1st Action Plan (Continental Plan for Foot-and-Mouth Disease Research) was approved. In 1977, the document "Foot-and-mouth disease-free areas"[19] was approved.

In the 1970s, the Campaign to Combat Foot-and-Mouth Disease (CACOFA), a program financed by the IBRD (International Bank for Reconstruction and Development), coordinated by MAPA/MT [9] was established.

The strategy of this campaign was focused on the eastern region of the former state of Mato Grosso, composed of TrêsLagoas (administrative headquarters of the program), Anaurilândia, Bataguassu, Brasilândia, Água Clara, Aparecida do Taboado, Paranaíba, Inocência and Cassilândia - a region that had the largest bovine population at the time, since the cattle ranch of Mato Grosso was scarce[20].

At that time there were no refrigerators in this region, Mato Grosso do Sul had 04 refrigerators (02 in Campo Grande, 01 Anastácio and 01 in Dourados), which led to a greater movement of cattle (Fig.10) for the slaughterhouse and also fattening in the neighboring state of São Paulo[9][21].



Fig.10: Means of transport of cattle by the river

This campaign brought immense progress to the state's livestock, because through it began to carry out the work of animal health defense that consisted of registering the properties, adapting them through minimal structures (corrals and pickets) and the requirement to vaccinate at least one dose for transit of these animals [20].

After the creation of the state of Mato Grosso do Sul, TrêsLagoas became a training center of this program for veterinarians who registered, attended a vaccination stage on site and then disseminated these learnings in their municipalities, implementing cacofa[20][9].

The year 2008 was characterized by the consolidation of the High Surveillance Zone (Zav), which was implemented in response to the recommendations of the OIE mission. Its status is similar to that of a Buffer Zone, with more rigorous actions such as: individual identification and traceability of cattle, buffaloes and small ruminants, vaccination of cattle and buffaloes performed by the official service, registration of geographical location of all rural properties with susceptible animals. The structure of the official veterinary service has been strengthened especially for ZAV. The General Standards and Guidelines for the implementation of the veterinary surveillance system at ZAV were described by Normative Instruction No. 63, 2008, which determined the maintenance of a minimum structure of animal health defense for the region [22].

The condition of free area without vaccination was restored to the High Surveillance Zone (ZAV), in the border region of Mato Grosso do Sul with Paraguay and Bolivia, in February 2011 [23].

In 2015, Brazil continued to chair the OIE Regional Commission in the Americas, participated in the World Assembly of Animal Health and meetings of the Standing Veterinary Committee of the Southern Cone - CVP[24].

That same year, Brazil also participated in the group of experts who developed the "Technical Guide for the last

stage of the PHEFA", approved at the 5th Extraordinary COSALFA held in Cuiabá, MT. meetings were held between the official surveillance services (SVOs) of Brazil, Peru and Bolivia at international borders to discuss issues of common health interest. The SVOs of Mato Grosso and Mato Grosso do Sul supervised vaccination, updating cadastral and promoted health education actions together with producers in a 15 km strip of the border [24].

In 2019, with the recommendation of the OIE, the High Surveillance Zones and other regions of Mato Grosso do Sul were unified, thus forming a single free area with vaccination. Approval was ratified during the General Assembly 88, in May 2020, Resolution No. 7 [25].

e) **Epidemiological control of foot-and-mouth disease**

Epidemiological control for foot-and-mouth disease consists in strengthening actions related to inspections at strategic points such as: airport, ports, fixed posts located on intermunicipal, interstate and national borders. It is also linked to the control of property registration, in the verification of animals susceptible to the disease. The existence of vaccination, control of distribution, storage and commercialization of vaccination. Conducting epidemiological serum studies for the detection of circulating agents. And perhaps the main one, the work of health education and social communication in the population, guiding them, with simple and objective language[26].

The control of foot-and-mouth disease in the state of Mato Grosso do Sul is carried out by the implementation of the National Program for the Eradication of Foot-and-Mouth Disease – PNEFA, using compulsory vaccinations at 2 specific times of the year, the months of May and November being the conditions defined as mandatory vaccination of cattle and buffalo herds, and serological surveys with frequency and design defined by the Ministry of Agriculture [26].

Also according to BRAZIL (2018), a quality control based on 6 parameters is carried out in vaccines produced and destined to trade, which are emulsion stability, safety, tolerance, sterility, potency and antibody research against non-structural proteins. The vaccine should be bivalent, containing subtypes A and O of inactivated aphthovirus[27].

Actions such as improvement of the care and surveillance system, supervision of animals, products and by-products, diagnosis, definition of areas of greater susceptibility (risk) are part of the epidemiological control of the disease[26].

In the state of Mato Grosso do Sul, since the end of 1993, the use of vaccines with oily adjuvant, with trade

controlled by the Agency, and responsibility for acquisition and application by producers[28] is mandatory.

The aim of this study was to describe the story through narrations, actions and facts related to the control and eradication of foot-and-mouth disease in Mato Grosso do Sul, through the work developed by IAGRO.

II. MATERIAL AND METHODS

a) Research Design

This work, as far as its nature is, will be a bibliographical research with a qualitative lyused approach, since it is intended to narrate the story through personal narratives, actions and recorded facts and or personal communication, on the control and eradication of foot-and-mouth disease in Mato Grosso do Sul. In this study, no statistical methods and techniques will be used, the approach will be case report [29].

The research will be delineated through a case study. "The case study refers to the survey with greater depth of a given case or group in all its aspects. However, it is limited because it is restricted to the case studied, which cannot be generalized"[30].

The research is characterized with an explanatory nature, providing greater familiarity with the problem and identifying the factors that determine or contribute to the occurrence of phenomena[31] (GIL, 2008).

b) Data collection

Data were collected from official documents, theses and dissertations, scientific articles, folders among others, which served as the basis for the elaboration of this scientific work.

c) Personal Communication

Interviews were conducted with active and inactive IAGROpublic service personand alsoMAPAPublic service person, through visual recordings made via mobile phone and also by telephone, where this information was transcribed contributing to the narration of the facts and the history of the creation of IAGRO and the control and eradication of Foot-and-Mouth Disease in Mato Grosso do Sul.

d) Personal document analysis

Because it is a case report work, official documents were collected in iagro archives, and these were analyzed and studied with the objective of supporting the accomplishment of this work. Data obtained from the E-SANIAGRO system, which is the official data system of IAGRO and the compilation of data generated by all

existing departments in IAGRO, documents that are under the care of the health education division were also used.

III. RESULTS AND DISCUSSION

a) Health education

IAGRO has always held lectures with the municipalities with the help of representative entities (trade unions, associations and small producers) where animal health defense programs were addressed - distribution of folders on the programs, held courses of agents in animal health, municipal seminars for animal health, seminars for high school teachers and delivered educational material in the barriers of supervision [8].

In 2007 began a project called Pedagogical Workshop on Animal and Plant Sanitary Defense, with the objective of bringing the work of agricultural sanitary defense closer to educational practices developed in schools. This project worked the teacher through booklets, where he acquired technical and scientific knowledge, and then he used it in the classroom with his students. From its creation until 2017, 20 Workshops were given with a total of 1949 participating teachers and 16433 kits distributed to students. This project is no longer active today, due to lack of investment and pedagogy [32].

In Law 3.823 of 2009 in Art. VII, the Socio-Educational Seminar was established for the producers, where they attended two lectures related to agribusiness and animal health defense and carried out a questionnaire. This seminar before the pandemic was held once a month in person simultaneously throughout the state, in the regional municipalities. Since September 2020, 643 seminars have been held with an audience of 9.232 listeners [32].

In addition to the lectures, there were courses of agent in agricultural health aimed at small farmers, there were 47 courses with 712 listeners. There is also distribution of educational material, total of 92.234. IAGRO's health education is also present in agricultural events, has technical terms of cooperation with agribusiness representative entities (SENAR, FAMASUL, EMBRAPA) sharing knowledge, giving lectures, delivering material or even doing training[8].

IAGRO's health education, after the pandemic changed the way the information reached the rural producer, using social media to clarify health events, guidelines and also communication channels where he can ask his questions and ask questions. The information also follows through radio and television campaigns [8].

One of the innovations and achievements was the cooperation agreement signed with the Federal Institute of

Mato Grosso do Sul -IFMS/IAGRO, which made possible the idealization and realization of the Specialization in Sanitary Education and Communication in Agricultural Defense for IAGRO public service persons, showing the need and importance of personal qualification so that we can increasingly make the state of Mato Grosso do Sul strong and competitive in the agricultural sector [32].

a) Interviews

❖ Interview with veterinarian Dr. Gelson Sandoval Jr.

Veterinary Physician graduated from the Federal University of Mato Grosso do Sul (UFMS) in 1982, a servant of IAGRO since 1989 starting in Bodoquena, in 1990 he went to the municipality of Paranaíba, in 1991 he went to Corumbá where he remained for 9 years and after this period, moved to Campo Grande in 1999 working for another 3 years in the Local Unit, after that in the Division of Sanitary Education, where it remains to this day.

He participated not directly in actions with affected animals, but there was an episode of focus at the New Horizon Auction where there were two Comitivas that took the animals to Aquidauana, where it was "bursting Foot-and-mouth Disease" within the municipality of Aquidauana. Upon learning of the incident, what answered the occurrence was the Local Unit of Aquidauana and the corumbá team was to carry out the interdiction and cleaning (Fig. 11 and 12) of the Novo Horizonte auction venue and it was the only time that the interdiction of the enclosure was seen for two to three months. This occurred in the early 1990s, where The PNEFA was not yet as we know today with all eradication actions.



Fig.11: Vehicle disinfection jobs



Fig. 12: Cleaning and disinfection work

Already official focus where there was personal participation, it was at the end of the 1990s that it was in 1998 in the municipality of Porto Murinho and then in the focus of 2005/2006 in Eldorado, Japorã and Mundo Novo.

The occurrence in Porto Murinho was much less stressful because they were in two large properties in isolation in a large municipality that was naturally more isolated, so it was relatively easier to contain the contamination. What he received was the task of performing the periphery vaccination that was done together with the Rural Union of Porto Murinho.

At the time one wondered what would happen if the Foot-and-Mouth Disease virus entered the area of Settlements, small estates and indigenous villages, and that is exactly what happened in Japorã.

Participation in the focus of Japorã, Eldorado and Mundo Novo began in the middle of November, acting mainly in the dissemination of actions, and interaction with producers who refused to allow the sacrifice of their animals.

Upon arriving, he participated in a meeting at the City Hall where the IAGRO/MAPA team was present, there were angry producers (Fig. 13) especially with the evaluation and the amounts and payment terms for the animals that were being eliminated. Because there were allegations of differentiated amounts paid in the acquisition by the producers and were not the same presented by the evaluation team (formed by technicians from IAGRO, MAPA and Rural Union), values of approximately 50 to 60% of what the producers claimed to have paid in their acquisition, generating a lot of dissatisfaction on the part of the producers.



Fig. 13: Occurrences in the municipality in movements of revolt of producers.

The next day, when he went to start his activities in the municipality of Japorã, when he stopped at the barrier about 10 km before the city, he was instructed to return and take refuge in the Military Police Battalion, because there was a movement of people who were tipping over IAGRO cars, threatening invasion in the Local Unit. It was a very embarrassing situation because everything that should not happen in a focus was happening, such as meetings in positive batches for foot-and-mouth disease and then the producers returned to their lots.

The function of Health Education in the focus was initially the dissemination of actions, what was happening and why it was happening and mainly to overcome the resistance of producers. Explain each of the actions and the time it would take at first to solve them, and before taking a more drastic action against the producer, the conversation to 'break' the resistance of producers to slaughter their animals with all care.

It was a very good experience for the possibility of talking to producers of all kinds and knowing their realities as well as understanding their condition.

What was learned from this whole situation was that IAGRO has a lot to work on in the "relationship with society", there was very clear this deficiency. The Veterinarian has not since his academic training, preparation for this relationship with people, interaction with the community. What needs to be understood is that we depend on the relationship with the producer so that our work is done and well executed, because without this good interaction, there will be no possibility of execution of the work.

Health Education failed like other health defense actions, because if it had been well performed, the focus would not occur. After the occurrence is opened, what can

be done in the scope of Sanitary Education, it becomes more difficult to work because we enter a situation of "explaining what will happen", because we fall into a protocol of norms that no longer depends on teaching but on communicating. Credibility takes years to conquer and you lose in minutes.

It was seen that the GEASE process did not meet the small producer, because the slaughtered animal was indemnified, but the small one mainly depended on a small crop, a third-party service, the production of those animals and suddenly nothing else can be done on that lot. The debts of incentive programs had to be forgiven because they could not honor their basic commitments let more bank loans from government programs. So the money paid by the animals only served to make the accumulated debts of previous months paid. In the end, they had no animals, no money and all work was started from scratch.

As a message of what has become of experience, is that we need to improve our relationship with the community. Doing Sanitary Education is doing Health Defense intelligently, and those who do not do sanitary education in their work, are working against themselves.

❖ Interview with veterinarian Dr. Elvio Patatt Cazolla

Veterinary Physician graduated from the Federal University of Santa Maria (UFSM) in 1985 and is a federal public service person since 2002 in the Ministry of Agriculture, crowded in the Federal Superintendence of Agriculture (SFA) in the Service of Supplies and Animal Health, was a servant of IAGRO until the year 2001.

He had the opportunity to participate in the last three outbreaks of Foot-and-mouth Disease that occurred in Mato Grosso do Sul in 1998 in the municipality of Porto Murtinho, 1999 in the municipality of Naviraí and last in 2005/2006 in the municipalities of Eldorado, Mundo Novo and Japorã, already as a federal servant of the Ministry of Agriculture.

With regard to Porto Murtinho, an anonymous notification was received in the Regional of the time in the municipality of Aquidauana in early February 1998, and the Regional Dr. Adenan summoned him in the Local Unit of Garden and Campo Grande was dr. Afonso who accompanied him.

Upon arriving at the property, the presence of lesions was verified (Fig.14) already healed suggestive of vesicular disease in the animals, and when instilling the employee of the property, they were told that there were pigs also with injuries, but that they only returned at night to collect themselves in the "egg" of the mangueiro. Thus, they returned to the city and scheduled to return to the

farm at night. Upon arriving at the Local Unit, they made the first surveys of movements of the property and interdiction of the plug and returned around three in the morning to take samples of the pigs in question.



Fig.14: Inspection in cattle for injury detection

It is interesting that the material was collected and there was a positive VIA result, which was the test at the time used for unvaccinated animals (pigs, sheep and goats) and for cattle the EITB was already used.

Thus, there was the confirmation of focus of Foot-and-mouth Disease in Porto Murtinho. It is worth mentioning that this was the first health emergency implemented in the country, this was a reference milestone for Mato Grosso do Sul and Brazil, as it was the first health emergency following the OIE Land Animal Code.

Then, the work began in February and were closed in July with full release. They were in two large properties, which did not hinder the work.

To highlight at this time, that in 1992, there was the reformulation of the Foot-and-Mouth Disease Program, no longer being a control program to be of eradication of the disease making a union between Brazil and the other countries of the continent with the same objective.

Brazil in this objective was well planned, at the time divided into five major livestock circuits and Mato Grosso do Sul being part of the Midwest circuit along with part of São Paulo, Minas Gerais, Goiás, Tocantins and Mato Grosso. The goal of this Circuit was in the year 2000 to be free of Foot-and-mouth disease with vaccination. With the occurrence of this event in Porto Murtinho, there was a concern that the state would be harmed, but as the work was very well executed and coordinated by Dr. Geraldo, now director of the Department of Animal Health, there was also the expectation that it would not hinder the plans of the Circuit, but unfortunately in January 1999, there was another introduction of the virus.

Thus, there was a complication of the process, as they would be in 1999 with the final steps to plead free area with vaccine within the Midwest circuit. There was already a previous work of updating cadastral, seroepidemiological studies to prove the absence of viral circulation, but unfortunately we can not follow the Circuit after this occurrence.

They were at a meeting in the municipality of Cuiabá where the other states were very clear saying they would not expect Mato Grosso do Sul. This caused a great deal of damage to the state because in 2000, Mato Grosso do Sul became a buffer area. The other states of the Midwest Circuit were recognized by the OIE as a free area with vaccination different from the MS, so any animal from the MS that went to these other states should quarantine and serology at the origin and destination, this greatly devalued the value of our animals.

The year 2000 was also marked by a great serology in the state to recover the status of free with vaccination in the year 2001.

This story summarizes what were the occurrences of Porto Murtinho and Naviraí that were very similar because they were in two large properties where there were good conditions for the eradication of foci.

A few years later, in 2005, there was reintroduction of the virus in an entirely different condition, with extreme difficulty to carry out the work, in a region with many small rural properties, many roads, an incredible permeability, dry border with the neighboring country. In the investigations conducted together with the police, there were strong indications of irregularly entering animals from Paraguay, on the other hand this country replied that there was nothing focused on its territory.

With all these difficulties, ends the year 2005 with 33 foci, the confirmations occurred in October and takes almost 4 months to sacrifice all the animals of the foci in Mundo Novo, Eldorado and Japorã, and another appearance occurs in April 2006 on a property in Japorã, taking another week for it to be drunk.

The sequence of the work recommended by the OIE was the sacrifice of the animals followed by sanitary void and introduction of sentinel animals, these sentinels (previously tested and not vaccinated) are followed for 30 days and tested 3 times with clinical inspection and thermometry during this time. At that moment, it was thought that everything was right. There one should go to a seroepidemiological study where paired harvests are made to prove that the measures that were taken were sufficient to eliminate any source of infection of the disease, proving that there was no viral circulation.

Unfortunately, in the serologies performed, a high reactivity was observed, both in the first serology and in the second within the three municipalities, and at the same time serology was performed outside the municipalities where no reactivity was found.

What became clear was that these actions were sufficient to prevent the virus from leaving the contaminated area, but it did not prevent the virus from circulating within that area.

In this, around 34.000 animals had already been sacrificed, from there the Department of Animal Health determines that any type of source of infection be eliminated, including direct and indirect contacts, including epidemiological links, and therefore be referred for sanitary slaughter. Another 44.000 animals were sent to slaughter.

For costs, the economic loss was around 8,5 million in the first phase plus almost 9 million in the second phase, this in dollars.

Situations have passed that are not expected to happen as confrontations, questioning, but what caught the most attention was the mainly political opportunism of people.

They were called to a meeting in the municipality of Japorã by the mayor in the City Council, and the main question of the producers was that they would like to receive in advance the values of the animals that would still be slaughtered, and it was said that it would not be possible by a series of legal procedures that needed to be done. From a certain moment, the mayor said that from that moment on he would no longer support the actions of IAGRO and MAPA and that he would be at the side of the producers, causing a "boiling" within that place.

After this situation, it was perceived that this whole situation was architected in an opportunistic way to promote itself politically. Leaving there, returning to Eldorado, in the early hours, countless buses full of settlers, indigenous, small producers, were arriving in the city. They broke into the iagro office, tried to set fire to the vehicles, tried to break into the parish house that was the warehouse that was guarded by the Civil Defense.

Apart from situations of total interdiction of refrigerators in the municipalities that were the great employers of the region, many people were unemployed, there was very great social movement. Almost 100% of the properties of one of these municipalities were settlements, and there was a case of a lady who had 2 children and was pregnant with a third, looking for the welfare staff, because she was hungry because she had nothing else and had not received the compensation money yet. This greatly impacted the teams that worked there.

Therefore, the importance of our actions and the effective awareness of all actors involved in the eradication of this disease.

The message that remains is that we went through all this and today we are in a much more comfortable sanitary condition, the neighboring countries that we had many problems precisely with sanitary conditions, greatly improved their condition because today the vision is different. Having the idea of the importance in the work of defense so that the sanitary condition is maintained and we continue advancing, after all our state is dependent on livestock, since when an event of this size happens, it is not only livestock that suffers.

IV. CONCLUSION

After more than 40 years of Animal Health Defense, the state is close to being able to receive the status of Free Area Without Vaccination for Foot-and-Mouth Disease. The work so far has been arduous, but the achievements are thanks to the tireless efforts of Iagro's public service person, who have often not been recognized as they should. Animal health is due to several factors, among which it is directly linked to health education and social communication.

The advantages of Mato Grosso do Sul in becoming a Free Area Without Vaccination for Foot-and-Mouth Disease are immeasurable, since there will be a reduction in vaccine costs, reduction of losses with injuries and a drop in milk production associated with the vaccination procedure, improving the structure of the official service, since these will be available for the control of other diseases, will stimulate increased exports, improvement of refrigeration plants, among others.

The fact that Mato Grosso do Sul achieved the status of free area for foot-and-mouth disease does not mean that the work of IAGRO is finished, it has just begun. From that moment on, efforts will be more focused on surveillance, that is, the transit of animals and products of animal and plant origin and for the community the guidance in notifying the Official Service in case of any suspected illness, the role of health education becomes much more important.

ACKNOWLEDGEMENTS

We are grateful to IAGRO for providing the information for the production of this paper, together with the IFMS for providing this moment of learning.

REFERENCES

- [1] Barcelos, J. (2015). Mato Grosso do Sul - 1978/1979 - Utopia x Realidade. Editora Simplíssimo Livros.
- [2] Governo MS. (2021). Institucional Governo do Mato Grosso do Sul, Perfil do Mato Grosso do Sul. Disponível em: <http://www.ms.gov.br/institucional/>. Acesso em: 05 de outubro de 2021.
- [3] IBGE. (2021). Município de Naviraí 2020. Retrieved May 26, 2021, from <https://www.ibge.gov.br/cidades-e-estados/ms/navirai.html>
- [4] Governo MS. (1979). Lei de criação do MATO GROSSO DO SUL, Decreto-Lei nº 9, de 1º de janeiro de 1979. Disponível em: https://www.tjms.jus.br/legislacao/public/pdf-legislacoes/decreto-lei_n_9.pdf. Acesso em 05 de outubro de 2021.
- [5] Junior, et al. (1983). A pecuária de corte na economia Sul matogrossense, Embrapa.
- [6] MATO GROSSO DO SUL. (1979). Official Gazette of Mato Grosso.
- [7] IAGRO. (2000). Lei nº 2.152, de 26 de outubro de 2000. Portal IAGRO. Retrieved April 27, 2021, from <https://www.iagro.ms.gov.br/apresentacao/>
- [8] IAGRO. (2021). Relatório oficial QUALISV.
- [9] LEITE, R. S. (2021). Interview by telephone. IAGRO.
- [10] PANAFTOSA. (2004). Centro Panamericano de Febre Aftosa. Relatório de Houston - Conferencia Hemisférica para Erradicação da Febre Aftosa nas Américas. http://www.panaftosa.org.br/inst/intensGiefa/rel_Houston.pdf
- [11] LYRA, T. P. M., & SILVA, J. A. (2004). A febre Aftosa, 1960-2002. Arquivo Brasileiro de Medicina Veterinária e Zootecnia, 56(5), 565-576.
- [12] JUNIOR, G. S. (2006). Foco de Febre Aftosa em Japorã, MS: Reflexos em Assentamento Rural.
- [13] IAGRO. (1998). Relatório oficial Foco de Febre Aftosa no município de Porto Murtinho,
- [14] IAGRO. (2000). Relatório oficial Foco de Febre Aftosa no município de Naviraí.
- [15] IAGRO. (2006) Relatório oficial Foco de Febre Aftosa nos municípios de Eldorado, Japorã e Mundo Novo, 2006.
- [16] IAGRO. (2008). Portaria IAGRO/MS nº 1.423 de 21 de janeiro de 2008. http://www3.servicos.ms.gov.br/iagro_ged/pdf/1162_GED.pdf
- [17] BRASIL. (2011). Instrução Normativa SDA nº 13, de 24 de Março de 2011.
- [18] PANAFTOSA. (2004). Compromisso com la erradicacion con la Febre Aftosa en las Americas desde 1951, 2018. <https://www.paho.org/es/documentos/folleto-panaftosa-comprometida-con-erradicacion-fiebre-aftosa-america-desde-1951>
- [19] PANAFTOSA. (1981). Resoluciones y Recomendaciones de la Comision Sudamericana para Lucha contra la Febre Aftosa 1973-1981. Serie de monografias cientificas y tecnicas no. 9, 86p
- [20] ROHR, A. (2003) Trabalho de Conclusão de Curso
- [21] BELARMINO, A. (2021). Interview by telephone. IAGRO

- [22] PANAFTOSA. (2008). Situación de los Programas de erradicación de la fiebre aftosa, AmericadelSur.
- [23] PANAFTOSA. (2011). Situación de los Programas de erradicación de la fiebre aftosa, AmericadelSur.
- [24] PANAFTOSA. (2015). Informe de Situación de los programas de erradicación de la Fiebre Aftosa Sudamerica e Panama.
- [25] PANAFTOSA. (2019). Informe de Situación de los programas de erradicación de la Fiebre Aftosa Sudamerica e Panama.
- [26] BRASIL. (2020). Instrução normativa nº 48 de 14 de julho de 2020 – MAPA.
- [27] BRASIL. (2018). Instrução normativa nº 11 de 18 de Janeiro de 2018 - MAPA
- [28] IAGRO. (2021). Planilha de ocorrências de Febre Aftosa no MS – Arquivo interno do órgão.
- [29] PRODANOV, C. C.; FREITAS, E. C. (2013) Metodologia do Trabalho Científico: métodos e técnicas da pesquisa acadêmica e do trabalho acadêmico. 2 ed. Novo Hamburgo: Feevale.
- [30] MARCONI, M. A.; LAKATOS, E. M. (2017) Metodologia Científica. 7 ed. São Paulo: Atlas.
- [31] GIL, A. C. (2008) Como elaborar projetos de pesquisa. 4 ed. São Paulo: Atlas
- [32] IAGRO. (2021) Planilha de animais abatidos/sacrificados nos focos de Febre Aftosa no MS – Arquivo interno do órgão.

Framework for transition from traditional to PSS products

Eloiza Kohlbeck¹, Fernanda Hänsch Beuren², Alexandre Borges Fagundes², Delcio Pereira², Debora Barni de Campos²

¹Production Engineering, Department of Industrial Technology, Santa Catarina State University, São Bento do Sul, Santa Catarina, Brazil

²Department of Industrial Technology, Santa Catarina State University, Rua Luiz Fernando Hastreiter, 180, Centenário, São Bento do Sul, Santa Catarina, Brazil

Received: 19 Sept 2021,

Received in revised form: 05 Nov 2021,

Accepted: 15 Nov 2021,

Available online: 30 Nov 2021

©2021 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— *Circular Economy, Framework,
Product-Service Systems, PSS Product.*

Abstract— *As the globalization process has intensified environmental issues and the competitive pressure among organizations, business proposals based on circularity, such as Product-Service Systems (PSS), represent an alternative in face of sustainable development. However, the literature does not present an orientation for the implementation process of business proposals classified as Product-Service Systems. This research gap supports the objective of this work: to develop a framework to enable the transition from traditional products (based exclusively on products or services) to products that compose a Product-Service System proposal. In order to meet this goal, this research performs a systematic literature review, where 55 papers are analyzed in order to answer the following research questions: i) What is the difference between servitization and Product-Service Systems? and ii) What is the strategic organizational alignment needed to promote the transition from a traditional product to a PSS product? The bibliographic results were the basis for the development of the framework, where strategies to promote this transition process are presented and classified according to the ReSOLVE structure. Thus, the originality and value of this research is concentrated in the development of the framework, which can be used as an orientation for companies and researchers when characterizing a PSS product or when making the transition to PSS business proposals.*

I. INTRODUCTION

The intensification of industrial activities, added to the development paradigm based on linear economy [12], brings negative externalities to the environment and socioeconomic aspects [3]. In this context, the approach on sustainable design gains academic and organizational notoriety [45] due to the search for alternatives to offer products and services under the perspective of sustainable development [6], considering the principles of Circular Economy [7], [8].

Looking for solutions capable of meeting the three dimensions of sustainability (environmental, social and economic) [5], [9] highlight the contribution of Product-Service Systems (PSS) business proposals. This approach was first presented by Goedkoop [10], and represents an opportunity for differentiation in the value chain [11], since it contributes to waste minimization [12] and to the extension of product lifetime [13] through functional optimization [14]. Therefore, to ensure the sustainability of PSS business proposals, it is necessary to adopt a systemic perspective [15], considering the entire life cycle of

products and services [16], from conception to final disposal [17].

However, the transition from a traditional business proposition (based exclusively on products or services) to a PSS business model represents a challenge for both researchers and the job market, since this topic of investigation is still poorly developed in the literature [18]. Furthermore, there is no clarification about the relationship that sustainability establishes with the PSS business proposal, since there are authors who present the denomination Sustainable Product-Service Systems (SPSS) [19]–[21], others state that sustainability represents one of its foundations [5], [10], [22], [23], while others treat servitization and Product-Service Systems as synonyms. In view of this, [20] highlights the need to collect data regarding product design aiming at the extension of its life cycle and the best performance of a PSS business proposition.

Based on the above, the objective of this work is to develop a framework to enable the transition from traditional products to PSS products. To this end, this study i) conducts a systematic literature review in order to answer the following research questions: 1) What is the difference between servitization and Product-Service Systems? 2) What is the strategic organizational alignment needed to promote the transition from a traditional product to a PSS product? ii) proposes a framework to enable this transition process.

This paper is structured as follows: section 2 describes the methods employed in this research. Section 3 presents the results of the systematic literature review (bibliometric and content analysis). Section 4 presents the discussions of this work and proposes the framework for the transition from a traditional product to a PSS product, based on sustainability. Finally, section 5 concludes this work and points out perspectives for future studies.

II. RESEARCH METHODS

A systematic review was conducted in order to understand the state of the art of the topic of this research, retrieving collective perceptions based on the theoretical synthesis of existing studies [24]. Moreover, [25] point out that systematic reviews are widely conducted in works concerning Product-Service Systems, (e.g. [16], [26]–[28]), highlighting the relevance and academic interest in this research method.

The report for systematic reviews and meta-analyses (PRISMA) [29], [30] was used to structure the literature review into four steps: I - identification of articles, II - screening of articles, III - eligibility, and IV - inclusion of

studies [31]; as presented in Figure 1.

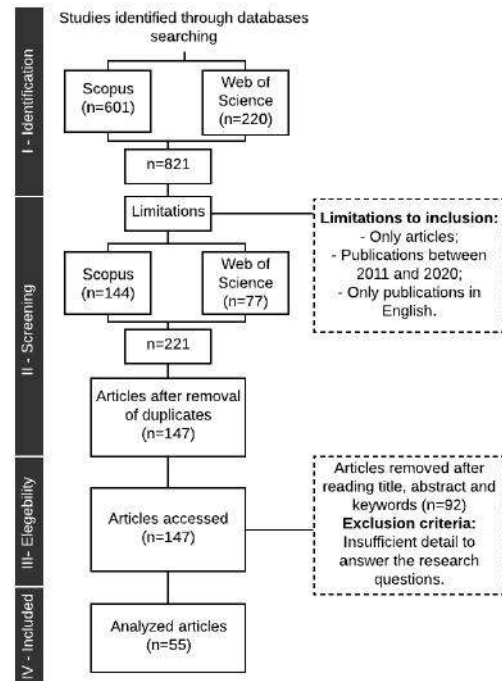


Fig. 1: PRISMA - Search parameters

For the selection of scientific articles (step I of the PRISMA method), the Scopus and Web of Science databases were used, considered the most comprehensive [32]. The combination of keywords presented in Table 1 was used to compose the initial sample of papers to be analyzed.

To further refine the results obtained in stage I, a bibliographic search was performed using search filters (stage II), limiting the results to scientific articles published between 2011 and 2020 and written in English. Thus, 221 articles were identified, as shown in Table 1.

Table.1: Keyword combinations

Keywords	Scopus	Web of Science
"PSS product"	13	4
"Product service system*" and "product* development"	59	43
"Product service system*" and " product life cycle"	24	14
"Product service system*" and "product* design" and "sustainab*"	48	16

Excluding the duplicates, 147 papers were selected, which composed the bibliometric analyses, presented in section 3.1. According to [33] bibliometric analyses allow for a quantitative analysis of research trends in a research domain, through knowledge maps, such as cooperation and co-citation relationships. Bibliometric tools provided by the VOSviewer® and Excel® software were used in the following analyses: temporal trend of publications, main journals, geographical distribution of publications and co-citation of authors. Since VOSviewer® limits the use of only one database, Scopus (144 papers) was used because it presented a greater number of results than Web of Science (77 papers) [34].

In steps III and IV, title, abstract and keywords of the articles were analyzed. Thus, 55 papers were selected to compose the content analysis, which presents the answers to the following research questions: i) What is the difference between servitization and Product-Service Systems? ii) What is the strategic organizational alignment required to promote the transition from a traditional product to a PSS product?

To answer the second research question, characteristics of a PSS product were identified and presented through a generic model. Aiming to organize and synthesize the information obtained in the literature, these characteristics were classified according to the ReSOLVE structure [35]. According to [14] the ReSOLVE framework organizes the principles of the Circular Economy according to six dimensions: regenerate, share, optimize, loop, virtualize and exchange. Therefore, the Circular Economy is approached in this work as a facilitator of the transition process from a traditional product to a PSS product.

In order to organize the bibliographic information, the characteristics of a PSS product present a coding system, applied in each dimension of the ReSOLVE structure. In this way, the characteristics were presented as follows: Re1 to Re7 represent the guidelines of the regenerate dimension; S1 to S6, of the share dimension; O1 to O6 correspond to the characteristics of optimize; L1 to L7, loop; V1 to V6, virtualize and; E1 to E6, exchange.

III. RESULTS

The first section of this chapter (3.1) presents the results of the bibliometric analysis. Section 3.2 presents the content analysis, where the difference between servitization and Product-Service Systems is presented, in addition to a brief state of the art on the models that exist in the literature, on which the framework proposed in this work is based.

3.1 Bibliometric analysis

Figure 2 presents the annual evolution of publications, highlighting the progressive increase of papers referring to the topic of this research, since publications in the last three years represent 44% of the total, emphasizing the trend and the academic relevance of this approach.

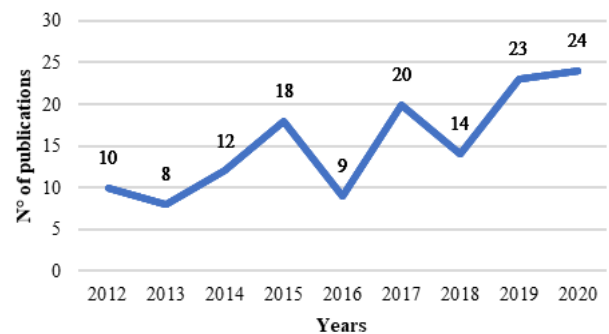


Fig. 2: Temporal trend of publications

Figure 2 highlights a sharp increase in publications in 2017 and 2019, of 122% and 64%, respectively. It can be observed that in this period there was a large amount of articles published in the *Journal of Cleaner Production* and *Sustainability* journals, which presented several special issues referring to Circular Economy and the Product-Service System, justifying this increase in publications.

Figure 3 corroborates this finding, highlighting that the *Journal of Cleaner Production* and *Sustainability* journals have the largest number of publications in the sample analyzed, since together they represent 31% of the total number of papers in the bibliographic portfolio.

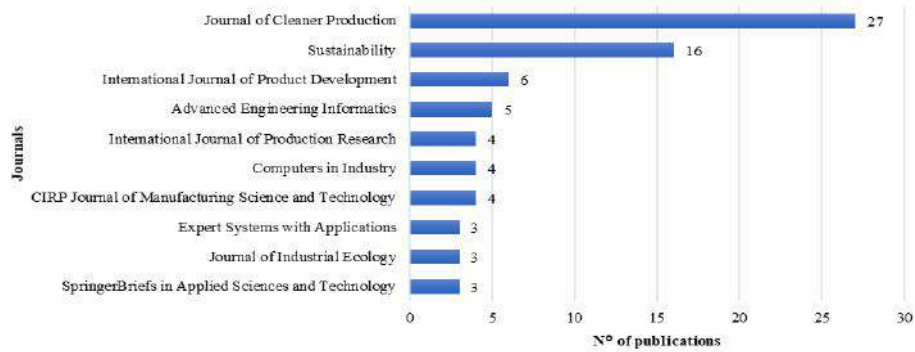


Fig. 3: Main journals

Figure 4 highlights that although there is global involvement with the topic of this research, publications are predominantly concentrated in countries with developed economies. The works of [36] and [9] corroborate this finding, highlighting the need for investment in Research and Development (R&D) in all spheres of the economy, so that they mutually meet the guidelines of sustainable development.

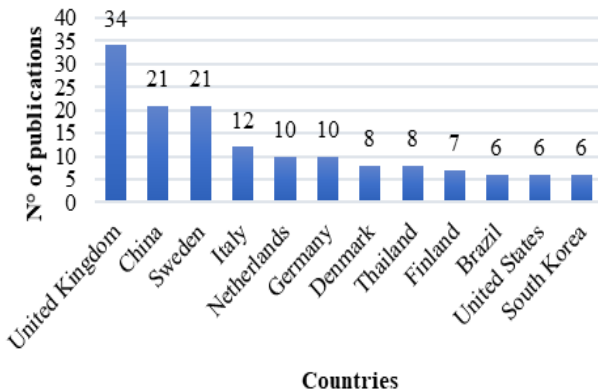


Fig. 4: Geographical distribution of publications

Figure 5 shows an author co-citation network, where we observe the formation of three clusters, forming a bibliometric network composed of 26 nodes.

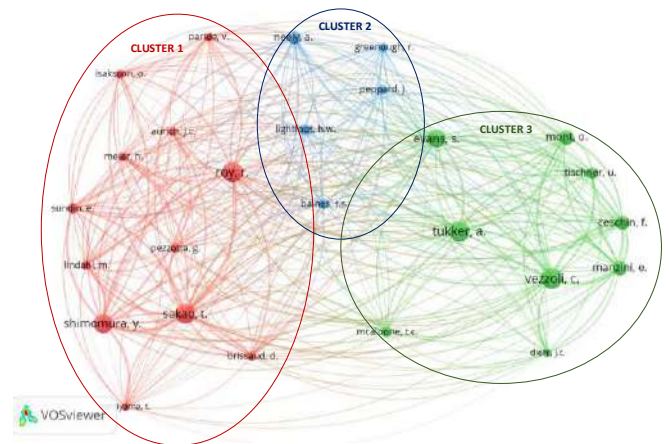


Fig. 6: Co-citation of authors

The predominant approach of group 1 is about sustainable design, where the authors Roy, R. (138 citations) and Sakao, T. (130 citations) stand out. [39] point out that the value proposition is tied to the durability of products, which should be designed considering the principles of Life Cycle Engineering. Furthermore, Sakao, T. points out the importance of ecodesign and Circular Economy to enable the transition to sustainable proposals [40,41].

Group 2 deals predominantly with servitization, with emphasis on the authors Neely, A. (78 citations) and Baines, T. S. (60 citations). In this group, two literature review papers are widely cited, developed by Baines in 2007 [11] (in partnership with Neely, A.) and by Baines in 2009 [40]. The high citation rate of these works is due to the definition of the concept of servitization by [40], where the author highlights its potential for differentiation and increased competitiveness in the labor market [11], [40].

Finally, group 3 deals with servitization from the perspective of sustainability (mainly in the environmental

aspect), where the main approach is related to the Product-Service System. This group presents pioneer authors in the studies about PSS, such as Tukker, A., Manzini, E., Vezzoli, C. and Mont, O., where they stand out with a great amount of citations. These authors present definitions and classifications of [22], [41], [42], and highlight its systemic perspective by mutually contributing to the environmental, social and economic spheres of the Triple Bottom Line (TBL).

3.2 Análise de conteúdo

Several authors highlight that the adoption of sustainable manufacturing and eco-friendly operations represents a competitive advantage [14], [43]–[45], as it captures new revenue streams [1], [43], [46] and expands the target audience, given the consumer's increased awareness of sustainable development [12], [20]. Seeing the relevance and urgency for alternatives engaged with this context, [47] highlights the need to foster continuous innovation in reducing environmental impacts and improving equity and social cohesion.

[43] point out that the transition from the exclusive sale of products to a proposal based on servitization represents a promising perspective of value proposition,

since it encompasses a systemic vision of the entire life cycle of products and services [2], [12], [16], [43]. Therefore, it is essential to make information available during all phases of the life cycle, especially in the early stages of development, since they demand more strategic planning [44], [48], [49]. Furthermore, [44] point out that the relationship of a business proposal with sustainability is largely determined in the early stages of the life cycle.

Based on these principles, Product-Service Systems differ by considering the environmental, social and economic scopes since the conception of products and services [5]. In view of this, [5] highlight that it is necessary to conduct research on how to develop, implement and monitor business proposals based on sustainability, since there is scarce literature on ecodesign and PSS design [50]. However, there is no consensus in the literature about what relationship sustainability establishes with business proposals classified as servitization or Product-Service Systems. Thus, Table 4 presents the main differences between these approaches.

Table.2: Differences between servitization and Product-Service Systems

	Servitization	Product-Service Systems
Definition	Servitization is the innovation of an organization's capabilities and processes to shift from selling products to selling products and services, adding value to the use or functionality [40].	A Product-Service System is composed of products, services, actor networks, and infrastructure, which aim to increase competitiveness, satisfy customer needs and reduce environmental impacts, when compared to traditional product and service proposals [10].
Scope with greater focus on the Triple Bottom Line (environmental, social and economic)	Economic [43]. The transition from selling traditional products to servitized propositions represents an economic value proposition, capturing new revenue streams, increasing profitability, and sustaining a competitive advantage [43].	Environmental [9], [21], [43], [44]. One of the main reasons for driving the adoption of PSS solutions is their ability to drastically reduce resource consumption and environmental degradation, without reducing the customer's sense of well-being and satisfaction [19], in order to consider sustainability under socio-ethical aspects [9].
Main competitive differentials	Capturing new revenue streams [43].	Customer engagement, offering maintenance, repair, upgrade, and other services [51].
	Broader value proposition [43].	Sustainable innovation, integrating environmental, social, and economic development [5].
	Efficient use of resources [52].	Product development based on lean manufacturing [53].
Cases	Kindle. The e-book content is delivered instantly at a more affordable cost and with easier access and payment; therefore, Kindle enriches the core value Amazon offers customers as an online bookstore [54].	Water purifier. The business proposal presents a concern with the raw material used in the conception of the product, opting for alternatives with less environmental degradation and more durability [55].

Empresas como *General Electric, Xerox, Canon e Parkersell* mostraram um aumento considerável nas vendas e lucros de serviços desde meados da década de 1990. Estas empresas destacam-se por manter a competitividade e a originalidade ao promover uma oferta integrada de produtos e serviços [54].

Electric car sharing system. The work of [57] uses Life Cycle Analysis (LCA) to identify the impacts of the proposal with respect to global warming, photochemical oxidation, eutrophication, and abiotic resource depletion. Thus, products and services are designed from the perspective of sustainable development.

Table 2 highlights that the main difference between servitization and Product-Service Systems is the greater relationship of PSS with sustainability. Although servitization contributes to a more efficient use of resources [52], the relationship of PSS with sustainable development occurs from the conception of the product offered to its final destination [5].

Given this context, the work of [49] provides a perspective of implementation of business proposals based on sustainable development, where the authors emphasize that it is not only the production process that must be environmentally friendly, but also its supply, distribution and retail. In view of this, [49] present a framework proposing waste and supply chain management, which is structured according to the stages of the Product Development Process (PDP): pre-development, development and post-development.

[58] corroborate with the work of [49] highlighting that, according to the principle of product integrity, designers should aim to avoid obsolescence and make sure that resources can be recovered with the highest level of integrity. Through this perspective, the authors point out that business proposals become engaged with the Circular

Economy, where efforts are directed towards extending the useful life of products, extending their intervention horizon for final disposal.

[59] emphasize that Product-Service Systems correspond to a strategy capable of contributing to the circularity of business proposals. The authors substantiate this assertion through a case study in the textile industry, which supported the development of a framework that presents five PSS strategies capable of contributing to the Circular Economy: operational support, periodic maintenance, product sharing, end-of-life management (EoL) and optimized outcome. However, the work of [13] highlights the need for a strategic organizational alignment to promote the adequacy of a business proposal to the principles of Product-Service Systems.

IV. DISCUSSIONS

Based on the literature results, this section presents the strategic alignment needed to promote the transition from a traditional product to a PSS product. To this end, the literature data were arranged according to the ReSOLVE structure and synthesized into a framework (Figure 7).

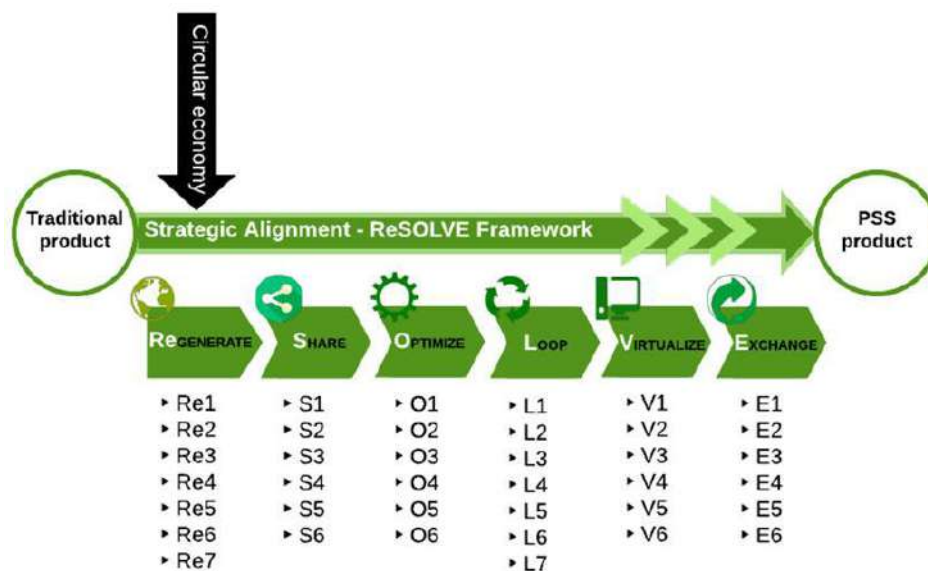


Fig.7: Framework - Transition to a PSS product

In view of this, Table 3 presents the characteristics of a PSS product according to the "Regenerate" dimension.

Table.3: Characteristics of a PSS Product: Regenerate Dimension

Coding	Characteristics	Sources
Re1	Design for final disposal	[45], [59]
Re2	Modular design	[1], [2], [18], [20], [45], [46], [50], [60]–[65]
Re3	Ecodesign or Design for X (DfX)	[14], [20], [45], [50], [52], [66]
Re4	Cleaner Production (CP) - Lean Manufacturing	[12], [45], [52], [53], [62], [67], [68]
Re5	Avoiding the rebound effect	[59], [65]
Re6	Ease of composting	[45]
Re7	Repair or reform	[1], [2], [4], [12], [14], [18]–[20], [45], [52], [59]–[62], [64], [65], [69]–[74]

Table 3 highlighted that "Repair or reform" (Re7) and "modular design" (Re2) corresponded to the most cited characteristics of this dimension, where several authors point out that modularization facilitates procedures such as repair, reuse, and failure tracking; increasing the efficiency of the business proposal [20], [50], [63]. Moreover, the principles of ecodesign and design for X (DfX) (Re3) should be considered during manufacturing, assembly, disassembly and modularity of parts, in order to increase the quality and reliability of products and services offered [20].

[5] highlights that for the successful adoption of sustainable manufacturing it is essential to take a systematic approach from concept development, product design and manufacturing, to end-of-life product management, which should be planned based on EoL strategies (Re1). Thus, the interdependencies between material, energy, and climate impact need to be taken into

consideration at the product design stage, where possible rebound effects (Re5) should be considered as early as possible to have the lowest possible impact [65].

According to [23], Product-Service Systems are based on lean manufacturing principles (Re4), where the Production Planning & Control (PPC) sector must support a wide variety of alternatives based on the Circular Economy, considering flexible production planning aiming at dematerialization, waste minimization [14], easy disassembly of parts [2], and reuse and composting of materials (Re6) [45].

Next, Table 4 presents the characteristics of a PSS product according to the "Sharing" dimension.

Table.4: Characteristics of a PSS Product: Share dimension

Coding	Characteristics	Sources
S1	Availability and flexibility	[14], [46], [60], [68], [72], [75]
S2	Extended product life cycle or intensified use	[1], [9], [13], [14], [24], [45], [59], [64], [65], [69], [73]
S3	Redistribution	[12], [59]
S4	Reduce obsolescence	[1], [4], [14]
S5	Reuse	[1], [2], [4], [9], [12], [14], [18], [20], [24], [45], [46], [50], [59], [64], [65], [67], [68], [72], [73], [75]–[77]
S6	Shared use	[14], [64], [78]

In order to meet the challenges of climate change and limited resource availability, a PSS product must provide a maximum benefit by extending its useful life (S2) [65] and decreasing obsolescence (S4) [14], while optimal material and resource decisions must be made, taking into account the entire life cycle and Circular Economy goals [65].

In this context, the sharing of products and services (S6), through business proposals such as Product-Service Systems, represent a path to a reduced level of product obsolescence [14], since design centered on the functional outcome, encourages organizations to design alternatives

based on redistribution (S3) [12] and reuse (S5) [46]. Thus, the close relationship with the customer is vital to design versatile products [14] that offer high availability and flexibility (S1) [60].

To maintain the user's engagement and loyalty to the business proposition, it is necessary to constantly monitor the business proposition [48], in order to identify possible flaws in the system and opportunities to optimize the products and services offered. In view of this, Table 7 highlights the characteristics of a PSS product according to the "Optimize" dimension of the ReSOLVE framework.

Table.5: Characteristics of a PSS Product: Optimize Dimension

Coding	Characteristics	Sources
O1	Updates	[2], [4], [14], [18], [19], [24], [45], [51], [52], [62], [70], [72], [73], [79], [80]
O2	Durability and functional optimization	[1], [4], [14], [24], [45], [52], [64], [70], [73]
O3	Easy to disassemble parts	[1], [2], [4], [9], [14], [20], [64], [73]
O4	Warranty and spare parts supply	[18], [20], [25]
O5	Maintenance	[1], [2], [14], [18]–[20], [24], [25], [43], [45], [46], [51]–[53], [59]–[62], [64], [65], [67], [68], [70]–[73], [76], [77], [79]
O6	Standardization of parts	[1], [62]

As highlighted in the "Sharing" dimension, a PSS business proposition contributes to reducing product obsolescence. For this, it is necessary to promote functional optimization (O2) [52], in order to support the customer by providing warranty [18], maintenance [43] and the supply of spare parts [20] (O4 and O5). This increases the reliability of the business proposition and customer satisfaction [81], making the customer more likely to remain an active consumer.

In this context, [1] analyze how product upgradeability (O1) is associated with a PSS business proposition. The

authors identify that component upgradability extends the life of products, and point out that design during the early life (BoF) phase enables the deployment of innovations during the mid-life (MoL) and end-of-life (EoL) phases [1]. Thus, designers are in charge of designing for ease of upgrading and prolonging the use of products [58]. This requires standardization of parts (O6), aiming at ease of assembly and disassembly (O3), in order to restructure production patterns [19], making them more circular.

Next, Table 6 presents the characteristics of a PSS product according to the "Loop" dimension.

Table.6: Characteristics of a PSS product: Loop dimension

Coding	Characteristics	Sources
L1	“Cradle to Cradle” Approach	[18], [65], [66], [69], [73]
L2	Circular design	[4], [12], [14], [43], [45], [49], [65], [73], [82]
L3	Reverse manufacturing	[73]
L4	Recycling	[1], [2], [4], [9], [12], [14], [18], [20], [24], [50], [52], [59], [64], [65], [67], [68], [71], [73], [76], [77]
L5	Reconditioning	[1], [14], [19], [59], [62], [65], [69], [72]
L6	Remanufacturing	[1], [2], [4], [9], [14], [18], [20], [24], [45], [50], [52], [59], [62], [64], [65], [68], [72], [75]–[77]
L7	Cascade use	[12], [14], [45], [73]

The work of [66] highlights that while natural materials are biologically reused, synthetically produced resources must be kept in a closed circuit, through a "cradle to cradle" approach (L1). [12] corroborates the work of [66] by stating that Reverse Logistics represents a value creation tool, since it contributes to several practices guided by the Circular Economy, such as recycling (L4), remanufacturing (L6), and reconditioning (L5). Thus, [12] point out that this holistic perspective of manufacturing and Reverse Logistics (L1) should be approached according to the principles of circular design (L2), where [9] highlight the importance of adopting a comprehensive perception of the entire life cycle of products and services, using Life Cycle Analysis (LCA) methods.

However, for the effectiveness of a PSS business proposal, it is necessary to engage stakeholders in order to mobilize the State, organizations and citizens [83] towards sustainable production and consumption patterns (SDG 12) [84]. To this end, [83] points out the need to implement the 5R's of Circular Economy: refuse, rethink, reduce, reuse and recycle [85]. In this way, the client takes responsibility to follow the sorting and recycling guidelines [83], enabling the reuse and cascading use of products (L7).

Table 7 shows the characteristics of a PSS product according to the "Virtualize" dimension of the ReSOLVE structure.

Table.7: Characteristics of a PSS product: Virtualize dimension

Coding	Characteristics	Sources
V1	Consulting and advisory services	[24], [59], [62], [70], [71]
V2	Co-creation	[19], [74]
V3	Customization or personalization	[14], [19], [53], [60]–[62], [86]
V4	Traceability and transparency	[14], [18]
V5	Operational support, advise on efficient use	[2], [12]
V6	Virtualization to improve eco-design (Ex: Additive Manufacturing and Big Data)	[14], [52], [68]

[87] and [14] point out that virtualization (V6) through Information Technology (IT) tools, Big Data systems and additive manufacturing (3D printing) increase the performance of PSS business proposals, besides contributing with waste elimination, since they enable an understanding of the whole life cycle of products. Therefore, the incorporation of technologies in business proposals represents an alternative to sustainable development [50].

[18] highlight that the use of IoT and Big Data-based technologies improve product design and attract new customers through co-creation (V2) [74], customization and personalization [86]. Moreover, these technologies facilitate product monitoring and tracking, enable the provision of advice and consulting (V1) [18], [71],

provide technical and operational support (V5), and facilitate upgrading, maintenance (preventive and predictive), and deployment of end-of-life (EoL) strategies [18].

In this context, keeping the engagement between provider and consumer drives the development of optimizations and the increase of customer satisfaction [20]. In view of this, [14] highlight that the use of electronic devices improves the traceability and transparency (V4) of the flow of materials and information, enabling the identification of customer demands and the opportunity for optimizations in the business proposals.

Finally, Table 8 presents the characteristics of a PSS product according to the "Exchange" dimension.

Table.8: Characteristics of a PSS Product: Dimension Exchange

Coding	Characteristics	Sources
E1	Increased performance and efficiency	[64]
E2	Switch to resource- and energy-	[4], [9], [12], [14], [43], [45], [52], [53],

	efficient alternatives	[59], [64], [65], [67], [73], [76]
E3	Elimination of waste	[12], [68]
E4	Redesign	[9], [13], [20], [65], [69], [71], [72]
E5	Rethink	[1], [12]
E6	Replacing non-renewable materials with more sustainable alternatives	[12], [14], [50]

In the face of climate change and limited resource availability [65], PSS business proposals have the potential to promote energy efficiency (E2) [69] through functional selling [88], where PSS product design is based on waste elimination (E3) [12]. Furthermore, this energy efficiency potential is extended by adopting an approach that integrates Product-Service Systems and Circular Economy, where the remanufacturing of components has a large potential to reduce CO2 emissions [89]. In this context, the seventh Sustainable Development Goal (affordable and clean energy) extols the need to promote access to research and innovation in the face of energy efficiency, including the deployment of renewable and clean alternatives (E6) [90].

[47] emphasizes that it is essential to rethink (E5) and redesign (E4) production and consumption patterns, in order to maintain the balance between the environmental, social, and economic spheres [91], where [70] extols the need to adopt a closed loop system, based on the increase in performance (E1) and the reuse of components. In this way, benchmarking decisions that lead to the replacement of linear production patterns represents a value creation strategy, where organizations can advertise their engagement with sustainable development (green marketing) [92].

V. CONCLUSION

This investigation employs a two-pronged approach, combining bibliometric and content analysis, which provided a broad overview to meet the objective of this research, in order to propose a conceptual model to enable the transition from a traditional product to a PSS product. The bibliometric analysis highlighted that although the publications referring to the topic of this research are increasing over the years, they are concentrated in developed or developing countries. In this context, a research opportunity emerges, where one can address how to disseminate PSS business propositions in economies of different levels of economic development.

The answer to the first research question (What is the difference between servitization and Product-Service Systems?) provided an understanding of the fundamentals

of a PSS business proposal, where it is concluded that the engagement of Product-Service Systems with sustainability is not only an externality of the dematerialization process, since the relationship with the environmental scope of the Triple Bottom Line must occur since the conception of the products and services. The answer to the second research question (What is the strategic organizational alignment needed to promote the transition from a traditional product to a PSS product?) highlights the contribution of the Circular Economy (ReSOLVE structure) with this transition process, and has as a result the development of a framework, which can be used as a guideline for companies and researchers when characterizing a PSS product or when making the transition to this business model.

Although this study focused on the PSS product, it is observed that its characteristics are related to its other dimensions (services, actors network and infrastructure), highlighting the systemic approach of Product-Service Systems. Based on the results of this research, future studies can focus on the validation of the proposed framework with PSS experts and on the analysis of its practical feasibility, analyzing it in cases, in order to measure the contribution of the strategies identified and organized according to the ReSOLVE structure. Thus, these conclusions provide a theoretical basis for the development of research with empirical approaches that allow the contributions of the inter-relationship between Product-Service Systems and Circular Economy to be amplified.

REFERENCES

- [1] Khan, M. A., Mittal, S., West, S., & Wuest, T. (2018). Review on upgradability – A product lifetime extension strategy in the context of product service systems. *Journal of Cleaner Production*, 204, 1154–1168. <https://doi.org/10.1016/j.jclepro.2018.08.329>
- [2] Bech, N. M., Birkved, M., Charnley, F., Kjaer, L. L., Pigosso, D. C. A., Hauschild, M. Z., McAloone, T. C., & Moreno, M. (2019). Evaluating the environmental performance of a product/service-system business model for Merino Wool Next-to-Skin Garments: The case of Armadillo Merino®. *Sustainability (Switzerland)*, 11(20).

- <https://doi.org/10.3390/su11205854>
- [3] Baldassarre, B., Keskin, D., Diehl, J. C., Bocken, N., & Calabretta, G. (2020). Implementing sustainable design theory in business practice: A call to action. *Journal of Cleaner Production*, 273, 123113. <https://doi.org/10.1016/j.jclepro.2020.123113>
- [4] Sinclair, M., Sheldrick, L., Moreno, M., & Dewberry, E. (2018). Consumer intervention mapping-A tool for designing future product strategies within circular product service systems. *Sustainability (Switzerland)*, 10(6). <https://doi.org/10.3390/su10062088>
- [5] Jin, M., Tang, R., Ji, Y., Liu, F., Gao, L., & Huisingh, D. (2017). Impact of advanced manufacturing on sustainability: An overview of the special volume on advanced manufacturing for sustainability and low fossil carbon emissions. *Journal of Cleaner Production*, 161, 69–74. <https://doi.org/10.1016/j.jclepro.2017.05.101>
- [6] Neramballi, A., Sakao, T., Willskytt, S., & Tillman, A.-M. (2020). A design navigator to guide the transition towards environmentally benign product/service systems based on LCA results. *Journal of Cleaner Production*, 277. <https://doi.org/10.1016/j.jclepro.2020.124074>
- [7] Ellen MacArthur Foundation. (2013). *Towards the Circular Economy vol.1. Economic and Business Rationale for an Accelerated Transition (Vol. 1)*.
- [8] de Kwant, C., Rahi, A. F., & Laurenti, R. (2021). The role of product design in circular business models: An analysis of challenges and opportunities for electric vehicles and white goods. *Sustainable Production and Consumption*, 27, 1728–1742. <https://doi.org/10.1016/j.spc.2021.03.030>
- [9] Ceschin, F., & Gaziulusoy, I. (2016). Evolution of design for sustainability: From product design to design for system innovations and transitions. *Design Studies*, 47, 118–163. <https://doi.org/10.1016/j.destud.2016.09.002>
- [10] Goedkoop, M. J. C. J. G. van H. H. R. M. te R. P. J. M. R. (1999). *Product Service systems , Ecological and Economic Basics Product Service systems , Ecological and Economic Basics* (Issue (Report for the Dutch ministries of Economic Affairs and of Environment)).
- [11] Baines, T. S., Lightfoot, H. W., Evans, S., Neely, A., Greenough, R., Peppard, J., Roy, R., Shehab, E., Braganza, A., Tiwari, A., Alcock, J. R., Angus, J. P., Basti, M., Cousens, A., Irving, P., Johnson, M., Kingston, J., Lockett, H., Martinez, V., ... Wilson, H. (2007). State-of-the-art in product-service systems. *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*, 221(10), 1543–1552. <https://doi.org/10.1243/09544054JEM858>
- [12] Julianelli, V., Caiado, R. G. G., Scavarda, L. F., & Cruz, S. P. de M. F. (2020). Interplay between reverse logistics and circular economy: Critical success factors-based taxonomy and framework. *Resources, Conservation and Recycling*, 158, 1–12. <https://doi.org/10.1016/j.resconrec.2020.104784>
- [13] Sholihah, M., Maezono, T., Mitake, Y., & Shimomura, Y. (2019). PSS Strategic alignment: Linking service transition strategy with PSS business model. *Sustainability (Switzerland)*, 11(22). <https://doi.org/10.3390/su11226245>
- [14] Jabbour, A. B. L. de S., Rojas Luiz, J. V., Luiz, O. R., Jabbour, C. J. C., Ndubisi, N. O., de Oliveira, J. H., & Horneaux Junior, F. (2019). Circular economy business models and operations management. *Journal of Cleaner Production*, 235, 1525–1539. <https://doi.org/10.1016/j.jclepro.2019.06.349>
- [15] Franca, C. L., Broman, G., Robert, K.-H., Basile, G., & Trygg, L. (2017). An approach to business model innovation and design for strategic sustainable development. *Journal of Cleaner Production*, 140(1, SI), 155–166. <https://doi.org/10.1016/j.jclepro.2016.06.124>
- [16] Beuren, F. H., Gomes Ferreira, M. G., & Cauchick Miguel, P. A. (2013). Product-service systems: A literature review on integrated products and services. *Journal of Cleaner Production*, 47, 222–231. <https://doi.org/10.1016/j.jclepro.2012.12.028>
- [17] Nunes, I. C., Kohlbeck, E., Beuren, F. H., Pereira, D., & Fagundes, A. B. (2021). Life cycle analysis of electronic products for a product-service system. *Journal of Cleaner Production*, 2, 135907. <https://doi.org/10.1016/j.jclepro.2021.127926>
- [18] Bressanelli, G., Adrodegari, F., Perona, M., & Saccani, N. (2018). Exploring how usage-focused business models enable circular economy through digital technologies. *Sustainability (Switzerland)*, 10(3). <https://doi.org/10.3390/su10030639>
- [19] Vezzoli, C., Ceschin, F., Diehl, J. C., & Kohtala, C. (2015). New design challenges to widely implement “Sustainable Product-Service Systems.” *Journal of Cleaner Production*, 97, 1–12. <https://doi.org/10.1016/j.jclepro.2015.02.061>
- [20] Kuo, T.-C., Chiu, M.-C., Hsu, C.-W., & Tseng, M.-L. (2019). Supporting sustainable product service systems: A product selling and leasing design model. *Resources, Conservation and Recycling*, 146, 384–394. <https://doi.org/10.1016/j.resconrec.2019.04.007>
- [21] Shokohyar, S., Mansour, S., & Karimi, B. (2014). A model for integrating services and product EOL management in sustainable product service system (S-PSS). *Journal of Intelligent Manufacturing*, 25(3), 427–440. <https://doi.org/10.1007/s10845-012-0694-x>
- [22] Mont, O. K. (2002). Clarifying the concept of product-service system. *Journal of Cleaner Production*, 10, 237–245. <https://doi.org/10.1109/ACIIDS.2009.18>
- [23] Mourtzis, D., Vlachou, A., & Zogopoulos, V. (2017). Cloud-based augmented reality remote maintenance through shop-floor monitoring: A product-service system approach. *Journal of Manufacturing Science and Engineering, Transactions of the ASME*, 139(6). <https://doi.org/10.1115/1.4035721>
- [24] Reim, W., Parida, V., & Örtqvist, D. (2015). Product-Service Systems (PSS) business models and tactics - A systematic literature review. *Journal of Cleaner Production*, 97(July 2014), 61–75. <https://doi.org/10.1016/j.jclepro.2014.07.003>
- [25] Bertoni, A., Bertoni, M., Panarotto, M., Johansson, C., & Larsson, T. C. (2016). Value-driven product service systems development: Methods and industrial applications. *CIRP Journal of Manufacturing Science and Technology*,

- 15, 42–55. <https://doi.org/10.1016/j.cirpj.2016.04.008>
- [26] Annarelli, A., Battistella, C., & Nonino, F. (2016). Product service system: A conceptual framework from a systematic review. *Journal of Cleaner Production*, 139, 1011–1032. <https://doi.org/10.1016/j.jclepro.2016.08.061>
- [27] Fernandes, S. da C., Pigosso, D. C. A., McAloone, T. C., & Rozenfeld, H. (2020). Towards product-service system oriented to circular economy: A systematic review of value proposition design approaches. *Journal of Cleaner Production*, 257. <https://doi.org/10.1016/j.jclepro.2020.120507>
- [28] Tukker, A. (2015). Product services for a resource-efficient and circular economy - A review. *Journal of Cleaner Production*, 97, 76–91. <https://doi.org/10.1016/j.jclepro.2013.11.049>
- [29] de Jesus Pacheco, D. A., ten Caten, C. S., Jung, C. F., Sassanelli, C., & Terzi, S. (2019). Overcoming barriers towards Sustainable Product-Service Systems in Small and Medium-sized enterprises: State of the art and a novel Decision Matrix. *Journal of Cleaner Production*, 222, 903–921. <https://doi.org/10.1016/j.jclepro.2019.01.152>
- [30] Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., & Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (prisma-p) 2015 statement. *Systematic Reviews*, 4(1), 1–9.
- [31] Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement (Reprinted from *Annals of Internal Medicine*). *Physical Therapy*, 89(9), 264–270. <https://doi.org/10.1371/journal.pmed.1000097>
- [32] Aghaei Chadegani, A., Salehi, H., Md Yunus, M. M., Farhadi, H., Fooladi, M., Farhadi, M., & Ale Ebrahim, N. (2013). A comparison between two main academic literature collections: Web of science and scopus databases. *Asian Social Science*, 9(5), 18–26. <https://doi.org/10.5539/ass.v9n5p18>
- [33] Zhou, C., & Song, W. (2021). Digitalization as a way forward: A bibliometric analysis of 20 Years of servitization research. *Journal of Cleaner Production*, 300, 126943. <https://doi.org/10.1016/j.jclepro.2021.126943>
- [34] Benachio, G. L. F., Freitas, M. do C. D., & Tavares, S. F. (2020). Circular economy in the construction industry: A systematic literature review. *Journal of Cleaner Production*, 260, 121046. <https://doi.org/10.1016/j.jclepro.2020.121046>
- [35] Ellen MacArthur Foundation. (2015). *Delivering the Circular Economy a toolkit for policymakers*.
- [36] Retamal, M. (2019). Collaborative consumption practices in Southeast Asian cities: Prospects for growth and sustainability. *Journal of Cleaner Production*, 222, 143–152. <https://doi.org/10.1016/j.jclepro.2019.02.267>
- [37] Roy, R., Tiwari, A., Stark, R., & Lee, J. (2017). Editorial for the Special Issue on Through-Life Engineering Services. *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*, 231(13), 2241. <https://doi.org/10.1177/0954405417733604>
- [38] Alamerew, Y. A., Kambanou, M. L., Sakao, T., & Brissaud, D. (2020). A multi-criteria evaluation method of product-level circularity strategies. *Sustainability (Switzerland)*, 12(12), 1–19. <https://doi.org/10.3390/su12125129>
- [39] Brambila-Macias, S. A., & Sakao, T. (2021). Effective ecodesign implementation with the support of a lifecycle engineer. *Journal of Cleaner Production*, 279, 123520. <https://doi.org/10.1016/j.jclepro.2020.123520>
- [40] Baines, T. S., Lightfoot, H. W., Benedettini, O., & Kay, J. M. (2009). The servitization of manufacturing: A review of literature and reflection on future challenges. *Journal of Manufacturing Technology Management*, 20(5), 547–567. <https://doi.org/10.1108/17410380910960984>
- [41] Manzini, E., & Vezzoli, C. (2003). A strategic design approach to develop sustainable product service systems: Examples taken from the “environmentally friendly innovation” Italian prize. *Journal of Cleaner Production*, 11(8 SPEC.), 851–857. [https://doi.org/10.1016/S0959-6526\(02\)00153-1](https://doi.org/10.1016/S0959-6526(02)00153-1)
- [42] Tukker, A. (2004). Eight types of product-service system: Eight ways to sustainability? Experiences from suspronet. *Business Strategy and the Environment*, 260, 246–260.
- [43] Simone, H., & Remmen, A. (2019). A framework for sustainable value propositions in product-service systems. *Journal of Cleaner Production*, 223, 25–35. <https://doi.org/10.1016/j.jclepro.2019.03.074>
- [44] Sousa-Zomer, T. T., & Miguel, P. A. C. (2017). A QFD-based approach to support sustainable product-service systems conceptual design. *International Journal of Advanced Manufacturing Technology*, 88(1–4), 701–717. <https://doi.org/10.1007/s00170-016-8809-8>
- [45] Maccioni, L., Borgianni, Y., & Pigosso, D. C. A. (2019). Can the choice of eco-design principles affect products’ success? *Design Science*, 5. <https://doi.org/10.1017/dsj.2019.24>
- [46] Guo, W., & Jiang, P. (2019). Product service systems for social manufacturing: A new service system with multi-provider. In Y. F. Ivanov D. Dolgui A. (Ed.), *IFAC-PapersOnLine* (Vol. 52, Issue 13, pp. 749–754). Elsevier B.V. <https://doi.org/10.1016/j.ifacol.2019.11.205>
- [47] Vezzoli, C., Ceschin, F., & Diehl, J. C. (2015). Sustainable Product-Service System Design applied to Distributed Renewable Energy fostering the goal of sustainable energy for all. *Journal of Cleaner Production*, 97, 134–136. <https://doi.org/10.1016/j.jclepro.2015.02.069>
- [48] Beuren, F. H., Sousa-Zomer, T. T., & Cauchick-Miguel, P. A. (2017). Proposal of a framework for product-service systems characterization. *Production*, 27. <https://doi.org/10.1590/0103-6513.20170052>
- [49] Moreira, N., de Santa-Eulalia, L. A., Ait-Kadi, D., Wood-Harper, T., & Wang, Y. (2015). A conceptual framework to develop green textiles in the aeronautic completion industry: a case study in a large manufacturing company. *Journal of Cleaner Production*, 105, 371–388. <https://doi.org/10.1016/j.jclepro.2014.09.056>
- [50] Kanda, W., Sakao, T., & Hjelm, O. (2016). Components of business concepts for the diffusion of large scaled environmental technology systems. *Journal of Cleaner*

- Production*, 128, 156–167. <https://doi.org/10.1016/j.jclepro.2015.10.040>
- [51] Igba, J., Alemzadeh, K., Gibbons, P. M., & Henningsen, K. (2015). A framework for optimising product performance through feedback and reuse of in-service experience. *Robotics and Computer-Integrated Manufacturing*, 36, 2–12. <https://doi.org/10.1016/j.rcim.2014.12.004>
- [52] Hallstedt, S. I., Isaksson, O., & Rönnbäck, A. A. Ö. (2020). The need for new product development capabilities from digitalization, sustainability, and servitization trends. *Sustainability (Switzerland)*, 12(23), 1–26. <https://doi.org/10.3390/su122310222>
- [53] Mourtzis, D., Fotia, S., & Vlachou, E. (2017). Lean rules extraction methodology for lean PSS design via key performance indicators monitoring. *Journal of Manufacturing Systems*, 42, 233–243. <https://doi.org/10.1016/j.jmsy.2016.12.014>
- [54] Kim, S., Son, C., Yoon, B., & Park, Y. (2015). Development of an innovation model based on a service-oriented product service system (PSS). *Sustainability (Switzerland)*, 7(11), 14427–14449. <https://doi.org/10.3390/su71114427>
- [55] Hänsch Beuren, F., Amaral, C. E. do, & Cauchick Miguel, P. A. (2012). Caracterização de um sistema produto-serviço com base no seu ciclo de vida: análise em um purificador de água disponível no Brasil. *Exacta*, 10(1), 13–26. <https://doi.org/10.5585/exacta.v10n1.3592>
- [56] Martinez, V., Bastl, M., Kingston, J., & Evans, S. (2010). Challenges in transforming manufacturing organisations into product-service providers. *Journal of Manufacturing Technology Management*, 21(4), 449–469. <https://doi.org/10.1108/17410381011046571>
- [57] Guyon, O., Millet, D., Garcia, J., Margni, M., Richet, S., & Tchertchian, N. (2021). Prioritisation of modelling parameters of a free-floating car sharing system according to their sensitivity to the environmental impacts. *Journal of Cleaner Production*, 296, 126081. <https://doi.org/10.1016/j.jclepro.2021.126081>
- [58] den Hollander, M. C., Bakker, C. A., & Hultink, E. J. (2017). Product Design in a Circular Economy: Development of a Typology of Key Concepts and Terms. *Journal of Industrial Ecology*, 21(3), 517–525. <https://doi.org/10.1111/jiec.12610>
- [59] Kjaer, L. L., Pigosso, D. C. A., Niero, M., Bech, N. M., & McAloone, T. C. (2019). Product/Service-Systems for a Circular Economy: The Route to Decoupling Economic Growth from Resource Consumption? *Journal of Industrial Ecology*, 23(1), 22–35. <https://doi.org/10.1111/jiec.12747>
- [60] Zhang, Z., Xu, D., Ostrosi, E., & Cheng, H. (2020). Optimization of the product-service system configuration based on a multilayer network. *Sustainability (Switzerland)*, 12(2). <https://doi.org/10.3390/su12020746>
- [61] Zhang, L., Zhang, J., Duan, Z.-Y., & Bryde, D. (2015). Sustainable bike-sharing systems: Characteristics and commonalities across cases in urban China. *Journal of Cleaner Production*, 97, 124–133. <https://doi.org/10.1016/j.jclepro.2014.04.006>
- [62] Sakao, T., Hara, T., & Fukushima, R. (2020). Using Product/Service-System Family Design for Efficient Customization with Lean Principles: Model, Method, and Tool. *SUSTAINABILITY*, 12(14). <https://doi.org/10.3390/su12145779>
- [63] Song, W., & Sakao, T. (2017). A customization-oriented framework for design of sustainable product/service system. *Journal of Cleaner Production*, 140, 1672–1685. <https://doi.org/10.1016/j.jclepro.2016.09.111>
- [64] Mendoza, J. M. F., Sharmina, M., Gallego-Schmid, A., Heyes, G., & Azapagic, A. (2017). Integrating Backcasting and Eco-Design for the Circular Economy: The BECE Framework. *Journal of Industrial Ecology*, 21(3), 526–544. <https://doi.org/10.1111/jiec.12590>
- [65] Halstenberg, F. A., Lindow, K., & Stark, R. (2019). Leveraging circular economy through a methodology for smart service systems engineering. *Sustainability (Switzerland)*, 11(13). <https://doi.org/10.3390/su11133517>
- [66] Held, M., Weidmann, D., Kammerl, D., Hollauer, C., Mörtl, M., Omer, M., & Lindemann, U. (2018). Current challenges for sustainable product development in the German automotive sector: A survey based status assessment. *Journal of Cleaner Production*, 195, 869–889. <https://doi.org/10.1016/j.jclepro.2018.05.118>
- [67] Scheepens, A. E., Vogtländer, J. G., & Brezet, J. C. (2016). Two life cycle assessment (LCA) based methods to analyse and design complex (regional) circular economy systems. Case: Making water tourism more sustainable. *Journal of Cleaner Production*, 114, 257–268. <https://doi.org/10.1016/j.jclepro.2015.05.075>
- [68] Yang, M., Evans, S., Vladimirova, D., & Rana, P. (2017). Value uncaptured perspective for sustainable business model innovation. *Journal of Cleaner Production*, 140, 1794–1804. <https://doi.org/10.1016/j.jclepro.2016.07.102>
- [69] Kaddoura, M., Kambanou, M. L., Tillman, A.-M., & Sakao, T. (2019). Is prolonging the lifetime of passive durable products a low-hanging fruit of a circular economy? A multiple case study. *Sustainability (Switzerland)*, 11(18). <https://doi.org/10.3390/su11184819>
- [70] Bake, J. S., Pereira Pessôa, M. V., & Sipke, H. (2020). Mapping challenges and methodologies for providing PSS - a thematic and descriptive analysis. *Cogent Business and Management*, 7(1). <https://doi.org/10.1080/23311975.2020.1809945>
- [71] Kim, Y. S., Suzuki, K., & Hong, S. J. (2020). Product redesign for service considerations using affordances for service activities. *Sustainability (Switzerland)*, 12(1). <https://doi.org/10.3390/su12010255>
- [72] Fargnoli, M., Costantino, F., Di Gravio, G., & Tronci, M. (2018). Product service-systems implementation: A customized framework to enhance sustainability and customer satisfaction. *Journal of Cleaner Production*, 188, 387–401. <https://doi.org/10.1016/j.jclepro.2018.03.315>
- [73] De los Rios, I. C., & Charnley, F. J. S. (2017). Skills and capabilities for a sustainable and circular economy: The changing role of design. *Journal of Cleaner Production*, 160, 109–122. <https://doi.org/10.1016/j.jclepro.2016.10.130>
- [74] van Dam, S., Visser, F. S., & Bakker, C. (2020). The Impact

- of Co-Creation on the Design of Circular Product-Service Systems: Learnings from a Case Study with Washing Machines. *DESIGN JOURNAL*, 24(1), 29–50. <https://doi.org/10.1080/14606925.2020.1851427>
- [75] Garetti, M., Rosa, P., & Terzi, S. (2012). Life Cycle Simulation for the design of Product-Service Systems. *Computers in Industry*, 63(4), 361–369. <https://doi.org/10.1016/j.compind.2012.02.007>
- [76] Jensen, J. P., & Remmen, A. (2017). Enabling Circular Economy Through Product Stewardship. *Procedia Manufacturing*, 8, 377–384. <https://doi.org/10.1016/j.promfg.2017.02.048>
- [77] Huang, Y.-C., Tu, J.-C., & Kuo, K.-P. (2017). Establishing sustainable design and development for plastic mold under product service system. *Advances in Mechanical Engineering*, 9(7). <https://doi.org/10.1177/1687814017709699>
- [78] Yoon, B., Kim, S., & Rhee, J. (2012). An evaluation method for designing a new product-service system. *Expert Systems with Applications*, 39(3), 3100–3108. <https://doi.org/10.1016/j.eswa.2011.08.173>
- [79] Ayala, N. F., Paslauskis, C. A., Ghezzi, A., & Frank, A. G. (2017). Knowledge sharing dynamics in service suppliers' involvement for servitization of manufacturing companies. *International Journal of Production Economics*, 193, 538–553. <https://doi.org/10.1016/j.ijpe.2017.08.019>
- [80] Khan, M. A., West, S., & Wuest, T. (2020). Midlife upgrade of capital equipment: A servitization-enabled, value-adding alternative to traditional equipment replacement strategies. *CIRP Journal of Manufacturing Science and Technology*, 29, 232–244. <https://doi.org/10.1016/j.cirpj.2019.09.001>
- [81] Vence, X., & Pereira, Á. (2019). Eco-innovation and Circular Business Models as drivers for a circular economy. *Contaduría y Administración*, 64(1), 1–19. <https://doi.org/10.22201/fca.24488410e.2019.1806>
- [82] Tu, J.-C., Huang, Y.-C., Hsu, C.-Y., & Cheng, Y.-W. (2013). Analyzing lifestyle and consumption pattern of hire groups under product service systems in Taiwan. *Mathematical Problems in Engineering*, 2013. <https://doi.org/10.1155/2013/710981>
- [83] Korsunova, A., Horn, S., & Vainio, A. (2021). Understanding circular economy in everyday life: Perceptions of young adults in the finnish context. *Sustainable Production and Consumption*, 26, 759–769. <https://doi.org/10.1016/j.spc.2020.12.038>
- [84] Jetly, M., & Singh, N. (2019). Analytical study based on perspectives of teacher educators in India with respect to education for sustainable development. *Journal of Teacher Education for Sustainability*, 21(2), 38–55. <https://doi.org/10.2478/jtes-2019-0016>
- [85] Ping Tserng, H., Chou, C. M., & Chang, Y. T. (2021). The key strategies to implement circular economy in building projects-a case study of Taiwan. *Sustainability (Switzerland)*, 13(2), 1–17. <https://doi.org/10.3390/su13020754>
- [86] Alaei, N., Kurvinen, E., & Mikkola, A. (2019). A methodology for product development in mobile machinery: Case example of an excavator. *Machines*, 7(4). <https://doi.org/10.3390/machines7040070>
- [87] Zhang, D., Hao, M., & Morse, S. (2020). Is environmental sustainability taking a backseat in china after covid-19? The perspective of business managers. *Sustainability (Switzerland)*, 12(24), 1–24. <https://doi.org/10.3390/su122410369>
- [88] Ionaşcu, I., & Ionaşcu, M. (2018). Business models for circular economy and sustainable development: The case of lease transactions. *Amfiteatru Economic*, 20(48), 356–372. <https://doi.org/10.24818/EA/2018/48/356>
- [89] Lieder, M., Asif, F. M. A., Rashid, A., Mihelič, A., & Kotnik, S. (2018). A conjoint analysis of circular economy value propositions for consumers: Using “washing machines in Stockholm” as a case study. *Journal of Cleaner Production*, 172, 264–273. <https://doi.org/10.1016/j.jclepro.2017.10.147>
- [90] United Nations Development Programme. (2020). *Goal 7: Affordable and clean energy*. <https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-7-affordable-and-clean-energy.html>
- [91] Kohlbeck, E., Melo, A., Fagundes, A. B., Pereira, D., Beuren, F. H., & Ueno, O. K. (2021). Pre-development of products: methodology applied in a proposal oriented to the Sustainable Development Goals. *RISUS - Journal on Innovation and Sustainability*, 12(1), 116–134.
- [92] Jena, S. K., Sarmah, S. P., & Sarin, S. C. (2017). Joint-advertising for collection of returned products in a closed-loop supply chain under uncertain environment. *COMPUTERS & INDUSTRIAL ENGINEERING*, 113, 305–322. <https://doi.org/10.1016/j.cie.2017.09.024>

Genetic divergence in corn with forage potential in the Municipality of Santa Maria of Barreiras-PA

Weder Ferreira dos Santos^{1*}, Maria Angelica Oliveira Marinho², Layanni Ferreira Sodré Santos³, Joênes Mucci Peluzio⁴, Marcela Cristina Agustini Carneiro da Silveira Tschoeke¹, Guilherme Benko de Siqueira⁴, Fernando Barnabé Cerqueira⁵, Talita Pereira de Souza Ferreira¹, Cícero Antonio Sobreira Fidelis⁶, Laura Carneiro Silva¹, Magno de Oliveira⁷

¹Federal University of Tocantins, Gurupi, Tocantins, Brazil.

Email: eng.agricola.weder@gmail.com*

²CEULP/ULBRA, Palmas, Tocantins, Brazil.

³E.M.E.I.F Ullisses Guimarães, Santa Maria of Barreiras, Pará, Brasil.

⁴Federal University of Tocantins, Palmas, Tocantins, Brazil.

⁵Faculty Guaraí, Guaraí, Tocantins, Brazil.

⁶Federal Institute of Pará, Conceição do Araguaia, Pará, Brazil.

⁷University of Valley Taquari - Univates, Rio Grande do Sul, Brazil.

*Corresponding Author

Received: 03 Oct 2021,

Received in revised form: 14 Nov 2021,

Accepted: 23 Nov 2021,

Available online: 30 Nov 2021

©2021 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 -Silage, Nitrogen fertilization, Zea
mays. Breeding.

Abstract-The objective of this work was to estimate the genetic divergences in corn with forage potential in the southern region of Pará. Two competition trials of corn cultivars were installed, one under high nitrogen (150 kg ha^{-1} from N) and another under low N (0 kg ha^{-1} from N) applied in Cobertura, a crop 2020/21 in the State of Pará ($8^{\circ}18'32''\text{S}$, $50^{\circ}36'58''\text{O}$, 150 meters of altitude). The experimental design used in each assay was randomized blocks with three replicates and 11 maize cultivars, three varieties of open pollination, one single hybrid, seven double hybrids, and one triple hybrid. The following characteristics were analyzed: plant height (AP) in cm, the height of spike (AE), stem diameter (DC), spike diameter (DE), stem and leaf pasta (MCF), spike mass (ME), and full plant mass (MTP). For the analysis of genetic divergence, dissimilarities measures were used that were determined according to the multivariate analysis model, allowing the achievement of dissimilarities, residual covariances, and means of populations. Genetic divergence was evaluated by multivariate procedures with the generalized Mahalanobis distance, the Tocher optimization clustering method, and Singh's criterion to quantify the relative contribution of the seven characteristics. By estimating Mahalanobis distances, maize genotypes AG8088PRO2 X P33-16 showed a greater distance. The Tocher method was efficient in separating the groups. The characteristics of full plant mass and mass of stem and leaf were the ones that most contributed to genetic divergence.

I. INTRODUCTION

The figures for full corn production in Brazil in 2020/2021 crop reached 108 million tons, with a planted area of 19.5 million hectares, and average productivity of 5,543 kg ha⁻¹, focusing on the second harvest, which full about 77% of grain production. Comparing these values with the 2019/2020 crop, there was an increase of 5.4% in full production [1].

The consumption of corn goes beyond domestic use, these products are used in the production of various foods, such as snacks, sweet popcorn, breakfast cereals, and children's foods, and the manufacture of loaves of bread or in the brewing and pharmaceutical industries and mining [4]. For animal consumption, corn demand in Brazil was 52.0%, 30.4% for aviculture, 13.6% for pig farming, and 8.0% for cattle [2].

Silage is a very old process used for the conservation of fodder, based on the fermentation of plant sugars and acidification (pH reduction), being one of the most used conservation methods in Brazil to ensure food supply during the dry season. Numerous forages can be used for this purpose, however, corn stands out due to highly desirable characteristics such as high productivity, low buffer power, high sugar content, and high energy content [5].

When the objective is to obtain good silage, it is indispensable to manage adequately in all stages, from planting to harvest. The use of nitrogen fertilizers is one of the indispensable stages of management and that requires a lot of care, as it is directly correlated with the high yield of the crop, especially in the case of grasses [6]. In addition,

the choice of cultivar is one of the extremely important factors to be observed, because it is necessary to consider both agronomic characteristics and bromatological characteristics [7].

For the choice of cultivar, studies of genetic divergence involving corn crop have been used concerning seed quality in Santa Catarina [8], grain production in southern Brazil [9], grain production in Tocantins [10, 11, 12 and 13], oil and protein content in Tocantins [14, 15 and 16], water stress in the Tocantins [17], forage production in the semi-arid [18], and grain production in Pará [19 and 20]. However, there are few studies involving genetic divergence in corn aiming at the production of fodder in northern Brazil.

Because of the above, the objective of this study was to evaluate the genetic divergence of eleven maize genotypes with forage potential in the municipality of Santa Maria of Barreira in the southern region of the State of Pará.

II. MATERIAL AND METHODS

Two competition trials of corn cultivars were installed at Sítio Vitória (8°18'32" S, 50°36'58" O, and 150 meters of altitude), located in the municipality of Santa Maria das Barreiras-PA (Figure 1), one under low nitrogen, with 0 kg ha⁻¹ of N, and another under high nitrogen, with 150 kg ha⁻¹ of N, both in coverage. The doses were determined according to the lowest and highest expected productivity for the corn crop according to [21]. Sowing was carried out on November 14, 2020.

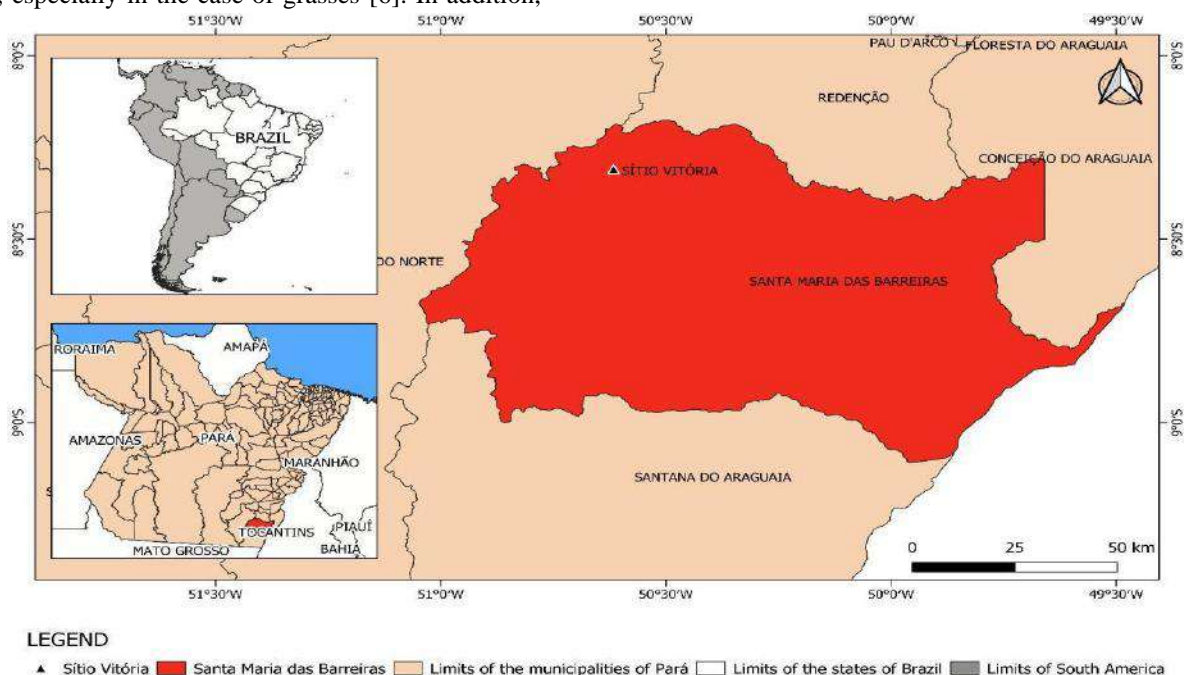


Fig.1. Location Map of Sítio Vitória, in the municipality of Santa Maria das Barreiras, State of Pará.

The region has a predominantly tropical climate according to Koppen as Aw, with rains in summer and a distinctly dry season in winter. The precipitation and

temperature data obtained over the conduction period of the experiment are presented in Figure 2.

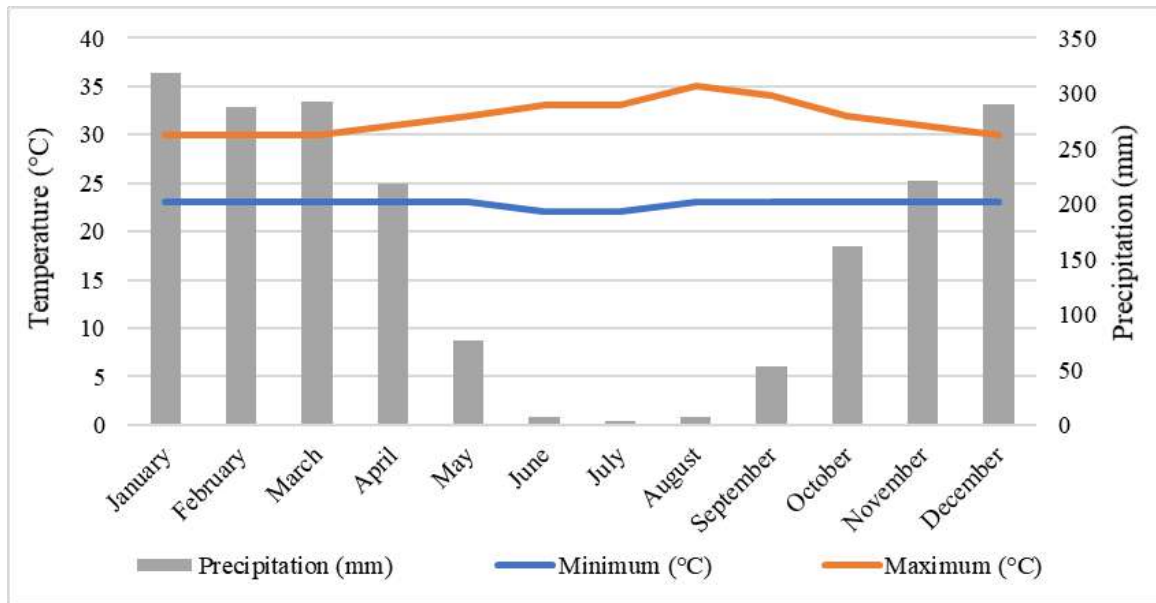


Fig.2. Precipitation climatological averages, minimum temperature, and a maximum of the municipality of Santa Maria of Barreiras, Estado of the Pará in the year of 2019.

Fonte: Climatempo [22].

The soil, representative of the study area, is of the sandy frank textural class, with very low phosphorus and calcium availability, low magnesium, and medium

potassium, according to table 1 data from chemical and textural soil analysis.

Table 1. Chemical attributes and soil granulometry were used in the first epoch of the experiment. Santa Maria of Barreiras-Pará, 2018.

pH	Pmeh	K	S	Ca ⁺²	Mg ⁺²	Al ⁺³	H+Al	M.O.	C.O.
	mg.dm ⁻³				cmolc.dm ⁻³			dag.kg ⁻¹	%
4.8	4.9	43	3.0	1.7	0.3	0.20	3.10	1.7	1.0
SB	CTCt	V%		M	Clay	Silt	Sandfull		
	mg.dm ⁻³					%			
2.11	5.21	40		9.0	15.0	5.0	80.0		

Two competition trials of corn cultivars were installed, one installed under low nitrogen, with 0 kg ha⁻¹ of N, and the other under high nitrogen, with 150 kg ha⁻¹ of N, both in cover. The doses were determined according to the lowest and highest expected productivity for the corn crop according to [21].

The experimental design used in each assay was randomized blocks with eleven treatments and three replications. The treatments consisted of maize cultivars, three varieties of open pollination, a single hybrid, seven double hybrids, and a triple hybrid, whose characteristics are found in Table 2.

Table 2. Agronomic characteristics of corn cultivars used in the experiment.

Nomecomercial	Base	Transgenia	Ciclo	Finalidade	Nível
AG1051	HD	C	SMP	G/MV/SPI	M/A
AG8088PRO2	HS	PRO2	P	G/SPI	A
ANHEMBI	PPA	C	P	G/SPI	B/M
BRS 3046	HT	C	SMP	MV	M/A
M274	HD	C	P	G/SPI	B/M
PR 27D28	HD	C	SP	G/SPI	B/M
P33-16*	HD				M
P33-11*	HD				M
P29-M12*	HD				M
P36-19*	HD				M
P40-8*	HD				M

HS: Simple hybrid; HD: Double hybrid; HT: Triple hybrid; PRO2: Technology VT PRO 2™; C: Conventional; P: Precocious; SMP: Semiprecocious; SP: Superprecocious; G: Grain; MV: Green corn; SPI: Silage of the whole plant; A: High; M: Medium and B: Low; * Experimental genotypes.

The experimental plot consisted of 4 rows of 5.0 m long with the spacing of 0.9 m between rows, being considered the two central rows as useful areas.

Sowing was performed in a groove with a depth of approximately 0.04 m, soon after seedling emergence, thinning was performed to obtain the spacing of 0.20 m between plants, and a final population of 55,555 plants ha⁻¹.

The cultural and phytosanitary control treatments of diseases, pests, and weeds were carried out according to the technical recommendations of the crop [23].

For soil preparation, a gradation was used followed by the leveling of the area. Pre-planting fertilization was calculated according to the levels obtained through soil analysis [23], 300 kg ha⁻¹ of formulated 5-25-15 (N-P₂O₅-K₂O) + 0.5% Zn was applied.

The cover fertilization was performed with 150 kg ha⁻¹ from N in the trial High N. The source used was urea (45% from N), totaling 333.33 kg ha⁻¹ urea, it was divided into two stages, the first in stage V₄ and the second in stage V₈[21].

The harvest was carried out in the two central rows, during the period when the plant was in the R5 (hard farinaceous) stage, due to the period in which the driest matter accumulates in the plant [23].

The following characteristics were analyzed: plant height (AP) in cm, ear height (AE) in cm, stem diameter

(DC) in mm, ear diameter (DE) in mm, stem mass and leaf (MCF) in g, ear mass (ME) in g, and full plant mass (MTP) in g.

For the analysis of genetic divergence, measures of dissimilarities were used that were determined according to the multivariate analysis model, allowing the obtaining of dissimilarities, residual covariances, and means of populations.

For group formation, using together with the data from high and low N, the grouping method by Optimization of Tocher [24], whose calculations were based on the Generalized Mahalanobis Distance [25], and the Singh criterion [26] were applied. to quantify the relative contribution of the seven traits evaluated in genetic divergence.

Statistical analyses were performed using the Computational Genes program [27].

III. RESULTS AND DISCUSSION

The measures of genetic dissimilarity, estimated from the Mahalanobis distance (Table 3), presented a high magnitude (31.13 to 688.29), indicating the presence of genetic variability among genotypes. [13] found magnitude ($D^2= 4.8$ to 79.2), [16] found a magnitude of D^2 from 0.4 to 328.7 and [12] found magnitude ($D^2= 4.0$ to 644.6) in corn crop.

Table 3. Estimation of Mahalanobis distances (D^2) maximum and a minimum of maize genotypes.

Genotype	Bigger		Minor	
	Distance D^2	Genotype	Distance D^2	Genotype
BRS 3046	271.34	(AG8088PRO2)	31.13	(P33-11)
M 274	371.82	(AG8088PRO2)	44.22	(BRS 3046)
AG8088PRO2	688.29	(P33-16)	115.49	(P36-19)
ANHEMBI	388.74	(PR 27D28)	32.68	(P29-M12)
PR 27D28	614.82	(P33-16)	181.03	(P36-19)
AG1051	530.12	(AG8088PRO2)	50.17	(M 274)
P33-16	688.29	(AG8088PRO2)	37.49	(P40-8)
P33-11	404.8	(AG8088PRO2)	31.13	(BRS 3046)
P29-M12	515.34	(PR 27D28)	32.68	(ANHEMBI)
P36-19	267.29	(P33-16)	54.73	(BRS 3046)
P40-8	487.64	(PR 27D28)	37.49	(P33-16)
Biggerdistance		688.29		(AG8088PRO2xP33-16)
Minordistance		31.13		(BRS3046 x P33-11)

In parentheses are represents genotype(s).

The combination of cultivars AG 8088PRO2 x P33-16 (Table 3) were considered the most divergent ($D^2=688.29$), followed by PR 27D28 x P33-16 ($D^2=614.82$) and AG 1051 x AG 8088PRO2 ($D^2=530.12$). The shortest distances were between the combinations BRS 3046 x P33-11 ($D^2 = 31.13$), ANHEMBI x P29-M12 ($D^2 = 32.68$), P33-16 x P40-8 ($D^2 = 37.49$), M274 x BRS 3046 ($D^2 = 44.22$). Combinations that result in longer distances may be an indication that cultivars may come from different germplasm banks [28, 11, 12, 19, 13 and 20].

Cluster analysis by the Tocher method separates the materials into different groups so that there is intragroup homogeneity and intergroup heterogeneity [29]. By this method, the cultivars were grouped into three groups (Table 4).

Table 4. Grouping by the Tocher method, based on the dissimilarity expressed by the Generalized Mahalanobis Distance.2

Group	Access
I	BRS 3046, M 274, ANHEMBI, AG 1051, P33-16, P33-11, P29-M12, P36-19 e P40-8
II	PR 27D28
III	AG8088PRO2

The first large group separated by the Tocher method was composed of nine genotypes (BRS 3046, M 274,

ANHEMBI, AG 1051, P33-16, P33-11, P29-M12, P36-19, and P40-8), the second group by a genotype (PR 27D28), and the third group formed by a genotype (AG 8088PRO2). This information confirms which genotypes are more divergent [18, 28, 11, 12, 19, 13, 20]. In this case, AG 8088PRO2 and PR 27D28, because they were the most divergent, constituted isolated groups.

The mean intergroup distances, derived from the Tocher optimization method (Table 5), indicate which groups are the most divergent. Thus, the least divergent groups were II and III (211.68) and the most divergent Groups I and III (409.11).

Table 5. Mean distances between groups formed by genetic divergence analysis in maize genotypes.3

Group	II	III
I	356.78	409.11
II		211.68

Regarding the contribution of the characteristics to the study of genetic divergence (Table 6), the one that most contributed was the full plant mass (MTP) (53.74%), followed by the mass of stem and leaf (MCF) (31.09%). The lowest contributions were: stem diameter (CD) (1.31%) and plant height (PA) (1.65%). Thus, the characteristics of the DC and AP can be discarded from future evaluations, as they contribute little to discriminate the evaluated materials, and can then reduce time, labor,

and costs in the improvement programs [28, 11, 12, 19, 13 and 20].

Table 6. The relative contribution of traits in the genetic dissimilarity of genotypes.

Variable	Value in%
Plant height	1.65
Spike height	4.44
Stem diameter	1.31
Ear diameter	3.65
Stem mass and leaf	31.09
Cob mass	4.12
Full plant mass	53.74

IV. CONCLUSION

By estimating Mahalanobis distances, maize genotypes AG8088PRO2 X P33-16 showed a greater distance.

The Tocher method was efficient in separating the groups.

The characteristics of full plant mass and mass of stem and leaf were the ones that most contributed to genetic divergence.

REFERENCES

- [1] CONAB - Companhia Nacional de Abastecimento. Acompanhamento Safra Brasileira de Grãos: v.6 - Safra 20/21 - n.6 - sexto levantamento. Brasília: CONAB, 2021. 106p. Disponível em: <<https://www.conab.gov.br>>. Acesso em: 26 out. 2021.
- [2] Contini, E., Mota, M.M., Marra, R., Borghi, E., Miranda, R.A., Silva, A.F., Silva, D.D., Machado, J.R. A., Cota, L.V., Costa, R.V., Mendes, S.M. 2019. Milho: caracterização e desafios tecnológicos. Brasília, DF: Embrapa Milho e Sorgo. Disponível em: <<https://ainfo.cnptia.embrapa.br/digital/bitstream/item/195075/1/Milho-caracterizacao.pdf>>. Acesso em: 18 out. 2021.
- [3] ABIMILHO – Associação Brasileira das Indústrias do Milho. Estatísticas do milho. 2021. Disponível em: <<http://www.abimilho.com.br/estatisticas>>. Acesso em: 27 out. 2021.
- [4] Strazzi, S. 2015. Derivados do milho são usados em mais de 150 diferentes produtos industriais. Revista Visão Agrícola–USP/ESALQ. 13: 146-150.
- [5] SENAR - Serviço Nacional de Aprendizagem Rural. 2011. Silagem de milho e sorgo: produção, ensilagem e utilização. Brasília: SENAR, 2011.
- [6] Kappes, C., Arf, O., Arf, M.V.; Ferreira, J. P., Dal Bem, E.A.; Portugal, J.R.; Vilela, R.G. 2013. Inoculação de sementes com bactéria diazotrófica e aplicação de nitrogênio em cobertura e foliar em milho. Semina: Ciências Agrárias. 34(2): 527-538.
- [7] Gomes, M.S., Von Pinho, R.G., Ramalho, M.A.P., Furtado, D.F. 2006. Alternativas para seleção de híbridos de milho envolvendo vários caracteres visando à produção de silage. Revista Brasileira de Milho e Sorgo. 5(3): 406-421.
- [8] Prazeres, C.S., Coelho, C.M.M. 2016. Divergência genética e heterose relacionada à qualidade fisiológica em sementes de milho. Bragantia. 75(4): 411-417.
- [9] Nardino, M., Baretta, D., Carvalho, I.R., Follmann, D.N., Ferrari, M., Pelegrin, A.J., Szarecki, V.J., Konflanz, V.A., Souza, V.Q. 2017. Divergência genética entre genótipos de milho (*Zea mays* L.) em ambientes distintos. Revista de Ciências Agrárias. 40(1): 164-174.
- [10] Dias, M.A.R., Melo, A.V., Santos, V.M., Santos, D.P.S., Nunes, H.V. 2018. Divergência genética entre progênies de milho na região centro-sul do estado do Tocantins. Revista Engenharia na Agricultura. 26(6): 483.
- [11] Santos, W.F., Maciel, L.C., Sodré, L.F., Silva, R.M., Afféri, F.S., Freitas, J.H., Pereira, J.S. 2017. Diversidade genética em genótipos de milho para baixo nível tecnológico em Gurupi, TO. Tecnologia & Ciência Agropecuária. 11(2): 21-24.
- [12] Santos, W.F., Afféri, F.S., Pelúzio, J.M., Sodré, L.F., Rotili, E.A., Cerqueira, F.B., Ferreira, T.P.S. 2018. Diversidade genética em milho sob condições de restrição ao nitrogênio. Journal of Bioenergy and Food Science, 5(2): 44-53.
- [13] Silva, K.C.L., Santos, W.F., Afféri, F.S., Peluzio, J.M., Sodré, L.F. 2019. Diversidade genética em cultivares de milho de plantio tardio sob diferentes níveis de nitrogênio no Tocantins. Revista de Agricultura Neotropical. 6(3): 92-100.
- [14] Santos, W.F., Pelúzio, J.M., Afféri, F.S., Sodré, L.F., Santos, D.S., Farias, T.C.M. 2014. Variabilidade genética e eficiência de uso do nitrogênio em populações de milho para teor de óleo. Revista de Ciência Agrárias. 57(3): 312-317.
- [15] Santos, W.F., Afféri, F.S., Peluzio, J.M. 2015. Eficiência ao uso do nitrogênio e biodiversidade em genótipos de milho para teor de óleo. Enciclopédia Biosfera, 11(21): 2916-2925.
- [16] Sodré, L.F., Santos, W.F., Ascêncio, S.D., Peluzio, J.M., Silva, R.M., Reina, E. 2017. Divergência genética em milho para baixo e alto nitrogênio visando à produção de óleo e proteína. Pesquisa Agropecuária Pernambucana, 22(1): 1-7.
- [17] Melo, A.V., Santos, V.M., Lopes, T.M., Dias, M.A.R., Nunes, H.V. 2019. Divergência genética entre híbridos de milho em condições de deficiência hídrica. Revista de Agricultura Neotropical. 6(3): 66-75.
- [18] Carvalho, M.N., Silveira, E.S., Menezes, B.S., Oliveira, T.R.A., Oliveira, G.H.F. 2020. Caracterização e divergência genética de genótipos de milho com potencial forrageiro avaliados em região semiárida. Agri-Environmental Sciences. 6: 13-13.
- [19] Santos, W.F., Milhomem, D.A., Silva, Z.D., Barbosa, A.S., Ferreira Junior, O.J., Santos, L.F.S., Santos, M.M., Ferreira, T.P.S., Maciel, L.C., Oliveira, M. 2019. Genetic divergence in corn indifferent concentrations of the powder. International Journal of Development Research, 9(11): 31099-31102.

- [20] Silva, R.M., Santos, W.F., Andrade, M.R., Silva, Z.D., Santos, L.F.S., Peluzio, J.M., Bequiman, L.R.S., Luz, C.N.M., Dias, V.C., Borges, T.A.S.L., Martins, A.L.L., Oliveira, M. 2019. Agronomic Performance and Genetic Divergence in Corn (*Zea mays*) in the Cerrado-Amazon Ecotone. *International Journal of Plant & Soil Science*, 31(1): 1-7.
- [21] Ribeiro, A.C., Guimarães, P.T.G., Alvarez V.V.H. 1999. *Recomendações para o uso de corretivos e fertilizantes em Minas Gerais – 5a Aproximação*. Viçosa: Comissão de Fertilidade do Solo do Estado de Minas Gerais.
- [22] CLIMATEMPO. 2021. *Climatologia: Santa Maria das Barreiras, PA. 2021*. Available at: <<https://www.climatempo.com.br/climatologia/6858/santa-mariadasbarreiras-pa>>. Access in: 06 out. 2021.
- [23] Borém, A., Galvão, J.C.C., Pimentel, M.A. 2015. *Milho: do plantio à colheita*. Viçosa: Editora UFV.
- [24] Rao, C.R. 1952. *Advanced statistical methods in biometric research*. New York: John Willey. 390p.
- [25] Mahalanobis, P.C. 1936. On the generalized distance in statistics. *Proceedings of the National Institute of Sciences of India*. (2): 49-55.
- [26] Singh, D. 1981. The relative importance of characters affecting genetic divergence. *The Indian Journal of Genetics and Plant Breeding*, 41:237-245.
- [27] Cruz, C.D., Regazzi, A.J. 2007. *Modelos biométricos aplicados ao melhoramento genético*. Viçosa: Imprensa Universitária, 480p.
- [28] Coelho, D.R., Santos, W.F., Sodrê, L.F., Pelúzio, J.M., Assunção, F.A., Pereira, J.S., Fonseca, S.L., Oliveira, M., Duarte Júnior, B.L., Silva, R.M. 2019. Genetic Divergence in Corn Genotypes in the South of the State of Pará. *International Journal of Advanced Engineering Research and Science*. 6(6): 471-475.
- [29] Cruz, C.D., Carneiro, P.C.S., Regazzi, A.J. 2014. *Modelos biométricos aplicados ao melhoramento genético*. 3 ed. Viçosa: UFV. 668p.

A Quinquennial Prevention and its applicability for the coarctation of mental illnesses in the practice of prevention of the Family Health Strategy in a pandemic period

A Prevenção Quinquenária e sua aplicabilidade para a coarctação de enfermidades mentais na práxis de profissionais da Estratégia Saúde da Família em período de pandemia

Quinquennial Prevention and its applicability to the coarctation of mental illnesses in the praxis of professionals of the Family Health Strategy during a pandemic period

La Prevención Quinquenal y su aplicabilidad a la coartación de enfermedades mentales en la praxis de los profesionales de la Estrategia Salud de la Familia durante un período pandémico

Richardson Lemos de Oliveira¹, Wilder Kleber Fernandes Santana², Claudemir Santos de Jesus³, Heberth Almeida de Macedo⁴, Allan Corrêa Xavier⁵, Marcelia Alves de Souza Martins⁶, Priscila de Jesus Rosa⁷, Carine Nunes Pereira⁸, Camilla Del Giudice Dias⁹, Angélica Cristina Castro Soares¹⁰, Jorge Agostinho de Farias Júnior¹¹

¹Docente da Universidade Castelo Branco/ Mestrado em Saúde Pública pela Universidade Nacional de La Plata (UNLP)

²Universidade Federal da Paraíba (UFPB)

³Escola de Enfermagem Anna Nery – Universidade Federal do Estado do Rio de Janeiro (EEAN/UFRJ)

⁴Faculdade de Ciências e Tecnologia Albert Einstein

⁵Universidade Federal do Estado do Rio de Janeiro (UFRJ)

⁶Universidade Federal Fluminense (UFF)

⁷Universidade Estácio de Sá

⁸União Brasileira de Faculdades (UNIBF)

⁹Especialista em Saúde da Família – Universidade do Estado do Rio de Janeiro (UERJ)

¹⁰Especialista em Saúde da Família – Universidade Castelo Branco (UCB)

¹¹Mestre em Clínica Médica – Universidade Federal do Rio de Janeiro (UFRJ)

Received: 25 Sept 2021,

Received in revised form: 11 Nov 2021,

Accepted: 22 Nov 2021,

Available online: 30 Nov 2021

©2021 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— *Prevention, Family health strategy, Healthcare professionals.*

Descriptors— *Prevention. Family Health Strategy. Health professionals.*

Descritores— *Prevenção. Estratégia Saúde da Família. Profissionais da saúde.*

Descriptores— *Prevención. Estrategia de salud de la familia. Profesionales de la salud.*

Abstract— *Introduction: This study discusses the phenomenon of Quinquennial Prevention and its applicability to the coarctation of mental professionals in the praxis experienced in recent months by professionals of the Family Health Strategy in their work context. Objective: to carry out descriptive-argumentative research of the Quinquennial Prevention strategies and their applicability in professionals working in the Family Health Strategy during the pandemic scenario. Method: Build an experience report that seeks to describe in a relevant way the given experience/experience of the authors or team, contributing to the discussion, exchange of ideas and propositions. Results: Quinquennial prevention has been more effective and with much more intensity in the current scenario, which seeks to alleviate the ailments and consequences caused by the Covid-19 pandemic (SARS-COV-2). Conclusion: The five-year prevention strategies propose to reduce the workload for health professionals, in addition to preventing the onset of diseases such as, for example, Burnout Syndrome.*

Resumo— *Introdução: Este estudo discute o fenômeno da Prevenção Quinquenária e sua aplicabilidade para coarctação de enfermidades mentais na práxis vivenciada nos últimos meses por profissionais da Estratégia Saúde da Família em seu contexto laboral. Objetivo: realizar uma pesquisa descritivo-argumentativa das estratégias de Prevenção Quinquenária e sua aplicabilidade em profissionais que atuam na Estratégia Saúde da Família durante o cenário pandêmico. Método: Construir um relato de experiência que busca descrever de forma relevante a dada experiência/vivência dos autores ou equipe, contribuindo para a discussão, troca de ideias e proposições. Resultados: a prevenção Quinquenária tem sido mais eficaz e com muito mais intensidade no atual cenário, que busca amenizar as mazelas e consequências provocadas pela pandemia da Covid-19 (SARS-COV-2). Conclusão: As estratégias de prevenção quinquenária propõem a redução da sobrecarga laborativa para os profissionais de saúde, além de prevenir do surgimento de enfermidades como, por exemplo, a Síndrome de Burnout.*

Resumen— *Introducción: Este estudio discute el fenómeno de la Prevención Quinquenal y su aplicabilidad a la coartación de enfermedades mentales en la praxis vivida en los últimos meses por los profesionales de la Estrategia Salud de la Familia en su contexto laboral. Objetivo: realizar una investigación descriptivo-argumentativa de las estrategias de Prevención Quinquenal y su aplicabilidad en los profesionales que trabajan en la Estrategia Salud de la Familia durante el escenario pandémico. Método: Construir un informe de experiencia que busque describir de manera relevante la experiencia / vivencia de los autores o equipo, contribuyendo a la discusión, intercambio de ideas y propuestas. Resultados: La prevención quinquenal ha sido más efectiva y con mucha más intensidad en el escenario actual, que busca paliar las dolencias y consecuencias provocadas por la pandemia Covid-19 (SARS-COV-2). Conclusión: Las estrategias de prevención quinquenal proponen reducir la carga de trabajo de los profesionales de la salud, además de prevenir la aparición de enfermedades como, por ejemplo, el Síndrome de Burnout.*

I. INTRODUÇÃO

O estudo desenvolvido que discute o fenômeno da Prevenção Quinquenária e sua aplicabilidade para coarctação de enfermidades mentais na *práxis* vivenciada nos últimos meses por profissionais da Estratégia Saúde da Família em seu contexto laboral. A pandemia do Covid-19 teve sua propagação generalizada e passou a ser entendida como grave problemática de saúde pública a partir de março de 2020, quando a Organização Mundial da Saúde¹(OMS), como autoridade mundial no âmbito da Saúde, implementou as medidas de contingenciamento para controle e disseminação.

Durante esse período, os profissionais que atuaram e atuam na linha de frente, independentemente dos níveis de atenção à saúde, além de serem atores principais para o combate a pandemia seguem atuando dia após dia neste enfrentamento². Atualmente, os profissionais da saúde podem contar com a vacinação para o combate da pandemia através do mecanismo de prevenção, em que a vacina conta como aliada além da necessidade de colaboração populacional para manutenção do controle e disseminação do vírus, haja vista que, conforme estudos científicos da Fiocruz, baseando-se em dados da OMS, “a vacinação é responsável por evitar cerca de 2,5 milhões de mortes por ano, número que poderia ser bem maior, com mais 1,5 milhão de vidas salvas, caso a cobertura vacinal fosse melhorada em todo o mundo”³.

Em tempo, a abordagem sobre prevenção de enfermidades vem sendo pauta de discussões pelas autoridades de saúde, inclusive foi abordado seu conceito, fazendo diferenciação sobre promoção da Saúde na Carta de Otawa na década de 80, no Canadá, a qual gerou documento norteador com metas para Saúde em que foi sugerida a implementação de políticas públicas saudáveis⁴. “O termo 'prevenir' tem o significado de "preparar; chegar antes de; dispor de maneira que evite (dano, mal); impedir que se realize”⁵. Nesse sentido, entendemos que “A prevenção em saúde "exige uma ação antecipada, baseada no conhecimento da história natural a fim de tornar improvável o progresso posterior da doença”⁶ bem como trabalha no sentido de ações preventivas e intervenções orientadas a evitar o surgimento de doenças específicas, o que acaba reduzindo sua incidência e prevalência nas populações⁵.

É nessa perspectiva que o Ministério da Saúde do Brasil (2013) define os níveis de prevenção como: *Primário, Secundário, Terciário e Quaternário*. Apesar das peculiaridades de cada nível, cada um possui suas

características para aplicação. Mais recentemente ouvimos com frequência a abordagem sobre o termo *Prevenção Quinquenária* que “trata-se de um novo nível de medidas preventivas que visa à melhoria da qualidade dos cuidados prestados aos pacientes, sobretudo com foco no cuidador, de onde emergem os cuidados”⁷, o qual tem sido mais eficaz e com muito mais intensidade no atual cenário.

Diante de tais discussões introdutórias, este estudo delimitou como objetivo geral realizar uma pesquisa descritivo-argumentativa das estratégias de Prevenção Quinquenária e sua aplicabilidade em profissionais que atuam na Estratégia Saúde da Família durante o atual cenário pandêmico.

Sendo assim, o presente manuscrito está estruturado em duas seções, além das notas iniciais. Em primeiro momento, no a) *Eixo teórico sobre a evolução dos níveis de prevenção*; b) *Traçado metodológico*, buscou-se discutir sobre a pesquisa científica, as etapas da investigação e sua aplicabilidade; tendo como parâmetro estudos recentes que entraram em protagonismo nos últimos 6 (seis) anos acerca da prevenção quinquenária.

Eixo teórico sobre a evolução dos níveis de prevenção

Segundo o Ministério da Saúde, as estratégias de *prevenção primária* consistem em redução ou remoção de fatores que possam colocar a saúde individual ou coletiva em risco, ou seja, é necessário a interferência antes mesmo da problemática se instalar. Um exemplo disso é a vacinação⁸. Aplicando-se à realidade, averiguou-se que a vacina ainda era algo utópico, e era necessário abusar de estratégia de promoção da saúde para amenizar o contágio e atingir o objetivo, que neste caso, era específico.

Já a prevenção secundária agrega um conjunto de procedimentos e ações realizadas para detectar um problema de saúde em estágio inicial, muitas vezes em estágio subclínico, no indivíduo ou na população, facilitando o diagnóstico definitivo, o tratamento e reduzindo ou prevenindo sua disseminação e os efeitos de longo prazo⁸. A prevenção terciária, conforme descrevem Gusso e Gomes⁹, com base no relatório de Dawson sobre as propostas de organização dos serviços de saúde, caracteriza-se pela recuperação da saúde e redução máxima do dano, com proposta de reabilitação, visando manter a independência do indivíduo.

A seguir, o quadro elucidará os três níveis de prevenção que, segundo o Ministério da Saúde⁷ fazem inter-relação entre a atividade médica e a saúde pública, reiterando assim a discussão realizada anteriormente.

Primária (promoção da saúde e proteção específica)	A promoção da saúde aparece como prevenção primária, confundindo-se com a prevenção referente à proteção específica (vacinação, por exemplo). Corresponde a medidas gerais, educativas, que objetivam melhorar a resistência e o bem-estar geral dos indivíduos (comportamentos alimentares, exercício físico e repouso, contenção de estresse, não ingestão de drogas ou de tabaco), para que resistam às agressões dos agentes. Também diz respeito a ações de orientação para cuidados com o ambiente, para que esse não favoreça o desenvolvimento de agentes etiológicos (comportamentos higiênicos relacionados à habitação e aos entornos).
Secundária (diagnóstico e tratamento precoce; limitação da invalidez)	Engloba estratégias populacionais para detecção precoce de doenças, como por exemplo, o rastreamento de câncer de colo uterino. Também contempla ações com indivíduos doentes ou acidentados com diagnósticos confirmados, para que se curem ou mantenham-se funcionalmente saudáveis, evitando complicações e mortes prematuras. Isto se dá por meio de práticas clínicas preventivas e de educação em saúde, objetivando a adoção/mudança de comportamentos (alimentares, atividades físicas etc.).
Terciária (reabilitação)	Consiste no cuidado de sujeitos com sequelas de doenças ou acidentes, visando a recuperação ou a manutenção em equilíbrio funcional.

Fig.1: Os níveis de prevenção com base em Leavell e Clark (1965)

FONTE: DEMARZO, Marcelo Marcos Piva. Reorganização dos Sistemas de Saúde. UNASUS, 2008

Vislumbrando este conceito de Leavell e Clark, a trajetória sequencial destas ações, resultariam na conhecida “história natural da doença”. A seguir, representamos um quadro para elucidar o entendimento:

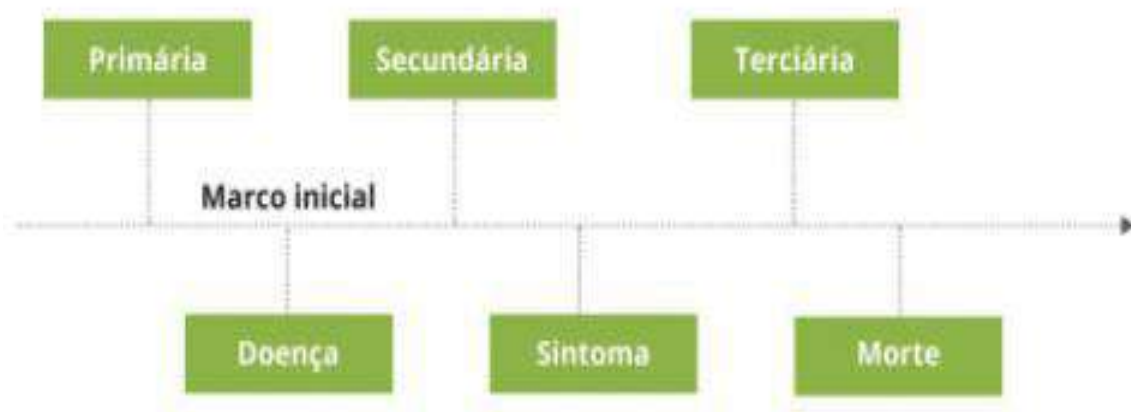


Fig.2: Fluxo sequencial da “história natural das doenças”

FONTE: GUSSO e GOMES. Evolução da Promoção à Saúde na Saúde suplementar e Atenção Primária à Saúde (APS), 2021.

A percepção dos autores sobre a evolução das enfermidades há de ser questionada, pois algumas doenças não apresentam sintomas, por outro lado, nem todos os sintomas apresentados podem ser relacionados as respectivas doenças que o paciente apresenta e por fim, nem toda doença obrigatoriamente levará a morte.

Essa percepção, foi notada pelo médico Marc Jamouille, realizando mudança no paradigma alterando a construção cronológica defendida anteriormente e modificando a proposta do eixo único para um eixo cartesiano apresentando o Eixo “X” sendo a ótica do paciente e o Eixo “Y” sendo a atuação profissional. Esse

câmbio, resultou na criação de um campo extra chamado: *Prevenção Quaternária*.

A definição atual do Dicionário Wonca Internacional: “Ação tomada para identificar o paciente em risco de supermedicalização, para protegê-lo de uma nova invasão médica e para sugerir a ele intervenções, que são eticamente aceitáveis”¹⁰ [Tradução nossa]. A prevenção quaternária aborda a questão principal do que se constitui como “muita” ou “pouca” medicina. Ela é a quarta forma de prevenção de doenças, e também a quarta etapa de ação dos médicos de família¹¹.

O Ministério da Saúde⁷ reitera que a prevenção quaternária é a detecção de indivíduos em risco de

intervenções, diagnósticas e/ou terapêuticas, excessivas para protegê-los de novas intervenções médicas

inapropriadas e sugerir-lhes alternativas eticamente aceitáveis.

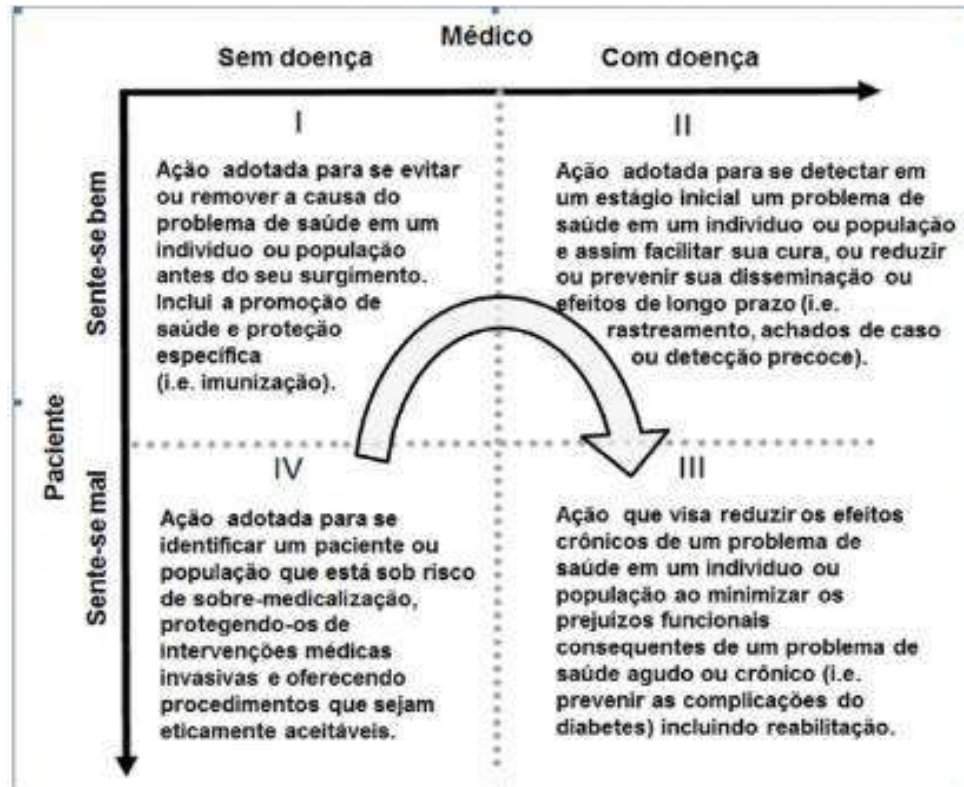


Fig.3: O impacto da Prevenção Quaternária em todos os níveis de Atenção:

FONTE: JAMOULLE, M. et al (2015)

As definições das atividades preventivas nestes quatro níveis parecem partir do princípio garantido de que o médico, como elemento único, é alicerce estável desde que seja possuidor da melhor evidência científica e/ou desde que seja praticante dos princípios éticos que deverão reger o seu exercício profissional.¹⁵

Como último nível de prevenção, na atualidade, a prevenção quinquenária foi definida em 2014 pelo médico de família José Agostinho Santos que pode perceber que os profissionais do cuidado também precisam ser cuidados. Esse nível de prevenção prevê o surgimento da Síndrome de Burnout em profissionais da saúde que refletirá no cuidado prestado aos pacientes.

Na ótica de Pêgo e Pêgo, “O termo “Burnout”, de origem inglesa, designa algo que deixou de funcionar por exaustão de energia. Pode-se dizer que o termo descreve uma síndrome com características associadas, que representam uma resposta aos estressores laborais crônicos”¹².

Os sinais são caracterizados por um conjunto de sintomas como: exaustão profissional, despersonalização, insatisfação com a realização profissional que pode ser por má adaptação em alguma unidade ou setor que resulta em estresse e tensão.

O fato que nos chama atenção, a prevenção quinquenária quando aplicamos ao contexto atual que seguimos vivenciando provocado pela pandemia do Covid-19, no faz refletir sobre a saúde mental dos profissionais que atuam na linha de frente, tornando assim relevante nossa pesquisa e possibilitando discutirmos mais sobre a temática mais adiante.

II. TRAJETO METODOLÓGICO:REVISÃO INTEGRATIVA

Como método, optamos por um relato de experiência que busca descrever de forma relevante a dada experiência/vivência dos autores ou equipe de forma

exitosa ou não, mas que possa trazer contribuição para a discussão, troca de ideias e proposições, objetivando trazer novos ideais e melhorias para o cuidado em saúde².

E é nesta perspectiva, que podemos observar o transcurso da práxis dos profissionais da saúde, no decorrer desse período de início até os dias atuais do enfrentamento. Diante desta realidade, podemos observar tais nuances de diferentes ângulos.

Como gerente técnico de Clínica da Família no município do Rio de Janeiro, o papel de gerenciar as

demandas da unidade fica a cargo, assim como conduzir as estratégias espontânea que vem surgindo com o decorrer do tempo.

No início da pandemia, por volta de maio/junho de 2020, começamos o enfrentamento desse grande desafio, onde podíamos contar apenas com ferramentas como: Educação Popularizante em Saúde, medidas de distanciamento social e as estratégias em alguns níveis de prevenção.

Quadro I: Análise de dados

Título	Autores	Periódico	Idioma	País	Ano
Prevenção quinquenária: Prevenir o dano para o paciente, actuando no médico	José Agostinho Santos	Revista Portuguesa de Medicina Geral e Familiar	Português de Portugal	Portugal	2014
Resgate das relações abusivas em que nos encontramos: uma questão de prevenção quinquenária	José Agostinho Santos	Revista Brasileira de Medicina de Família e Comunidade	Português Brasileiro	Brasil	2019
Metáforas e medicamentos, nos itinerários de Saúde / doença de jovens universitários	Júlia Maria Guilherme Ribeiro Antunes	International Journal of Developmental and Educational Psychology	Português Brasileiro	Espanha	2015

Fonte: Criação dos próprios autores;

Estratégias de prevenção Quinquenária aplicada a profissionais da Estratégia Saúde da Família

O conceito da prevenção quinquenária propõe qualidade para a vida de profissionais da saúde objetivando-se na melhora dos cuidados prestados aos pacientes, através de profissionais que se encontram em boas condições para a atenção ao paciente¹³.

Sendo assim, conforme o texto de Antunes¹⁴, tal temática já vem sendo debatida durante alguns anos, no objetivo de focar a atenção no cuidador para reduzir, indiretamente, o dano no paciente, trazendo assim, o desenvolvimento de ações de prevenção quinquenária num patamar de importância similar às medidas de prevenção primordial, primária, secundária, terciária e quaternária¹⁵. Isto é, as medidas nesta *prevenção quinquenária* não passam por criar atividades desde estímulo à actualização científica ou ao cumprimento dos princípios éticos do

cuidar, mas por estratégias que conduzam à evicção do erro que surge de uma deterioração do bem-estar biopsicossocial do médico¹⁵.

“Já sabemos que *burnout* é definido como um estado de plena exaustão física e/ou psicológica que germina da produção contínua e intensiva de respostas concertadas perante as elevadas exigências no local de trabalho”^{14;15}.

A prevenção desta doença delinea-se num fluxo particular: prevenir o dano para o paciente, atuando no médico. Esta atuação diferencia-se de qualquer das outras categorias de prevenção (que se centram no campo biopsicossocial do paciente e na relação médico-paciente), visto “[...] o uso excessivo dos recursos tanto materiais como humanos, testando os limites, constitui uma tentação para a qual alguns administradores ou gestores poderão facilmente ceder.”¹⁵

Categorização e denominação dividida em esferas com base no estudo de José Agostinho Santos (2014; 2019)

Atores	Estratégias
Profissionais de Saúde	Estratégias que tem, como objetivo final, criar alterações ou manutenções favoráveis dos aspectos intrínsecos e biopsicossociais do médico, enquanto pessoa (existe uma componente afetiva no raciocínio médico);
Paciente e Comunidade	Estratégias que visam gerar mudanças na comunidade onde o médico pratica o exercício profissional, de maneira a criar uma maior fluidez da relação médico-paciente;
Ambiente Laboral	Estratégias que pretendem criar modificações a nível do local de trabalho que favoreçam a maximização do potencial profissional (recursos humanos, equipamento necessário no gabinete, adequabilidade dos sistemas informáticos de suporte à prática clínica, proximidade de outras especialidades médicas para referência e/ou discussão quanto à decisão clínica, protocolos de atuação clínica);
Gestão Governamental/Administrativa	Estratégias que vão ao encontro da satisfação do médico enquanto empregado de uma entidade que o contrata (nomeadamente, o fornecimento de redes de suporte às suas atividades);

Fonte: Criação dos próprios autores;

Esses níveis distribuídos em quatro níveis estratégicos contam com agentes que perpassam pelos diferentes níveis e desenvolverá distintas atribuições.

- *Dentro do nível interno do profissional encaixam-se todas as estratégias que potenciem uma expansão do conhecimento das suas necessidades intrínsecas enquanto ser humano, com o seu passado e seus desejos/feridas/prazeres/padrões, e de como tais necessidades são relevantes para o seu desempenho e relações em qualquer esfera da sua vida, incluindo profissional. Estas medidas incitam, também, um autocuidado por parte do profissional (estabelecer bons estilos de vida com tempo para exercício físico, boa nutrição, reflexão pessoal, trabalho interno...)¹⁵*
- *A nível do paciente, incluem-se medidas que possam gerar uma transformação mais ou menos significativa a nível da comunidade e que possam ser facilitadoras da comunicação médico-paciente logo desde o primeiro momento de consulta. Aqui residem planos estratégicos que englobam um sutil convite ao paciente para ter um papel mais consciente na relação que estabelece (relação médico-paciente, enfermeiro-paciente ou outra) e valorizar esta relação¹⁵*
- *No local de trabalho, as estratégias poderão criar um campo para expressão máxima da faceta profissional do trabalhador de saúde e incidirão no incremento qualitativo das condições de trabalho (como recursos humanos adequados às necessidades populacionais, disponibilidade de materiais e de equipamentos tecnológicos*

funcionais, programas informáticos que criem um suporte intuitivo de registro e pesquisa clínica, instalações especialmente arquitetadas para um cuidado em saúde personalizado e que permitam o sigilo e a privacidade do paciente, elaboração de consensos interpares de atuação clínica e de articulação multiprofissional ou, não menos relevante, criação de momentos de lazer em equipe e que são correntemente denominados de momentos de team building)¹⁵

- *A nível governamental ou da tutela, estabelecem-se estratégias desenvolvidas na perspectiva do profissional enquanto funcionário de uma instituição e que integram a adequação dos contratos nas instituições públicas ou privadas quer sob o prisma remuneratório quer sob o prisma de horário (cumprimento das horas de pausa, evicção de sobrecarga laboral com horas extraordinárias ou exequibilidade do número de consultas por hora, permitindo ao profissional ter tempo para o seu autocuidado)¹⁵*

Ainda menciona Santos que “as organizações prestadoras de cuidados de saúde são responsáveis pela melhoria contínua da Qualidade dos seus serviços e pela garantia de elevados padrões de cuidados, criando um ambiente que estimule a excelência dos cuidados clínicos”¹⁵

III. CONCLUSÕES

Ao longo do manuscrito foi possível perceber que as estratégias de prevenção quinquenária descritas pelo autor propõem a redução da sobrecarga laborativa para os profissionais de saúde. Ainda que estas estratégias não descrevam qual contexto para sua aplicação que se nota de cunho generalista, percebe-se que há melhor adequação para sua implementação no contexto da Atenção Primária à Saúde (APS), especificamente na Estratégia Saúde da Família (ESF). Além disso, não foram identificadas mudanças no fluxo ou adaptação para o atual contexto pandêmico.

Portanto, conclui-se a importância de suas aplicações, no caso específico da prevenção quinquenária, de maneira intensiva e efetiva por parte dos gestores, mas melhorar a condição laboral de profissionais que se encontram na linha de frente contra o Covid-19, assim como a redução dos estressores e prevenção do surgimento de enfermidades como, por exemplo, a Síndrome de Burnout.

REFERÊNCIAS

- [1] World Health Organization (WHO). Director-General's statement on IHR Emergency Committee on Novel Coronavirus (2019-nCoV). Geneva: WHO; 2020. [cited 2020 Apr 16]. Available from: [https://www.who.int/news-room/detail/23-01-2020-statement-on-the-meeting-of-the-international-healthregulations-\(2005\)-emergency-committee-regarding-the-outbreak-of-novelcoronavirus-\(2019-ncov\)](https://www.who.int/news-room/detail/23-01-2020-statement-on-the-meeting-of-the-international-healthregulations-(2005)-emergency-committee-regarding-the-outbreak-of-novelcoronavirus-(2019-ncov)).
- [2] Santana, WKF et al., Professionalization in higher Education, Teaching and plural Identities: Contemporary Challenges *International Journal of Advanced Engineering Research and Science*, 8(7) - 2021.
- [3] FIOCRUZ. *Coronavírus notícias*. Disponível em: <https://portal.fiocruz.br/coronavirus-noticias>. Acesso em: 18.10.2021
- [4] Euclides, CLC. *A implementação da Política Nacional de Promoção Da Saúde na Atenção Primária sob a perspectiva de profissionais de saúde*. Dissertação (Mestrado em Saúde Coletiva). Universidade Federal do Pará. 2018. Disponível em: http://repositorio.ufpa.br/jspui/bitstream/2011/10377/1/Dissertacao_ImplementacaoPoliticaNacional.pdf Acesso em: 22.10.2021
- [5] Czeresnia, D. Freitas, CM. *Promoção da Saúde: conceitos, reflexões, tendências*. 1ª reimpressão: 2003 (1ª edição: 2003).
- [6] Leavell, S. & Clarck, E. G. *Medicina Preventiva*. São Paulo: McGraw-Hill, 1976. LUPTON, D. *The Imperative of Health: public health and the regulated body*. Londres: Sage, 1995.
- [7] PEBMED. *Portal Brasileiro de Atualização em Medicina do Brasil*. Disponível em: <https://pebmed.com.br/prevencao-quinquenaria-o-que-precisamos-saber/> Acesso em: 29/09/2021.
- [8] Brasil. Ministério da Saúde. (2017). *Política Nacional da Atenção Básica*. Brasília – Distrito Federal. Disponível em: [https://bvsms.saude.gov.br/bvs/saudelegis/gm/2017/prt2436_22_09_2017.html#:~:text=Aprova%20a%20Pol%C3%AAdtica%20Nacional%20de,%C3%9Anico%20de%20Sa%C3%BAde%20\(SUS\)](https://bvsms.saude.gov.br/bvs/saudelegis/gm/2017/prt2436_22_09_2017.html#:~:text=Aprova%20a%20Pol%C3%AAdtica%20Nacional%20de,%C3%9Anico%20de%20Sa%C3%BAde%20(SUS)) Acesso em: 15.10.2021
- [9] Gusso, Gustavo; Gomes, Samuel Ramos. Evolução da Promoção à Saúde na Saúde suplementar e Atenção Primária à Saúde (APS). *José Cechin*, p. 13, 2021.
- [10] Martins C, Godycki-Cwirko M, Heleno B, Brodersen J. *Quaternary prevention: reviewing the concept*. *Eur J Gen Pract*. 2018 Dec;24(1):106-111.
- [11] Jamouille, M. Prevenção quaternária: primeiro não causar dano. *Revista Brasileira de Medicina de Família e Comunidade*, Rio de Janeiro, v. 10, n. 35, p. 1–3, 2015. Disponível em: <https://rbmf.org.br/rbmf/article/view/1064>. Acesso em: 27 set. 2021.
- [12] Pêgo, Fpl; Pêgo, DR (2016). Síndrome de burnout. *Rev. bras. med. trab*, p. 171-176.
- [13] Santos, JA (2019). Resgate das relações abusivas em que nos encontramos: uma questão de prevenção quinquenária. *Revista Brasileira de Medicina de Família e Comunidade*.
- [14] Antunes, JMGR. Metáforas e medicamentos, nos itinerários de Saúde / doença de jovens universitários. *International Journal of Developmental and Educational Psychology*. 2015.
- [15] Santos, JA. Prevenção quinquenária: Prevenir o dano para o paciente, actuando no médico. *Revista Portuguesa de Medicina Geral e Familiar*. 2014.

Dental treatment of children with krabbe syndrome with tracheostomy - Clinical case report

Jéssica Raíssa Sarmiento Fernandes¹, Lívia CoutinhoVarejão¹, Rebeca Luzia Solarte Barbosa², Rodrigo Marocchio Pavane³, Mário Jorge Souza Ferreira Filho²

¹Faculdade do Centro Oeste Paulista – FACOP/IBEN - Manaus/Amazonas – Brasil

²Centro de Ensino e Pesquisa em Reabilitação Oral – CEPROEDUCAR, Manaus/Amazonas –Brasil

³Centro Universitário do Norte – UNINORTE – Manaus/Amazonas - Brasil

Received: 26 Sept 2021,

Received in revised form: 10 Nov 2021,

Accepted: 18 Nov 2021,

Available online: 30 Nov 2021

©2021 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—*Sturge-Weber Syndrom,
Tracheostomy, Pessoascom Necessidades
Especiais*.

Abstract—*People with special needs, have momentary or permanent limitations, one or more barriers, with physical, motor, cognitive, mental or sensory biological etiology. Dentistry for patients with special needs is the only specialty that works with all ages and is present in the three strands of dental care at home, outpatient and hospital allowed by the federal council. Krabbe Syndrome is an autosomal recessive neurodegenerative disease resulting from a deficiency of the enzyme galactosylceramidase, affecting the demyelination of the central and peripheral nervous system. In the literature, there are no reports on outpatient dental care for people with tracheostomy or Krabbe's disease. Given this, the objective of this study is to monitor and treat the oral health of a child with a rare syndrome with tracheostomy, who can have good oral health free of caries and periodontal disease. Thus, bringing the benefit of accessibility to outpatient dental care for children with tracheostomy, avoiding hospital interventions.*

I. INTRODUCTION

According to the Brazilian Law for the Inclusion of Persons with Disabilities, in article 2, a person with a disability is considered a long-term impediment with etiology of a physical, mental, intellectual or sensory nature that they have, which, in interaction with one or more barriers, can obstruct their full and effective participation in society on equal terms with other people. Based on this, the demographic census (2019) released by the Brazilian Institute for Static Geography (IBGE), indicates that approximately 45 million people have some type disability, that is, 25% of the Brazilian population 1 .

The Ministry of Health and the Federal Council of Dentistry recognize that dentistry for patients with special needs individuals with simple or complex changes, momentary or permanent, biological, physical, mental,

social and/or behavioral etiology that require a special, multidisciplinary approach and protocol specific^{1,2}.

Krabbe syndrome is an autosomal recessive neurodegenerative disease characterized by a deficiency of the enzyme galactocerebrosidase^{3,4}. Described in 1916 by neurologist KnudHaroldsenKrabbe, he observed neuropathological characteristics in five children with diffuse sclerosis in the brain ³.

Rare disease with an estimated incidence of 1:100,000 live births³. It can be classified into two clinical forms: early childhood and late^{3,4}. Main symptoms are: excessive crying, irritability, stiffness, seizures, motor delay, dysphagia, seizures, loss of vision^{3,4}. With poor prognosis and rapid evolution, the life success rate is almost impossible^{3,4}.

The dysphagia of the disease leads to the need for tracheostomy, a surgical procedure that aims to unblock the airways^{5,6}. It can be performed at any age, it is classified as temporary or permanent, depending on the patient's disability⁶. In most cases, feeding is compromised and there may even be the need for an enteral tube. Regardless of the route and nutrition, oral health and cleaning of the tracheal tube must be redoubled^{23,13}.

In the oral cavity, there are over 700 species of bacteria that make up the oral microbiota that act as beneficial and harmful pathogens⁷. In both situations, pH, presence of nutrients, salivary flow and retention factors that facilitate the maturation of the biofilm with the imbalance of a of these four pillars, the perfect opportunity for oral diseases can occur, they can lead to death⁷.

Patients with special needs with motor difficulties and/or more time-consuming intellectual processing have poor or non-existent oral hygiene and do not have the necessary dexterity to use dental floss and brushing⁸.

Given this context, the objective of this work through clinical report, is to show the preventive dental treatment of a person with Krabee syndrome with tracheostomy, performed in an outpatient setting, paying attention to the techniques of behavioral management, preventive care and treatments. Thus cooperating for a quality perspective of life for these individuals.

II. CASE REPORT

Patient SRO, leucoderma, female, 05 years old, tracheostomized, attended the dental clinic for Patients with Special Needs at the Instituto Brasileiro do Norte (IBEN-AM), accompanied by a mother for dental treatment with the main complaint of gingival bleeding, bad breath and sporadic teeth grinding.

In the first consultation, an oral evaluation, a treatment plan, a clinical case study and exposure of biological images of the quarterly evolution of oral health for scientific purposes were requested and authorized by means of an informed consent form.

During the anamnesis, the mother reported that the patient is the first case of a person with a disability in the family, unplanned pregnancy, uneventful prenatal period that could present risks for the baby. In the postnatal period, around the age of two years, the child suffered trauma and, twenty-four hours after the event, developed a fever of forty degrees Celsius, loss of movement in the upper and lower limbs and regression in oral communication. The mother informs that the patient does

not have systemic changes, she has neurological monitoring in the public health system every six months, she does not use continuous medication and does not have allergies. Their food is provided twice a day by nasogastric tube and orally

When asked about oral health care, the mother reported that she tried to brush at least once a day, never attempted to use dental floss and fluoride toothpaste. She breastfed exclusively until she was six months old and then introduced a bottle until she was two years old with a dairy compound.

On extraoral examination of the patient, there is a constant purulent secretion in his tracheal tubule, total motor dependence, involuntary, non-verbal spasms. (Figure 1 and 3).

On intraoral examination, open bite class II, mixed arch dental wear caused by bruxism, periodontal disease with presence of calculi and presence of active carious lesion. (Figure 2)

Defined treatment plan: prophylaxis, tartarectomy and fluoride application.

The organization of the bench and ergonomics during the service were adjusted to the patient's comfort. (Figure 4 and Figure 6)

Respecting and adapting the handicap of the disabled person at the beginning of the procedure, asepsis of the oral cavity was performed, using 0.12% chlorhexidine digluconate brand ORAL-B soaked in sterile gauze with the aid of a wooden tongue depressor made with a popsicle stick adhesive tape. (Figure 5)

All consultations were carried out in the patient's wheelchair, sometimes with the need for protective stabilization. Guidance to the mother and demonstration of the brushing technique. (Figure 6)

Preventive control appointments followed the sequence. Placement of a children's lip retractor brand indusbelo.

The prophylaxis was carried out with ALLplan prophylactic paste with strawberry flavor and sswHITE pumice stone. Periodontal probing with the aid of the millimeter probe WHO, for subgingival and supragingival root planing, the instrumental gracey curettes 5-6,7-8,1-12,13-14, mini five curettes 5-6,7-8 were used ,11-12,13-14 and ultrasonic scallermicrodont device, sterile gauze, relative isolation for application of strawberry fluoride. (Figure 3)

In the first visit, caries was observed in the initial active process in element 53, with the application of fluoride varnish. The importance of oral care at home was

reinforced to family members for the regression of this caries. (Figure 8)

In the second visit, eruption of permanent teeth 11 and 21 is noticed. Patient without presence of carious lesion. With accumulation of dental calculus predominant in the posterior region. (Figure 9 and 10)

In this preventive return, element 52 was extracted naturally without anesthetic, as it was already in the exfoliative phase. On that day, the mother was explained how she should remove the other little teeth that were in the exfoliative phase. (Figure 11 and 12)

Following the treatment plan, this was the post pandemic consultation, with the birth of tooth 22, gum hyperemia and no oral disease. Current brushing happens three times a day, flossing with a cable was an efficient alternative for introducing this habit. (Figure 12 and 13)

The total treatment time was nine months of treatment without any pain or discomfort, with caries or periodontal disease being controlled, but with the presence of idiopathic gingival hyperplasia. (Figure 14)

Even with the uncontrollable spasms and the outpatient setting, it was possible to carry out the proposed treatment plan, with a favorable prognosis. Creating a daily care routine with the help of wood style opener and 0.12% chlorhexidine, small round head soft toothbrush and fluoridated toothpastes. (Figure 1)

During the consultations, difficulties were faced, such as the excess of dental calculi that were supported with the aid of a diaper that the patient uses to control the excretion of the tracheal tubule so that there was no obstruction of the tracheal tube. Especially the communication disorder that did not allow the patient to interact with the professional and the dental environment.

III. FIGURES



Fig. 1: Explanation of stabilization for oral health care.
Font: Author's collection.

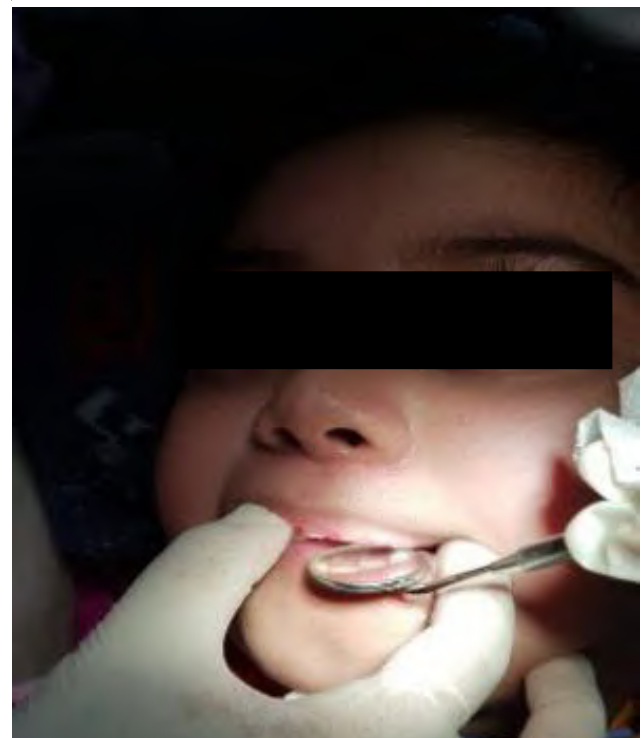


Fig. 2: Initial clinical examination.
Font: Author's collection.



Fig. 3: intraoral analysis and secretion control.
Font: Author's collection.



Fig. 5: Intraoral asepsis
Font: Author's collection.



Fig. 4: Organization of preventive care workbench.
Font: Author's collection.



Fig. 4: Organization of preventive care workbench.
Font: Author's collection.



Fig. 7: All patient care was carried out in her wheelchair
Font: Author's collection.



Fig. 8: Initial record.
Font: Author's collection.



Fig. 11: Stabilization of the patient to perform procedures.
Font: Author's collection.



Fig. 9 and 10: Initial record, showing a lot of dental calculus being removed
Font: Author's collection.



Fig. 12: Deciduous dental element extraction (52).
Font: Author's collection.

IV. DISCUSSION

Krabbe's Syndrome is a degenerative leukodystrophy⁴. It has a difficult prognosis and rapid neurological degeneration, which causes muscle spasm, visual impairment, irritability, uncontrollable crying, respiratory difficulty. The average lifespan of these people is twenty-four months^{3,4}.

In the analyzed articles, it can be seen that the need for tracheostomy is fundamental for the quality of life of these individuals who have respiratory difficulties^{25,5,16}. However, in the literature, in all case reports, patients became residents of hospitals and the nursing team was responsible for oral hygiene care in the hospital environment, differently from the report.

The first dental appointment in a human being's life should happen around 6 months of age, but children with special needs are rarely taken to the dentist early, mainly due to lack of encouragement from the medical team 10,9,

It is important that dental surgeons master the behavioral management technique to avoid skipping necessary oral health education steps. Refer to general anesthesia only when all methods are ineffective^{10,11,7,9}. People with Down's Syndrome, for example, when undergoing general anesthesia may present some complications because they have a short neck and macroglossia, making trachial incubation difficult¹¹.

It emphasizes that people with Krabbe's disease who are discharged from hospital must be monitored by a multidisciplinary team with physiotherapists, nurses and medical staff, to maintain respiratory functionality³. Perez et al (2013), emphasizes the importance of oral health care for patients with neurodegenerative diseases with tracheostomy, in the prevention and control of infectious foci of oral origin that favor the risk of respiratory complications, which can lead people with disabilities to death.

Nogueira JWS, Jesus CAC (2017) and BASSAN LT et (2018), both demonstrated in a literature review format that the oral hygiene care protocol for patients who use mechanical ventilation in pediatric and adult intensive care units use brushing with toothpaste to control biofilm when they present teeth and use of 0.12% chlorhexidine gluconate antiseptic antimicrobial to avoid ventilator pneumonia and possible systemic infections.

Scientifically proven that people with special needs are more prone to oral diseases such as tooth decay and periodontal disease. Such risk factors are aggravated in the disabled by the use of baby bottles, cariogenic diet and lack of office visits¹⁵. Therefore, it is up to the dental surgeon to show, perform and monitor guardians and/or



Fig. 13: prophylaxis and fluoride application.
Font: Author's collection.



Fig. 14: Prophylaxis and fluoride application.
Font: Author's collection.



Fig. 15: Final aspect.
Font: Author's collection.

caregivers in maintaining the oral health of their dependents^{15, 16,17}.

V. CONCLUSION

The present work showed the efficiency and possibility of preventive control in the outpatient setting of people with Krabs Syndrome with tracheostomy, avoiding hospital interventions.

According to the studies carried out and the follow-up of the case report for nine months, there was a gap in the scientific literature on the care of people with rare diseases in an outpatient setting.

REFERENCES

- [1] Lei Brasileira de Inclusão da Pessoa com Deficiência (Estatuto de Pessoa com Deficiência), Lei 13.146. 2013
- [2] Campos CCC, et al. Manual prático para o atendimento odontológico de pacientes com necessidades especiais. Ministério da Saúde Universidade Federal de Goiás. Triagem: 2ª edição 2009.
- [3] Lima K M et al. Abordagem multiprofissional na Doença de Krabbe: relato de caso. Rev Neurocienc 2021;29:1-9
- [4] Sano T S .Doença de Krabbe: a importância da diagnóstico precoce para seu prognóstico. Krabbe disease: the importance of early diagnosis to prognosis. Einstein, 2012;10(2):233-5.
- [5] Cruz F S et al. Traqueostomia - Conduas e Técnica. Rev. Cir. Traumatol. Buco-Maxilo-Fac., Camaragibe v.20, n.2, p. 40-44, abr./jun. 2020 Brazilian Journal of Oral and Maxillofacial Surgery – BrJOMS.
- [6] Teixeira, L A S, Castro MCS. Pacientes com traqueostomia: conhecimentos, atitudes e práticas das equipes do serviço de atenção domiciliar. Revista Sustinere, Rio de Janeiro, v7,n2,p324-361, jul-dez,2019.
- [7] Herculano, A B S. et al. Qualidade de saúde bucal e pneumonia associada à ventilação mecânica. Arch Health Invest 6(7) 2017
- [8] Nunes R. et al. Prevalência de alterações bucais em pessoas com deficiência na clínica da universidade do extremo sul catarinense. Oral changes prevalence in persons with disability at the clinic of universidade do extremo sul catarinense. Odontol. Univ. Cid. São Paulo 2017; 29(2): 118-28, mai-ago ISSN 1983.
- [9] Cerqueira, RB, Vicentini A N, Botelho MPJ. Utilização de técnicas de manejo infantil para o atendimento ambulatorial de pacientes com hidrocefalia. 2012 Anais Eletrônico VI Mostra Interna de Trabalhos de Iniciação Científica ISBN 978-85-8084-413-9.
- [10] Perez, MOD et al, Abordagem odontológica em um paciente com doença Tay-Sachs: relato de caso. Rev. Bras. Pesq. Saúde, Vitória, 15(2): 112-115, abr-jun, 2013
- [11] Ussui A, et al. Características bucais e manejo com comportamental de pacientes com Síndrome de Down. e-Acadêmica, v. 1, n. 3, e15, 2020 (CC BY 4.0).
- [12] Gonçalves, GC. Qualidade de vida da pessoa com traqueostomia na área do grande Porto. Dissertação de Mestrado 2012. Site <https://comum.rcaap.pt/handle/10400.26/9367>.
- [13] Nogueira JWS, Jesus CAC. Higiene bucal no paciente internado em unidade de terapia intensiva: revisão integrativa. Rev. Eletr. Enf. [Internet]. 2017 [acesso em: 28/08/2021];19:a46. Disponível em: <http://doi.org/10.5216/ree.v19.4148>
- [14] Bassan LT, Peres MPS, Franco JB. Oral care in prevention of ventilator-associated pneumonia in neonatal and pediatric intensive care unit: protocol proposal. Rev. Bras. Odontol. 2018;75:e1183
- [15] Resende VLS, Castilho LS, Viegas CMS, Soares. Risco para a Cárie em Dentes Decíduos de Portadores de Necessidades Especiais Risk Factors for Caries in Temporary Teeth in Disabled Children MA 1519-0501. 2007.
- [16] Miranda AF, Sousa LB, Piauilino AIF. Intervenção odontológica em paciente com síndrome rara – Doença de Huntington Dental Intervention To The Patient With Rare Syndrome. R CO. 2017;1(2):6-11.
- [17] Chirano, CSB, Resende GB, Ribeiro EOA, Soares KS. Síndrome de Rett: abordagem odontológica Chirano, CSB. et al. RvAcBO, 2019; 8(2):15-19.
- [18] PREVITALI EF, Ferreira MCD, Santos MTBR. Perfil dos Pacientes com Necessidades Especiais Atendidos em uma Instituição de Ensino Superior Privada Profile of Special Needs Patients Assisted at a Private Higher Education Institution. Pesq Bras Odontoped Clin Integr, João Pessoa, 12(1):77-82, jan./mar., 2012 DOI: 10.4034/PBOCI.2012.121.12

Case study on Sustainable Regional Development and Dairy Livestock: An Organic Approach to Processes

Estudo De Caso Sobre O Desenvolvimento Regional Sustentável E A Pecuária Leiteira: Uma Abordagem Orgânica Dos Processos

Márcia Estela Daltoé Krampe, Adriana Wachholz, Camila Pohl Frohlich

Doutoranda do Programa de Pós-Graduação em Desenvolvimento Regional - PPGDR. Universidade de Santa, Cruz do Sul – UNISC.

Received: 19 Sep 2021,

Received in revised form: 13 Nov 2021,

Accepted: 19 Nov 2021,

Available online: 30 Nov 2021

©2021 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— Dairy Herd, Organic Milk, Mastitis.

Palavras chave— Rebanho Leiteiro. Mastites. Leite Orgânico.

Abstract— The present case study addresses one of the most commented and recurring subjects when it comes to dairy herds, considering that mastitis, both clinical and subclinical, is a disease that affects practically all dairy herds in the country and in the world. And, analyzing, from the discussions held in the discipline of Environment and Development, there is a theoretical basis, with questions that involve the dynamics related to the organic production systems, as a way to prevent diseases in the herd and to enable the consumer healthy products within an ecological context. Thus, it is not intended to exhaust the issue in question, but is expected to be a contribution to milk producers and society in general within this subject that is directly linked to food security. Therefore, this theme can also be analyzed in the context of sustainable regional development.

Resumo— O presente estudo de caso aborda, um dos assuntos mais comentados e recorrentes quando se trata de rebanho leiteiro, tendo em vista que a mastite tanto clínica como sub clínica é uma doença que acomete praticamente todo o rebanho leiteiro do país e do mundo. Analisando, a partir das discussões realizadas na disciplina de Meio Ambiente e Desenvolvimento, há um embasamento teórico, com questões que envolvem a dinâmica relacionada aos sistemas de produção orgânica, como forma de prevenir doenças no rebanho e possibilitar ao consumidor produtos saudáveis dentro de um contexto ecológico. Assim, não se pretende esgotar o assunto em questão, mas espera-se que seja uma contribuição aos produtores de leite e a sociedade em geral dentro deste assunto que está diretamente ligado a segurança alimentar. Importante ressaltar que, esta temática possa ser

analísada também no contexto do desenvolvimento regional sustentável.

I. INTRODUÇÃO

A conscientização sobre produtos orgânicos e o desenvolvimento regional sustentável, tem se intensificado nos últimos tempos, onde nos deparamos com várias tendências do mercado consumidor, e em especial a preferência aos produtos ecologicamente corretos, com um apelo a um estilo de vida saudável e livre de agrotóxicos. Esta ideia tem sido muito difundida pelos profissionais da área da saúde, meios de comunicação, mídias sociais, e etc., gerando assim, nichos de mercado específicos para produtos orgânicos a fim de alcançar esta parcela da população que está priorizando um estilo de vida mais saudável e sustentável.

O desenvolvimento sustentável, surge como elos entre a economia e a ecologia, promovendo uma reaproximação entre estes campos do saber. A ecologia vem nos fornecendo muitos conhecimentos valiosos sobre a sua capacidade de suporte do meio, ou ainda, seus limites de uso. Portanto, para que possamos aproveitar os recursos da natureza, sem abrir mão das comodidades do progresso, precisamos estabelecer até que ponto poderemos usufruir destes recursos, sem sacrificar as demandas futuras. Estes, são desafios que precisamos mensurar para que possamos gerar tecnologias que nos ajudem a utilizar estes recursos naturais, sem esgotá-los, priorizando a qualidade ambiental, tendo uma agricultura menos dependente de produtos químicos, uma indústria menos poluente, com mais materiais recicláveis, e etc. (BURSZTYN e BURSZTYN, 2012).

E, já se percebe atualmente esta conscientização sustentável em todos os setores, gerando impactos também no âmbito rural. Há um apelo muito forte ao consumo de produtos orgânicos, naturais, ou ainda livre de agrotóxicos.

Assim, neste contexto rural, especificamente a pecuária leiteira tem se beneficiado destes conceitos orgânicos, a fim de conseguir ter na produção do leite *in natura* e seus derivados, por exemplo, um sistema de produção ecologicamente correto. Para isso, este setor tem investido em insumos que lhe proporcionem um produto adequado a este mercado consumidor exigente e por outro lado, ter ganhos de qualidade e produtividade, por investir em técnicas e manejos agroecológicos.

Dentro desta busca pela qualidade e sustentabilidade dos processos, identifica-se na pecuária de leite grandes desafios no tocante a sanidade do rebanho e sua produção, para que consigam estar dentro destes conceitos de sustentabilidade. E dentre estes desafios, podemos destacar

as mastites no rebanho leiteiro, como uma das doenças mais graves e recorrentes nos rebanhos leiteiros.

A mastite é uma doença muito séria e que gera grandes preocupações, em virtude de que é a doença mais frequente nos animais destinados a produção leiteira e que gera um impacto muito negativo no rebanho, pois está associada a perda de produtividade, menor rendimento na produção de derivados lácteos, diminuição do tempo de prateleira do produto, custos com medicamentos, honorários veterinários, todo descarte do leite durante o tratamento e período de carência, além da possibilidade de perda de tetos, e até mesmo pode levar ao óbito do animal, em casos mais severos (LANGONI, 2013).

As mastites são tratadas com medicamentos alopáticos, normalmente antibióticos, que além de agredir o animal em termos de manipulação das dosagens, que normalmente são intramamários ou intramusculares, ainda há a questão da carência, onde durante este período que pode ser entre 5 a 20 dias, o leite deve ser descartado.

Por outro lado, é crescente o interesse por estratégias que aumentem os mecanismos de defesa da glândula mamária, pois este é o órgão diretamente afetado nas ocorrências de mastites. Assim, muitos autores, entre eles Domingues (2001), Fonseca e Santos (2007), Souza (2009), Faria (2010) e Waldron (2011), têm dado ênfase aos efeitos da nutrição sobre o sistema imunológico do animal, principalmente o uso de determinados micronutrientes que afetam a resposta imune das vacas leiteiras. Entre estes micronutrientes, podemos destacar o selênio, o cobre e o zinco, além das vitaminas E e A.

Outra estratégia orgânica e com cunho sustentável, em termos de combate às infecções e fortalecimento das defesas da glândula mamária, é o uso de medicamentos homeopáticos para o tratamento curativo e preventivo de quadros de mastites clínicas e subclínicas. Mesmo sendo técnicas pouco difundidas e que tem uma certa resistência por parte de técnicos, já existem vários autores destacando a viabilidade do uso destas tecnologias (SANTOS E GRIEBELER, 2006).

O presente estudo de caso consiste em um relato de caso do uso do produto Imunomilk, que é um suplemento mineral, vitamínico e homeopático, indicado para o tratamento curativo e preventivo da mastite, na suplementação alimentar de um rebanho leiteiro com incidência de mastite subclínica (CCS elevada). Sendo que, neste estudo de caso foram acompanhadas as variações de CCS e a variação da produção de leite a partir da suplementação do produto.

Assim, mediante estas informações introdutórias, o presente estudo de caso contemplará, além desta introdução, outras quatro seções, sendo a segunda uma conceituação e contextualização sobre o Rebanho leiteiro e seus aspectos funcionais, além de outros sub tópicos, que nos trazem os argumentos que visam sustentar a discussão, seguido do método, os resultados e as discussões, e por fim, as considerações finais.

II. REBANHO LEITEIRO: ASPECTOS DA NUTRIÇÃO FUNCIONAL

Em se tratando de nutrição funcional adequada as necessidades fisiológicas do rebanho, temos os micronutrientes que afetam o sistema imune e atuam como substâncias antioxidantes, que são sistemas ou compostos que previnem ou reduzem os efeitos negativos da ação dos radicais livres. Sendo que estes, desencadeiam reações em cascata que causam danos aos tecidos. Por isso, trabalhar o sistema imunológico dos animais, se torna algo fundamental para conseguirmos um rebanho sadio (WALDRON, 2011).

Assim, vários nutrientes têm relação direta com o funcionamento adequado do sistema imune, o que consequentemente afeta a capacidade da vaca em responder ao desafio de uma nova infecção na glândula mamária. Entre os nutrientes mais estudados estão o Selênio, a vitamina E, vitamina A, zinco e cobre. Fortalecer o sistema imunológico do rebanho, se torna algo essencial para evitar doenças (FONSECA E SANTOS, 2007).

A deficiência de selênio pode levar a maior susceptibilidade a doenças ou á progressão da mesma. A manutenção de níveis adequados de selênio (Se) é essencial para a regulação da resposta imune. Assim, a suplementação de selênio pode apresentar-se como uma ferramenta viável no controle da mastite e demais enfermidades (SOUZA, 2009).

A literatura nos mostra, que a capacidade de ação dos neutrófilos, células que atuam na eliminação da infecção através da fagocitose, fica reduzida em animais com deficiência em selênio, assim, vacas com níveis de selênio abaixo do normal possuem uma alta predisposição ao desenvolvimento de infecções intramamárias (DOMINGUES, 2001).

A combinação do selênio e da vitamina E, influenciam na função das células fagocitárias, importantes células de defesa do organismo. Tanto o selênio como a vitamina E funcionam como antioxidantes, ou seja, eliminam os radicais livres formados durante processos de inflamação. Dessa forma, deficiências desses elementos podem

determinar quadros de mastite, com maior duração e sinais clínicos mais severos (FARIA, 2010).

Além do impacto direto na produção de vários mediadores do processo inflamatório, a vitamina E apresenta efeitos estimulatórios do sistema imune. A suplementação de vitamina E em vacas leiteiras reduz significativamente a ocorrência de casos clínicos de mastite, o número de infecções intramamárias após o parto e a gravidade e duração destas infecções, enquanto a vitamina A, possui função importante na resposta ao estresse, o qual apresenta efeito depressor do sistema imunológico (FONSECA E SANTOS, 2007).

As infecções mamárias mais severas ocorrem em animais com baixa concentração plasmática de vitamina A. A vitamina A tem influência sobre a manutenção da integridade do epitélio funcional mamário e o envolvimento com a resposta imune celular, além de influenciar a secreção de queratina, substância que forma uma barreira física protetora contra a entrada de micro-organismos patogênicos. (PASCHOAL E ZANETTI, 2004)

No entanto o cobre, atua nos mecanismos de defesa da glândula mamária, uma vez que é constituinte fundamental de importantes enzimas no desencadeamento de processos inflamatórios. Essas enzimas protegem os tecidos contra a oxidação por radicais livres invasores. A deficiência de cobre na suplementação, faz com que os radicais livres produzidos pelo organismo durante o processo de combate à infecção, destruam o próprio tecido mamário. Esta destruição, em alguns casos, pode ser tão intensa que a ação dos radicais livres pode ser mais destruidora que a ação dos próprios micro-organismos. Assim, há uma consequente redução na produção de leite e elevação nos custos dos tratamentos (FARIA, 2010).

Outro micro-elemento importante para o fortalecimento do sistema imunológico é o zinco. Níveis deficientes de zinco afetam marcadamente a morfologia das células envolvidas na resposta imune, a contagem de polimorfonucleares e monócitos, e a resposta geral do sistema imune (DOMINGUES, 2001).

Além disto, o zinco é importante para a manutenção da integridade da pele do úbere e da camada de queratina na extremidade do teto, que forma uma barreira física à entrada de microrganismos patogênicos no interior da glândula mamária (FARIA, 2010).

Baseado nestas informações podemos observar a importância de uma suplementação com aditivos, vitaminas e minerais com dosagens adequadas, para a sanidade e bem-estar animal. Produzir leite de qualidade, com segurança alimentar e dentro de princípios orgânicos de produção, ainda é um desafio para a maior parte dos pecuaristas brasileiros, porém se forem adotadas medidas preventivas e

sustentáveis para o controle de enfermidades como a mastite, por exemplo, teremos avanços no tocante a sanidade dos rebanhos e a qualidade dos produtos que chegam até a mesa da população.

2.1 Mastite clínica e subclínica

A mastite é uma das principais doenças que acomete os rebanhos leiteiros no Brasil e no mundo, causando perdas significativas devido a redução da produtividade leiteira, aumento dos custos de produção, além da debilitação geral do status sanitário do rebanho (PHILPOT e NICKERSON, 2002).

As mastites podem ser classificadas como subclínicas ou clínicas. A mastite subclínica, por não ser detectada de forma visual, apresenta uma maior importância epidemiológica, pois esta enfermidade acontece e evolui de forma silenciosa pelo rebanho. Neste tipo de mastite, não se percebem alterações macroscópicas à inspeção do úbere ou de sua secreção, ou seja, não se visualizam alterações externas no úbere do animal. Por isso é considerada a mais perigosa, pois se manifesta internamente e seu diagnóstico é observado por alterações da CCS, causando seu aumento excessivo, além da redução da produção de leite. Pode ser diagnosticada pela contagem eletrônica da CCS ou ainda visualmente através do teste *California Mastitis Test* (CMT), que por ser um teste extremamente visual, nem sempre é confiável, sendo contestado por alguns técnicos (BARBALHO & MOTA, 2001).

Quantidades elevadas de CCS no leite, compromete a qualidade dos produtos lácteos produzidos. Estas quantidades elevadas de células somáticas no leite cru, indicam que o animal está com mastite, devido a reação inflamatória da glândula mamária, frequentemente associada à infecção bacteriana. Os animais com mastite, apresentam menor produtividade, além de alterações na composição do leite, as quais estão associadas a defeitos tecnológicos em produtos lácteos (MONTANHINI, 2018).

E no caso de um animal acometido com mastite subclínica, por ser uma doença silenciosa, se não for observada e tratada precocemente, o quadro pode evoluir para uma mastite clínica.

A mastite clínica, pode ser diagnosticada com sinais clínicos, como por exemplo, grau 1: ocorrem alterações no leite; grau 2: alterações no leite e o úbere do animal se torna endurecido; e grau 3: quando a vaca apresenta também sintomas gerais, como febre. O quadro clínico acima, evidencia que o diagnóstico precoce e medidas preventivas de controle, são a melhor solução tanto para a sanidade do animal quanto para a viabilidade da propriedade. Animais com mastite clínica, além de apresentar um mal-estar geral,

febre, dificuldades de se alimentar e perda de tetos, há casos em que a gravidade é tamanha que pode levar ao óbito do animal (LANGONI, 2013).

A identificação e a quantificação de todos os prejuízos causados pela mastite sobre os sistemas de produção não são tão simples, pois dependem de inúmeros fatores. Porém, os principais componentes para o custo final da mastite são: redução da produção de leite em função de mastite subclínica; custo dos casos de mastite clínica; medicamentos; consulta veterinária; custos do descarte e morte prematura de alguns animais; e, prejuízos da indústria por redução na qualidade e rendimento industrial de derivados. (FONSECA e SANTOS, 2007).

A mastite é uma doença multifatorial e depende da interação, principalmente, entre três fatores: condição do animal, componentes ambientais e agente etiológico. Os fatores relacionados ao ambiente podem ser representados pelo tipo de ordenha, manejo, clima e nutrição (PRESTES, 2002).

Dentre os fatores relacionados ao ambiente no desenvolvimento da mastite, a nutrição tem um papel importante, e muitas vezes é negligenciado, apesar de ser facilmente corrigida quando comparada a outros fatores. A dieta e a condição nutricional de uma vaca influenciam diretamente na ocorrência, gravidade e duração de quadros de mastites, isso porque determinados nutrientes afetam direta ou indiretamente diferentes mecanismos de defesa, incluindo função leucocitária, transporte de anticorpos e integridade do tecido mamário (FARIA, 2010).

No Brasil, a qualidade do leite mostra que entre 20 a 50% dos produtores não atendem às exigências mínimas em relação à contagem bacteriana total (CBT), que no momento é de 600.000 UFC/mL de leite, para as regiões Sul, Sudeste e Centro-Oeste. Se os produtores conseguirem adotar práticas higiênicas na ordenha, através de ações simples, como limpeza e desinfecção dos tetos, antes e após a ordenha, utilização de toalha de papel, limpeza do ambiente, antes e após a ordenha, por exemplo, certamente haverá redução na CBT, independente do sistema ser ordenha manual ou mecânica. Com ações simples de manejo, haverá a redução da carga microbiana na superfície dos tetos, e assim, redução da taxa de novas infecções intramamárias. Com pequenas alterações no manejo dos animais, já se consegue bons resultados. Em termos de Contagem de Células Somáticas, CCS, acima de 200.000, significa que já há infecção na glândula mamária, e conseqüentemente mastite subclínica (LANGONI, 2013).

Tratar um caso de mastite não é uma tarefa fácil, além de muito oneroso. E erradicar se torna algo praticamente impossível, tendo em vista que está se tratando de uma bactéria que está no ambiente. E, qualquer alteração na

rotina alimentar, stress, ambiente, etc., já afeta o sistema imunológico dos animais, deixando-os suscetíveis a doenças. E neste intuito, melhorar o manejo, controlar CBT e CCS, se tornam indispensáveis ao produtor de leite. Além de, como medida preventiva, utilizar bons produtos que possam sanar as necessidades diárias de alimentação e suplementação aos animais. Prevenção é o ponto principal.

2.2 Homeopatia e orgânicos

A produção orgânica de leite, sendo algo muito difundido atualmente apresenta um grande crescimento, sendo limitado pela oferta. No Brasil até 2005 a produção do leite orgânico era de 0,01% de 24 bilhões de litros e cresceu para 0,02% (6,8 milhões de litros em 2010). Da produção total de leite produzida no Brasil, tivemos 28 bilhões de litros em 2010, conforme dados de levantamentos feitos pelo projeto Sistemas orgânicos de produção animal em 2011, junto a produtores e cooperativas em diferentes estados (AROEIRA et al., 2005).

Em se tratando de leite orgânico, seu mercado, legislações e adaptações gerais, percebe-se que este mercado tem crescido muito nos últimos anos, devido a uma demanda por alimentos naturais e saudáveis. Neste aspecto, conseguir as certificações destes produtos, há uma série de exigências no que se refere a quais insumos se utiliza neste sistema. A não utilização de fertilizantes químicos, agrotóxicos, antibióticos, e tantas outras exigências, são pré-requisitos para obter a certificação de produto orgânico. Porém, como não se realiza antibióticoterapia na fase de secagem, observou-se maior incidência de mastite em rebanhos orgânicos, quando comparados aos convencionais (SANTOS, 2001). Assim, para evitar estes efeitos adversos sobre o bem-estar animal e produtividade desses rebanhos, tratamentos naturais precisam ser avaliados (PEIXOTO et al., 2009).

E neste intuito, os produtos homeopáticos são os mais indicados para os sistemas orgânicos de produção, apesar de ser uma técnica um pouco contestada no meio acadêmico, por não ter comprovações científicas de sua eficácia. Inclusive é uma exigência do ministério da agricultura que nas embalagens de produtos homeopáticos, seja impresso, a não comprovação científica.

E, os valores praticados ao consumidor final, ainda são elevados. Porém, as pessoas têm se conscientizado que quanto mais natural for sua alimentação, menor será o uso de medicamentos e mais saudável se tornará. E neste intuito, mesmo não tendo uma participação de mercado expressiva, é um nicho de mercado a ser explorado. As propriedades rurais que fazem uso da produção orgânica em seus processos, tem a capacidade de oferecer ao mercado consumidor um alimento, livre de agrotóxicos, mais saudável e seguro. Além da seguridade alimentar, há a

segurança do produtor e do meio ambiente, uma vez que por não conter patógenos causadores de doenças, possui um sistema de produção limpo, portanto ecologicamente correto.

E dentro desta visão e esta nova perspectiva orgânica e ecológica, além do uso de minerais e vitaminas, cresce a cada dia o uso de produtos homeopáticos para o tratamento de mastite, surgindo dentro deste apelo por produtos e produções orgânicas de leite.

A homeopatia é uma abordagem médica que respeita a sabedoria do corpo. É uma abordagem que utiliza medicamentos que estimulam os sistemas defensivos e imunológicos para que o próprio corpo inicie o processo de cura” (ULLMAN, 1993). O tratamento homeopático se fundamenta no uso de medicamentos, em doses mínimas ou infinitesimais, capazes de produzir no indivíduo sintomas semelhantes aos produzidos pela doença (SANTOS e GRIEBELER, 2006).

Neste estudo de caso foi utilizado o produto imunomilk, que é um produto natural, composto por micro-minerais orgânicos, vitaminas protegidas e homeopatia. Este produto é recomendado para controle de mastites clínicas e subclínicas e demais infecções, além de fortalecimento do sistema imunológico e redução da CCS.

O uso de homeopatia em sistemas orgânicos de produção é o mais usual, em virtude de poder tratar as enfermidades ao qual os bovinos leiteiros são acometidos e não gerar resíduos no leite, podendo ser tratados os animais de forma natural, com um custo menor, sem gerar stress ao animal, e promovendo este nicho de mercado, para fins de gerar um desenvolvimento regional sustentável.

2.3 Desenvolvimento regional sustentável

O conceito de desenvolvimento regional sustentável sinaliza uma alternativa às teorias e aos modelos tradicionais do desenvolvimento, desgastados numa série infinita de frustrações (BRÜSEKE, 1994).

Santos (1982) destaca que “a tecnologia foi posta a serviço de uma produção em escala planetária, onde nem os limites dos estados, nem os dos recursos, nem dos direitos humanos são levados em conta”. O entendimento de que o progresso das áreas tecnológicas e científicas levaria a humanidade a um rápido desenvolvimento econômico e social vem se mostrando ineficaz. Esse novo rumo gerado pelas conseqüências do crescimento econômico acelerado ainda gera diversos debates (LIMONAD, 2004).

Uma sociedade em desenvolvimento regional sustentável é projetada de tal forma que seu modo de vida, seus negócios, sua economia, suas estruturas físicas, sua tecnologia não interfira com a inerente habilidade da natureza de manter a sua teia da vida. Tanto é assim que "a

produção e o consumo considerem o meio ambiente como o fator preponderante nas suas decisões, que a regeneração e conservação dos ecossistemas sejam prioritárias em relação à produção e ao consumo da economia" (AGOSTINI; AREND, 2015, p. 16)

O desenvolvimento sustentado é aquele que responde às necessidades do presente sem comprometer a capacidade das gerações futuras de responder às suas necessidades, assim, esta definição está centrada na sustentabilidade do desenvolvimento econômico e é criticada por vários autores, que insistem que não se pode pensar nas gerações futuras quando parte da geração atual não atende às suas necessidades básicas (CAPRA, 1996).

E dentro de um pensamento de descontinuidade do pensamento chave da sustentabilidade, conforme citado acima por Capra (1996), que é não esgotar os recursos, pensando nas gerações futuras, vários setores podem ter sua continuidade comprometida, em especial a agricultura familiar. Se o produtor não consegue ver perspectiva de futuro na atividade, conseqüentemente ele incentiva seus filhos a abandonar a atividade.

Os princípios base sustentáveis, são de extrema importância para o desenvolvimento rural e deveriam ser observados e inseridos em qualquer processo de planejamento e desenvolvimento que envolva a melhoria da qualidade de vida de uma população.

Portanto, um exemplo em torno do desenvolvimento regional sustentável, também seria a dificuldade de acesso ao financiamento para empreendimentos locais, e principalmente em relação a agricultura familiar, pois para o produtor agregar valor aos seus produtos, no caso de produção de orgânicos, se houvessem mais incentivo por parte do governo, seria mais fácil a implantação destes sistemas, num custo menor ao produtor, e conseqüentemente repassados num valor interessante ao consumidor, incentivando o consumo dos mesmos.

Por vezes, o difícil acesso a recursos de financiamento oferecidos por políticas públicas que utilizam os sistemas bancários tradicionais pode ter como elemento de transformação dessa realidade a presença de novos mecanismos cooperativados de crédito. O acesso ao crédito é um importante instrumento de fortalecimento da autonomia dos atores locais, que se tornam independentes de políticas assistenciais, normalmente manipuladas

politicamente pela rede local de poder dominante (FLORES, 2006).

Neste sentido, e dentro dos princípios e pilares do desenvolvimento regional sustentável e dos sistemas orgânico de produção orgânica, de leite, por exemplo, podemos observar que esta seria uma alternativa muito viável ao produtor rural, ao passo que estaria manipulando insumos naturais que oferecem um bem estar animal, não oferecendo riscos a sua saúde e nem ao meio ambiente, além de poder oferecer um produto seguro e saudável ao consumidor final.

III. MÉTODO

Para a realização do estudo foi escolhido um rebanho bovino de vinte e um animais, de uma propriedade localizada na cidade de Cruzeiro do Sul, situada no interior no estado do Rio Grande do Sul. Este rebanho é recorrente em casos de mastite clínica e subclínica, sendo que a média de CCS de tanque é acima das 900 mil células/ml de leite.

As análises de CCS foram realizadas no Laboratório de Análise de Leite da Univates (Centro Universitário Univates), em Lajeado/RS.

Antes do início da avaliação do produto, foram realizadas duas coletas de amostras individuais de leite, de todos os animais em produção, para análise de CCS, aos 14 e 7 dias antes do início do tratamento. Na mesma oportunidade, também foi realizada a medição da produção de leite individual de cada animal.

Para a realização do trabalho, foram excluídos os animais que não apresentavam quadros de mastite clínica ou subclínica (animais que não apresentaram casos clínicos na última lactação e com média de CCS individual abaixo de 200 mil células por ml), animais considerados crônicos (alta CCS e casos clínicos recorrentes) e os animais para os quais faltavam menos de 70 dias para entrarem no período seco.

Desta forma, os animais remanescentes foram divididos em dois grupos homogêneos de 6 animais cada grupo. Para esta divisão, foram usados os seguintes critérios: a) nível de CCS (média das duas coletas antes do início do tratamento); b) Produção de leite (média das duas amostragens antes do início do tratamento); c) DEL (dias em leite); e, d) número de lactações.

Os grupos ficaram divididos em grupo A e grupo B, conforme a Tabela 1.

Tabela 1: Divisão dos grupos de animais:

ANIMAIS	Média CCS (x 1.000)	Média de Produção (Litros)	DEL	Nº Lactações
88	1.189	24,8	109	5
2464	2.216	17,3	352	2
11046	552	31,8	18	4
11483	242	29,3	109	2
12173	343	21,5	201	2
13108	157	19,8	109	1
Média do Grupo A	783	24,0	150	2,7
30	353	20,5	140	4
61	3.160	23,5	140	6
1281	134	21,5	140	5
2993	329	28,3	109	1
11042	93	37,3	171	4
12352	241	20,0	10	2
Média do Grupo B	718	25,6	118	3,7

Fonte: Elaborado pelas autoras (2018)

O grupo A recebeu o tratamento com o produto Imunomilk, enquanto que o grupo B foi o grupo controle. Imunomilk é um suplemento mineral, vitamínico e homeopático utilizado para o controle preventivo e curativo de mastite, cujos níveis de garantia por quilograma do produto são: 230 gramas de cálcio, 80 gramas de cobalto, 950 miligramas de cobre, 1.000 miligramas de manganês, 2.000 miligramas de niacina, 120 miligramas de selênio, 900.000 unidades internacionais de vitamina A, 20.000 unidades internacionais de vitamina D3, 2.500 unidades internacionais de vitamina E, 4.500 miligramas de zinco e medicamento homeopático (carbo vegetabilis CH12, phytolacca decandra CH12, pulsatilla nigricans CH12, sulphur CH12, bixa orellana 0,75 gramas e sacarose q.sp.100 gramas).

Para o acompanhamento dos resultados, foram realizadas coletas semanais de amostras de leite dos animais dos dois grupos (Imunomilk e Controle) para a análise individual da CCS. Também foi realizada, a medição da produção de leite destes animais. Estas coletas se iniciaram sete dias após o início do tratamento e se estenderam por dez semanas, totalizando dez coletas e setenta dias de tratamento com o produto.

O tratamento utilizado para o grupo A (Imunomilk) foi o seguinte: a) dia um até o dia vinte: 200 gramas do produto Imunomilk / vaca / dia, sendo 100 gramas após a ordenha da manhã e 100 gramas após a ordenha do fim da tarde; b) do dia vinte e um até o dia setenta, 50 gramas do produto Imunomilk / vaca / dia, sendo 25 gramas após a ordenha da manhã e 25 gramas após a ordenha do fim da tarde. Além da inclusão de Imunomilk na dieta dos animais do grupo A, nas doses acima descritas, não houve nenhuma outra alteração na dieta e manejo dos animais.

IV. RESULTADOS E DISCUSSÃO

Para mensurar os resultados, foi realizada uma análise estatística, onde o teste de hipóteses escolhido para este estudo foi o teste t *Student*, ou simplesmente teste t. Foi escolhido este método pois neste caso em questão, se fez necessário avaliar as diferenças entre as médias entre dois grupos. Este teste foi realizado no software excel da Microsoft. Abaixo, seguem os resultados obtidos através da análise estatística aplicada, através da tabela 2.

Tabela 2: Teste-t: duas amostras presumindo variâncias equivalentes

	Média Imunomilk	Média Controle
Média	442,2727273	927,6363636
Variância	6825,818182	382865,2545
Observações	11	11
Variância agrupada	194845,5364	
Hipótese da diferença de média	0	
gl	20	
Stat t	-2,57871502	
P(T<=t) uni-caudal	0,008966395	
t crítico uni-caudal	1,724718243	
P(T<=t) bi-caudal	0,017932789	
t crítico bi-caudal	2,085963447	

Fonte: Elaborado pelas autoras (2018)

Conclusão: Stat t < t crítico

Verdadeiro: Stat t < t crítico (-2,578 < 1,724), rejeitamos a hipótese ao nível de 5% de significância.

Portanto, os resultados médios dos tratamentos não são iguais, ou seja, houve impacto do uso do produto na redução dos valores de CCS.

Pelo resultado da análise estatística, podemos observar que a média de CCS dos animais do grupo suplementados com imunomilk, foram bem menores do que

as médias obtidas no grupo controle, gerando um impacto muito positivo na média deste rebanho suplementado com imunomilk.

Os resultados relativos à avaliação da CCS antes do início do tratamento encontram-se na Tabela 3.

Tabela 3 – Avaliação da CCS dos grupos Imunomilk e Controle, antes do início do tratamento.

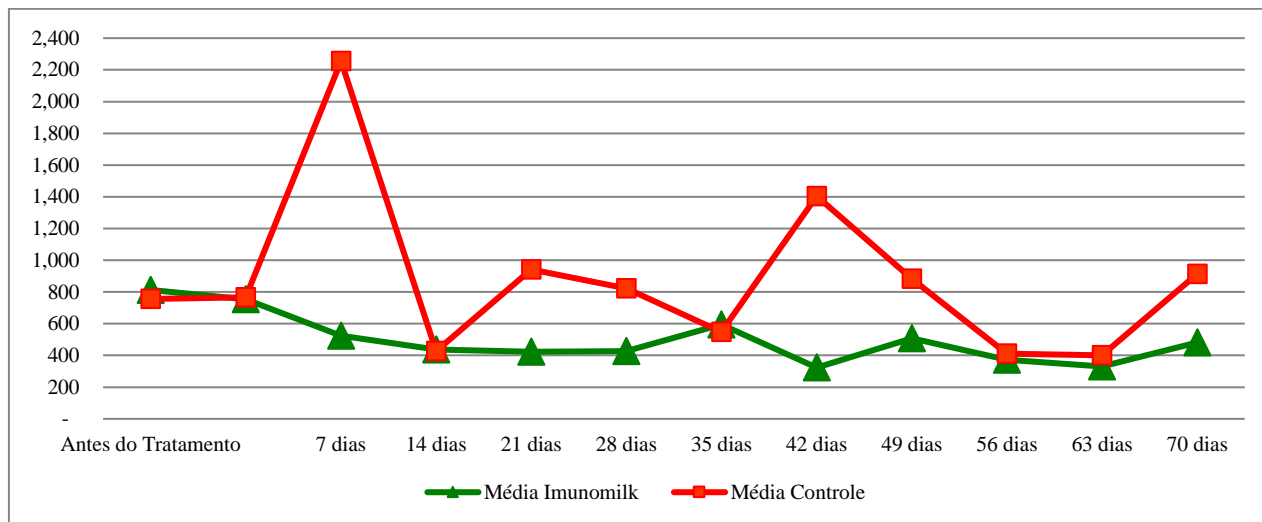
ANIMAIS	09 dez Antes do Tratamento	16 dez	Média
88	1.410	967	1.189
2464	2.443	1.989	2.216
11046	433	670	552
11483	192	292	242
12173	334	352	343
13108	63	251	157
Média Imunomilk	813	754	783
30	272	433	353
61	3.148	3.171	3.160
1281	147	121	134
2993	86	572	329
11042	123	63	93
12352		241	241
Média Controle	755	767	761

Fonte: Elaborado pelas autoras (2018)

Nesta tabela 3, podemos observar que a média geral de CCS está bastante elevada nos dois grupos. Usando como referencia que segundo a literatura, e referendado com os dados já apontados no referencial teórico, uma média de

CCS aceitável é que esteja abaixo de 200.000, acima deste valor, o rebanho se encontra com indícios de mastite subclínica. Para uma melhor visualização dos resultados, as médias de cada avaliação foram colocadas no Gráfico 1.

Gráfico 1 – Avaliação das médias



Fonte: Elaborado pelas autoras (2018)

Analisando-se os resultados obtidos, se observa que o grupo Imunomilk apresentou queda nos valores de CCS e, ainda, manteve uma maior estabilidade de resultados, com menos variação ao longo do tratamento.

Já o grupo controle teve maior instabilidade de resultados apresentando, em algumas avaliações resultados semelhantes aos do grupo Imunomilk. Porém, na maioria das avaliações com resultados, o grupo Controle apresentou resultados bem superiores (acima do dobro) aos resultados do grupo Imunomilk.

Na média das dez avaliações realizadas durante o tratamento, observamos que o grupo Controle apresentou uma CCS média de 900.000 células / ml, enquanto que o grupo Imunomilk apresentou uma CCS de 442.000 células / ml.

Na comparação entre o antes e o depois do tratamento, observa-se que a produção média das vacas suplementadas com Imunomilk, que antes do tratamento era de 1,6 litros a menos por vaca, depois do tratamento foi de 0,2 litros a mais por vaca, o que resulta em uma diferença de produção da ordem de 1,8 litros/vaca/dia.

Os resultados deste estudo de caso demonstram que o grupo de animais suplementados com Imunomilk obtiveram redução média da CCS superior a 50%.

Com relação à produção de leite, observa-se que a redução da CCS obtida no pelo grupo Imunomilk influenciou positivamente a produção de leite em 1,8

litros/dia, quando comparados o antes e o depois do tratamento.

Portanto, observa-se que a produção orgânica de leite além de ser algo totalmente saudável para a população, é alto rentável para o produtor e agrega um bem estar animal bem considerável, como aumento de imunidade o que faz com que se utilize menos medicações e assim gerando menos stress ao animal.

V. CONSIDERAÇÕES FINAIS

O estudo apresentado demonstra claramente os benefícios da produção orgânica não somente sobre a saúde animal, mas sobre a cadeia leiteira como todo. Enquanto o produtor de leite agrega valor ao seu produto, a sociedade é eximida de distintos impactos ambientais, como a contaminação do solo e da água por medicamentos e químicos.

Percebemos que os valores das sociedades têm forte influência sobre os rumos do mercado capitalista, fomentando novos meios, tipos e processos de produção. A produção de orgânicos, nestes termos, vem ao encontro desta transformação do pensamento sobre consumo – rumando à segurança alimentar.

A economia afeta, pois, o estado geral do meio ambiente. O estilo de desenvolvimento tem, assim, muito a ver com os impactos ambientais emanados do sistema econômico. Determinando

as quantidades e os tipos de bens a serem produzidos e consumidos, bem como a organização da produção e as tecnologias que esta emprega, afeta tanto a extração de recursos energéticos e naturais do meio ambiente, como as emissões de resíduos para o meio ambiente e as incursões sobre o espaço” MUELLER (2007, pg. 31).

Portanto, apesar deste trabalho compartilhar uma análise específica acerca da produção orgânica na cadeia leiteira, o ponto de destaque observado é de que a mudança por novos meios e técnicas de produção podem ser pensados em termos de sustentabilidade ambiental, mas mais do que isso, de valorização dos produtos e fomento econômico aos produtores, e ainda abrangendo este conceito de pensamento, sob a ótica do local e do regional e seu desenvolvimento.

REFERÊNCIAS

- [1] AGOSTINI, Cíntia; AREND, Silvio Cezar. Desenvolvimento Regional Sustentável: indicadores e qualidade de vida no Vale do Taquari/RS. Taquara: Revista do Desenvolvimento Regional, 2015.
- [2] AROEIRA, L. J. M. ; PACIULLO, D. S. C. ; FERNANDES, E. N. ; PIRES, M.F.A.; MORENZ, M. F. ; MACEDO, R. de O. Caracterização da produção orgânica de leite em algumas regiões do Brasil. In: In: Reunião anual da associação latino americana de produção animal, 19, 2005. Anais... Tampico: ALPA, 2005.
- [3] BARBALHO, T. C. F.; MOTA, R. A. Isolamento de agentes bacterianos envolvidos em mastite subclínica bovina no estado de Pernambuco. Revista Brasileira de Saúde e Produção Animal, v. 2, 2001.
- [4] BRÚSEKE, F.J. O problema do desenvolvimento sustentável. In: CAVALCANTI, C. (org.) Desenvolvimento e Natureza: estudos para uma sociedade sustentável, 1994.
- [5] BURSZTYN, Maria Augusta; BURSZTYN, Marcel. Fundamentos de política e gestão ambiental: os caminhos do desenvolvimento sustentável. Rio de Janeiro: Garamond, 2012.
- [6] CAPRA, F. A Teia da Vida. Tradução de Newton Roberval Eichenberg. São Paulo: Cultrix, 255p., 1996.
- [7] DOMINGUES, P.F., LANGONI, H.; PADOVANI, C.R., et al. Determinação de gordura, proteína, cobre, ferro, manganês, zinco e contagem de células somáticas no leite de vacas com mastite subclínica. Ciências Agrárias, Londrina, v. 22, n.2, p. 169-174, jul./dez. 2001.
- [8] FARIA, B.N. Nutrição e mastite: micronutrientes previnem a mastite. Artigos Técnicos Rehagro, 2010 [on line] Disponível em <<http://www.rehagro.com.br/plus/modulos/noticias/ler.php?cdnoticia=1963>>. [Data de acesso: 28 de julho de 2012].
- [9] FLORES, Murilo. A identidade cultural do território como base de estratégias de desenvolvimento - Uma visão do estado da arte. Santiago, Chile: RIMISP, 2006. Disponível em: http://indicadores.fecam.org.br/uploads/28/arquivos/4069_FLORES_M_Identidade_Territorial_como_Base_as_Estrategias_Developmento.pdf
- [10] FONSECA, L.F.L.; SANTOS, M.V. Estratégias para controle da Mastite e Melhoria da Qualidade do Leite. Ed. Manole, Barueri, SP. 2007.
- [11] LANGONI, H. Qualidade do leite: utopia sem um programa sério de monitoramento da ocorrência de mastite bovina. Pesq. Vet. Bras. 33(5):620-626, 2013. Acesso em: 21 de Júlio 2018.
- [12] LIMONAD, Ester et al. Brasil Século XXI: por uma nova regionalização. São Paulo: Max Limonad, 2004. (Disponível no EAD). MINISTÉRIO DA INTEGRAÇÃO NACIONAL - PNDR II. Disponível em: <http://www.integracao.gov.br/web/guest/nova-politica-nacional-de-desenvolvimento-regional>.
- [13] MONTANHINI, M. T. M. Influência da qualidade do leite cru em produtos lácteos processados. Online. Disponível em: <https://www.milkpoint.com.br/artigos/industria/influencia-da-qualidade-do-leite-cru-em-produtos-lacteos-processados-209474/>. Acesso em: 01 ago 2018.
- [14] MUELLER, Charles C. Os economistas e as relações entre o sistema econômico e o meio ambiente. Brasília: Editora Universidade de Brasília (FINATEC), 2007.
- [15] PASCHOAL, J.J.; ZANETTI, M.A. Efeito da suplementação de vitamina A sobre a incidência de mastite em vacas da raça Holandesa. Arquivo Brasileiro de Medicina Veterinária e Zootecnia, Belo Horizonte, v.56, n.2, abr. 2004.
- [16] PEIXOTO et al. Incidência de mastite bovina em animais homeopatizados. Rev. Inst. Latic. “Cândido Tostes”, Mar/Jun, no 367/368, 64: 66-71, 2009.
- [17] PHILPOT, W. N.; NICKERSON, S. C. Vencendo a Luta Contra a Mastite. Piracicaba: Westfalia Landtechnik do Brasil, 2002. 192p.
- [18] PRESTES, D.S.; FILAPPI, A.; CECIM, M. Susceptibilidade à mastite: fatores que a influenciam – uma revisão de literatura. Revista da FZVA, Uruguiana, v. 9, n. 1, p. 118-132, 2002.
- [19] SANTOS, J.S.; GRIEBELER, S.A. Tratamento Homeopático da Mastite do Gado Leiteiro. Cultura Homeopática, n. 14, p. 9 – 11, 2006.
- [20] SANTOS, Milton. Sociedade e espaço: a formação social como teoria e método. Espaço e Sociedade. Petrópolis: Vozes, 1982.
- [21] SOUZA, F.N., BLAGITZ, M.G., LATORRE, A. O. et al. Efeito da suplementação in vitro de selênio sobre a produção intracelular de peróxido de hidrogênio em células polimorfonucleares de bovinos: implicações na resistência à mastite. Ciência Animal Brasileira. Suplemento 1 - VIII Congresso Brasileiro de Buiatria – Anais, 2009.
- [22] ULLMAN, D. Homeopatia – Medicina para o século XXI. Ed. Cultrix, São Paulo – SP, 1993.
- [23] WALDRON, M.R. Interações entre Metabolismo e Imunidade no Periparto. XV Curso novos enfoques na produção e reprodução de bovinos. Anais, 2011.

Evaluation of the Infiltration of different Endodontic Cement in Simulated Channels

Lígia Catarine Avelino Negre, Lucireni Morais Costa, Nathalia Moreira De Araujo, Eduardo Fernandes Marques

Instituto Tocantinense Presidente Antônio Carlos ITPAC/Porto Nacional – Tocantins

Received: 21 Sept 2021,

Received in revised form: 09 Nov 2021,

Accepted: 20 Nov 2021,

Available online: 30 Nov 2021

©2021 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— Simulated Channels,
Endodontic cements, Infiltration.

Abstract— The main role of the apical sealing provided by endodontic cements is to prevent marginal infiltration of the root canals, contributing to the success of the endodontic treatment. The current work aims to evaluate the infiltration of different endodontic cements in simulated canals. Data collection was exploratory, quali-quantitative, carried out in 40 simulated channels, where they were instrumented with a Logic 2 rotary system, irrigated with 2.5% sodium hypochlorite and filled with different cements, paying attention to the spatulation time, execution of the obturation technique and root canal irrigation volume. Where they were divided into G1 (n= 10) – Endofill, G2 – Sealer 26, G3 – Pulp Canal Sealer and G4 – Mta Fillapex. The results achieved in the research show that groups G1 and G3 presented greater infiltration of the filling cement, compared to groups 2 and 4. Based on this, it is concluded that Endofill and Pulp Canal Sealer cements present greater infiltration in the root canal system compared to cements Pulp Canal Sealer and MTA Fillapex.

I. INTRODUCTION

Endodontic treatment has several objectives and, among the main ones, is the resolution of inflammation. This type of intervention deals with highly complex processes and, at the same time, requires a very professional handling, as it requires a three-dimensional knowledge of dental anatomy. Teeth have the pulp cavity, where the dental pulp, a richly vascularized fibrous connective tissue that extends through the interior of the tooth, is found. This area can be affected by infectious diseases caused by microorganisms, which infect the entire root canal system (GAVINI, 2018).

In order to be successful in endodontic treatment, in addition to mechanical instrumentation, it is necessary to use suitable materials, such as gutta-percha and filling cements, which provide a good seal, thus avoiding recontamination of root canal systems (MARQUES et al., 2011).

Mechanical instrumentation is done with endodontic files that aim at cleaning and shaping the root canals (PRADO; ROCHA, 2017).

Currently, rotary instruments are preferred in endodontics, with the objective of facilitating the treatment, reducing the time of endodontic sessions, bringing greater comfort to the patient, avoiding physical stress and with the same effectiveness as manual instruments.

Endodontic cements are responsible for the hermetic filling of the root canals, as they fill the ramifications present in this system, formerly occupied by pulp tissue. Furthermore, in the lateral condensation technique, cement is used to reduce the interface between the cones (PRADO; ROCHA, 2017).

There are several types of endodontic cements on the market, with different chemical properties, but with the same objective to prevent infiltration through apical sealing. They are divided into cements based on zinc oxide-eugenol,

resin cements, those containing calcium hydroxide, glass ionomer based and silicone based (MARQUES et al., 2011).

Furthermore, efficiency is linked to the material's ability to offer good flow, adhesion and antimicrobial capacity. The literature also points out other important characteristics, which are observed as possible advantages and/or criteria for choices, such as settings time, ease of handling and final market price (TEIXEIRA, 2014).

The endodontic cement is used together with gutta-percha, which is a material present in the cones for root canal fillings. The most important characteristics of an endodontic cement are related to its ability to promote a seal as perfect as possible and to be tolerated by the apical tissues (ESTRELA, 2013).

According to previous discussions, Estrela (2013) states that one of the most widely used materials for filling the root canal would be gutta-percha, due to its ease of handling during the treatment. Among the countless benefits of its use, gutta percha provides many benefits for the root canal, such as the possibility of condensation and adaptation due to its irregularity, thus being a necessary tool for the endodontic procedure.

A good infiltration is the result of an adequate management of the endodontic treatment, associated with the choice of the ideal cement, to obtain a good sealing and apical flow. Therefore, it is necessary to study existing cements and practice endodontic techniques. To better serve the dental field, simulated canals were created that mimic the anatomy of the canal systems, allowing for realistic procedures to be carried out in them, facilitating learning, technique and better visibility of the filling materials inside the canal.

With this idea in hand, the objective of this work is to evaluate the infiltration of different endodontic cements in simulated canals.

II. METHODOLOGY

Forty simulated channels were used (IMdoBrasil, São Paulo, Brazil). Subsequently, the length of the roots was standardized at 15 mm with the aid of an endodontic calibrating ruler (Dentsply/Sirona, Tusla - USA). A 10 k file (Dentsply/Sirona, Tusla - USA) was previously introduced to check for possible interference, with catheter movement.

It was carried out with the Prodesign Logic 25/06 motor and rotary system (Easy, Belo Horizonte – Brazil), followed by preparation of the cervical third with a Prodesign Logic 06/25 file (Easy, Belo Horizonte – Brazil) towards the crown – apex respecting the canal anatomy, always maintaining a minimum distance of 5 mm from the

apical limit on radiography and in curved canals until the beginning of curvature.

Then, odontometry was performed with a K 10 file (Dentsply/Sirona, Tusla - USA) where it was introduced into each canal until it was visualized in the apical foramen. The working length was determined 1 mm short of the apical foramen. Subsequently, a Prodesign Logic 25/06 file (Easy, Belo Horizonte – Brazil) instrumented 1mm short of the real length of the tooth.

During the entire instrumentation, irrigation was carried out with 2.5% sodium hypochlorite (Manipulation Pharmacy – Fórmula and Action – São Paulo – SP), 10 mL Lüer Slip plastic syringe (Advantive, Nanchang Jangxi - China) and disposable needle 25 x 0.55 (BD, Curitiba - PR). 30 mL of solution were used per experimental unit. The needle was introduced during the entire instrumentation process until reaching 2 mm short of the working length. Os canais, ao término do preparo, foram secos com pontas *capillary tips* (Ultradent Products, Inc, South Jordan, Utah, USA) acopladas a sugador de alta potência e com cones de papel absorvente (Tanari, Manacapuru - AM).

Final irrigation was performed with 3 mL of 17% EDTA (Manipulation Pharmacy – Fórmula and Action – São Paulo – SP). First, 1 mL of 17% EDTA was introduced, followed by ultrasonic vibration with 25 IRRI S insert (VDW; Endo Ultrasonic Files, Endodontic Synergy, Munich, Germany) at a frequency of 30 kHz. The ultrasound insert was connected to a piezoelectric ultrasound operating at 30 kHz (CVDent 1000; CVD Vale, São José dos Campos, SP, Brazil), set at power level 3, for a period of 20s. This process was repeated 2 more times. After this process, irrigation was performed with 5 mL of sodium hypochlorite (Farmácia Formula & Ação, São Paulo - SP). The canals were dried with capillary tips (Ultradent Products, Inc, South Jordan, Utah, USA) coupled to a sucker high power and with absorbent paper cones (Tanari, Manacapuru - AM).

At the time of sealing cement selection, the standardized simulated channels were divided into 4 groups:

- G1 (n= 10) - Use of Endofill cement
- G2 - Use of Sealer cement 26
- G3 – Use of Pulp Canal Sealer cement
- G4 – Use of Mta Fillapex cement

The filling cements were mixed according to the manufacturer's recommendations.

After manipulation of the endodontic cement, the canals were filled using the McSpadden thermomechanical technique, the technique is summarized in the adaptation of

the main gutta-pecha cone to the actual working length (C.R.T.). The compactor must have the same diameter as the largest file used. The main cone is placed inside the channel and the compactor is adjusted with the help of the digital spacer on the channel walls until it encounters light resistance, and then the contra-angle drive starts in a clockwise direction, keeping it in position for 4 to 5 seconds to make the gutta-percha plasticized.

Disposal of the materials used in this study were placed in a hospital waste bag (Azeplast Indústria e Comércio Ltda., Santa Catarina – Brazil), made in accordance with ANVISA standards, after completing the laboratory procedures for this research. The hospital waste bag, with biological material, was presented to Fapac/Itapc Porto Nacional's biologically hazardous material disposal

sector for disposal, in accordance with ANVISA regulations.

III. RESULTS

The methodology used in this research allowed us to obtain data from the four groups of endodontic cements studied, regarding their flow, sealing and infiltration. Below are digitized images of the samples with results obtained, equating the four cements. Figure 1 - Endofil, figure 2 - Sealer 26, figure 3 - Pulp Canal Sealer and figure 4 - Mta Fillapex. The cements with greater and better flow, sealing and infiltration were Endofil and Pulp Canal Sealer. However, the cements Sealer 26 and MTA Fillapex did not reach the desired flow, sealing and infiltration.

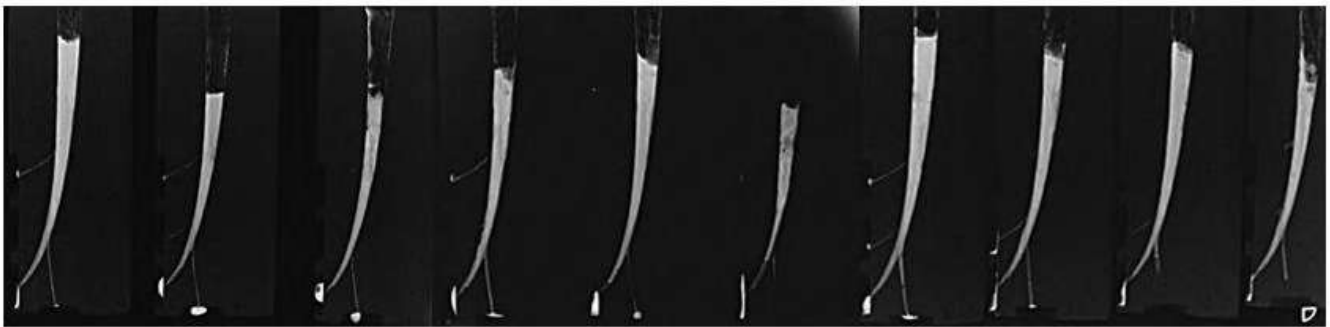


Fig.1: Endofil

Source: Own Authorship



Fig.2: Sealer 26

Source: Own Authorship

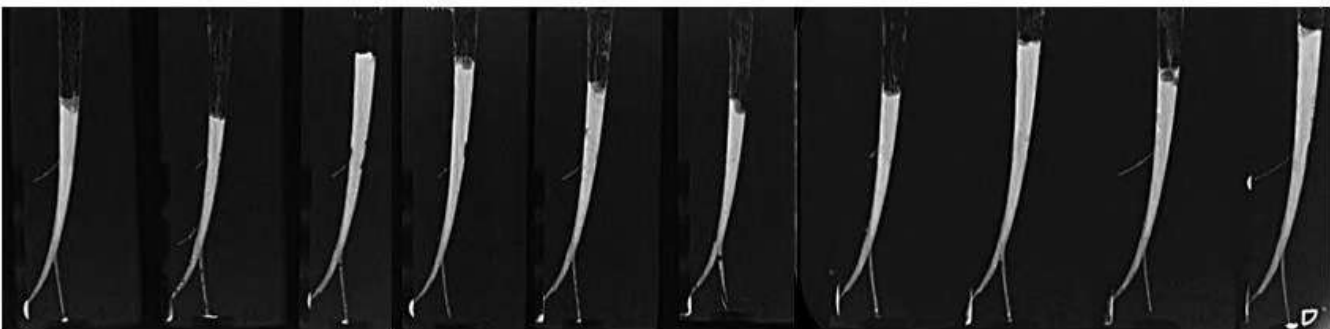


Fig.3: Pulp Canal Sealer

Source: Own Authorship



Fig.4: MTA Fillapex
Source: Own Authorship

IV. DISCUSSION

Endodontic therapy allows us to understand the importance of each stage of treatment, especially when it comes to the obturation process. It is the materials we use in the obturation, together with good technique, that we are able to achieve success in root canal treatment.

Endodontic cements help to fill the root canals, filling spaces, isthmuses and accessory canals. Depending on the composition of each filling cement, its flow may be different, thus interfering with the sealing process of the root canal system.

The constant appearance of new materials and the search for an ideal filling cement lead researchers to analyze the physical and biological properties of these cements, which are often objects of study regarding infiltration (OLIVEIRA et al., 2011).

As a result, our research sought to evaluate, through simulated canals, the infiltration of four endodontic cements used in endodontics with the justification of providing better guidance to the dental surgeon in choosing a more suitable endodontic cement for the filling process. root canals, thus enabling a seal as tight as possible. The cements chosen for this study were Endofill, Sealer 26, Pulp Canal Sealer and Mta Fillapex, due to their characteristics and properties such as biocompatibility, radiopacity and impermeability. During the entire instrumentation of the simulated canals, care was taken with irrigation with 2.5% sodium hypochlorite, drying of the canals and handling of the filling material, in order to be prepared to receive cementation and obtain good results.

Previous studies are recognized that root canal filling techniques that use heat to plasticize the filling material succeed in better adapting this material to the dentin walls. Furthermore, it provides better sealing of the entire root canal system, filling even lateral canals efficiently. Root canal filling techniques without the

addition of heat do not approximate this filling result (Maniglia-Ferreira et al., 2010).

The research allowed us to understand that infiltration is of great value for endodontic treatment, as it is the infiltration of cements that fills the spaces where gutta percha cannot reach, that is, the greater the infiltration, the better the filling cement will be.

Comparing the radiographic exams of the simulated canals filled with the chosen cements, we can observe that the Endofill and Pulp Canal Sealer cements demonstrated success in their infiltration. As shown in figure 1, of the Endofill cement, the material managed to flow through the lateral channels and fill empty spaces, as shown in figure 3, of the Pulp Canal Sealer cement. The cements Sealer 26 and Mta Fillapex were not able to carry out the flow and infiltration of the material in the lateral channels and free spaces of gutta percha. Therefore, we can say that the filling material of first choice for dental surgeons can be either Endofill or Pulp Canal Sealer, as they present excellent infiltration.

V. CONCLUSION

Based on this, it is concluded that Endofill and Pulp Canal Sealer cements present greater infiltration in the root canal system compared to cements Pulp Canal Sealer and MTA.

REFERENCES

- [1] ESTRELA, CARLOS. **Endodontia Laboratorial e Clínica**. 1ª edição. São Paulo-SP: Editora Arte Médicas Ltda. 2013.
- [2] MARQUES, Karlel; RUON, Vanessa; VOLPATO, Lusiane; MARENGO, Gláucia; HARAGUSHIKU, Gisele; FILHO, Flares; LEONARDI, Denise. Selamento apical proporcionado por diferentes cimentos endodônticos. **STOMATOS- Revista de Odontologia da ULBRA**, Universidade Luterana do Brasil, Rio Grande do Sul, volume 17, número 32, páginas 24-32, janeiro/ junho, 2011.

- [3] OLIVEIRA, Elias; QUEIRÓZ, Mário; MELO, Tiago; ROSA, Gabriela; RODRIGUES, Nathalia. Análise comparativa da infiltração coronária em canais obturados com dois diferentes cimentos endodônticos. **Revista da Faculdade de Odontologia- RFO**, Passo Fundo-RS, volume 16, número 3, páginas 282-286, setembro/dezembro, 2011.
- [4] PRADO, Maíra; ROCHA, Nedi. **Endodontia Princípios Para Prática Clínica**. 1ª edição. Rio de Janeiro: MEDBOOK- Editora Científica Ltda. 2017.
- [5] SENA, Ana Luíza Moraes. **Avaliação do escoamento de cimentos obturadores endodônticos**. 2018. 28 páginas. Monografia (Graduação em Odontologia) Universidade Federal do Rio Grande do Norte, Centro de Ciências da Saúde, Departamento de Odontologia, Natal-Rn.
- [6] REISS-ARAÚJO, Cristina; Saúde de ARAÚJO, Sinara; BARATTO FILHO, Flares; Carvalho REIS, Luciana; Rivera FIDEL, Sandra. Comparação da infiltração apical entre os cimentos obturadores AH Plus, Sealapex, Sealer 26 e Endofill por meio da diafanização. **RSBO- Revista Sul- Brasileira de Odontologia**, volume. 6, número. 1, 2009, páginas. 21-28 Universidade da Região de Joinville, Joinville, Brasil 2009.
- [7] ROCHA, Bianca; ESCOLA, Gustavo; TOMAZINHO, Luis Fernando; BRUNINI, Henrique. Análise da capacidade de preenchimento dos canais radiculares de cimentos endodônticos. **Revista Brasileira de Cirurgia e Pesquisa Clínica – BJSCR**, Umuarama-Paraná, volume 31, número 1, páginas 39-43, junho/agosto, 2020.
- [8] SYDNEY, Gilson; FERREIRA, Mônica; DEONIZIO, Marili; LEONARDI, Denise; BATISTA, Antonio. Análise do perfil de escoamento de seis cimentos endodônticos. **Revista Gaúcha de Odontologia- RGO**, Porto Alegre, volume 57, número 1, páginas 7-11, janeiro/março, 2009.
- [9] VALERA, M. C.; ANBINDER, A. L.; LEONARDO, M. R.; PARIZOTO, N. A.; KLEINKE, M. U. Cimentos endodônticos: análise morfológica imediata e após seis meses utilizando microscopia de força atômica. **Pesquisa Odontológica Brasileira**, volume 14, número 3, páginas 199-204, julho/setembro, 2000.

Gingivectomy for smile aesthetics

Gabriela Gonzalez Galvão¹, Naiara Souza Barbosa¹, Gabriela Meira²; Gabriel Catunda²

¹Graduates of the Dentistry Course at Centro Universitário Metropolitano de Manaus – CEUNI/FAMETRO.

²Teacher of the Dentistry Course at Centro Universitário Metropolitano de Manaus – CEUNI/FAMETRO.

Received: 21 Sept 2021,

Received in revised form: 09 Nov 2021,

Accepted: 18 Nov 2021,

Available online: 30 Nov 2021

©2021 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— *Aesthetics, Gingivectomy, Smile.*

Abstract— *Gingival appearance plays an important role in smile aesthetics and may influence the individual's relationship in society. In search of a standard of beauty stereotyped by the media, the demand for patients is growing in dental offices. Currently, professionals in the field suggest the anatomization of the smile through surgical techniques used accordingly, with each etiology and diagnosis. Gingivectomy presents itself as an ally for this anatomization, making the removal of hyperplastic gingival tissue, as well as providing a physiological contour of this gingiva. The present study aims to carry out an integrative review of the scientific evidence related to gingivectomy for smile aesthetics. The methodology used was an integrative review, with a qualitative approach, whose data collection was carried out in August and September 2021, developed in six stages. In the first stage of the study, 316 articles were found, which referred to gingivectomy for smile aesthetics. After reading the titles of selected articles, 112 articles were selected. After reading the abstracts, only 59 studies were selected to be included in the critical and full reading. Finally, 14 studies met the inclusion criteria. Studies have shown that new technologies in the field of dental aesthetics have made gingivectomy a simple solution for gum repair. The benefits are many, especially to improve the prognosis of patients with periodontal disease or tooth decay. It is a dental treatment to make the gummy smile disappear with 100% effectiveness.*

I. INTRODUCTION

The main common objective of the various types of dental specialties is based on the restoration of health and the aesthetic and masticatory function of a patient. Today, however, people often seek dental treatment for aesthetic reasons, forcing professionals to find ways to achieve more harmonious and symmetrical smiles, in order to ensure satisfactory rehabilitation (KATO et al., 2019; TURCATO; PERUFFO, 2019; REDDY et al., 2019).

The factors normally involved in the aesthetic consideration of a smile are related to the lips, position, size, shape and color of the teeth, as well as the proximity between the gingival tissue and the teeth. Other factors associated with esthetics are related to health, tooth

discoloration, proper gingival morphology and contours, all considered essential for an attractive smile. Among the various disorders that can compromise the aesthetics of the smile are gingival excess or exacerbated gingival exposure, a condition known as gingival smile (ÖNKÜ et al., 2017; SEKER; AKDEMIR, 2020).

Gummy smile is recognized by the American Academy of Periodontology (AAP) as a deformity and mucogingival condition that affects the area around the teeth. Allen in 1998 stated that gingival exposure less than 2-3 mm can be considered attractive, with overexposure (> 3 mm) being generally considered unattractive and known as gummy smile, which is generally considered an aesthetic problem. However, the perception of excessive gingival exposure is

also subject to cultural and ethnic preferences. In some European countries, gingival exposure of up to 4 mm or more is acceptable, while exposure greater than 2-3 mm is considered ugly in the USA (BATISTA; PINTO, 2020; PEREIRA FILHO et al., 2020).

The main etiological factors related to gummy smile involve gingival (altered passive eruption), skeletal (excess vertical maxillary), and muscular (upper lip hyperfunction) characteristics. Altered passive eruption occurs when the periodontal complex does not migrate apically towards the cemento-enamel junction, covering part of the clinical crown, resulting in short teeth. This coverage can present esthetic complications, especially in patients with a high smile line. The prevalence of gummy smile is 10% in the population aged between 20 and 30 years, being more common in women than in men (HORTKOFF et al., 2017; TURCATO; PERUFFO, 2019).

Some consequences of this alteration are the short clinical crown and excess gingival tissue. For the diagnosis and planning of altered passive eruption, some authors suggest the association of radiographic analysis, transgingival probe measurement and, more recently, the use of cone beam computed tomography. The therapeutic procedure will depend on the etiology and severity of the case, which may indicate the removal of excess and remodeling of the gingival tissues. The gingivectomy procedure is indicated when there is a need for remodeling only the gingival tissues, when the elements are partially open with the crown. When the bone level is adjacent to the cemento-enamel junction or even covering it, gingivectomy is performed together with the osteotomy. In these cases, surgical techniques to lengthen the clinical crown can effectively resolve aesthetic problems (KATO et al., 2019; TURCATO; PERUFFO, 2019; REDDY et al., 2019).

The aim of this study was, therefore, to carry out an integrative review of the scientific evidence related to gingivectomy for smile esthetics.

II. LITERATURE REVIEW

2.1 ETIOLOGY

According to the literature, gingival smile can be defined as a state in which the smile line moves apically beyond the anteroposterior teeth, causing excessive exposure of the maxillary gingiva during the smile. The main etiology of gingival growth is bacterial plaque and tartar, indicative of poor oral hygiene. Other general factors include the use of certain medications known for their hyperplastic effects. These drugs include cyclosporine A used as an immunosuppressive agent in transplant patients to prevent tissue rejection and phenytoin prescribed for

people with epilepsy (BATISTA; PINTO, 2020; PEREIRA FILHO et al., 2020).

Hormonal imbalances, such as pregnancy and puberty, as well as certain hematological conditions, such as leukemia, may be responsible for the genesis or worsening of gingival enlargement. Etiologies can vary widely and various elements can interact while smiling. These elements involve the labial, dental and gingival components of the smile and the dynamic relationships between them; not only lip length, but also activity, clinical crown size, dentoalveolar extrusion and excessive vertical maxillary height are the main causes (HORTKOFF et al., 2017; TURCATO; PERUFFO, 2019).

Healthy gingiva is represented by specific clinical features such as pale pink color, dull and dotted surface, firm and resilient consistency, volume dependent shape and gingival contour with a thin margin and ending against the tooth like a knife blade. When submitted to periodontal probe, its depth can vary from 1-3 mm and should not present bleeding in this exam (BATISTA; PINTO, 2020).

Hyperplasia resulting from failure of oral hygiene is one of the most common complications related to gingival enlargement, since the accumulation of biofilm from food debris causes the proliferation of inflammatory cells and pathogenic bacteria, causing the gingiva to present edema, reddish coloration, loose and with chances of spontaneous bleeding (ARAÚJO; BARROS, 2018; PEREIRA FILHO et al., 2021).

There are risk factors that can predispose to gingival hyperplasia, such as the use of orthodontic appliances or medications, but their development is directly linked to poor hygiene, creating space for the installation of dental biofilm, which is the etiological agent of the vast majority of periodontal problems (BRITO et al., 2016).

The implantation of dental appliances facilitates gingival inflammation and has a great influence on the oral microbiota, but these conditions can be reversed in people who have adequate oral hygiene (NUNES et al., 2020; SOUZA et al., 2021).

The presence of periodontal pockets is detected through the probing depth. For this, the level of clinical attachment of each patient is measured to analyze the periodontal biological space, which includes gingival sulcus (0.69 mm), junctional epithelium (0.97 mm), that is, taking into account that in the state natural presents 2 to 3 mm of healthy structure that extends from the alveolar bone crest to the gingival margin (HORTKOFF et al., 2017; TURCATO; PERUFFO, 2019).

2.2 INDICATIONS

According to several authors, the gummy smile prevails with a percentage of 10% in the age group from 20 to 30 years old and occurs much more in women than in men. Excessive gingival exposure decreases with age. As a consequence, it can offer an aesthetic aspect of a "young appearance" (BRITO et al., 2016; ORTKOFF et al., 2017; TURCATO; PERUFFO, 2019).

2.3 PREPARATION

The diagnosis of gummy smile must be accurate and based on a detailed and careful analysis of the factors and the degree of their participation in the occurrence of gummy smile. In contrast to a pleasant smile, a gummy smile is characterized by excessive gingival exposure associated with a high smile line that can be linked to several causes. These causes include abnormal tooth eruption proven by a short clinical tooth crown, short length or hyperactivity of the upper lip muscles, or excessive vertical maxillary growth (KATO et al., 2019; TURCATO; PERUFFO, 2019; REDDY et al., 2019).

The "smile line" is a parameter very commonly used to analyze and categorize a patient's smile. According to several studies on smile perception by orthodontists and laypersons, it is a valid tool to assess the aesthetic appearance of a smile and to quantify the amount of gingival exposure of a smile (BATISTA; PINTO, 2020; PEREIRA FILHO et al., 2020).

The data needed for a proper diagnosis include medical and dental histories, extraoral and intraoral clinical examinations, study models and photographs. Cephalometric analysis provides comprehensive information about craniofacial structures. However, the evaluation of the gummy smile is mainly clinical. Thus, this analysis serves to confirm possible alveolar-skeletal etiologies (SEKER; AKDEMIR, 2020).

2.4 GINGIVECTOMY

Many patients go to dental offices in search of a beautiful and harmonious smile to increase their self-esteem. Currently, there is a great search for oral aesthetics, where the smile harmony is determined not only by the shape, position and color of the teeth, but also by the gingival tissue, which can be corrected with surgical techniques such as gingivectomy (HORKOFF et al., 2017; TURCATO; PERUFFO, 2019).

Gingivectomy is an easy-to-perform technique and generally well accepted by patients, who, according to the correct indications, can obtain satisfactory results in terms of esthetics and dentogingival harmony. The procedure consists of removing the gingival deformities resulting in a better gingival contour, which can be performed by

removing the inserted, papillary and marginal gingiva when there is no periodontal disease. However, it can be indicated for clinical enlargement of the crown or remodeling of thick margins, removal of hyperplasia caused by a variety of factors, or even removal of supra-osseous periodontal pockets (BATISTA; PINTO, 2020; KUMAR et al., 2015; LIONE et al., 2019; SEKER; AKDEMIR, 2020).

After gingival hyperplasia is observed, surgery is usually indicated for treatment, the ideal is always to be associated with basic periodontal therapy, and after scaling and root planning, the adequacy of the oral environment, with elimination of all outbreaks of infection, aiming at awaken the patient through oral hygiene guidelines, care and concern with oral health, this being the most important phase of treatment to obtain a healthy gingival condition (KUMAR et al., 2015; LIONE et al., 2019).

In general, surgical removal of 1 to 2 millimeters of gingival tissue resolves most cases of gummy smile, but when the gingiva in height is very significant, a more complex surgery must be performed (BATISTA; PINTO, 2020; PEREIRA FILHO et al., 2020).

During the surgical technique, it is possible to perform the incision with the conventional or electrosurgical scalpel (electrosurgical scalpel), although the former is the most used and most preferably among professionals, both achieving the same satisfactory aesthetic results, being a choice obtained during the treatment plan and in patient-professional harmony, for each specific case (BRITO et al., 2016; ÖNKÜ et al., 2017; SEKER; AKDEMIR, 2020).

After preparing the surgical field and oral antiseptics, local infiltration anesthesia is performed and bleeding points are marked, both buccally and lingually. To determine the bleeding points and, therefore, the gingival portion to be removed, the depth of the probe is marked with a millimeter probe with the aid of an explorer (BATISTA; PINTO, 2020).

Thus, the union of these points is performed with Kirkland gingival, the literature also describes the use of a 15c blade connected to a scalpel handle and also the use of an electric scalpel to perform this step, and for the interproximal areas it is the gingiva of Orban, and sometimes a McCall 13/14 curette can be used to remove gum tissue, dental calculi, or dental biofilm. After removing the gingival collar, gingivoplasty is performed with Kirkland gingivectomy and cuticle pliers at the surgical site, in order to improve esthetics, favoring tissue repair and restoring the functional shape of the gingiva, which is covered with surgical cement for protection and favoring tissue repair (KATO et al., 2019; TURCATO; PERUFFO, 2019; REDDY et al., 2019).

There are also high-frequency lasers, such as the carbon dioxide laser, which can be used transoperatively to remove the gingival collar, as they have long wavelengths, are better absorbed by tissues with large extensions of water, evaporating more easily and providing the removal of the gingiva without causing deep burns, replacing the use of conventional scalpels (ÖNKÜ et al., 2017; SOUZA et al., 2021).

The carbon dioxide laser stimulates blood clotting in small vessels, allowing it to act in a controlled area, being indicated for very vascular areas and in patients where infection control is essential, as the laser has the ability to transform an area contaminated or infected in a sterile wound, also inhibiting the formation of abnormal cells, through the lining of the lymphatic vessels, in addition to little contraction, scar formation, usually does not require surgical cementation or suture and the pain remains for a few seconds after surgery, generating little postoperative discomfort allowing the patient to return to normal activities (KUMAR et al., 2015; LIONE et al., 2019; NUNES et al., 2020).

The first step in establishing a correct diagnosis is to properly classify the gingival level, taking into account variables such as sex, age and periodontal health. The defined causes for gingival growth can be characterized by numerous factors (orthodontic reasons, maxillary growth, drug-induced, pathologies) and aggravated according to factors such as age, sex, hygiene and systemic condition of the affected patient (NUNES et al., 2020; SOUZA et al., 2021).

The side effect of conventional gingivectomy procedures is excessive bleeding during surgery. This bleeding limits the surgeon's convenience and decreases the surgical success rate. However, the conventional technique can be easily performed and a precise incision with well-defined margins can be administered with minimal damage to the lateral tissue (HORTKOFF et al., 2017; KATO et al., 2019; REDDY et al., 2019).

Electrosurgery provides excellent hemostasis during surgery, but thermal damage to surrounding tissue is one of the drawbacks. Recently, laser is used for gingivectomy due to its reduced number of patients, discomfort and better hemostasis, less postoperative pain, better patient acceptance and reduced recurrence rate. Comparison of the diode laser with conventional surgery showed that patients

treated with the laser required less infiltration anaesthesia, had reduced bleeding during and after surgery, showed rapid postoperative hemostasis and improved postoperative comfort (ÖNKÜ et al., 2017; SEKER; AKDEMIR, 2020).

Healing after the gingivectomy procedure is an important factor influencing treatment success. It is known that platelets affect wound healing by integrating complex cascades among their mediators, which include several cytokines, transforming growth factors, platelet growth factors and vascular endothelial growth factors. Also, release of activated platelets and many substances that promote tissue repair. Consequently, the ability of platelets to form fibrin clots has been clinically used to promote healing. The influence of various techniques on healing is also important when choosing the gingivectomy method (KUMAR et al., 2015; LIONE et al., 2019).

III. METHODOLOGY

Integrative review, with a qualitative approach, whose data collection was carried out in August and September 2021, developed in six stages. In the first two stages, the justification, question and objective of the research were outlined. In the third stage, the Scielo, Pubmed and Lilacs databases were defined as research sources.

In the fourth stage, the inclusion criteria were: articles focused on gingivectomy for smile aesthetics, registered from January 2015 to July 2021, containing the words "gingivectomy", "aesthetics" and "smile", or in the title, abstract or keywords. In the fifth stage, a critical evaluation was carried out through a data collection script with the following information: author, year, objective, methodology and main results. In the sixth and final stage, the results were obtained, using content analysis for theoretical evaluation.

IV. RESULTS AND DISCUSSION

In the first stage of the study, 316 articles were found, which referred to gingivectomy for smile aesthetics. After reading the titles of selected articles, 112 articles were selected. After reading the abstracts, only 59 studies were selected to be included in the critical and full reading. Finally, 14 studies met the inclusion criteria, as shown in Figure 1.

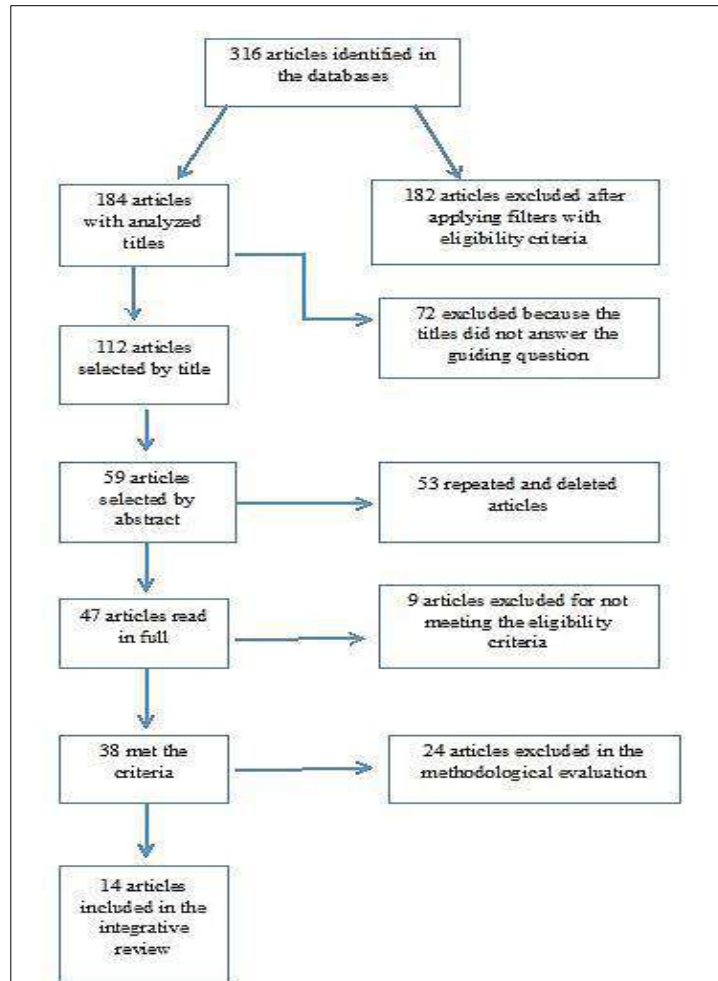


Fig. 1: Selection of studies for review.

This review comprises 14 articles published from January 2015 to July 2021. Of the selected sample, three were literature reviews, two prospective randomized studies, and nine clinical cases, as shown in Table 1.

Table.1: References used in this review.

Authors	Year	Methodology	Objective	Main results
Araújo e Barros	2018	Literature review	Establish the etiology, diagnosis and treatment, through periodontal plastic surgery, to correct gummy smile.	It is possible to restore the patient's self-esteem through periodontal surgery, however, it is necessary for the dentist to know that, sometimes, interdisciplinarity is necessary to resolve the case.
Batista e Pinto	2020	Literature review	Relate the etiology, diagnosis and technique for correcting gummy smile using gingivectomy and gingivoplasty procedures.	It is possible to restore the patient's self-esteem through periodontal surgery, being effective gingivoplasty and gingivectomy techniques to correct gummy smile, and the correct

				diagnosis and selection of the surgical technique are of fundamental importance for the success of the treatment.
Brito et al.	2016	Clinical case	To report a clinical case of a patient who exhibited excessive gingiva when smiling, having upper lip hyperfunction as the etiology.	Through clinical and photographic analysis, it was found that the association of techniques resulted in a smile harmonic and more aesthetically pleasing, with a decrease in gingival exposure during the smile from 8mm to 2mm.
Hortkoff e Copia	2019	Clinical case	To demonstrate the clinical case of a patient who presented after a gingivectomy and gingivoplasty surgery gingival necrosis in the tooth area 21.	The case led to the search for a solution for necrosis where the treatment was conservative without exposing the patient to a gingival esthetic defect and implied the development of a clinical protocol, highlighting measures to be taken in case of post-gingivectomy complications.
Kato et al.	2019	Clinical case	Clarify the process of replacing junctional epithelium (EJ) with oral gingival epithelium (EGO) cells using a green fluorescent protein (GFP) positive dental germ transplantation method.	GFP-positive EJ was partially replaced by EGO cells and completely replaced on day 200 after transplantation, whereas there was no difference in integrin β 4 (Itgb4) and laminin 5 (Lama5) expression between EJ before and after replacement by EGO cells.
Kumar et al.	2015	Prospective randomized study	Assess whether laser has any advantage over electrocautery in performing gingivectomy procedures.	Both techniques, with adequate adhesion to safeguards, can be used to remove gingival growth with equal efficiency and wound healing ability. There is no advantage of diode laser over electrocautery in performing gingivectomy.
Lione et al.	2021	Clinical case	To compare the use of diode laser with conventional surgery, evaluating the effectiveness of gingivectomy as an adjunct to non-surgical periodontal treatment in the management of gingival enlargement	Adjuvant use of scalpel gingivectomy and laser gingivectomy was more effective in controlling gingival inflammation than non-surgical periodontal treatment alone at 1, 3, and 6 months. In the control group, greater improvement in periodontal parameters was seen within 3 months, depending on a

			during orthodontic treatment.	self-care approach to managing gingival enlargement.
Nunes et al.	2020	Clinical case	To report a clinical case of correction of gummy smile associated with the eruption passive altered through gingivectomy in internal bevel and osteotomy with reverse planning and aided by a surgical guide developed to facilitate the technique, where the OHIP and VAS questionnaire was done to assess the improvement in quality of life and pain in the post-operative.	Knowing that aesthetics is closely linked to The individual's quality of life is essential to employ predictable planning, using techniques such as diagnostic wax-up and surgical guidance, which provide a more reliable procedure.
Önkü et al.	2017	Clinical case	Compare the use of 940 nm diode laser with conventional surgery in the treatment of soft tissue in gingivectomy procedures in terms of patient satisfaction.	This study shows that the diode laser has a great advantage over conventional surgery in gingivectomy procedures.
Pereira Filho et al.	2020	Clinical case	To discuss the results of the clinical crown augmentation procedure for aesthetic purposes, presenting two clinical cases of patients with gingival hyperplasia and altered passive dental eruption.	To perform the gingivectomy, several factors must be analyzed prior to the procedure, including aesthetic factors, biotype periodontal, the cause of the alteration and the need or not for osteotomy.
Reddy et al.	2019	Prospective randomized study	Compare the effectiveness of LLLT, Gengigel and Hiora SG gel post-gingivectomy.	Gengigel performed better than Hiora SG gel, both clinically and histologically, being close to the laser group. However, many more studies with a larger sample size need to be done to assert the benefits of LLLT and Gengigel, as noted in this study.
Seker e Akdemir	2020	Clinical case	Evaluate the effect of non-thermal atmospheric pressure plasma (NTAPP) on gingival wound healing.	NTAPP increases epithelialization and stimulates wound healing after gingivectomy and gingivoplasty. However, further clinical studies with larger sample sizes are needed to

				determine the exact benefits of NTAPP for the healing of gingival wounds.
Souza et al.	2021	Clinical case	To report a case of gingival asymmetry correction using the gingivectomy technique with minimal osteotomy traumatic.	When correctly indicated and performed, the technique of gingivectomy with osteotomy only via the sulcular route, using a periodontal chisel, without flap elevation, is effective in correcting asymmetries in the anterior teeth.
Turcatto e Peruffo	2019	Literature review	Discuss the use of periodontal plastic surgery, by gingivectomy and gingivoplasty techniques, for harmonizing the gummy smile, also addressing aspects of etiology, diagnosis and proper treatment for such situations	Gingivectomy and gingivoplasty are minimally invasive surgical techniques for correction of the gummy smile, easy to perform, presenting immediate and predictable results, but which depend on the professional's theoretical and practical knowledge to achieve an aesthetic and functional result.

Most professionals share the opinion that a beautiful smile is harmonic is influenced by the dentogingival relationship, in this sense, they start from the ideathat the upper lip must be located at the same level as the tissue margingingival of the dental elements called maxillary central incisors. There may also be a small part of the gum on display, as you understandthis denotes a younger appearance (SOUZA et al., 2021).

It is important to assess the patient's esthetic expectations and show the possible therapeutic solutions that fit the patient. Studies have revealed that botulinum toxin is considered one of the minimally invasive, quick and accessible modalities that can replace extensive surgical procedures for correction of severe gummy smile (ARAÚJO; BARROS, 2018; REDDY et al., 2019). In the essay by Brito et al. (2016), the association of treatments in this clinical case – surgery periodontal plastic surgery and application of botulinum toxin type A – achieved a very satisfactory result, as it instituted esthetic correction through less gingival exposure in the patient's smile and speech. The option for isolated treatments could not culminate in the excellence of the achieved result.

Gingival enlargement is a condition that commonly develops during orthodontic treatment. Orthodontic appliances are irritation and plaque retention factors that impede oral hygiene and control of gingival inflammation. Studies of gingival hypertrophy in young people

undergoing orthodontic treatment with fixed appliances are described and treated by gingivectomy. This surgical procedure generated morphological conditions of the gingiva allowing better control of the plaque and the ongoing orthodontic treatment. Periodic controls in children and adolescents are necessary for a healthy periodontium during orthodontic therapy. Collaboration between orthodontists and periodontists is one of the most important keys to treatment success (PEREIRA FILHO et al., 2020; TURCATTO; PERUFFO, 2019).

Secker and Akidemi (2020) point out in their studies that enlargement of the clinical tooth crown, correction of interproximal craters, removal of high and thick margins, in addition to elimination of gingival growth due to hormonal factors, use can be considered as indications for gingivectomy. of drugs or due to the accumulation of dental biofilm. However, for Önkü et al. (2017), when there is an intention to remove supraosseous periodontal pockets, there is an indication for gingivectomy, but, in this case, gingivoplasty is contraindicated for this purpose.

Several studies have shown that LLLT has a beneficial effect on pain reduction. The results of the study by Kumar et al. (2015) showed that the mean pain score in the test group was comparatively lower on the 3rd postoperative day, on the 7th postoperative day and at the end of 1 month than the control group. These results explain the positive effect of LLLT on the patient's pain response after scalpel

gingivectomy. Patients in the test group that has LLLT experienced significantly less postoperative pain compared to the control group. Based on the results of Reddy et al. (2019), it can be concluded that LLLT using 940 nm diode laser at an energy density of 4 J/cm² as an adjunct to the scalpel gingivectomy procedure can be used to reduce postoperative pain and discomfort and assist in better wound healing. However, Kumar et al. (2015) emphasize that it is necessary to establish effective laser application protocols, allowing this new therapy to be used in periodontology and bringing more comfort to patients. Further studies should be conducted along with several other surgical procedures to assess the effect of adjunctive use of LLLT on wound healing and patient response.

V. CONCLUSION

Studies have shown that new technologies in the field of dental esthetics have made gingivectomy a simple solution for gum repair. The benefits are many, especially to improve the prognosis of patients with periodontal disease or tooth decay. It is a dental treatment to make the gummy smile disappear with 100% effectiveness.

REFERENCES

- [1] ARAÚJO, A.; BARROS, T. SORRISO GENGIVAL: Etiologia, diagnóstico e tratamento por intermédio de gengivectomia e gengivoplastia. **Artigo** (Curso de Odontologia). Centro Universitário São Lucas, Porto Velho, 2018.
- [2] BATISTA, B.; PINTO, T. Cirurgia plástica periodontal: tratamento estético por técnica de gengivectomia e gengivoplastia. **Artigo** (Curso de Odontologia). Centro Universitário São Lucas, Porto Velho, 2020.
- [3] BRITO, E. et al. Gengivectomia/gengivoplastia associada à toxina botulínica para correção de sorriso gengival. **Braz J Periodontol.** v. 26, n. 3, p. 50-56, 2016.
- [4] HORTKOFF, D. et al. Complicação por necrose gengival pós gengivectomia e gengivoplastia: um relato de caso. **Centro de ensino superior dos Campos Gerais – CESCAGE**, v.1, n. 1, p. 63-70, 2017.
- [5] KATO, M. et al. Visualization of junctional epithelial cell replacement by oral gingival epithelial cells over a life time and after gingivectomy. **Scientific Reports.** v. 9, n. 7640, p. 1-11, 2019.
- [6] LIONE, R. et al. Conventional versus laser gingivectomy in the management of gingival enlargement during orthodontic treatment: a randomized controlled trial. **European Journal of Orthodontics**, v. 1, n. 1, p. 1–8, 2019.
- [7] KUMAR, D. et al. Comparative evaluation of healing after gingivectomy with electrocautery and laser. **Journal of oral biology and craniofacial research.** v.5, n. 1, p. 69-74, 2015.
- [8] ÖNKÜ, E. et al. Comparison of gingivectomy procedures for patient satisfaction: Conventional and diode laser surgery. **Selcuk Dent J.** v. 1, n. 1, p. 1-4, 2017.
- [9] NUNES, I. et al. Desenvolvimento de guia cirúrgico para auxiliar na técnica de gengivectomia em bisel interno com osteotomia: relato de caso. **Research, Society and Development**, v. 9, n. 7, p. 1-35, 2020.
- [10] PEREIRA FILHO, C. et al. Gengivectomia com finalidade estética: relato de dois casos clínicos. **Revista Eletrônica Acervo Saúde.** v. 13, n. 42, p. 1-8, 2020.
- [11] REDDY, S. et al. Efficacy of Low-level Laser Therapy, Hyaluronic Acid Gel, and Herbal Gel as Adjunctive Tools in Gingivectomy Wound Healing: A Randomized Comparative Clinical and Histological Study. **Cureus.** v. 11, n. 2, p. 1-14, 2019.
- [12] SEKER, D.; AKDEMIR, M. The effect of non-thermal atmospheric pressure plasma application on wound healing after gingivectomy. **Int Wound J.** v.17, n. 12, p. 1376–1383, 2020.
- [13] SOUZA, A. et al. Correção de assimetria gengival através de gengivectomia com osteotomia minimamente traumática. **Arch Health Invest.** v.10, n. 6, p. 888-891, 2021.
- [14] TURCATO, E. PERUFFO, V. Correção do sorriso gengival por intermédio de cirurgia plástica periodontal: gengivoplastia e gengivectomia. **Artigo** (Curso de Odontologia). Centro Universitário São Lucas, Porto Velho, 2019.

Chronopharmacology and its importance in the therapy of Rheumatoid Arthritis: A Systematic Review

Gresiane Santos Conceição¹, Renata de Oliveira Gomes^{1, 2}, Denis de Melo Soares²

¹Salvador University (UNIFACS)

²Post Graduation Program in Pharmacy of Federal University of Bahia.

Received: 19 Sep 2021,

Received in revised form: 13 Nov 2021,

Accepted: 19 Nov 2021,

Available online: 30 Nov 2021

©2021 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— *Chronopharmacology, Rheumatoid arthritis, Chronic inflammation.*

Abstract— *Rheumatoid arthritis (RA) is a chronic, autoimmune and inflammatory disease that primarily affects the joints. The symptoms of RA are most pronounced in the morning, fluctuating throughout the day. Studies report cases of failure in current RA therapy. With the intention of collaborating to reduce these failures, it is suggested to implement the knowledge related to Chronopharmacology. Thus, the aim of this study is to highlight the importance of Chronopharmacology in the efficiency of pharmacological treatment of RA through a systematic review. The search for scientific studies related to the theme was carried out in the databases PubMed, Lilacs, Scielo and Google Scholar from August 2019 to April 2020. This work brought together studies that demonstrated aspects related to the topic, and also allowed to bring possible solutions for application of this science in the clinical practice of Pharmacists and other health professionals. The information obtained in this research revealed that the administration of the drugs used by patients with RA according to the circadian rhythm provided a significant improvement in the symptoms, in addition to favoring the regression of the disorder. However, there is a need for further studies to show that the uses of disease-modifying antirheumatic drugs (DMARDs) have their action more potentiated when chronopharmacological principles are used.*

I. INTRODUCTION

Rheumatoid arthritis (RA) is a chronic inflammatory systemic disease of the joints. This inflammation is caused by alterations in the body's defense system¹. Defined as an autoimmune disorder, the severity of RA can be graded as mild, moderate or severe, causing acute and chronic inflammation accompanied by a proliferative and destructive process of the joint tissues, which may eventually result in joint deformity².

The morbidity and severity of rheumatoid arthritis are more significant when involve other organs of the patients, thereby causing a decrease in life expectancy and

an inability to perform daily activities^{1,3,4}. Previous estimates reported that, in Brazil, 1.3 million people are affected by the life-threatening condition⁵. Interestingly, the frequency is 2 to 3 times higher in women over 40 years old, with a high incidence in the fifth decade of life⁶.

Inflammation of rheumatoid arthritis is not constant, but oscillates during the day. However, stiffness, edema and pain are more intense in the morning, thus directly influencing the routine of individuals, and resulting in a decrease in their functional capacities⁷. Ohdo et al.⁸ affirm that the administration of drugs when they are more effective or better tolerated is an alternative to

increase the efficacy of the pharmacotherapy used by these patients. This variation is associated with chronopharmacology, a science that aims to assess the activity of drugs according to biological rhythms, for example, the sleep-wake cycle⁷.

The term chronopharmacology was created in the early 1960s, and its first application to clinical medicine was in the timing of steroid therapy to mitigate both real and potential toxicity, and to increase its effectiveness⁹. Dallmann et al.¹⁰ reported that various physiological aspects of mammals, including sleep, breathing and arterial tensions, vary according to the time of day, being regulated by internal biological rhythms.

Chronopharmacology aims to explore the predictable changes in the therapeutic action of drugs depending on the time of administration on a 24-hour scale^{7,8,11-13}. Among the different organic functions, there is a series of rhythms that vary throughout the day, which are classified as circadian rhythms (circa = “close” or “about”, dian = “day”)¹⁴.

Chronopharmacology is of paramount importance, since the kinetics and dynamics of drugs are directly affected by biological rhythms and the time of administration, which are crucial factors for the pharmacological effect¹⁵. Therefore, it is necessary to consider that, after being used, a medication may undergo changes in its effect according to the moment, within the circadian cycle, when it reaches the target organ^{8,16-18}.

Previous studies reported cases of failure in current therapy of rheumatoid arthritis¹⁹⁻²². Rubbert-Roth et al.²³ stated that approximately 30 to 40% of patients discontinue treatment with anti-TNF due to primary failure, secondary loss of response or intolerance. Patients can also stop treatment owing to side effects. Other possible reasons for variability include adherence problems, cessation of methotrexate when synthetic treatment is initiated or differences in the pharmacokinetics of drugs²³. Indeed, adverse events and lack of efficacy are the most important reasons for ending the use of disease-modifying drugs²⁴.

From this perspective, there is a need to discuss the relevance of chronopharmacology in the therapy of rheumatoid arthritis, which may correlate the influence of chronopharmacology on the therapeutic success of patients with such disease. Thus, the aim of the present systematic review is to assess the importance of chronopharmacology

in the efficiency of RA drug treatment, contributing to its adherence and decreasing treatment tolerance.

II. METHODOLOGY

The present research is a systematic review of the literature organized in the following stages: choice and delimitation of the study; establishment of keywords and inclusion and exclusion criteria, and analysis of the information collected. The search was conducted through the electronic databases Medline/PubMed, Lilacs, Google Scholar and Scielo, aiming to find a significant number of related studies from August 2019 to April 2020. The following descriptors, in English and Portuguese languages, were used: “Chronopharmacology and Rheumatoid Arthritis” and “Chronopharmacology and Chronic Inflammation”. An initial analysis was performed based on the abstract of all papers that met the inclusion criteria. After reading the abstracts, the selected articles were obtained in full to be examined according to the established inclusion criteria. The inclusion criteria were: studies with human subjects, complete articles published in Portuguese or English languages in the period from 2010 to 2020 and which are related to the topic of the study. The exclusion criteria were: review articles, *in vitro* studies, articles that are not related to the addressed topic and that are outside the mentioned period of publication or in other languages than those aforementioned.

III. RESULTS AND DISCUSSION

Complying with the previously established methodology, the search for articles yielded 23 references. These searches were carried out based on keywords directly associated with the central theme of this study. Firstly, 10 articles were retrieved in the Pubmed database. After the initial analysis by reading the abstracts, 3 articles were selected and 7 were excluded for being review articles. 13 articles were identified in the Google Scholar database, and after reading the titles and abstracts, 5 articles were selected and 8 were excluded according to the inclusion criteria. No articles were found in Lilacs and Scielo databases.

Then, the 8 articles initially selected after reading the abstracts were eligible for full appraisal, and only 3 met the inclusion criteria. The studies selected for the review are demonstrated according to the PRISMA model, described in Figure 1.

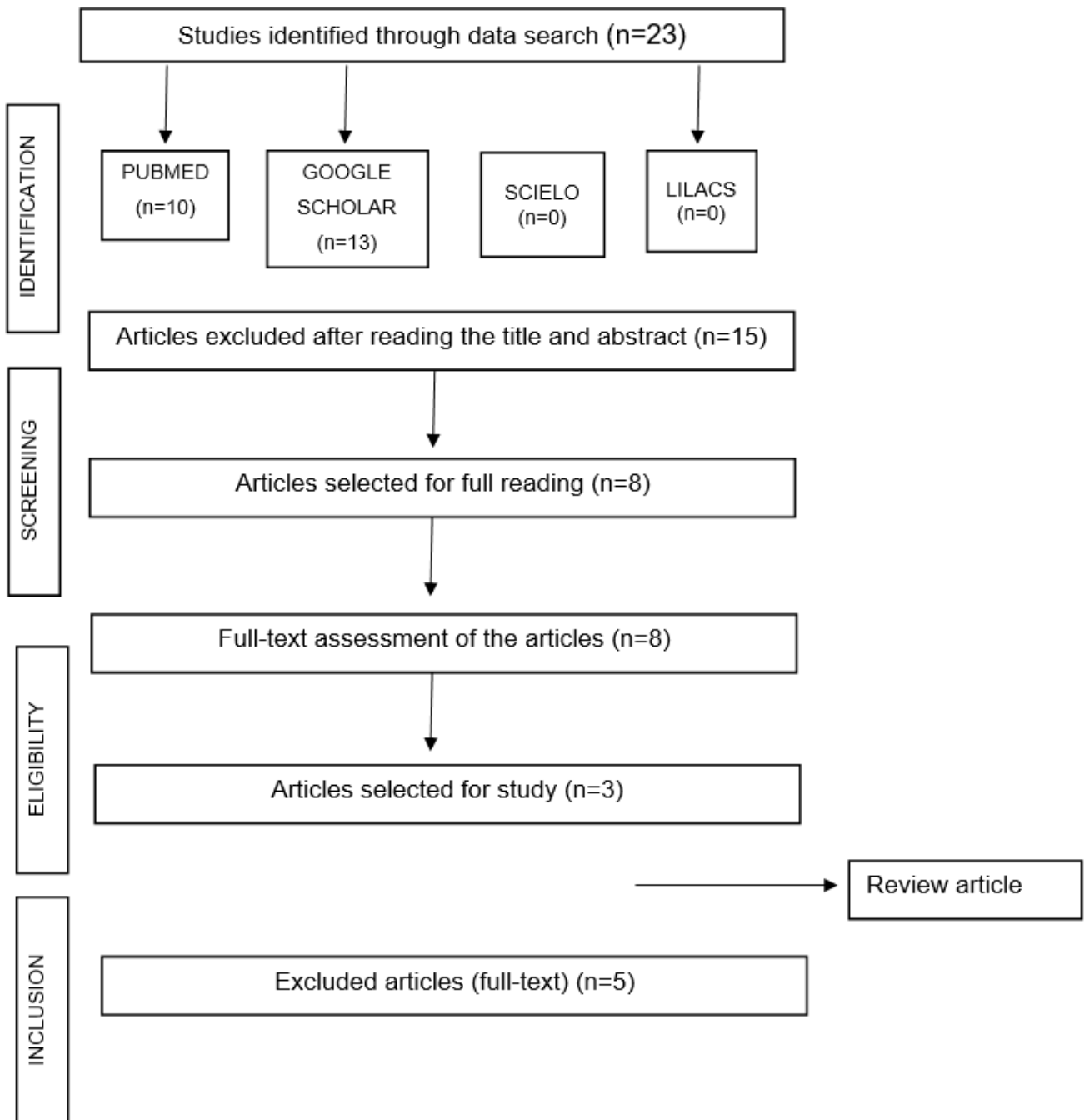


Fig.1 - Flowchart of the selection of articles

Source: The authors, 2020.

The selected studies (Chart 1) were performed in diverse countries, being one in Germany, one in the United States and onereseach conducted in two different countries, Germany and Poland. Regarding these 3 studies, the drug used for clinical tests in volunteer patients was a modified-release formulation of the oral corticosteroid class, being administered at night during the entire

treatment period (Table 1). After completing the total sum of patients who participated in the 3 studies, it was found that 647 patients had active RA, defined as the target audience of each study. Of these, only 581 patients completed the research. Each volunteer started the study without changing their therapy with other anti-rheumatic drugs.

Chart 1 - Articles selected after inclusion and exclusion criteria

Title of the article, authorship and year	Type of study	Objective
Aiming at pathophysiological rhythms: chronotherapy with prednisone exhibits sustained efficacy in rheumatoid arthritis ²⁵ .	Double-blind	To investigate the safety and long-term effectiveness of chronotherapy with a new modified-release prednisone for up to 12 months.
Effect of new therapeutic glucocorticoids on circadian rhythms of hormone and cytokine levels in rheumatoid arthritis ²⁶ .	Clinical tests	To study the circadian dynamics of serum IL-6, other cytokines and cortisol in 9 patients before and after 2 weeks of therapy, using a formulation that releases prednisone at 2 am (after ingestion at 10 pm).
Chronotherapy with low dose of prednisone for rheumatoid arthritis: a randomized clinical trial (CAPRA-2) ²⁷ .	Double-blind	To evaluate the efficacy and safety of low-dose prednisone chronotherapy using a new modified-release formulation for the treatment of rheumatoid arthritis.

Source: Search performed by the authors in databases. Salvador, 2019.

Table 1 - Chronopharmacotherapeutic studies in patients with rheumatoid arthritis

Therapeutics	Number of patients with RA	Duration	Administration hour	Bibliographic reference
MR prednisone 2 to 10mg per day	288	9 months	At 21:30 and at 22:30	Buttgereit et al. ²⁵
MR prednisone 5mg	9	14 days	At 10pm	Kirwan et al. ²⁶
MR prednisone 5mg	350	12 weeks	After dinner	Buttgereit et al. ²⁷

Source: The authors, 2020.

MR: modified-release.

The main joint manifestation presented by patients affected by rheumatoid arthritis is morning stiffness. This symptom is responsible for causing difficulty and limiting movement²⁸. In the selected articles,

significant improvements in morning stiffness were greater in the group using prednisone chronotherapy, being represented by 241 patients (Figure 2).

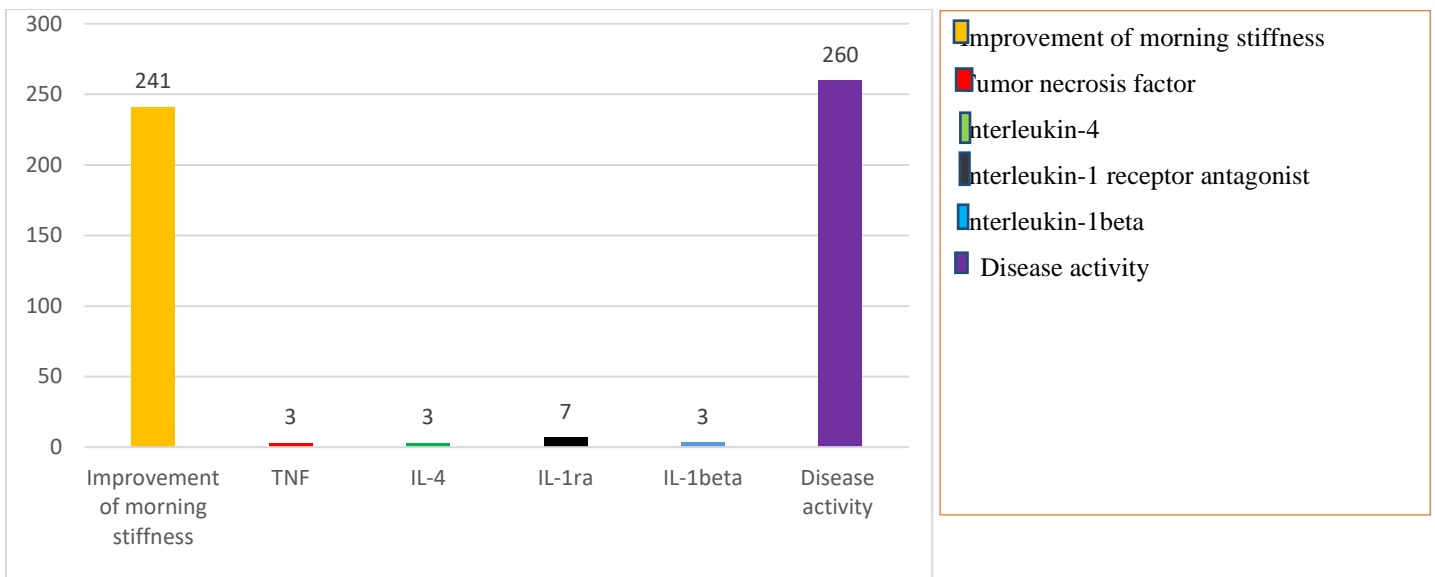


Fig.2 - Improvements revealed by patients after using modified-release prednisone at night.

Source: The authors, 2020.

The studies exhibited that, after treatment with MRprednisone, only 3 patients had high levels of TNF. Additionally, high levels of interleukin-4 and interleukin-1 beta were observed, as shown in Figure 2. According to Kirwan et al.²⁶, these data suggest that a subgroup of patients is resistant to glucocorticoids in general. Besides that, in a precise and quantified study²⁷, it was reported that about a quarter of patients may have clinical and cellular resistance to glucocorticoids. Further, 7 patients had levels of IL-1RA (Figure 2), which is secreted by macrophages and acts as a natural inhibitor of IL-1³⁰ activity. In the study by Buttgerit et al.²⁷, TNF levels remained unchanged, while Buttgerit et al.²⁵ did not assess this parameter. According to Lucas et al.³¹, the tumor necrosis factor-alpha is one of the most important cytokines involved in rheumatoid arthritis. In fact, the Tumor Necrosis Factor (TNF) is a key regulator in the inflammatory cascade, being responsible for the activation of lymphocytes, stimulation of the release of proteolytic enzymes by macrophages and production of other inflammatory cytokines, such as IL-6 and IL-3. Normally, the body naturally blocks the excess of TNF. However, in rheumatic disease, it remains active and induces more inflammation³².

In rheumatoid arthritis, inflammation of the synovial membrane is caused in part by excessive production of cytokines, including interleukin IL-6. IL-6 is increased in RA, correlating with disease activity^{28,33}. Importantly, the selected studies demonstrated that patients who used the treatment involving chronotherapy showed a greater reduction in the levels of this cytokine. The study by Kirwan et al.²⁶ revealed that the only cytokine that

had measurable circadian variation was IL-6, in addition to stating that morning stiffness and pain in rheumatoid arthritis are accompanied by an increase in serum interleukin-6 (IL-6) from 2:00 am to 7:00 am. In this same study, a surprising observation was the circadian pattern of cortisol. After two weeks of treatment with MR prednisone with nighttime-release, patients had lower serum cortisol in the afternoon and at night, with an earlier and more pronounced increase of this hormone in the early morning.

Cortisol, also known as stress hormone, is an intrinsic hormone of great importance, being secreted by the adrenal glands daily. According to the circadian rhythm, the cortisol level should be low at night. The hormone has a rhythmic secretion that can be altered due to disturbances in the circadian system³⁴. Chronic variations in its concentrations can lead to different disorders, including diabetes, depression, cancer and arthritis. Ribeiro³⁵ affirms that the production of cortisol by the hypothalamic-pituitary-adrenal axis during the active phase interrupts the secretion of pro-inflammatory cytokines. Thus, this process reveals that the circadian rhythm has a strong impact on autoimmune diseases and their treatment.

Pain management is the highest priority for patients affected by RA^{36,37}. Heiberg et al.³⁶ reported that pain is the factor in which almost 70% of patients would like to see progress. According to Walsh et al.³⁸, pain not only affects patients directly, but also indirectly contributes to the psychological and social impact of RA. Pain assessment and disease activity have also been assessed in previous studies^{25,27}. Based on a functional

capacity score questionnaire (DAS28), it was found that 260 patients showed clinically relevant improvements in this parameter (Figure 2).

The American College of Rheumatology (ACR) criteria for RA are often used as aids in diagnosis³⁹. ACR rates are scales for measuring changes in rheumatoid arthritis symptoms³. In the selected articles, there was a significant improvement in ACR20 and ACR50 response rates versus MR prednisone^{25,27}. As shown in Figure 3, 85% of the patients who were treated with MR prednisone exhibited an improvement of 20% in the ACR20 score and 22% achieved an ACR50 response.

The studies conducted by Paolino et al.⁴⁰ and Naafs⁴¹ corroborated with that by Buttgerit et al.²⁷, since the authors suggested that the optimal time for glucocorticoid treatment is at night, in order to mimic the normal circadian rhythm of cortisol secretion. Still according to Naafs⁴¹, the symptoms of RA were attenuated when DMARDs were used with the prolonged release formulation, in comparison to the use of DMARDs in

monotherapy, emphasizing the possible promising future of chronopharmacology for the treatment of RA, as well as for other pathologies.

It is worthwhile noting that the use of chronopharmacology concepts in the treatment of rheumatoid arthritis is of great relevance, as it has contributed to the increase in the efficacy of the drugs, optimizing the time and dosage of them, besides providing significant improvement in symptoms, thus enabling a better quality of life for patients affected by the disease and its regression⁴².

The findings of the study indicated that, in order to increase the therapeutic effects of drugs and minimize their side effects, it may be useful to choose the most appropriate time of day for administration, in addition to pointing out that, to perform this process, the rhythmic markers could be monitored. Nainwal et al.¹² also affirm that drug administrations must be carried out at the moments when they are best tolerated in order to increase the efficacy of pharmacotherapy.

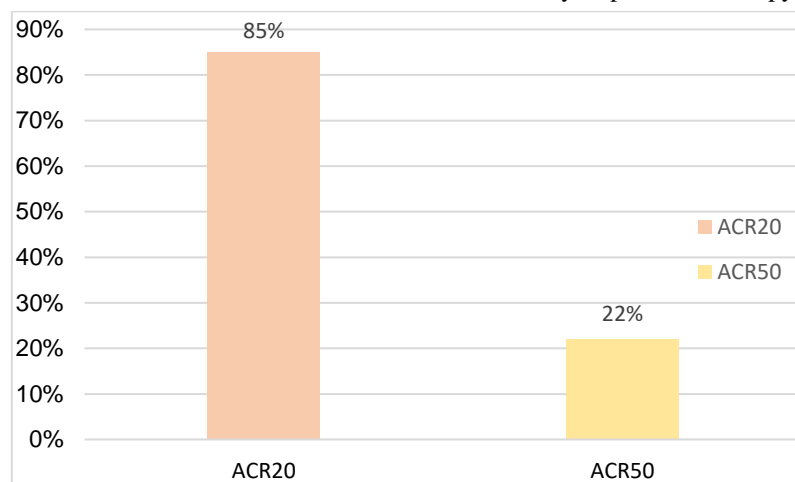


Fig.3 - Proportion of patients with responses related to the ACR criterion (American College of Rheumatology score).

Source: The authors, 2020.

According to Alsaikhan et al.⁴³, studies have evaluated the extent to which it is possible to use chronopharmacology in the medical field. This science has still been little applied due to the insufficient knowledge of professionals, including pharmacists. The pharmaceutical professional plays a pivotal role in society, being responsible for the well-being and quality of life, working to prevent issues related to the use of drugs⁴⁴. This professional has a remarkable role in providing information related to medications, including advice on the ideal time to administer them. In this context, it is essential to include the concepts of chronopharmacology during drug counseling⁴⁵.

One of the reasons for this lack of knowledge on the part of professionals is related to the little or no approach of this science in universities⁴⁵. The conventional curricula of pharmacy and medical schools are based on the biological concept of homeostasis (in which the internal physiological environment of the human body remains in a relatively constant state) as the only governing principle of biology and of the behavior of drugs⁴⁶. Thus, there is a need to include in the degree programs in Pharmacy and Medicine, for instance, the concepts associated with circadian rhythms that affect the administration of drugs.

Educational and professional training in chronotherapy, especially in the field of chronopharmacology to improve the knowledge, access to information, skills and competence of Pharmacists, as well as other health professionals in clinics, is also very useful to afford the safe and effective use of drugs in some cases⁴⁵. In order to choose the time of administration, it is important to discuss with the patient the time of day that symptoms appear more frequently⁴⁷.

According to Chen⁴⁸, the development of new drugs based on chronopharmacology has also been extensively explored, whose focus is to investigate circadian rhythms as a therapeutic target. Chen⁴⁸ states that the investigation of representative drug candidates that present targets in the circadian clock occurs with the use of approaches that involve chemical screenings that employ phenotypic assays measuring circadian reporter expression and the profile of some compounds in altering the cardinal characteristics of the circadian rhythm, period, phase and amplitude.

It is worth mentioning that some drugs already have this chronopharmaceutical technology. Some examples and applications are: in parenteral routes, which include chronomodulating infusion pumps, controlled-release microchip, transdermal drug delivery system for chronopharmaceutical applications, administration of drugs containing nanoformulations and oral administration⁴⁹, such as the CodaTM system (Chronotherapeutic Oral Drug Absorption System), a controlled-release system, in which the tablet has several layers, soluble and insoluble in water, with the drug positioned in the center and, as the water penetrates the system, the layers change and release the drug^{11,50}.

According to Tamosiunas¹¹, studies related to biological rhythms and their application in clinical practice, in addition to approaching the true human nature, will allow to plan treatments and the way to envision the health-disease process from another perspective. The author also reports that understanding the periods of greatest vulnerability or susceptibility to external agents or to the action of drugs can help to modulate the morbid processes more effectively and to improve the relationship between the risk and benefit of the drugs used.

IV. CONCLUDING REMARKS

Patients with rheumatoid arthritis present the most pronounced symptoms during the morning due to the inflammatory process involved with the circadian rhythm. For this reason, the studies herein showed that the pharmacological treatment of these patients must also

follow this pattern, being more effective when administered at night.

Patients with rheumatoid arthritis use a variety of drug classes. However, it was observed that the studies mentioned oral corticosteroids, a pharmacological class widely used by these patients. In turn, there was a need for further studies that addressed DMARDs, associating the potentiation of their effects with the use of chronopharmacology. Moreover, a limited number of articles met the inclusion criteria of this research, which is due to few studies in the area. Also, the systematic research is intentionally restrictive in order to demonstrate the importance of chronopharmacology in rheumatoid arthritis.

According to the findings, the formulation of modified-release prednisone (MR), when used at night, provided significant improvements in symptoms, allowing an optimization of time and dosage of drugs, better quality of life for patients affected by the disease and regression of the pathology. Thus, it is evident that the use of chronopharmacological principles in the pharmacological treatment of rheumatoid arthritis needs to be taken into account in clinical discussions.

Finally, through this review, possible solutions for the application of chronopharmacology in the clinical practice of pharmaceutical professionals and other health professionals were also mentioned, aiming at incorporating this science as a patient safety strategy.

REFERENCES

- [1] Gomes RKS, Pires FA, Nobre MRC, Marchi MFS, Rickli JCK. Impact of rheumatoid arthritis in the public health system in Santa Catarina, Brazil: a descriptive and temporal trend analysis from 1996 to 2009. *Rev. Bras. Reumatol.* 2017;57(3): 204-209.
- [2] Bagatini F. Estimativa dos custos relacionados à artrite reumatoide em pacientes atendidos por meio do componente especializado da assistência farmacêutica/MS na Farmácia Escola UFSC/PMF, 2008-2010. 2012.
- [3] Mota LMH, Cruz BA, Brenol CV, Pereira IA, Fronza LSR, Bertolo MB, Freitas MVC, Silva NA, Louzada-Junior P, Giorgi RDN, Lima RAC, Pinheiro GRC. Consenso da Sociedade Brasileira de Reumatologia 2011 para o diagnóstico e avaliação inicial da artrite reumatoide. *Rev. Bras. Reumatol.* 2011.
- [4] Wibelinger LM, Borges AM. Hidrocinesioterapia em portadores de artrite reumatóide. *Rev. Atenção Saúde.* 2012; 10(31).
- [5] Costa JO, Almeida AM, Guerra-Júnior AA, Cherchiglia ML, Andrade EIG, Acurcio FA. Tratamento da artrite reumatoide no Sistema Único de Saúde, Brasil: gastos com infliximabe em comparação com medicamentos

- modificadores do curso da doença sintéticos, 2003 a 2006. *Cad. Saúde Pública*. 2014; 30: 283-295.
- [6] Nagayoshi BA, Lourenção LG, Kobayase YNS, Paula PMS, Miyazaki MCOS. Rheumatoid arthritis: profile of patients and burden of caregivers. *Rev. Bras. Geriatr. Gerontol*. 2018; 21(1): 44-52.
- [7] Leite M, Fabrizyo M, Coimbra CC. A influência da cronofarmacologia no tratamento das doenças. *UningáReview*. 2012; 11(2).
- [8] Ohdo S, Koyanagi S, Matsunaga N. Chronopharmacological strategies: Intra-and inter-individual variability of molecular clock. *Adv. Drug Deliv. Rev*. 2010; 62(9-10): 885-897.
- [9] Marks V, English J, Aherne W, Arendt J. Chronopharmacology. *Clin. Biochem*. 1985; 18(3): 154-157.
- [10] Dallmann R, Brown SA, Gachon F. Chronopharmacology: new insights and therapeutic implications. *Annu. Rev. Pharmacol. Toxicol*. 2014; 54: 339-361.
- [11] Tamosiunas G, Toledo M. La cronofarmacología: un nuevo aspecto a considerar en la variabilidad de la respuesta terapéutica. *Arch. Med. Inter*. 2010; 32(4): 65-69.
- [12] Nainwal P, Nanda D, Rana V. Fundamentals of chronopharmacology and chronopharmacotherapy. *J. Pharm. Res*. 2011; 4(8): 2692-2695.
- [13] Da Silva BG, Coimbra CCBE, Carrara MA. Interferentes cronobiológicos do tratamento da insônia. *UningáReview*. 2017; 29(3).
- [14] Da Costa GJ, Lima KDA. Avaliação do conhecimento de médicos sobre a cronobiologia e a cronofarmacologia. *Anais do Seminário Científico da FACIG*. 2017; (1).
- [15] Wal P, Wal A, Rai AK, Saxena A. Chronopharmaceutics as a novel approach for drug delivery. *J. Pharma. Sci. Tech*. 2009; 1(2): 59-62.
- [16] Halberg F. Chronobiology. *Annu. Rev. Physiol*. 1969; 31(1): 675-726.
- [17] Duncan-Júnior WC. Circadian rhythms and the pharmacology of affective illness. *Pharmacol. Ther*. 1996; 71(3): 253-312.
- [18] Molina Cabrera R. La cronofarmacología en la respuesta farmacoterapéutica. *Gac. Méd. Boliv*. 2015; 38(1): 28-29.
- [19] Nam JL, Winthrop KL, Vollenhoven RFV, Pavelka K, Valesini G, Hensor EMA, Worthy G, Landewé R, Smolen JS, Emery P, Buch MH. Current evidence for the management of rheumatoid arthritis with biological disease-modifying antirheumatic drugs: a systematic literature review informing the EULAR recommendations for the management of RA. *Ann. Rheum. Dis*. 2010; 69(6): 976-986.
- [20] Atzeni, Fabiola et al. Long-term anti-TNF therapy and the risk of serious infections in a cohort of patients with rheumatoid arthritis: comparison of adalimumab, etanercept and infliximab in the GISEA registry. *Autoimmun. Rev*. 2012; 12(2): 225-229.
- [21] Low, Audrey SL et al. Relationship between exposure to tumour necrosis factor inhibitor therapy and incidence and severity of myocardial infarction in patients with rheumatoid arthritis. *Ann. Rheum. Dis*. 2017; 76(4): 654-660.
- [22] Favalli EG, Raimondo MG, Becciolini A, Crotti C, Biggioggero M, Caporali R. The management of first-line biologic therapy failures in rheumatoid arthritis: current practice and future perspectives. *Autoimmun. Rev*. 2017; 16(12): 1185-1195.
- [23] Rubbert-Roth A, Szabó MZ, Kedves M, Nagy G, Atzeni F, Sarzi-Puttini P. Failure of anti-TNF treatment in patients with rheumatoid arthritis: The pros and cons of the early use of alternative biological agents. *Autoimmun. Rev*. 2019; 102398.
- [24] Felson DT, Anderson JJ, Meenan RF. The comparative efficacy and toxicity of second-line drugs in rheumatoid arthritis results of two metaanalyses. *Arthritis Rheumatol*. 1990; 33(10): 1449-1461.
- [25] Buttgerit F et al. Targeting pathophysiological rhythms: prednisone chronotherapy shows sustained efficacy in rheumatoid arthritis. *Ann. Rheum. Dis*. 2010. 69(7): 1275-1280.
- [26] Kirwan JR, Clarke L, Hunt LP, Perry MG, Straub RH, Jessop DS. Effect of novel therapeutic glucocorticoids on circadian rhythms of hormones and cytokines in rheumatoid arthritis. *Ann. N. Y. Acad. Sci*. 2010; 1193(1): 127-133.
- [27] Buttgerit, Frank et al. Low-dose prednisone chronotherapy for rheumatoid arthritis: a randomised clinical trial (CAPRA-2). *Ann. Rheum. Dis*. 2013; 72(2): 204-210.
- [28] Perry MG, Kirwan JR, Jessop DS, Hunt LP. Overnight variations in cortisol, interleukin 6, tumour necrosis factor α and other cytokines in people with rheumatoid arthritis. *Ann. Rheum. Dis*. 2009; 68(1): 63-68.
- [29] Sliwiska-Stanczyk P, Pazdur J, Ziolkowska M, Jworski J, Kaminska-Tchorzewska E, Lacki JK. The effect of methylprednisolone on proliferation of PBMCs obtained from steroid-sensitive and steroid-resistant rheumatoid arthritis patients. *Scand. J. Rheumatol*. 2007; 36(3): 167-171.
- [30] Suzuki K, Fukutomi Y, Matsuoka M, Torii K, Hayashi H, Takii T, Oomoto Y, Onozaki K. Differential production of Interleukin 1 (IL-1) IL-6, tumor necrosis factor and IL-1 receptor antagonist by human monocytes stimulated with *Mycobacterium leprae* and *M. bovis* BCG. *Int. J. Lep. OtherMycobactDis*. 1993;61: 609-609.
- [31] Lucas D, Ponte LF, Torres F, Silva JN, Terra-Júnior AT. Uma abordagem sobre a inter-relação de citocinas na artrite reumatóide. *Rev. Cien. Faculdade de Educação e Meio Ambiente*. 2016; 7(1): 93-102.
- [32] Faleiro LR, Araújo LHR, Varavallo MA. A terapia anti-TNF- α na artrite reumatóide. *Semina: Ciências Biológicas e da Saúde*. 2011; 32(1): 77-94.
- [33] Wilder RL. Neuroendocrine-immune system interactions and autoimmunity. *Ann. Rev. Immunol*. 1995; 13(1): 307-338.
- [34] Kudielka BM, Butchal J, Uhde A, Wust S. Circadian cortisol profiles and psychological self-reports in shift workers with and without recent change in the shift rotation system. *Biol. Psychol*. 2007; 74(1): 92-103.
- [35] Ribeiro ATG. O papel do ritmo circadiano na fisiopatologia e tratamento de doenças autoimunes. 2019. Tese de Doutorado. Universidade de Coimbra.
- [36] Heiberg T, Kvien TK. Preferences for improved health examined in 1,024 patients with rheumatoid arthritis: pain

- has highest priority. *Arthritis Care Res.* 2002; 47(4): 391-397.
- [37] Lee YC. Effect and treatment of chronic pain in inflammatory arthritis. *Curr. Rheumatol. Rep.* 2013; 15(1): 300.
- [38] Walsh DA, McWilliams DF. Pain in rheumatoid arthritis. *CurrPainHeadache Rep.* 2012; 16(6): 509-517.
- [39] Villeneuve E, Nam J, Emery P. Critério de classificação da artrite reumatoide ACR-EULAR 2010. *Rev. Bras. Reumatol*, v. 50, n. 5, 2010.
- [40] Paolino S, Cutolo M, Pizzorni C. Glucocorticoid management in rheumatoid arthritis: morning or night low dose?. *Reumatol.* 2017; 55(4): 189.
- [41] Naafs MAB. Glucocorticoid chronotherapy: a mini-review. *Endocrinol Metab Int J.* 2018; 6(2): 118-122.
- [42] Nóbrega CBB. Cronofarmacologia: Administração de Medicamentos ao Ritmo Biológico. Tese (Mestrado) – Ciências Farmacêuticas, Instituto Superior de Ciências da Saúde Egas Moniz, 2015.
- [43] Alsaikhan F, ElAziz MAA, Alsubaie M, Aldosari SA, Alhamaad A. Antihypertensive medications and chronopharmacology: role of Saudi pharmacists in patient education. *Int. J. Dev. Res.* 2015; 5(3): 3831-5.
- [44] Otero MJ, Domínguez-Gil A. Acontecimentos adversos por medicamentos: una patologia emergente. *Farm. Hosp.* 2000; 24.
- [45] Kaur G, Gan YL, Phillips CL, Wong K, Saini B. Chronotherapy in practice: the perspective of the community pharmacist. *Int. J. Clin. Pharm.* 2016; 38(1): 171-182.
- [46] Smolensky MH, Peppas NA. Chronobiology, drug delivery, and chronotherapeutics. *Adv. Drug Deliv. Rev.* 2007; 59(9-10): 828-851.
- [47] Paim SMS, Barra DCC, Lanzoni GMM, Knih NS. Aplicação de cronofarmacologia no aprazamento de medicações em Unidade de terapia intensiva. 2019.
- [48] Chen Z. What's next for chronobiology and drug discovery. 2017.
- [49] Youan BC. Chronopharmaceutical drug delivery systems: Hurdles, hype or hope?. *Adv. DrugDeliv. Rev.* 2010; 62(9-10): 898-903.
- [50] Lanzillotti PF. Sistemas para liberação modificada de fármacos. 2012.

Educational Practice in Health: Teaching and Recognition in a Playful Way About Stroke

Wenderson Melo Martins¹, Samily Rocha Guimarães¹, Fabiana Costa Mourão¹, Francimeiry Antunes Santos¹, Matyse Soares dos Anjos Souza¹, Karen Pantoja Oliveira Meireles¹, Edson Seabra da Glória Junior¹, Jéssika Brenda Quaresma de Freitas¹, Adrian Matos de Souza¹, Leandra Nogueira Barbosa¹, Yasmin Cristino Monteiro², Saul Carneiro Gusmão³, André Felipe Assunção⁴, Valdo Freire Ribeiro⁴, Iasmin Ianne Sousa Tavares⁵, Estephany Victoria Oliveira Pinheiro⁶, Luiza Fernanda Ramos Soares⁷, Letícia Barbosa Alves⁸, Gleyssa Lene Nunes Carvalho⁸

¹Nursing students at the University of the Amazon – UNAMA, Brazil

Email: wendersonmartins2204@gmail.com

²Nursing students at the State University of Para – UEPA, Brazil

³Physical education student at the University of the Amazon – UNAMA, Brazil

⁴Pharmacy students at the University of the Amazon - UNAMA, Brazil

⁵Medicine student at the College of Higher Education of Amazônia Reunida – FESAR, Brazil

⁶Dental student at the University of the Amazon – UNAMA, Brazil

⁷Pharmacy student at Federal University of Pará - UFPA, Brazil

⁸Nurse completed the Academic Title of University of the Amazon – UNAMA, Brazil

Received: 29 Sept 2021,

Received in revised form: 13 Nov 2021,

Accepted: 21 Nov 2021,

Available online: 30 Nov 2021

©2021 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 Educational, Prevention, Recognition, Stroke.**

Abstract—*The ascularencephic is a disease in which blood flow is interrupted, being caused for ischemic reasons, when blood flow is obstructed in the vessels, or for hemorrhagic reasons, when the vessels are ruptured, causing hemorrhage in or near brain tissue. Objective: report the experience of members of an academic league of urgency and emergency interactive educational interventions were carried out, using realistic simulation about the identification maneuvers on ascularencephic in the in the municipality Ananideua/PA, Brazil. Method: This is an experience report with a qualitative approach and participatory method, elaborated from actions carried out in extension activities, of the Interdisciplinary Academic League in Urgency and Emergency. Results and Discussions: The educational action proved to be effective in raising the awareness of the participants, aiming to evaluate the efficacy of playful interventions as mediators in health education on the theme addressed. Conclusion: The use of educational practices as a disease prevention strategy is a positive means of strengthening communication with professionals and users of health services through active listenign.*

I. INTRODUCTION

The stroke is a disease in which blood flow is interrupted, being caused for ischemic reasons, when blood flow is obstructed in the vessels, or for hemorrhagic reasons, when the vessels are ruptured, causing hemorrhage in or near brain tissue [1].

It can cause several changes in the metabolic system, such as: ischemia, insufficient energy, acidosis, free radical formation, damage and cell death, being a serious health problem that requires immediate care. The main signs and symptoms are: numbness or weakness in the face, arms or legs, hemiplegia, confusion or changes in mental status, aphasia, visual impairment, abasia, loss of balance or coordination and severe headache [2].

We considered two types of risk factors with regard to stroke, non-modifiable risk factors, such as age, gender, family history among others and modifiable risk factors, which we can intervene to influence, prevent or treat, such as SAH (Systolic Arterial Hypertension); cardiovascular diseases; obesity; bright; smoking, etc. For a pre-hospital evaluation, a rapid test is performed using the Cincinnati Scale, consist in the early identification of the disease, through three ectoscopic parameters that are present in most victims: facial asymmetry, paresis in one or both of the upper limbs and speech alterations suggestive of aphasia, monotonous or dragged speech [3].

Stroke is the second leading cause of morbidity and mortality and occurs predominantly in middle-aged and elderly adults. When it does not lead to death, it causes a partial or complete disability dysfunction, resulting in a series of restrictions on activities of daily living, making the person totally or partially dependent [4]. Stroke the most correct term accepted by health professionals. Since anatomically it can affect the entire brain and not only the brain [5].

A transient type of a stroke is identified when the neurological deficit lasts less than 24 hours, that is, a short-term disorder, and can thus be considered a reversible dysfunction. However, when this dysfunction is long-lasting, that is, if it is maintained for more than 24 hours may result in the installation of permanent and irreversible lesions in the brain leading to the death of a group of neurons [6]. Stroke can occur in two ways: one of them is by occlusion of a vessel, called ischemic stroke, which represents the majority of cases in 85% and the other form occurs by a rupture of the intracranial vessels with extravasation of blood to the brain tissue or to the subarachnoid space, which is called hemorrhagic stroke represented in 15% with systemic arterial hypertension as the main cause [7].

According to Santos et. al [7], in Brazil, 99,732 deaths from cerebrovascular diseases were recorded in 2010, causing the equivalent of 166,000 hospital admissions in 2012. In addition, andprospective in the country, they presented an annual incidence of 108 cases per 100,000 inhabitants [8].

According to Lubini et al. [9] the practices developed from the precepts of the Unified Health System (SUS), as a strategy for prevention and health promotion, include health education. Which proposes the development of dialogued actions, with active and creative participation and that can contribute to the autonomy of users in their condition of autonomy of their health and disease trajectory [10]. Health education is characterized by strategies that focus on the quality of life of the population, because the purpose is to share among individuals, community, social movements and workers the promotion of autonomy and co-responsibility, in order to contemplate the principles of the SUS [11]. Educational practices in health are important instruments to stimulate the principles that govern the notion of self-care, and it is through it that a healthy life is sought. Health education, in addition to proposing alternative paths, also deserves this than for preparing for a critical self-awareness capable of reviewing concepts and values [12].

Therefore, educational practices in health include actions aimed at health promotion, prevention and risk minimization [13]. The promotion of educational practice in stroke, not only passed on the consciousness of the feeling but, as well as teaching actions of rapid conduct when witnessing the symptoms of the stroke, helps in the prevention of future sequelae that may arise. Studies show that about 70% of patients recover faster when urgently attended, as well as decreases the percentage of permanent sequelae [14].

II. METHODOLOGY

This is an experience report with a qualitative approach and participatory method, elaborated from actions carried out in extension activities, of the Interdisciplinary Academic League in Urgency and Emergency (LAIUEM) by students of the league being 12 students of the nursing course and 1 of the bachelor's degree in physical education. Interactive educational interventions were carried out, using realistic simulation about the identification maneuvers on stroke for the target audience of the action that were the patients of the Family Health Strategy Unit, in the municipality of Ananindeua-PA, with an average audience of 40 male and female people.

The educational intervention was carried out through the use of realistic simulation, which is a technique to

stage real situations, reproducing a scenario that allows the previous training of the desired practice [15].

LAIUEM had been invited to provide an educational action of playful strategy, aimed at evaluating the understanding of the population about stroke. The action was carried out in two days, 24 and 26 of November in 2020, in a structured environment for training, with practical scenarios organized.

The following were used as methodological materials and resources: media resource, TV, internet, darts and question board about stroke. The execution and management of all simulation processes were carried out by students from the Nursing and Physical Education course with the guidance and guidance of instructors linked to the Academic League.

The action was divided into two moments. At first, the playful method was performed, where the members of the academic league showed what the is and its complications, such as its diagnosis, treatment, and recognition of victims of stroke. Interactively, with simple communication and clarity for better understanding of participants. Then were invited some of the spectators to participate in a game of questions on the topic lectured, this activity lasted 30 minutes.

The game consisted of a random spectator being selected to throw a dart on a board of subdivisions by area - each of them being represented by a question - these being: "what is stroke?", "What are the symptoms?", "What are the causes?", "What is the treatment?", "How to prevent?", "How to help a stroke victim?", "What are the sequelae of a stroke?" and "How to identify a stroke victim?". Depending on where the individual threw and hit, on the board, he would have a specific question about AVE whose answer was previously taught through an educational lecture, so that learning is reinforced.

III. RESULTS AND DISCUSSION

During the action, the playful method was performed, being at the first moment, the members of the academic league showed what is the stroke and its complications, its diagnosis, treatment, as well as recognizing a victim with a vena, interactively, with simple communication and clarity for better understanding of the participants. After the lecture, some of the spectators were invited to participate in a game of questions on the topic lectured.

Depending on where the individual pitched and hit, on the board, he would have a specific question about stroke whose answer has already been taught previously through an educational lecture, so that learning is reinforced.

The action consisted of the explanation about the stroke, as a concept: the causes, risk factors, diagnosis, treatment and its main forms of prevention. Emphasizing the approach on how to recognize and how to trigger the victim's help in case of a VES. Using the playful method to bring more clarity and dynamism in the activity, encouraging participants to reflect and question about the proposed theme.

The action took part in 10 men and 32 women, the women showed to have more interest in self-care and well-being of health, where it was briefly explained about the care with adequate nutrition, obtain a balanced diet, not to do the use of alcohol or a control of excessive alcohol use, do a physical activity and get out of sedentary lifestyle, are important preventive recommendations to maintain quality of life, regardless of agegroup. At 20 years of age, young people do not usually present at risk, but it is important to start maintaining a healthy life, from 30 to 40 years health care is essential for a healthier senility, it is important to emphasize that stress and smoking are risk factors for a blood loss. From the age of 40 in addition to healthy habits, it is important to make periodic clinical evaluations to monitor and prevent the stroke.

According to Nunes et al. [16], in Brazil, despite the decline in mortality rates, it is still the main cause of death. Botelho et al. [8] the incidence of stroke doubles every decade after the age of 55, occupying a prominent position among the elderly population claims to be the most common cause of neurological disability in the world, thus leading to the great demand for diagnoses, resources and treatments.

In view of the playful activity, the members of the league answered the participants' questions. A relevant public doubt regarding the theme was the identification of the stroke. A video, of an educational nature, was shown to the participants, which granted further clarification. However, the specificities of emergency care were nebulous in the common understanding, although the main one, which is promptness and speed in care, was very well explained with the help of educational video.

The educational action proved to be effective in raising the awareness of the participants, aiming to evaluate the efficacy of playful interventions as mediators in health education on the theme addressed. In view of that, a veal is a disease that generates functional and cognitive dysfunction, personality or behavioral and communication change. These sequelae resulting from the disease generate levels of disabilities, compromising not only the patient, but the family and the community [16].

In the action performed, it was observed that there is a common knowledge about the stroke, however, little

criticality in relation to its causes and treatments. Also showed that most of the individuals who participated in the action showed to know superficially theoretical questions on the subject, however, they obtain experiences experienced by close people and family members who were affected by the stroke, who were voluntarily communicated to the students. This demonstrates, empirically, that the subject in question is present in the local reality. This situation only shows how fundamental the importance, clarification and training of the population to attend to emergency situations is thus avoiding the paralysis of the rescuer when deciding what the next step to follow is. It is added that the population must be able to act in any emergency situation, providing first aid care, thus defining first aid as immediate care provided to the sick person what can be performed by the population when recognizing [17].

In fact, the playful nature of the final moment, where an interactive activity was carried out on the subject, helped to keep the attention of our viewers, however, the dispersion of public attention was evident, although the objective explanations were simple and direct. Siqueira [18] state that educational institutions must present an environment with appropriate structure to the development of recreational activities due to opportunities for spontaneous behaviors, which are established in an integrated way among the cultural socio-cultural elements present. The educational spaces are constantly changing due to the great challenge of ensuring a quality education for all, and that respects the local, ethnic, social, cultural and biological diversity of each individual [19]. Because it is an older audience, interest in the activity was not as receptive as expected.

With regard to treatment, it is necessary that not only is their knowledge common as its practice as well, it is something routine in the daily life of the average man, given that the conditions associated with causes such as smoking, excessive alcohol consumption and obesity, are statistically also customary to the average Brazilian and characterized as a risk factor of the modifiable type [20].

It's understood that the urgency in the care of stroke requires rapid care so that the circulatory alteration is contained as soon as possible avoiding the diffusion of brain damage [21].

Sommer [22] estimates that the more neurons are lost every minute without treatment of the patient of the stroke, the more difficult the recovery of the tissue, therefore, the signals need to be efficiently identified and the care prioritized. There was interest in emphasizing during the presentation, questions related to the main causes of

stroke, which were duly explained, with hypertension and diabetes mellitus being the main objects of clarification.

Most strokes are attributed to high blood pressure, dyslipidemia syndromes and obesity, so stroke is treated as a diverse manifestation of comorbidities and risk factors that need to be analyzed from a multifunctional perspective in individuals' habits as a primary and secondary prevention strategy associated with self-care [23].

It was emphasized by the students showing that adequate, fast and well-structured care for patients with a stroke reduces mortality and morbidity. The results also show an impact on the academic community, since students and ligands of the academic league were instructed to seek up-to-date information and data on the dimension of the theme and oriented about the main forms of prevention to transmit to the target audience.

In addition, public presentations and clarification of doubts proved to be a good exercise for undergraduate students to transmit knowledge in the patient's language, which becomes essential in the development and apprenticeship in the professional relationship of the students of the nursing, physiotherapy, pharmacy, physical education and psychology courses with the patient during the playful action.

IV. CONCLUSION

The objective of educational actions and practices in the health area is to promote the care and prevention of diseases at various levels of complexity through a process of integration of scientific knowledge with the common and popular knowledge of individuals in order to develop a critical view in relation to such healthcare.

The use of educational practices as a disease prevention strategy is a positive means of strengthening communication with professionals and users of health services through active listening, humanized reception, playful practices and other strategies for integration and knowledge building, which also help in academic professional development and improvement

In this sense, educational actions that can positively interfere in the health-disease process and contribute to greater social control in quality of life - through prevention - are fundamental and are foreseen in the main public health policies in Brazil, besides producing an interdisciplinary academic collaboration accessible to the community public.

V. ACKNOWLEDGEMENTS

We would like to thank the members of the Interdisciplinary Academic League of Urgency and Emergency at the University of Amazônia for providing this extremely important action in health for the academic community of Pará.

REFERENCES

- [1] Alves, C. L., Santana, D. S., Aoyama, E. A. (2020) Acidentes Vascular Encefálico em adultos jovens com ênfase nos fatores de risco. *ReBIS*, [s. l.], n.2, v.1, pp. 1-6. Available: <https://revistarebis.rebis.com.br/index.php/rebis/article/view/61/56>.
- [2] Ferreira, S. (2020) Cuidados de enfermagem e a importância do enfermeiro no atendimento ao paciente com Acidente Vascular Encefálico. *Revista Espaço Ciência & Saúde*. 8(1); 1-9. Available: <<https://www.revistaeletronica.unicruz.edu.br/index.php/saude/article/view/289>>.
- [3] Almeida, P. M. V. D (2019) Tradução, adaptação transcultural, validade e confiabilidade das escalas Cincinnati, PrehospitalStrokeScale e Los Angeles PrehospitalStrokeScreen. Tese (Doutorado em Enfermeagem). São Paulo. Faculdade de Medicina, Universidade Estadual Paulista “Júlio de Mesquita Filho.
- [4] Oliveira, G. M. M., Brant, L. C. C., Polanczyk, C. A. (2020) Estatística Cardiovascular – Brasil 2020. *Arquivos Brasileiros de Cardiologia*, São Paulo. n. 115, v. 3, pp. 308-419. Available: <https://www.scielo.br/scielo.php?script=sci_arttext&pid=S0066-782X2020001100308>.
- [5] Braga, G. P. O Acidente Vascular Cerebral pode afetar qualquer um, com qualquer idade a qualquer momento. *Neurodrops*. Available: <<http://www.neurodrops.com.br/artigos/neurologia-vascular/o-acidente-vascular-cerebral-pode-afetar-qualquer-um-com-qualquer-idade-a-qualquer-momento-14>>.
- [6] Gaspari, A. P. (2018) Indicadores da assistência ao paciente com Acidente Vascular Cerebral Isquêmico e Ataque Isquêmico Transitório. Curitiba. Available: <<https://acervodigital.ufpr.br/bitstream/handle/1884/53493/R%20-%20D%20-%20ANA%20PAULA%20GASPARI%20.pdf?sequence=1&isAllowed=y>>.
- [7] Santos, J. V. S., et al. (2017) Os efeitos da capacitação de enfermeiros sobre avaliação de pacientes com Acidente Vascular Cerebral. *Revista de enfermagem UFPE online*. Recife. 11(5); 1763-8. Available: <http://www.revista.ufpe.br/revistaenfermagem/index.php/revista/article/view/8194/pdf_3062>.
- [8] Botelho, T. S., Neto, C. D. M., Araújo, F. L. C. A., Assis, S. C (2016). Epidemiologia do Acidente Vascular Cerebral no Brasil. *Temas da Saúde*. 16 (2); 361 – 377. Available: <<https://temasensaude.com/wp-content/uploads/2016/08/16221.pdf>>
- [9] Lubini, V. T., et al. (2018) Educação em saúde na comunidade: ações extensionistas em uma comunidade do Sul do Brasil. *Extensão em Foco*. n. 1, v. 14. Available: <<https://revistas.ufpr.br/extensao/article/view/36665>>.
- [10] Ministério da Saúde. (2007) Caderno de educação popular e saúde. Brasília: Ministério da Saúde. Available: https://bvsmms.saude.gov.br/bvs/publicacoes/caderno_educacao_popular_saude_p1.pdf
- [11] Ministério da Saúde. (2006) Política Nacional de Promoção da Saúde. Brasília: Ministério da Saúde. Available: https://bvsmms.saude.gov.br/bvs/publicacoes/politica_nacional_promocao_saude_3ed.pdf
- [12] Souza, L. M., Wegner, W., Gorini, M. I. P. C. (2007) Educação em saúde: uma estratégia de cuidado ao cuidador leigo. *Ver Latino-americano Enfermagem*, São Paulo. n.15, v.2, pp. 337-343. Available: <<https://www.lume.ufrgs.br/bitstream/handle/10183/65585/000622229.pdf?sequence=>>>.
- [13] Both, C. T., Werle, M. P., Costa, M. C., et al. (2017) Educação em saúde na estratégia de saúde da família: cuidado por meio de ações dialógicas e interativas. *Anais do I Congresso Internacional de Políticas Públicas de Saúde em defesa do sistema universal de saúde*; 6 a 8 de dezembro; Chapecó (SC), Brasil. Available: <<https://portaleventos.uffs.edu.br/index.php/CIPPS/article/view/7349/4818>>.
- [14] Azevedo, G. V. O., Araújo, A. H. V., Soyza, T. A (2018). Aspectos epidemiológicos do Acidente Vascular Encefálico na Paraíba em 2016. *Fisioterapia Brasil*. n. 19, v. 5, pp. 236-241. Available: <<https://portalatlanticaeditora.com.br/index.php/fisioterapia-brasil/article/view/2628>>.
- [15] Abreu, A. G., Freitas, J. S., Berte, M. et al., (2014). O uso da simulação realística como metodologia de ensino e aprendizagem para as equipes de enfermagem de um hospital infanto-juvenil: relato de experiência. *Ciência e Saúde*. n. 7, v.3. Available: <<https://revistaseletronicas.pucrs.br/index.php/faenfi/article/view/17874>>.
- [16] Nunes, D. L. S., Fontes, W. S., Lima, M. A. (2017) Cuidado de enfermagem ao paciente vítima de Acidente Vascular Encefálico. *Revista Brasileira de Ciências da Saúde*. n. 21, v. 1, pp. 87-96. Available: <<https://docs.bvsalud.org/biblioref/2018/04/883066/cuidado-de-enfermagem.pdf>>.
- [17] Pergola, A. M. A., Muglia, I. E. (2008) O leigo em situação de emergência. *Revista da Escola de Enfermagem da USP*. n. 42, v. 4, pp. 769-776. Available: <https://doi.org/10.1590/S0080-62342008000400021>.
- [18] Siqueira, I. B., Wiggers, I. D., Souza, V. P. (2012) O brincar na escola: a relação entre o lúdico e a mídia no universo infantil. *Revista Brasileira de Ciência e Esporte*, Florianópolis, n. 34, v. 2, pp. 313-326. Available: <http://www.scielo.br/pdf/rbce/v34n2/a05v34n2.pdf>.
- [19] Lima, B. A. S. (2013) O brincar na educação infantil: o lúdico como estratégia educativa. 76f. Monografia (Graduação em Licenciatura em Pedagogia) -Universidade

- de Brasília, Brasília, DF. Available: http://bdm.unb.br/bitstream/10483/4938/1/2013_BrunaAlessandraSilvaLima.pdf.
- [20] Rolindo, S. J. S., Oliveira, L. T., Silva, A. M. S. (2016) Acidente vascular cerebral isquêmico: revisão sistemática dos aspectos atuais do tratamento na fase aguda. *Revista Patologia do Tocantins, Palmas*. n. 3, v. 3, pp. 18-26. Available: < <https://sistemas.uft.edu.br/periodicos/index.php/patologia/article/view/2420>>.
- [21] Gagliardi, V. D. B., Simis, M. Cabeça, H. L. S., et al. (2018) Medical perception of stroke care conditions in Brazil. *Arquivos de Neuropsiquiatria, São Paulo*. n. 76, v. 1, pp. 13-21. Available: < https://www.scielo.br/scielo.php?script=sci_arttext&pid=S0004-282X2018000100013>. [Accessed: 25.11.2020].
- [22] Sommer, C. J. (2017) Clemens. Ischemic stroke: experimental models and reality. *Acta Neuropathologica*. n. 133, v. 2, pp. 145-261. Available: < <https://pubmed.ncbi.nlm.nih.gov/28064357/>>.
- [23] Rodrigues, M. S., Santana, L. F., Galvão, I. M. (2017) Fatores de risco modificáveis e não modificáveis do AVC isquêmico: uma abordagem descritiva. *Revista de Medicina, São Paulo*. n. 96, v. 3, pp. 187-192. Available: < <https://www.revistas.usp.br/revistadc/article/view/123442>>.

The Conditions of Periurban Agriculture in Porto Velho, Rondônia – Brazil: The Chacareiro Setor (2007-2008)

Ana Cristina Teixeira Alves¹, Adnilson de Almeida Silva²

¹Department of Geography, Federal University of Rondônia

²Department of Geography, Postgraduate Program in Geography, University Federal of Rondônia

Received: 29 Sept 2021,

Received in revised form: 15 Nov 2021,

Accepted: 21 Nov 2021,

Available online: 30 Nov 2021

©2021 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— Periurban agriculture, Family agriculture, Agricultural production, Chacareiro Sector, Porto Velho, Rondônia, Brazil.

Abstract— The objective is to analyze the condition of periurban agriculture through agricultural production developed in the Chacareiro Sector, municipality of Porto Velho, Rondônia - Brazil in the 2007-2008 biennium. The methodology used consisted of bibliographic research and the technique of data collection to obtain agrarian and demographic information about the study area in the INCRA Report, Porto Velho - RO, in 2008. Agricultural production is centered on: 30.49% in cassava, 27.65% in polyculture, 24.83% in chickens, 94.32% in natural pasture, produced on properties with up to 0.5 hectares by immigrant farmers, totaling 77.30% and from Rondônia with 22.70%. Peri-urban agriculture is characterized by family, traditional, horticultural agriculture based on basic necessities, aimed especially for consumption and practiced by immigrant and Rondônia farmers in mini-properties on the outskirts of the city.

I. INTRODUCTION

The urban population growth process engenders a progressive demand for food, in addition to this, the issues of poverty, unemployment, hunger and food insecurity still prevailing in humanity, especially in peripheral countries.

One of the strategies to combat this situation is the development of urban agriculture and peri-urban agriculture. This work focuses on periurban agriculture in the city of Porto Velho, in the state of Rondônia, located in the Western Amazon, Brazil. Peri-urban agriculture corresponds to an agricultural social movement developed in the peri-urban spaces of the city, developing on a small scale and making use of unoccupied land, belonging to private or public domains. These backyards and other spaces are used by individual or collective small urban farmers, which may or may not be organized in cooperatives. The main objective of this type of agriculture is to produce food for subsistence and/or commercialization.

The research was carried out in the Chacareiro Sector, located in the East Zone, on the outskirts of the city of Porto Velho, capital of the state of Rondônia. The location corresponds to an area of land occupation, belonging to Francisco Militão, since the late 1990s. Historically it is an area of litigation and conflicts, but despite this situation, 76% of the land is occupied by agricultural lots, presenting a valuation rate and land speculation lower than 25%, according to the sample of forms of respondents by INCRA, in years 2007 and 2008.

Agricultural production is based on traditional family farming, mainly aimed at subsistence, and practiced by immigrant farmers from different regions of Rondônia and Brazil. Predominates the cultivation of essential products such as: cassava, beans, corn and rice; livestock is developed in poultry and swine, among others. The problems identified are diverse and range from the lack of land

title, through difficulties in infrastructure, basic sanitation, availability of equipment for collective consumption, to the problem of urban violence.

The objective of this work is to analyze the condition of periurban agriculture through agricultural production developed in the Chacareiro sector, in Porto Velho, in the state of Rondônia, Brazil in the period 2007-2008.

The research's guiding question focuses on the conditions of periurban agriculture, especially agricultural products cultivated and reared in the Chacareiro Sector, in Porto Velho, Rondônia, in 2007 and 2008.

The area in focus is one of the main hardwood producing areas in the city of Porto Velho and faces infrastructure problems, devoid of collective consumption equipment, such as: electric lighting, paving of public roads, school, square, health center, public transport etc.

There are few data and studies on urban and peri-urban agriculture (AUP) in the state of Rondônia.

II. THEORETICAL REFERENCE

Peri-urban agriculture is one of the strategies to face problems in the city such as hunger, food insecurity, unemployment and urban poverty in the world, and is part of the program and actions of the United Nations Food and Agriculture Organization, FAO -UN in combating this dilemma. In addition to the search for quality of life and sustainability in cities foreseen in the actions and objectives of Agenda 21 and Agenda 30 proposed by the UN - United Nations Organization, in which Brazil is a signatory.

But how is periurban agriculture defined? According to Tivelli (2010, p.7) "periurban agriculture is the cultivation of plants and animal husbandry around the urban perimeter or around cities, aiming at local supply. The workforce resides in the urban environment." In addition to this, forestry is one of the economic activities developed in periurban agriculture, which exploits forest products such as wood, aromatic resins, cupuaçu, andiroba, açai palm, açai, tucumã etc. Other activities developed are floriculture and honey production.

The aforementioned author differentiates between rural and peri-urban agriculture:

The most important fact in peri-urban agriculture that differentiates it from rural agricultural production is that the former is integrated with the urban economy and the

environment of cities. Urban and peri-urban agriculture are embedded in the urban ecosystem and actively interact with it. (2012, p. 2).

Peri-urban agriculture absorbs urban labor, usually residing on the outskirts of cities, and its production is stored, marketed, distributed around it and in the city center. Thus, both labor and agricultural production are geared towards the urban environment. Food supply is exclusively to meet the needs of the consumer market in cities with fresh and perishable products, such as: vegetables, fruits, vegetables, meat, honey, flowers, etc.

First, the food supply is for the farmer and his family, the surplus may or may not be traded.

The Agriculture Committee of FAO-UN, Food and Agriculture Organization of the United Nations (sa, p.5) characterizes peri-urban agriculture: "Peri-urban" agriculture, as used here, refers to farm units close to town operate intensive semi- or fully commercial farms to grow vegetables and other horticulture, raise chickens and other livestock, and produce milk and eggs." Periurban agricultural production occurs intensively or semi-intensively due to the small territorial extension, usually and the horticultural agricultural activity that develops in small spaces.

Periurban agricultural production regarding the use of fertilizers and pesticides can be of organic origin with the use of branches, leaves, animal excrement etc. or of chemical origin, which are normally industrialized and toxic products. Agricultural pollutants are a dilemma to be faced in favor of sustainability and quality of urban life.

The territory of peri-urban agriculture is a transition band from rural land to urban land due to the geographic proximity of the city, the urban perimeter, the periphery and the influence of the urbanization process.

As for the land structure, it is generally characterized by lots, sites, farms, land properties territorially smaller in size than rural properties, they are mini properties of 0.5 ha, 1 ha up to 5 hectares, which may be smaller or larger in size in some cases. It is worth noting that periurban agriculture can be explored on medium and large rural properties, but as a rule, it is explored on mini properties through family farming. And the producer's condition varies, he can be land owner, small producer or not, tenant, land occupant, sharecropper, etc.

Family farming as a destination can be subsistence or commercial and employ a small number of

agricultural workers on a temporary or permanent basis. Most cases of periurban agriculture are geared towards subsistence, in some cases the surplus is sold at street markets, to middlemen, grocery stores, butchers, supermarkets, consumers and restaurants.

Peri-urban agriculture contributes to food security or reducing food and nutritional shortages for farmers involved in its production. It is a strategy to fight hunger in the world advocated by civil society, the UN-FAO, non-governmental entities and the Public Power. Periurban agricultural work dedicated to production can be integral or complementary to other professional activities.

The object of study of this work consists of the conditions of periurban agriculture in the Chacareiro sector of the city of Porto Velho, in the state of Rondônia, located in the Western Amazon of Brazil, which borders Bolivia.

By conditions of peri-urban agriculture we understand how the agricultural framework in the study area was in the years 2007 and 2008, with regard to cultivated products, collected forest products/plant extraction, eggs and the creation of small animals, the agrarian structure, the farmer's profile, type of housing and local infrastructure. This information was collected in the forms contained in the Report of the National Institute of Colonization and Agrarian Reform of Porto Velho – RO, for the years 2007 and 2008.

The spatial focus of this study is the Chacareiro Sector located on the outskirts, in the East Zone of the city of Porto Velho, an area of land occupation since 1999, and over the years it has been gradually occupied.

With regard to land use, there is a diversity of functions, such as: agricultural production, housing, riparian vegetation cover of the PiriQUITOS river.

Regarding the generation of employment and income with horticulture through urban and peri-urban agriculture, the FAO-UN(2012, p.1) states that:

Urban and peri-urban horticulture offers a way out of poverty. It has low start-up costs, short production cycles and high yields per unit of time and unit of land and water. Its products have high commercial value. Because it

is labor intensive, horticulture creates jobs, particularly for newcomers from rural areas. Of the 800 million people engaged in urban and peri-urban agriculture worldwide, 200 million produce for the market and employ 150 million people full-time.

In addition, peri-urban agriculture provides employment and income for the unemployed with low income and education who are excluded from the labor market, especially those of rural origin who have recently arrived in the city and who live on the outskirts of cities. In the Chacareiro Sector and other areas of peri-urban agriculture around the world, they offer employment to rural and urban workers. Urban agricultural production is carried out by farmers of rural and urban origin.

Periurban agriculture offers economic advantages in terms of business, such as: the need for low capital and high income in a short period of time, in addition to intensively absorbing labor, generating more job opportunities and contributing to the reduction of urban poverty, sustainability and economic development of the city.

III. RESULTS

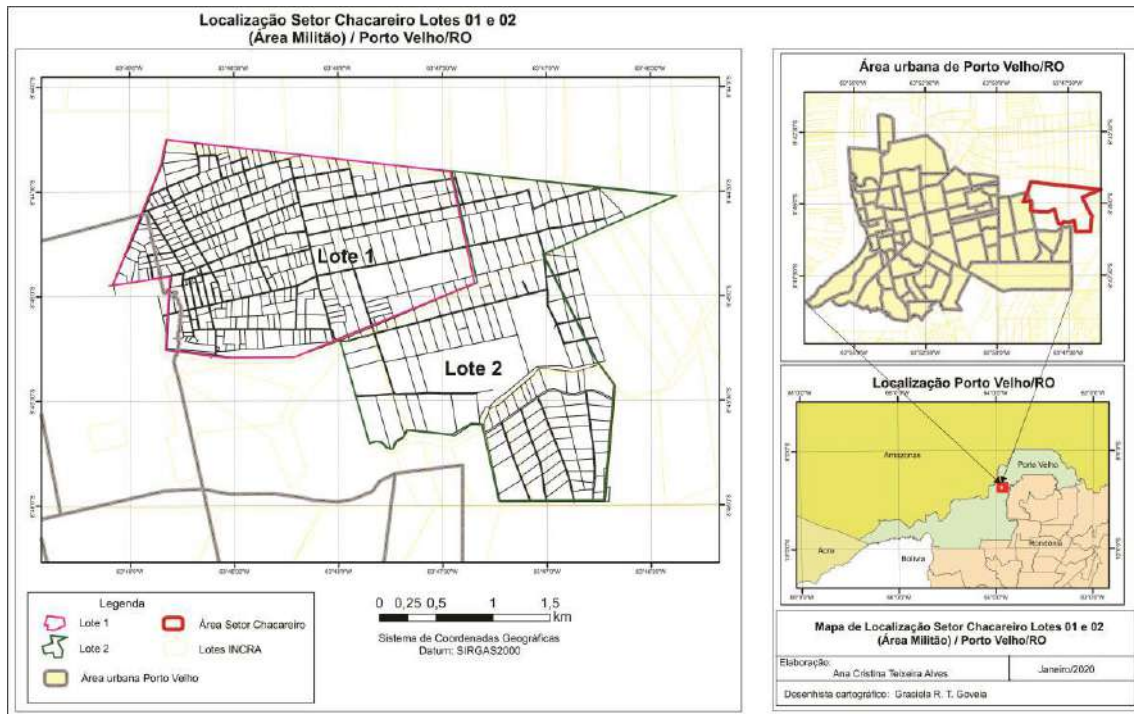
3.1 - The Farming Sector of Porto Velho, Rondônia

The information displayed here was organized from the data tab contained in the forms of the INCRA Report of Porto Velho-Rondônia, on the study area, referring to the years 2007 and 2008.

The Chacareiro Sector is an area of land occupation and owned by Mr Francisco Militão. The occupation process started around the year 1999, and some farmers claim that it was in the year 2000.

The study area is located on the outskirts of the city of Porto Velho, in the East Zone, in Rondônia, in the Western Amazon – Brazil and borders Bolivia, see Map 1. The East Zone is one of the most populated planning regions, address from the working class, far from the city center and which has been undergoing an intense process of urbanization.

Map 1 – Location of the Chacareiro Sector, Lots 1 and 2, in Porto Velho - RO

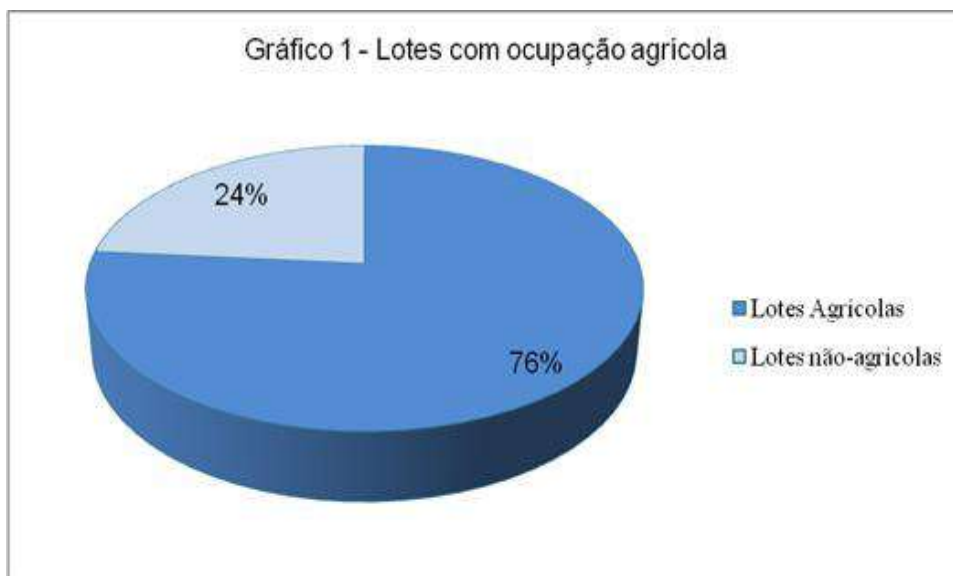


Source: INCRA Porto Velho – Rondônia, adapted by Ana C T Alves, 2020.

The Chacareiro Sector is an area that produces basic foodstuffs, centered on family farming, located outside the urban perimeter and faces increasing pressure from urbanization. It is an area of agrarian conflict, of litigation in which both the landowner and the occupants have tried to regularize land tenure for decades with the Public Power.

Observing Graph 1, it can be seen that 76% of the lots occupied by residents or not, had agricultural activity, demystifying the issue of speculation real estate. Despite the existence of some unoccupied land in the place, this is not exclusive to the area, given that the same occurs in other neighborhoods in the municipality of Porto Velho and in Brazil, in general.

Graph 1 - Lots with agricultural occupation



Source: INCRA, 2007 2008. Organization: Ana Cristina Teixeira Alves.

The use of land occupied in the Chacareiro Sector (76.0%) predominates the function of agricultural production and housing. As for the 24% of unoccupied soil, a portion of it is occupied by a vegetation cover present in some lots and in the gallery forest on the banks of the Piriquitos river.

The Chacareiro Sector is located (12 km) twelve kilometers from the city center of Porto Velho, outside the urban perimeter. However, it limits this perimeter. And it

is characterized by an area of farms that is under pressure from urban expansion and land subdivisions for the purpose of distribution to family members or friends and even for sale in smaller lots.

Added to this is the existence of unoccupied lots occupied by residents who do not carry out agricultural activities but urban professions, such as public servants, see table 1 and other professions.

Table 1 - Exercises public function, according to gender

Civil Service / Gender	Yes		No		Total	
	Freq.	%	Freq.	%	Freq.	%
Male	04	2,83	62	43,97	66	46,81
Female	03	2,12	40	28,36	43	30,49
No information					32	22,70
Total					141	100,00

Source: INCRA-RO, 2007 and 2008. Organization: A.C.T. Alves.

As it can be seen, Table 1 presents information obtained from the question on whether “Exercises a Public Function, according to Gender”.

Only 4 men and 3 women stated that they held public functions at the time, being less than 6% of the sample. 62 men and 40 women answered “no” and

together they make up more than 72% of this set of respondents. Another 32 forms were “no information” and represent 22.69% of the sample. It should be noted that there were also traders in the area, in addition to public servants, but they were an insignificant number compared to the land occupants.

Table 2 - Directly explores the area and has residence in the property

Direct exploration of the residence area				Residence area in the property				Total	
Yes		No		Yes		No			
Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
96	68,09	12	8,51	47	33,33	61	43,27		
No information								33	23,40
Total								141	100,00

Source: INCRA-RO, 2007 and 2008. Organization: A.C.T. Alves.

Faced with the question about “direct exploitation of the Area” and having “Residence in the Property” (Table 2), 33 forms did not present such information. However, of the 96 respondents who directly explored the area, 61 (43.26%) stated that they did not have residence in the

property at the time. Older farmers report that it was dangerous to live in the place due to violence, urban crime, in addition to few neighbors close to their residence and a lot of forest. Farmers were somewhat isolated and there were few side lines or roads.

Table 3 - Number of people residing in the property and number of people who work on the property

Number of People Residents of the Property	Freq.	%	Number of people who work on the property*			
			01	02	03	04
01	12	8,51	10	04	--	--
02	10	7,10	04	05	--	--
03	12	8,51	02	02	07	--
04	06	4,26	--	02	01	01
05	07	4,97	01	03	01	--
09 **	01	0,70	--	--	--	--
No Information	93	65,95				
Total	141	100,00	18	18	12	05

Source: INCRA-RO, 2007 and 2008. Organization: A.C.T. Alves.

* há trabalhadores que não residem no imóvel.

** o entrevistado

As for the topic "Number of people residing in the property and number of people working in the property", (Table 3), 93 forms did not present information, which represents 65.95% of the sample. Of those who responded, it appears that the number of people living in the property is greater, ranging from 1 to 5 people. In one case there were 9 members in a single property. working on the property varies more between 1 to 3 members – this suggests that many could be children without proper age for this type of work.

Table 4 - Existence (work) of Home Care Homemade

Homemade	Frequency	%
Yes	17	12,05
No	81	57,45
No Information	43	30,50
Total	141	100,00

Source: INCRA-RO, 2007 e 2008. Org.: A.C.T. Alves.

The Table 4, "Existence (work) of Home Care", 81 respondents (57.44%) answered "no", 43 forms did not indicate such information (30.49%) and only 17 (12.05%) answered yes, demonstrating that the vast majority worked directly on their lots. This breaks down the common thought that the occupants wish to obtain land, aiming at its future commercialization, a form of land speculation that prevails in Porto Velho.

Table 5 - Form of Obtaining the Land, according to the type of receipt

Obtaining the Land	Freq.	%	Land Voucher declared	
			Receipt	.without Documentation

Occupation	24	17,03	--	24
Assignment	02	1,41	--	02
Purchase*	27	19,15	11	15
Donation *	07	4,97	--	--
Settlement by the Association *	35	24,83	01	30
Withdrawal (from third parties)	01	0,70	01	--
Exchange of goods	02	1,41	02	--
No Information	43	30,50		
Total	141	100,00		

Source: INCRA-RO, 2007 e 2008. Org.: A.C.T. Alves.

* not all respondents informed what type of proof of land they have.

Regarding the "Form of Obtaining the Land, according to the type of receipt" (Table 5), most were settled by Association (35), followed by those who bought (27) and those who occupied (24), in addition to other forms as well. less indicated. However, the highest rate, representing 30.49% of the sample – 43 respondents, did not present such information. As for the receipt, it is observed that few claimed to have a receipt (around 10%), while the others, all those who occupied it, most of those who bought or were settled by association, were undocumented (more than 50% of the sample).

It should be noted that all tables prepared in this context present a significant amount of "no information" forms, through the organization of this sample related to the Occupational Survey of Mr. Militão's Area carried out by INCRA, between 2007 and 2008.

Source: INCRA-RO, 2007 and 2008. Organization: A.C.T. Alves.

The "Year of Current Occupation" (Table 6) was not answered by 31.20% of the sample. Among those who reported, the years mentioned were from 1999 to 2008, highlighting the year 2007, with 37 participants (26.24%), followed by 2004 with 13 (9.21%). It is observed that the year with the highest frequency of occupation of the area was 2007, exactly in the year that INCRA, at the request of the Public Ministry, carried out a registration of the occupants and generated a report.

Table 6 – Year of current occupation

<i>Year</i>	<i>Freq.</i>	<i>%</i>
1999	02	1,42
2000	10	7,10
2001	06	4,25
2002	03	2,12
2003	11	7,80
2004	13	9,22
2005	05	3,55
2006	09	6,39
2007	37	26,25
2008	01	0,70
No information	44	31,20
Total	141	100,00

Table 7 - Property location by street or rural line

Street or rural line	Freq.	%
Rua Raimundo Cantuária	25	17,74
Linha SantaTerezinha	04	2,84
Linha Mineiros	06	4,26
Linha Santarém	04	2,84
Linha Madre Paulina	18	12,77
Linha Costa Dias	12	8,51
Linha Afonso Brasil	04	2,84
Linha Paniago	01	0,70
Linha Salvador Lira	01	0,70
Linha 01	02	1,41
Linha 02	05	3,55
Linha 03	01	0,70
Linha Vinicius de Moraes	01	0,70
Linha Pastor Tavares	03	2,13
Linha Pé de Cedro	05	3,55
Linha Afonso Silva/Mineiros	01	0,70
Rua Airton Dias	01	0,70
Rua Três Amigos	03	2,13
Linha Jerusalém	10	7,14
Linha Pastor Leon Cruz	01	0,70
Linha Nova Aliança	02	1,41
Linha São Lázaro	01	0,70
Linha dos Piriqitos	11	7,81
Linha Kabutiá	01	0,70
No information	18	12,77
Total	141	100,00

Source: INCRA-RO, 2007 and 2008. Organization: A.C.T. Alves.

Table 7 shows a spatial concentration in the Raimundo Cantuária street (17,7%) and Madre Pauline line, due to easy access and proximity to bus stops, the primer street. The concentration of agricultural production and settlement are concentrated on Raimundo Cantuária street and Madre Paulina line.

Table 8 - Area explored per hectare (ha)

Exploration (ha)	Frequency	%
0,01	01	0,70
0,05	06	4,27
0,10	02	1,42
0,15	01	0,70
0,20	02	1,42
0,25	05	3,56
0,30	03	2,14
0,32	01	0,70
0,35	01	0,70
0,40	03	2,14
0,50	15	10,66
0,60	02	1,42
0,75	03	2,14
0,80	01	0,70
0,85	01	0,70
1,00	06	4,27
1,20	01	0,70
1,30	02	1,42
1,40	02	1,42
1,62	01	0,70
2,00	02	1,42
2,25	01	0,70
2,60	01	0,70
2,68	01	0,70
2,83	01	0,70
3,00	02	1,42
3,60	01	0,70
6,04	01	0,70
No information	72	51,08
Total	141	100,00

Source: INCRA-RO, 2007 e 2008. Organization: A.C.T. Alves.

The "Logged area per hectare (ha)" (Table 8) demonstrates a very large diversity, with a predominance of fractions of hectares, with the apex being the 0.50 ha option, cited by 15 respondents and representing 10.63% of the sample .

Most of the occupants reside in lots with a smallholding of up to 5 (five) hectares. dimension smaller than a rural module, site and

Table 9 - Hectares of areas explored by crops

Hectare (ha)	Crops */ Frequency					Sum
	Cassava	Beans	Corn	Rice	Miscellaneous	
0,01	01	--	--	--	03	04
0,02	01	--	--	--	--	01
0,03	03	--	--	--	--	03
0,05	06	01	04	--	10	21
0,10	01	01	--	--	01	03
0,13	01	--	--	--	--	01
0,15	07	02	--	--	--	09
0,20	04	--	--	--	--	04
0,25	01	02	01	--	--	04
0,30	06	--	--	02	--	08
0,37	--	01	--	--	--	01
0,40	--	--	--	--	01	01
0,45	03	--	--	--	--	03
0,50	07	01	01	--	08	17
0,60	04	--	01	--	--	05
0,70	02	01	--	--	--	03
0,80	01	--	--	--	--	01
1,00	03	--	02	--	--	05
1,12	01	--	--	--	--	01
1,50	03	--	--	--	--	03
1,75	01	--	--	--	--	01
1,80	02	--	--	--	--	02
No information						50
Total						151

Source: INCRA-RO, 2007 and 2008. Organization: A.C.T. Alves.

* Of the respondents who answered the question, some reported more than one type of culture.

In Table 9, it can be observed, regarding the “Type of Crop (cultivation) per ha”, that of the vegetables, cassava was the main highlight, having been mentioned by 43 respondents (30.49%). As for fruit production, 39 participants (27.65%) plant different crops, although the number of forms without information was also significant — 45 participants, totaling 31.91%.

Forms without information are formed by urban dwellers, farmers without production or not collecting data during field research.

Cassava's rusticity, its consumption is widespread in the Brazilian rural area, known as the “poor's bread”. It is a typical family farming crop, and usually cultivated by the peasant along with other agricultural products, such as beans, corn and rice. In addition, cassava stands out in the

Amazon region as a diet, according to Josué de Castro (1984, p.53):

The Amazon region represents, from an ecological point of view, a unitary type of food area that is very well characterized, having cassava flour as a basic food". In regional consumption of water flour with

fish, and added to açai wine, in addition to different culinary uses.

FAUSTO (1995), states that at the time of the Factories, in the 16th century, the indigenous people produced water flour and bartered with the Portuguese in search of products such as mirrors, pocket knives, daggers, etc.

Table 10 - Pasture per hectares (has)

Type of pasture Hectare(s)	Quantity per property					Freq.	%
	0,24 ha	0,60 ha	0,80 ha	1,00 ha	2,30 ha		
Brachiarão	01	--	--	02	01	04	2,84
Kikuyo	--	01	01	01	01	04	2,84
Without kikuyoe and brachiarão						133	94,32
Total						141	100,00

Source: INCRA-RO, 2007 and 2008. Organization: A.C.T. Alves.

As for "Pasture per Hectare" (Table 10), in 134 forms (95.03%) there was no pasture, 2.83% of the sample cited Quicuio and only 2.12% mentioned Brachiarão. It is worth noting that 95.3% without pasture means that it did not have Kikuyo and Brachiarão pasture plantations, but engaged in other agricultural activities, in addition to cases

of raising animals in natural and non-planted, cultivated pastures. From the "Type of rearing per head" (Table 11), 81 forms (57.44% of the sample) were without rearing, but of those mentioned, the chickens mentioned by 34 respondents (24.11% of the sample) predominated, reared in quantities small (under 50 heads).

Table 11 – Type of creation per head

Type of creation	Heads (unit)									Freq.	%
	Até 25	26 a 50	51 a 75	76 a 100	150	250	290	500	5000		
Poultry (Chicken)	13	15	02	02	01	01	01	--	--	35	24,83
Birds (Ducks)	01	06	--	--	--	--	--	01	--	08	5,68
Pigs	08	--	--	--	--	--	--	--	--	08	5,68
Goats	01	--	--	--	--	--	--	--	--	01	0,70
Horses	02	--	--	--	--	--	--	--	--	02	1,41
Bovine	01	01	--	--	--	--	--	--	--	02	1,41
Tilapia	--	--	--	--	--	--	--	--	02	02	1,41
No creation										83	58,88
Total										141	100,0

Source: INCRA-RO, 2007 and 2008. Organization: A.C.T. Alves.

Obs. One of the producers has more than one type of creation.

Poultry predominates over other creations, including cattle raising. Since that creation is a typical indicator of urban and peri-urban agriculture, farm farming is intensive or extensive. The last animals are raised free in the pasture, in a traditional way.

Table 12 – Place of birth by State of the respondent

Place of Birth/State	Attendance	%
Rondônia (Porto Velho)	17	12,06
Rondônia (interior)	15	10,64
Amazonas	06	4,26
Acre	06	4,26
Mato Grosso	04	2,84
Mato Grosso do Sul	02	1,42
Maranhão	03	2,13
Minas Gerais	01	0,70
Bahia	02	1,42
Rio Grande do Sul	01	0,70
Pará	02	1,42
Ceará	04	2,84
Paraná	07	4,97
Piauí	03	2,13
Pernambuco	01	0,70
São Paulo	03	2,13
Paraíba	01	0,70
Tocantins	01	0,70
Rio de Janeiro	01	0,70
No information	61	43,28
Total	141	100,00

Source: INCRA-RO, 2007 and 2008. Organization: A.C.T. Alves.

The “Naturality of the Respondent” (Table 12) was diversified, predominantly those born in Porto Velho (17 – 12.05%), followed by those from the countryside of Rondônia (15 – 10.63%). 61 forms were without this information and represent 43.26% of the sample. Of the respondents from other states, Paraná (7 – 4.96%), Amazonas and Acre (both with 6 – 4.25%) stood out. The forms without information occurred because the birthplace was extracted from the identity card, not all occupants attached this document, and we also carried out a sample to identify the birthplace. In the 1970s and 1980s, the heyday of official colonization in the State of Rondônia, there was a predominance of southerners, with the Paraná and Gauchos standing out, compared to the Rondônia.

Immigrants from Paraná and Rio Grande do Sul face several land tenure problems, such as: land concentration, land subdivision between descendent family members with fractioning in micro-properties smaller than the size of a minifundio insufficient to guarantee the family's sustenance, agricultural mechanization, frost and others.

IV. CONCLUSION

The Chacareiro Sector, despite being located on the edge of the urban perimeter and suffering the influence of urban expansion, shows that 76% of land use is agricultural. This area is a transition space between the rural and urban areas, constituting a suburban area. And it

has been under pressure from the urbanization process due to urban expansion, population growth and being located close to the urban perimeter. Family farming is the one existing in the place, practiced with traditional agricultural technique by immigrants and people from Rondônia in small farms, small properties smaller than 1 (one) hectare. Agricultural production has a horticultural vocation, based on the cultivation of vegetables, fruit and poultry farming, to a lesser extent on vegetables, hardwoods, swine, floriculture, beekeeping, forestry and fish farming.

REFERENCES

- [1] ALVES, Ana Cristina Teixeira. The Chacareiro Sector. In: Urban agriculture in Porto Velho, Rondônia: the Chacareiro sector. UNIR, Department of Geography. Porto Velho, RO, 2016.
- [2] CASTRO, Josué de. Geography of hunger, the Brazilian dilemma. Rio de Janeiro. Ed. Civilização Brasileira, 2008.
- [3] FAO - Food and Agriculture Organization of the United Nations. Urban and Peri-urban Agriculture. Available at: https://www.fao.org/unfao/bodies/coag/coag15/x0076e.htm#P106_11554. Accessed on November 8, 2021.
- [4] FAUSTO, Boris. History of Brazil. São Paulo. EDUSP, 1995.
- [5] NATIONAL INSTITUTE FOR COLONIZATION AND AGRARIAN REFORM (INCRA). INCRA report, survey on the landed property of Mr. Francisco Militão. Porto Velho, Rondônia – Brazil: INCRA, Porto Velho – RO, 2008.
- [6] TIVELLI, S.W. Urban and peri-urban horticulture. Available at: <http://www.aptaregional.sp.gov.br>. Supply Secretariat of the Government of the State of São Paulo. 2010. Accessed on: November 8, 2021.
- [7] _____. Urban and Periurban Agriculture: Which model do we want and what can we do? Research & Technology, vol. 8, n. 2, Jul-Dec 2011.

Augustin Ngom Jua: Political Development in Cameroon 1961-1972

Suh Hillary Sama

Department of History and Archaeology, Faculty of Letters and Social Sciences, University of Dschang, Cameroon.

Received: 01 Oct 2021,

Received in revised form: 10 Nov 2021,

Accepted: 20 Nov 2021,

Available online: 30 Nov 2021

©2021 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— Juas, Political, Development,
Achievement, Failures, Consequences,
Biography, Reunification.**

Abstract— *This article on the political figure A N Jua seeks to give the Political career of this Cameroonian actor in the political scene, most especially his government from 1961-1972. Here, we shall state the circumstances that led to his appointment, the achievement and failures of Augustin Ngom Jua's government not forgetting the consequences of the fall of Jua's Government, these prove his input to the Cameroonian People. Of importance is his Biography and private life, how it affected his political input in Cameroon from 1961-1972, his contribution or role to the reunification of Cameroon.*

Generally, Augustin Ngom Jua contributed immensely for the reunification of Cameroon, was the need at the time, he supported the Ahidjo government along with John Ngu Foncha, Hon. Francis I W Nkwain to build Cameroon as we see today.

This paper material is elaborated with the help of archives materials, documents and interviews from diverse libraries and personalities on bases of questions and answers and discussions. Actually, this actor contributed very much in Cameroon Political Development from 1965-1968.

I. INTRODUCTION

Augustin Ngom Jua a pro-unification Southern Cameroonian politician from the Grassfield advocated against EML Endeley.¹ For integration with Nigeria, alongside with Dr. John Ngu Foncha and their Kamerun National Democratic Party (KNDP). Jua who originated from the Grassfield Bamenda developed a charismatic personality which took him to his higher height through his withdrawal from the Kamerun National Council and Endeley as a leader and alongside with John Ngu Foncha in 1953 formed the Kamerun National Democratic Party (KNDP) replaced Foncha as Prime Minister of West Cameroon after handling the post of minister of West Cameroon and had support from within and outside. Jua became too strict in handling state affairs. This actually

reduced his stability in his political career which at this moment he was to be flexible and dynamic with his fellow Cameroonian brothers which he advocated to reunite with in 1961. All these tantamount to his failure in his political development. But viewing the political figure he gave much to the Cameroonian people because he was at the fore-front of secession and reunification of Southern Cameroon and the Republic of Cameroon, thanks to this political figure for his input. Here, our question goes thus who was Augustin Ngom Jua and what role he played in the political development of Cameroon from 1961-1972? To answer this question, it will be interesting to examine the Biography of Augustin Ngom Jua, his political Development: the Kamerun National Democratic Party (KNDP), Jua's achievements in West Cameroon and

¹ Interview with Mr. Mvouma Tankoh at Mankon Bamenda Feb 2011.

finally, his failures and fall from power in Cameroon political arena.²

II. BACKGROUND HISTORY OF CAMEROON

As history predicts or proves, Cameroon that shall forever remain Cameroon desired no agitation from whosoever is reasonable, only organization like the United Nations can alter her verdicts to this situation. The state of Cameroon has undergone some metamorphosis, that is, it has pass from one stage to another. Therefore, to identify Cameroon, one can actually start when the Portuguese visited the coastline purposely for exploration and trade. But before the said mentioned, the Egyptians and Carthaginians had visited the coastal regions of Cameroon under the auspices of Pharaoh Nacho II and Hano respectively.³ Other European countries later followed, that sprang the history of the scramble and annexation of Cameroon as a colony were, Britain, France, Spain, Dutch, Belgians and the Germans. Here, it should be noted that before 12 July 1884 when the German finally annexed Cameroon, the region that later became the German protectorate of Kamerun consisted and convened several independent indigenous polities varying in size and administrative system. These societies and their polities were highly jealous and each protected her independence.⁴ Considering the mad rush, the Germans became more interested and quickly, they colonised Cameroon and settle between 1884-1914. The First World War finally ousted the Germans out of Cameroon in 1916.⁵ The single administration or polity implemented to administer Cameroon thus led to the foundation for Kamerun identity and its citizens are claimed by some personality or people. As event continued to unfold Cameroon identity was later modified because at the end of the First World War, France and Britain conquered Cameroon under the Germans which permitted them to jointly govern. The areas under Germans still had their identity. On the Cameroon scene, these areas occupied by the allied powers and joint administration under the Anglo-French condominium were announced andenforced or implemented. Under General Dubell and Agmerich declaration, the division of the territory was effectuated on the 17th of March 1916.⁶ The two spheres of influence by

Britain and France became League of Nations mandatory territories in 1922 where the British gained 1/5 of the territory. After the Second World War these territories were transformed to United Nations Trusteeship because of the collapse of the League of Nations in 1939 by Hitler attack on Poland. The league was incapable to stop Hitler`s intentions. The British area of occupation was divided into two; Northern and Southern Cameroons.

Northern Cameroon was administered as an integral part of the Northern Regions of Nigeria while Southern Cameroons was administered as an integral part of the Eastern Region of Nigeria. The French sphere of Cameroon was administered in association with the French Equatorial African colonies. In 1953, Southern Cameroon witnessed political, economic and Social crisis in the Eastern region of Nigeria. In 1959 this region became of Nigeria which was transformed into a full region of the Federation of Nigeria in 1959. Hence, the French and British spheres had two different political administrations. Definitely, the three sections; British Northern Cameroon and French Cameroon had nothing to do with one another administratively from its inception under foreign influence.⁷ But after, in 1954 Dr. Emmanuel Mbela Lifafe Endeley, a medical officer, who became a political figure in the 1930s advocated for succession. Augustin Ngom Jua with John Ngu Foncha championed Evolutionary Reunification. Furthermore, Ndeh Ntumazah and supporters desired immediate Reunification. The greater population of the indigenous inhabitants of Mamfe, Bamenda, Wum, Kom, and Nkambe wanted succession, they supported A N Jua and Foncha who campaign and are the leaders of the Kamerun National Democratic Party (KNDP).⁸ In October 1959, leaders of the KNDP and CPNC were pressured to hold a plebiscite not later than March 1961 in which Southern Cameroonians shall decide if to integrate with Nigeria or vote for secession from Nigeria. In a confidential latter from Durand, delegate to the French High Commission in French Cameroon, to his British counterpart, E. Haworth, dated May 1959. It was revealed that Ahidjo was exceedingly concerned with putting a new country on its feet and his intension to preserve a properly independent state of the Cameroons outside any Union or Federation and the question of

² Interview with Mr. Mvouma Tankoh at Mankon Bamenda Feb 2011.

³ <http://crawfurd.dkHomepage> March 1st, 2010

⁴ V.G Fanso; *Cameroon History for Secondary Schools and Colleges. Vol 2, The colonial and post-colonial periods.* Macmillan, Cameroon. 1989. P.14

⁵ Ibid p 54-56

⁶ Lovett Z. Elango; "The Anglo-French condominium in Cameroon, 1914-1916; The myth and the Reality" International Journal of African Historical studies. 1985, p.659 and Louis Paul

Ngongo; *Histoire des Forces Religieuses au Cameroun: de la Premiers Guerre Mondiale à l'Independence 1916-1955.* Karthala, Paris, 1982 p, 15

⁷ Bongfen chem.-langhee, "The Road to the unitary state of Cameroon 1959-1972." In *Annals of the Faculty of Arts, Letters and Social Sciences, Series Science Humaines*, volume VI, N° 1 et 2. Janvier –Juillet 1990, p.6.

⁸ Francis I.W. Nkwain; *Cameroon: High Grounds for National Unity and peace*, Maryland Printers, Bamenda, 2008 p,33.

reunification was not of urgency. Ahidjo and Foncha received invitation to attend the Pan-Cameroonian Students Congress that was to take place in Yaounde on 22 of August 1959, Foncha, did not attend because he was aware of the opposition as an objective in UPC manifesto to be applied in the conference against the French High Commissioner to Cameroon, Xarie Torre. Foncha's message, he tenders in to the conference expressed his position for secession from Nigeria, which stated that anybody who makes reunification a condition for secession is an enemy working in favour of integration in the Nigerian federation. Later the atmosphere was set for a plebiscite of 10-11 of February 1961, that it will prove or show a better side for Southern Cameroonians. Jua played a glaring role to ensure that reunification is attained by all means.⁹

Under the chairmanship of Sir Sidney Phillipson, the participants failed to agree on either the alternatives question for voting.¹⁰ The KNDP under Foncha and Jua and the KNC-KPP delegates, once more, returned to the UN (United Nations) and after heated debates, they finally agreed in October 1959 on the Plebiscite questions and an eleventh hour meeting in London in November 1960 failed to alter the plebiscite questions.¹¹ They campaign widespread by requisitioning alignment with the one Kamerun angle CPNC in re-unification circles. Jua forge ahead with John Ngu Foncha and eradicate blackmail and slander intended to destroy the chances of the KNDP victory. Finally, the result in British Southern Cameroons shared a landslide victory for the KNDP, with 233, 571 vote as against 97, 741 for the CPNC. The result of Southern Cameroons faced togetherness again with their brothers of la Republique du Cameroun. A federal system was put in place as confirmed by the Foumban Conference of 1961 after French Cameroon and British Cameroon were already independent in January 1st 1960 and October 1st 1961 respectively.¹²

III. BRIEF BIOGRAPHY AND POLITICAL DEVELOPMENT OF AUGUSTIN NGOM JUA 1961-1972

A- Brief Biography

Augustin Ngom Jua was born in 1924 at Kom. After his primary and secondary education, he took up a teaching job and became very active in politics as from 1952. His

⁹ Ibid. p.29-30.

¹⁰ Victor Julius Ngoh, *History of Cameroon since 1800*. Press print, Limbe 1996, p, 214.

¹¹ Ibid.

¹² Claude Welch Jr; *Dream of unity: Pan Africanism and political Unification in West Africa* (New York, Cornell Universitypress, 1960) p. 231.

political career actually started when he joined the Kamerun National Congress KNC that was founded by Endeley in 1953. In 1954, Jua and Foncha withdrew from the KNC due to the fact that Endeley, its leader, was trying to deviate from the original aims of the party.¹³ In June 1955, Jua and Foncha created the KNDP with the aim of withdrawing the Southern Cameroons from Nigeria and reunifying the territory with the French Cameroon. During the 1959 elections, Jua contributed greatly in manipulating the Kom Traditional women's society, "Anloo" to unseat the KNC in the Kom area. In 1961, he was appointed Secretary of state for finance in the government of west Cameroon and in May 1965 he succeeded Foncha appointed by President Ahmadou Ahidjo as Prime Minister of West Cameroon. Jua's government was however short-lived as in 1968 he was dismissed by Ahidjo,¹⁴

B- Jua's Political Development from 1961 to 1972

From 1961-1965, Augustin Ngom Jua worked hardly, but before 1961 Augustin Ngom Jua work alongside with John Ngu Foncha to attain collaboration with Ahidjo to make Cameroon a better place for all Cameroonian to leave in unity. They both struggle and lead the KNDP that advocated for secession and reunification. The brain behind all these was under the full hearted support of A N Jua and finally, Southern Cameroon gain his independent by reuniting with East Cameroon. In their campaign A N Jua was also at the forefront. In 1962 Jua was popular under the KNDP and the entire Cameroon. Generally, he was appointed secretary of state for finance in west Cameroon. In 1962 Jua and Foncha as some historians like Eyongetah and Brain, has made it clear that after Foncha was A N Jua, were Cameroonian Nationalist in west Cameroon.¹⁵ Behind the success of the KNDP was Augustin Ngom Jua. The first political event in west Cameroon after reunification was the general election into the state legislative Assembly on 7th January 1962.¹⁶ The Kamerun National Democratic Party captured or gain 25 of the 37 seats winning an absolute majority, while the CPNC won 10 and the lone Kamerun and independent candidates won one seat each.¹⁷ One Kamerun declared support for the KNDP when the new Assembly was convened. The UC and KNDP became a "Unity Group", a true national party in the type of a federal Assembly, was

¹³ Victor Julius Ngoh, *History of Cameroon ...* p, 215.

¹⁴ Franckils Enow Botala Enow, *The advanced level History pathfinder*. Comprehensive college press, Buea, 2008.p, 205.

¹⁵ Ibid and T. Eyongelah and Brian, *A History of Cameroon*, Longman, London 1974. P.137. Foncha died on April 10th, 1999. Nouvel Expression N° 1501.s

¹⁶ V.G Fanso, *Cameroon History ...* p, 163

¹⁷ Ibid.

actually the model.¹⁸ Under Jua's close auspices, the CPNC wanted the KNDP to merged with the "Unity Group", the UC as the future unified national party. The existed some disagreement and these arguments prevented the togetherness of the two parties in west Cameroon House of assembly.¹⁹In 1963, with prospect in view, the post of prime minister of west Cameroon who to actually succeeded Foncha became a bond of contention, clashes confronted some personalities of the KNDP, men of ambition precipitated a rift within the governing KNDP. The competition scramble and search for the position of John Ngu Foncha is prime Minister began in mid-August 1963 during the ninth KNDP convention at Bamenda with the predicting assumption that whoever was elected first vice-President, the second position in the party's hierarchy, would be prime Minister whenever the post became vacant. This post was to be contested by the west Cameroon secretary of state for finance and federal minister of Transport, posts and Telecommunications, in the person of A N Jua and ST Muna respectively, viewed with, by one another for selection. The race was by A N Jua while S T Muna became the loser.²⁰ Muna supporter, E.T Egbe, who wanted to become secretary general lost the party post to Nzo Ekah-Nghaky.²¹ Actually, Jua defeated Muna in the election after a vote of 175 to 75. Jua's victory was partly due to the fact that he was a founding member of the KNDP. Many KNDP members preferred him to Muna who only joined the KNDP in 1958. But Muna

refused to acknowledge defeat and argued that no article in the KNDP constitution stipulated that Jua has to stand automatically nominee of the party for the post of prime minister in west Cameroon. Muna went further to argue that it was the President of the Federation who has to appoint the prime minister and not the KNDP. The tug of war or rift between A.N Jua and S.T Muna actually threatened the unity of the KNDP and speeded its breakup. These crises stemmed up to 1964 as Jua's government faced much opposition from Muna's colleagues.

By 1965, the KNDP responded to Muna and Egbe disturbances by colliding or had coalition government with the CPNC. In 1965, the state of west Cameroon had got three political parties which finally merged with the UC of Ahidjo from the East, a national level that became unique. Finally, the UC, KNDP, CUC on the first of September 1966, the four parties became one called C N U, the one elections scheduled at the end of 1966. It was only at the end of December 1967 CNU nominated 37 contestants and prescribed them as single state. After the election of 1968 in the month of January everyone had a sudden shock as decision arrived at by Cameroonian when he named S.T Muna to succeed Jua as the prime minister of west Cameroon. As event continued to evolve in 1970 west Cameroon received a sudden shuck when Ahidjo appointed S.T Muna as vice president to replace Foncha in the single state federal presidential elections. Putting away Jua and Foncha, Ahidjo invincibly gain authority and greater grounds in the CNU (Cameroon National Union). But later as event continued to unfold, the four parties held conventions which all surrendered their assets to the new autonomous party of Ahidjo. Finally, in 1969 the CNU held its first congress in Garoua, during which it celebrated a new political Bureau of 35 to replace the provisional Executive named in 1966.²²

Event from 1969-1972 went evolving with some successes and obstacles. The federal structures became complex and cumbersome due to the fact that the system was very expensive and meagre as indicated by Ahidjo. If Cameroon could attain National integration bilingualism could be enforced by 1972. Considering the fact that, the state of West Cameroon faced difficulties to balance its budget totalling more than two thousand million (francs) which was equal to an estimate of three quarters of the

¹⁸V.G Fanso, *Cameroon History* ... p, 163

¹⁹ Jua could be considered as the strongman behind the KNDP due to the fact that, Jua's position was representative of the KNDP as a whole, was that Southern Cameroons first sever its links with Nigeria and became an independent by opening negotiations for Reunification on a federal basis.

²⁰ Jua's and his closer collaborators considered replacing Foncha as leader of the KNDP, rallying support in the territory, and then presuming the UN into making secession versus integration the issues at the plebiscite. Failing that, he and his group would then decide to support integration as the lesser of two evils. When Jua made these views public, a powerful phalame of some KNDP leaders staunch supporters of Foncha, surrounded him for days and convinced him that Foncha would be able to secure Reunification on the basis of loose association similar to that of the present-day commonwealth or, at worst, on a confederal basis. With that assurance, Jua abandoned his new plans and returned to the fold. Bongfen-Chem -langhee, "The Road to the Unitary state of Cameroon, 1959-1972 ..." p.9.

²¹ The post of vice president of the KNDP became vacant. The struggle to occupy this post divided the leading members' of the KNDP like A.N Jua, IM. Bokwe, P.M Kemcha, I.N. Lafon and S.T Muna who all vined for it. After a lot of haggling and lobbying, Bokwe, Kemcha and Lefon were eliminated from the race leaving S.T Muna and A.N Jua as the main contenders. The post was strategic because who ever held it was automatically to succeed Foncha as Prime Minister of west Cameroon S.T Muna and A.N Jua hotly contested the post of vice president of the KNDP during ... convention of the party held at Bamenda in 1963... Botela, p.203.

²² The post president of CNU and president was accorded and handled by Ahidjo, Foncha and Prime Minister Tchougui of East Cameroon became respectively first and second vice-presidents, Samuel Kame became secretary General and Moussa Yaya, Ekah Nghaky and Egbe became Assistant General-Secretary. Prime Minister Jua of west Cameroon, Dr. Endeley, Dr Benard N. Fonlon and Henry Elangue were included as general members... V J Fanso p.166.

total budget.²³ This is evidence on a confidential letter drafted by AN Jua to Ahidjo. Jua wrote requesting a loan of five hundred million (CFA) from the federal government for the development of the socio-economic sector of West Cameroon. Jua said, if this loan is granted to him favourable by allowing him to negotiate with Banque Central (Central Bank) the financial crisis of West Cameroon budget will be solve.²⁴ As Jua was waiting ST Muna was appointed in 1968 to the post of prime minister of West Cameroon.²⁵ ST Muna now requested for a loan from Ahidjo of one hundred and fifty million to correct the global crisis reiterated by Jua for the 1968/1969 and 1969/1970 financial years. This instead helped Ahidjo to strengthen Unitary State of Cameroon as required his speech of 1972 which he said the heritage after forty years of separation would not be ignored but emphasis will be laid on bilingualism in a pluri-cultural state. "the federal structures appear to be a handicap to the rapid development of the country... my profound conclusion that the time has come to go further than a federal organisation of the state."²⁶ Furthermore, according to Ahidjo's speech as seen below

"It is a matter of providing the nation with institutional structures capable of giving the greatest possible effectiveness to its will for progress... starting from independent ... through reunification, must lead to the apotheosis of total National Unity".²⁷ Moreso, Ahidjo once said, there is neither Ewondo nor Douala, neither Bamileke nor Bulu, neither Foulbe nor Bassa; we are, one and all simple Cameroonians.

A N Jua's vigorous reaction of Ahidjo's vision gave a counter-offensive of Ahidjo to react also violently that Cameroonians voted for reunification and federalism in 1961.²⁸ Though Jua uncovered Ahidjo plans as he fore-see event, nothing changed the course as Ahidjo in May 1971 to 1972 made all well.²⁹

C-Augustin Ngom Jua and the Kamerun National Democratic Party (KNDP.)

The KNDP that came as a result of Endeley deviating from the Kamerun National Council (KNC) objectives by integrating with Eastern Nigeria, from 1953 to 1954, in 1955 Jua alongside Foncha formed the KNDP that its main objective was secession with Eastern Nigeria.

While some historians said, Endeley was won by his Yoruba wife to support the Yoruba-dominated A G.³⁰ While Jua wanted to follow his ancestral origin the Tikars. The KNDP outlined what British Cameroons would gain by seceding which Jua was not excluded from these objectives.

- We shall avoid being under independent Nigeria.
- Opening the door for direct negotiations for foreign interpreters.
- Creating opportunities for Cameroonians to give their best to developing themselves and their country.
- It will make Cameroon an identified nation.
- It will enable Her Majesty's Government to shoulder her responsibilities.
- It will serve the Cameroons from being placed in the analogous position now experienced by Togoland.
- We shall maintain our culture without external interference.
- It will give us scope to work out a principle by which we shall unite all sections of our country arbitrarily torn off by foreign powers.
- It will help us to see into the financial structure of the Territory and make it possible for the Government to work out financial policies.
- It will enable us accelerate the Cameroonisation of public services in the country.
- It will psychologically inspire the people of the Cameroonian to increase productivity through self-sacrifice, building up the country and work speedily towards independence.
- The current political advancement of Nigeria has made imperative for Southern Cameroons to take a definite stand to secession.
- It is our cherished plan to secede from the federation of Nigeria.³¹

Jua political vision ties with Foncha dreams that was Evolutionary Reunification as an objective of the KNDP. They established and took this line to untie the Cameroonian people. Furthermore, that is why the KNDP was in line with those of the UPC in French Cameroon which were the independence and reunification of the two Cameroons that was why Jua and Foncha sheltered the UPC that was banned in French Cameroon in 1955 at Kumba which it was later banned in West Cameroon while in Southern Cameroon, the UPC also supported and

²³V.G Fanso, *Cameroon History* ... p, 165.

²⁴ Interview with John Ngu Foncha, 1994 at his residence at Foncha avenue.

²⁵ Ibid.

²⁶ Ibid

²⁷ NAB. File N° 419/SI of 1967/2 a letter to the president, issues for discussion. December 2010.

²⁸ Francis IW. Nkwain, *Cameroon* ... p, 47.

²⁹ Ibid

³⁰VG Ngoh, *Cameroon 1884-1985: A Hundred years of History*, Navi-Group Publication, Limbe, 1987 p, 203.

³¹ Ibid. p, 204.

worked actively in Southern Cameroons to achieve the goals propounded by the KNDP.³² Citizens of Southern Cameroons and the Republic of Cameroon had a single nationality that is, that of Cameroons and another nationality of the Federal Republic of Cameroon. Jua actually propounded the constitutional modification on the proposals to Southern Cameroons delegation.

The Foumban Conference of 17-21 July 1961 delegate from southern Cameroons was led by the Prime Minister JN Foncha... A part of Foncha, the other Government representatives from Southern Cameroons was AN Jua, ST Muna and Kemcha.³³ During the Yaounde Tripartite Conference, August 2nd 1961, the Southern Cameroon delegation was led by Prime Minister JN Foncha and other members were ST Muna, minister of finance, commerce and industries and AN Jua, minister of social sciences. Jua was present, participated and accepted decisions that were advocated at the conference. Issues such as the army and Police force, customs, police, public works, ports meteorology, civil aviation, post and telecommunications, security, federal transport and stamp duties, civil servants and foreigners in the administration of Southern Cameroons was also discussed.³⁴

IV. EVENTS LEADING TO JUA'S APPOINTMENT AS THE PRIME MINISTER OF WEST CAMEROON

The appointment of most political figures usually stemmed from the individual dynamism in participating actively in a country's affairs for development. With this, Jua could not be exempted due to the fact that the federal constitution of Cameroon in 1965 stipulated the modification or amendment that no single individual should jointly handle the post of Prime Minister and Vice President of west Cameroon from 1961 to 1965 as did Foncha. Since Foncha was to abandon one of the post greatly created the room or space for Jua to assume the post of Prime Minister.³⁵ Furthermore, it should be noted that in 1963 in the KNDP Jua and Muna vied for the post of vice president of the party at which Jua campaign drew the interest of the people close to him. Finally, Jua won with a score of 175 against 75. He was a founding father of the party while ST Muna only joined the party in 1958 when he withdrew from the KNC. More so, at the 1964 convention in Kumba many members of the KNDP

preferred Jua to succeed Foncha as prime minister of West Cameroon. Jua gained wide support from West Cameroonians which he automatically handled the vacant post left by Foncha.³⁶ In the presidential elections of 1965, Ahidjo and Foncha won. And Ahidjo visited West Cameroon and their opinions especially from political personalities in Buea like members of the House of Assembly, House of Chiefs and members of government. Finally, Ahidjo confirm Jua as prime minister of the state of West Cameroon which Jua was appointed in 1965 as the second prime minister of West Cameroon.³⁷

A-Jua's Achievements in West Cameroon

Jua's appointment was greeted with joy by many west Cameroonians due to the fact that he was a pure federalist who advocated more rights for the state of west Cameroon. Jua was an honest outspoken political figure and frank in all his activities which won him some merits from 1965 to 1968 in the socio-economic and political domain in west Cameroon. Jua with the assistance of Foncha raise money for the salaries of the workers of west Cameroon and increased liquor license fees. He tackled embezzlement by executing embezzlers by sending them to prison.³⁸ In 1966, at the peak of the crisis Jua instituted a commission of inquiry to probe into the management of the bank with money for the payment of workers' salaries.³⁹ Hence, Jua move further and promoted small scale industries like Emens Textile, Britain industry, road maintenance under the public works Department (PWD) other means of transport like sea transport was opened at the Tiko wharves, Bota and Victoria: this actually enhanced trade links with other counties from far and near, thus improved on the welfare of west Cameroonians. Jua did not only end here, he went ahead with social amenities promotion; education, hydroelectricity power, planification of streets and roads, sanitary and health care inspections was dotted all over the territory that led to cleanliness or hygiene of the people.⁴⁰

Jua successfully integrated the people of West Cameroon in the event of building the nation politically. Jua's government worked in close collaboration with the

³⁶ Foncha as vice president had no specific duties of competence. He was weaker as vice president than primer before independence.

³⁷ Bessong Stephen Takang, *An illustrated History of Cameroon since 1800*. The Book House, Yaounde, 2008 p, 227.

³⁸ Jua also promoted the Cameroon marketing Board that was created in 1953, Cameroon Development Cooperation (CDC). Joseph B. Etienne.

³⁹ NAB, The growth of political parties in Southern Cameroon 1916-1960. Francis I W Nkwain, *Cameroon...* p, 47-48.

⁴⁰ Interview with Mr. MVouma Tankoh at Mankon Bamenda, February 2013.

³² Ibid. Daniel Abwas, Cameroon Tribune. Wednesday, October 8, 2003 p, 4 Interview granted by Essomba Essama/Raymond N. schoume p, 230.

³³ VG Ngoh, *History of Cameroon ...* p, 230.

³⁴ Ibid. p, 232.

³⁵ Bessong Stephen Takang; *An illustrated History of Cameroon since 1800*. The Book House, Yaounde, 2008 p, 198.

CPNC and promoted unity, peace cooperation and development in West Cameroon, after the Foumban Conference. He formed a coalition government; KNDP-CPNC as he appointed leading members of the CPNC as ministers or secretaries of state in his government. Politicians such as NN Mbile and S.N Tamfu, EML Endeley were made leaders of House of Assembly in West Cameroon. Not the least, Jua work seriously, hand in hand with the West Cameroon Mobile force and the self Defence group to protect the Bakossi people from attacks from the UPC for national peace and integrity in 1966 during the antagonism between the Bakossi-Bamileke wars. Jua actually restored order and checked terrorism in West Cameroon.⁴¹ Fighting against assimilation from Yaounde, Jua was offensive and defended the English educational system and legal system. He resisted the desire to transfer most state function from Yaounde and the closer of the international airport to the advantage of the airport in Douala and the ambition to close the Tiko, Bota and Victoria, the coastal outlet as to boast the port in Douala.⁴²

B-Failures and fall of A N Jua in Cameroon

Augustin Ngom Jua was dismissed because of the below reasons. Politically, Jua promoted regionalism against the wishes of Ahidjo. Actually in 1968 Jua was dismissed from office, because he opposed Ahidjo's attempt to transform Cameroon from a federal to a unitary state. He preferred the federal system from unitary system. Jua went further as far as walking against the affairs and activities of inspector Jean Claude Ngoh an administrator appointed by Ahidjo to West Cameroon, for special duties such as control the army, gendarmerie, radio and federal departments. This was the first ground to sack Jua by Ahidjo.

Additionally, in the economic domain, Jua was accused for mismanagement of government thus a financial scandal in the former Cameroon Bank that was created in July 1961 with a 250.000.000 as capital.⁴³

Moreso, Jua was caught in favouritism only to the KNDP members and exempted or gave very limited chances to others to lucrative post in the government as they were not awarded contracts. Jua mismanaged the

West Cameroon Development Agency for the construction of Presidency in Kom. Hence, the government of Jua was also a victim of nepotism due to his harassment of non-supporters among the civil servants. Ahidjo, in the December 1967 legislative elections experience a victory of CNU list of 37 candidates a sign of unpopular nature of Jua, at this time. Ten members decline in which two came from Jua and eight from Ahidjo while the list consists of all those that have been dismissed from the KNDP in 1965. More so, Jua was a radical as he tried to reject Ahidjo's inspector from Yaounde to west Cameroon and it was so because the discovery of petroleum was confirmed in West Cameroon.⁴⁴ Accurately, Jua was incapable to handle the Bakossi-Bamileke crisis or war as such Ahidjo preferred ST Muna, who was more loyal to him.

V. DISMISSAL OF A N JUA AS PRIME MINISTER OF WEST CAMEROON

The immediate fall of Jua came as a result of regional interest implemented by Jua in West Cameroon. The removal was seen upon as a hard blow, but it was only the beginning that waited the regime of Jua. Towards the regime reappointment of Jua much talk went on within the KNDP and the population at Buea. It was certain to all and Jua that he will still emerge as prime minister. On the day of announcement Mr. Jua had his acceptance speech in his coat pocket. On Thursday January 11th 1968, in a colourful ceremony in Buea; "House of Assembly" that marked the opening of the occasion to install Jua as Prime Minister, precisely before 10.am the parliamentarians, the ministers of Jua's government including Jua himself were presented in the hall following established protocol. Unfortunately, things began to work the other way round. The house speaker at the time W.N.H Effiom arrived the assembly ground at 10.am, shortly an Escort Rider arrived and stop, dispatched a note from the Presidency send by the President of the Republic due in Buea to appoint the New Prime Minister. The envelop was quickly unfolded read which the latter said;

"Honourable members, I have a message from His Excellency, the President of the Republic, which I wish to convey to the House; I Amadou Ahidjo, President of the Federal Republic of Cameroon, by virtue of ... do name Solomon Tandeng Muna, the Prime Minister of the Federal State of West Cameroon".⁴⁵

⁴¹ Ibid.

⁴² This matter surface when in 1966 depositors were refused withdrawals in several instances in the different branches of the bank because Jua has been tribalistic when authorizing granting of loans.

⁴³ Jua also dispersed a huge crowd of over two thousand people during the Referendum campaign in 1972 at his village at Kom thus Jua was a radical as he asks the population to go and on later day at Njinikom, Mbingo, Belo and Fundong Jua held his campaign.

⁴⁴ Enow Botela Enow, *The Advanced Level History ...* p, 208.

⁴⁵ Enow Botela Enow, *The Advanced Level History Pathfinder* Frankils Comprehensive College Press, Buea, 2008, p, 209.

On the assembly ground, many became perplex and still due to the appointment of ST. Muna. Muna presented his short speech to the members of the House for confirming the appointment. His new policy under the banner of CNU. At the end of the appointment ceremony, the Prime Ministers Mercedes car was waiting outside for Muna.⁴⁶

Jua learn a better lesson on that day. It was sad, gloomy and humiliating. Jua dismissal was too abrupt and the handing over was done immediately. He was dismissed during a ceremony that was organized in honour of Ahidjos visit to West Cameroon. Jua came as the Prime Minister of West Cameroon inside a Mercedes car that was official including a driver and Bodyguard. Hewas abandoned because of the New Prime Minister ST. Muna, and only his close friend gave him a lift back to his own private house. His dismissal was a blow to his political career and statesmanship. From 1968 to 1977 Jua experience a crucial moment in his life until his death. He died in 1977 from a coup plotted, he was poisoned. Before Jua died, his relationship with Muna was stained as well as Ahidjo.⁴⁷ Ahidjo made conditions for a united states after a tour of West Cameroon with his prime intension or goal to get the political temperature of the West Cameroonians.

At this moment, Ahidjo had gain the political bureau of the Cameroon National Union and the National Assembly that linked his objectives. On May 20th 1972, according to Decree N° 72/DF/236 of May 8, 1972, made necessary formalities for the referendum campaign. Jua and Foncha who did not have important posts of government join others and campaign in West Cameroon. "Jua explained the unitary draft constitution, identified the different polling stations in each area, emphasised on the method of voting and ended by appealing for a massive "yes" vote. Jua did all these in his own village at Mbingo, Belo, Njinikom and Fundong, usually on market days. Finally, west Cameroon, in their vast majority, approved Ahidjo's call for a unitary system in 1972. The Mezam Division got 136, 715 yes votes and zero No votes and void ballots zero. When combined with other divisions, yes votes were in total 730, 739, No votes 113, and void ballots 24. Cameroon was now united and trusted each other. At this period Jua and Foncha still aspire high.⁴⁸ Jua was only a politician among English-speaking personalities in the field of politics whose constitutional authority has acted accordingly. In 1972, they advocated for the establishment of a unitary system. Though he was

sacked in 1968 and Foncha in 1970, in 1972 they campaigned for the unitary system, they stage a comeback in the political arena during the referendum thus in a sort a solution to all the ills confronted their political, economic, social and constitutional amendment procedure.⁴⁹ Hence, due to Jua's present as an active political candidate who participated, a sound political Administrative framework was establish, Jua was the cornerstone of the federal administrative system.

VI. CONCLUSION

The political actor in West Cameroon from the grassfield Bamenda. Augustin Ngom Jua and his political development from 1961 to 1972 was characterised with achievements as he supported secession and integration with the Republic of Cameroon. Under the banner of KNDP Jua fought alongside with Foncha to unite Cameroonian people that became a platform of the party "Evolutionary Revolution". But before this, a brief history of Cameroon has been elaborated. As event continued to unfold, Jua became Minister of Finance in West Cameroon and later the Prime Minister. Jua recorded much popularity. But due to enormous conflicts with ST Muna and supporters, Jua and Ahidjo, Jua and IC Ngoh delegate from Yaounde to West Cameroon Jua's popularity started facing regression remorse. In 1968 Jua was dismissed in West Cameroon and was replaced by ST Muna.⁵⁰ In 1970, Foncha was replaced by ST Muna. The two became member of government with no power, thus the reunification did not result in a wide degree of decentralisation as KNDP had hoped. One of the reasons was that the government of Southern Cameroons had not received independence before negotiation with the Ahidjo government and hence was in a weak position to demand retention of power by the states.⁵¹ One of the obstacles that could not permit West Cameroon from standing was their population, the population of west Cameroon was only eight hundred thousand inhabitants while that of East Cameroon was four million inhabitants thus west Cameroon could not stand alone as a single entity. Due to

⁴⁹ Francis IwNkwain, *Cameroon ...* p, 55.

⁵⁰ Muna was born in 1912 and was a schoolmaster between 1932 and 1951. In 1951, he was elected to the Eastern Nigeria House of Assembly and he became Minister of Public Works in the KNC government. In 1958, when it became clear that the KNC was losing in popularity, he turned his political coat and joined the KNDP and, between 1959 and 1961, he held several cabinet posts in the KNDP Government. In 1961, he was appointed Federal Minister of Transport in the First Federal Government of Cameroon. In January 1968, he became Prime Minister

⁵¹ VG Fanso, *Cameroon History ...* p, 156-157 and Eyongetah and Brain, *A History of the Cameroon ...* p, 160.

⁴⁶ Ibid. These are words from the Mbile, an eye-witness to the event.

⁴⁷ Ibid.

⁴⁸ NAB. N° 0586/RNSNW/CP/TS, conduction of the 20th May Referendum in West Cameroon. December 2010.

the political development in west Cameroon that occurred in subsequent fold could not allow the smooth functioning of this part of the country hence created a lot of issues with no solution hence with no or less successes or achievements. But, due to its enormous perpetrating entanglement Jua was dismissed and the ousting of Jua from power was scandalous and humiliating. The subject of reflection could be seen after the death of Jua in 1977. What successes were recorded after Jua's death by his political successor or how was the political atmosphere of West Cameroon after him, a post S T Muna occupied simultaneously with that of vice-president of the Republic which he obtained in 1970. What was current, two years later, when S T Muna became Member and speaker of the National Assembly; a post he occupied until 1988 when he retired from public life? How was it administered by others?

REFERENCES

- [1] Takang Stephen B, *An Illustrated History of Cameroon since 1800*. The Book House Ayansbex Print Yaounde, 2008.
- [2] Nkwain Wainchom Isidor F, *Cameroon: High Grounds for National Unity and Peace* Maryland Printers, Bamenda, 2008.
- [3] Eyongetah. T and Brain R, *A History of the Cameroon*, Longman, London, 19785
- [4] Ngoh. V. J; *History of Cameroon since 1800*. Press print, Limbe, Cameroon. 1996
- [5] Ngoh V J, *The Untold Story of Cameroon Reunification 1955-1961*, 2014.
- [6] VG Ngoh, *Cameroon 1884-1985: A Hundred years of History*, Navi-Group Publication, Limbe, 1987 p, 203.
- [7] Anthony Ndi, *Southern West Cameroon, Revisited 1950-1972 Unveiling Inescapable Traps*, Volume One, Paul's press, Bamenda, 2013.
- [8] Fanso V.G; *Cameroon History for Secondary schools and colleges Vol 2. The colonial and post-colonial periods*. Macmillan London and Oxford. 1989.
- [9] Enow Botela E; *The advanced level History path-finder*. Frankils comprehensive college press, Buea 2008.
- [10] Welch Claude; *Dream of Unity: Pan Africa press*, 1960
- [11] Delancey, Mark W, and Mark Dike Delancey; *Historical Dictionary of the Republic of Cameroon* (3rd edition) Lanham, Maryland: The Scarecrow press 2000.
- [12] Jabiru Muhammadou Amadou, "The Historical Implications of Hon.Boja's Carpet Crossing in Southern Cameroons Politics" In *Pan Tikar Journal of History*, University of Bamenda, Vol 1, No.1, March 2013.
- [13] Suh Sama Hillary, "John Ngu Foncha and the Reunification process in Cameroon," In *Cinquantennaires De L'Independence et Reunification Du Cameroun Bilan, Enjeux et Perspectives, Actes Du Colloque de Dschang-10 au 12 mai 2010*, Dschang, Press Universitaire De Dschang (PUD), 2013.
- [14] Daniel Abwa, Cameroon Tribune. Wednesday, October 80, 2003.
- [15] Lovett Z. Elango; "The Anglo-French condominium in Cameroon, 1914-1916; The myth and the Reality" International Journal of African Historical studies. 1985.
- [16] Louis Paul Ngongo, *Histoire des Forces Religieuses au Cameroun : de la Premiers Guerre Mondiale à l'Independence 1916-1955*. Karthala, Paris, 1982.
- [17] Interview with John Ngu Foncha, 1994 at his residence at Foncha avenue.
- [18] Interview with Mr. Mvouma Tankoh at Mankon Bamenda Feb 2011. <http://crawfurd.dk> Homepage March 1st, 2010.
- [19] NAB. N° 0586/RSNSW/CP/TS, conduction of the 20th May Referendum in West Cameroon. December 2010.
- [20] NAB. File N° 419/SI of 1967/2 a letter to the president, issues for discussion. December 2010.
- [21] NAB, The growth of political parties in Southern Cameroon 1916-1960.

Comparison of ultrasound Fiberglass Pin Removal using or not using Operating Microscope

Isabela Cordeiro Reis, Nathalia Vieira Alves, Tainah Soares Nestor, Eduardo Fernandes Marques

Instituto Tocantinense Presidente Antônio Carlos – Porto Nacional - TO

Received: 03 Oct 2021,

Received in revised form: 13 Nov 2021,

Accepted: 22 Nov 2021,

Available online: 30 Nov 2021

©2021 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— Endodontics, Root canal
irrigants, Intraradicular retainers.

Abstract— Endodontics seeks to sustain teeth whose pulps, for some reason, have lost the quality of maintaining vitality or have become necrotic. Careful attention should be paid to cases of root canal infection as the solution for these cases is very difficult. The aim of this study was to compare the removal of fiberglass pins with ultrasound inserts using or not an operating microscope. Twenty human mandibular premolars were selected, instrumented with the Logic 25/06 system and irrigated with 2.5% sodium hypochlorite (NaOCl). The canals were dried, filled and the specimens stored in distilled water (maintained at 36.5°C and 100% humidity). Unobturation was performed until 5 mm of filling material remained in the apical region. The glass fiber retainers, previously selected, were cemented with an ED Primer adhesive system and Panavia F resin cement, then the samples were stored for 24 hours at 37°C. Subsequently, the dental elements were divided into two groups for the removal of intraradicular retainers with 25 IRRIS ultrasound insert: G1 - removal of fiberglass posts with ultrasound insert without microscope and G2 - removal of fiberglass posts with ultrasound insert without microscope. Subsequently, all teeth were subjected to longitudinal section in the mesiodistal direction with a 22 mm double-faced diamond disk, coupled to a straight piece and a micromotor cooled with air/water spray. After this procedure, an operating microscope at 12.5X magnification was used to verify the rest of the fiberglass post in the cervical, middle and apical thirds. G2 showed better results than G1 in removing the fiberglass post in the three root thirds. It is possible to conclude that the removal of the intraradicular retainers with ultrasound and microscope offer better results.

I. INTRODUCTION

The study is about comparing the removal of the fiberglass post with ultrasound using or not an operating microscope. It is noteworthy that a communicable disease that has several factors is dental caries, especially caused by excessive use of sugars, an element that causes the demineralization of the tooth surface caused by

fermentation of carbohydrates and bacteria that infect the oral cavity (NEWBRUM, 1988). Thus, tooth decay causes tissue loss and chronic inflammatory situations, acute with degenerative character and also pulp death, thus requiring endodontic treatment (FIGUEIREDO et al., 2003).

Endodontics seeks to sustain teeth whose pulps, for some reason, have lost the quality of maintaining vitality

or have become necrotic. Special attention must be paid to cases of root canal infection, as the resolution of this case is quite difficult (MELO, 2015).

Despite being widely employed with high success rates (NAUMANN et al., 2012; SARKIS-ONOFRE et al., 2014), there may be indigence of abscission of this retainer for access to the root canal and new endodontic/restorative treatment. Among the causes of failures are retainer loosening/decementation, retainer fracture/root restoration, tooth decay, periodontal disease, endodontic problems, short retainers and root fragility.

In order to have access to the root canal in the absence of partial or complete fillings, abscission of the retainer is important without excessive removal of dentin, perforation or fracture of the remaining tooth, so that a conservative endodontic treatment can be carried out, preserving the maximum amount of remnant healthy coronary and root (BERBERT et al., 2012).

Among the methods for abscission of the intraradicular retainer, there is the use of cutting ultrasonic tips and their associations (SOARES, 2009). It is one of the most widespread removal techniques. Among the methods prior to that mentioned, the tensile action methodology was used that acted through wear, such as drills, which acted on the cement line, causing tension and allowing its rupture, such as the use of ultrasound or the combination of drills and ultrasound. The use of ultrasound has the advantage of applying less force for removal, as the vibrations act on the cement line, causing its rupture (GARRIDO et al., 2009).

To perform this procedure, the operating microscope can be used, a device that has been widely used in Endodontics with the scope of minimizing the obscurity of the operative field, as it allows for high magnification and brightness, enabling the effective methods and providing a higher quality result (PELOTAS, 2017).

This is an easy-to-work instrument, as it is suitable for the office as it is a portable device and its size is favorable for handling. However, it should only be used who are knowledgeable about the techniques, as when it is used quickly, the learning curve will be short, given this fact, the operating microscope is a device of greater complexity and therefore must be used with dexterity. (WEST, 2016).

A little used, but very important function of this device, taking into account the intermediary of the coupled peripherals, is the camera/video, due to the fact that it is a great ally to be adapted together with the documentation of all clinical cases, which facilitates so that the scrub nurse has greater predictability of the case, thus increasing the chances of success in endodontic therapy (FERREIRA et al., 2010). This material, in addition to serving as a way to

record the procedure, can also be performed as learning material and as a way of providing legal protection, safeguarding the surgeon's and patient's rights.

Due to the adversities at the time of removal of the fiberglass post and the lack of precise studies regarding the choice of the best technique to remove them, it is necessary to carry out standardized studies (IZZELI et al., 2020). Thus, the objective of this study is to compare the removal of fiberglass pins with ultrasound inserts using or not an operating microscope, aiming to perform a more effective procedure, with more clarity, sharpness and seeking to minimize errors when removing the intraradicular retainer.

The aim of this study was to compare the removal of fiberglass pins with ultrasound inserts using or not an operating microscope.

II. METHODOLOGY

The study is an applied research, where its approach is quali-quantitative, exploratory in character, carried out on extracted human teeth.

The study was conducted using teeth donated by patients from the clinic and laboratory belonging to the Department of Dentistry of Instituto Tocantinense Presidente Antônio Carlos in Porto Nacional from February to March 2021.

Thirty human premolar premolars with single canals with apical root, transverse cross-sections straight and circular in the cervical, middle and apical thirds and similar diameters measured in millimeters of wireless Schick CDR digital radiography (Schick Technologies, Inc, Long Island City) were used. , New York, United States) (used at 60 kVp, 10 mA and (1/6 sec), then the largest and smallest diameters of the buccolingual root canal were measured in each third of the root (cervical, middle and apical) using a digital caliper. If a root canal displayed oval cross-section in two of the three thirds, were classified as oval and included in the sample.

Root scaling was performed with periodontal curettes (Duflex – SS White – Rio de Janeiro – Brazil), extracting any and all dirt on the external surface. The specimens were inspected with pumice (SS White – Rio de Janeiro – Brazil) and water, using Robinson brushes (KG Sorensen – Rio de Janeiro – Brazil) connected to a counter angle with a micromotor (Kavo, Joinville , Brazil). The specimens were deposited in 0.1% Timol (Manipulation Pharmacy – Formula and Action – São Paulo – SP) and remained for a period of no more than three months (MARQUES et al., 2012, MARQUES et al., 2020).

After cleaning, the crown section of the teeth was carried out in the amber/cementary connection with a 22

mm double-faced diamond disc (Fava, São Paulo, Brazil), joined to the straight piece and the micromotor (Kavo, Joinville - SC - Brazil) refreshed with air/water spray. The extension of the roots was standardized in 15 mm with the assistance of an endodontic calibrating ruler (Dentsply/Sirona, Tusla - USA). A 10 k file (Dentsply/Sirona, Tusla - USA) was placed in advance to verify possible interventions with catheter movement.

This process was carried out with the Prodesign Logic 25/06 motor and rotary system (Easy, Belo Horizonte – Brazil), followed by the preparation of the cervical third with a Prodesign Logic 06/25 file (Easy, Belo Horizonte – Brazil) towards the crown – apex respecting the canal anatomy, always maintaining a minimum distance of 5 mm from the apical limit on radiography and in curved canals until the beginning of curvature.

Afterwards, odontometry was performed with a type K 10 file (Dentsply/Sirona, Tusla - USA) where it was placed in each canal until it was visualized in the apical foramen. The working length was determined at 1 mm below the apical foramen. Then, a Prodesign Logic 25/06 file (Easy, Belo Horizonte – Brazil) instrumented 1mm short of the real length of the tooth.

In the process, the instrumentation consisted of irrigating with 2.5% sodium hypochlorite (Manipulation Pharmacy – Formula and Action – São Paulo – SP), 10 ml Luer Slip plastic syringe (Advantive, Nanchang Jangxi - China) and 25 x 0 disposable needle .55 (BD, Curitiba - PR). 30 ml of solution were used per experimental unit. The needle was placed throughout the instrumentation process until reaching 2 mm less than the working length.

The canals, at the end of preparation, were dried with capillary tips (Ultradent Products, Inc, South Jordan, Utah, USA) joined to a high-powered sucker and with absorbent paper cones (Tanari, Manacapuru - AM).

Final irrigation was performed with 3 ml of 17% EDTA (Manipulation Pharmacy – Formula and Action – São Paulo – SP). Initially, 1 ml of 17% EDTA was placed, accompanied by ultrasonic vibration with a 25 IRRIS insert (VDW; Endo Ultrasonic Files, Endodontic Synergy, Munich, Germany) at a frequency of 30 kHz. The ultrasound insert was connected to a piezoelectric ultrasound acting at 30 kHz (CVDent 1000; CVD Vale, São José dos Campos, SP, Brazil), glued at power level 3, in a time of 20s. This process was repeated 2 more times. After this method, irrigation was performed with 5 ml of sodium hypochlorite (Farmácia Formula & Ação, São Paulo - SP). The canals were dried with capillary tips (Ultradent Products, Inc, South Jordan, Utah, USA) attached to a sucker high power and with absorbent paper cones (Tanari, Manacapuru - AM).

The filling cement was used with AH Plus (Dentsply/Sirona, Munich, Germany) and spatulated according to the manufacturer's instructions.

After handling the endodontic cement, the canals were filled, in a single session, using the Continuous Wave Condensation technique (Buchanan, 1994), which adopts the principles of Schilder's technique (1967) using the Touch'n Heat equipment. For this purpose, M and FM accessory cones (Tanari, Manacapuru - AM) were chosen. These were measured using a calibrating endodontic ruler (Dentsply/Maillefer, Ballaigues - Switzerland) and adapted to the working length. The Touch'n Heat thermoplasticizer will cut, plastify and thicken the gutta percha inside the canals, up to 10 mm, inside the root canal. This phase of the filling is known as "Down Packing".

The specimens were analyzed under an operating microscope (M 9000 DF Vasconcellos SA – São Paulo) at 12.5X magnification, right after the root canal filling process, to check if any filling material (gutta percha and/or endodontic cement) will be present. present within 10 mm after using Touch'n Heat. If the existence of remaining filling material is verified, a probe altered for endodontics (Golgran, São Paulo - SP), or automated metallic condenser or Gates-Glidden drills (Dentsply/Maillefer, Ballaigues - Switzerland) will be used for its abscission.

White Post DCE n° 1 prefabricated pins (FMG Produtos odontológico LTDA – Joinville - SC) were used. The preparation for the post will be carried out with existing drills in the White Post DCE kit n° 1 (FMG Produtos odontológico LTDA – Joinville - SC), in the 11 mm of the root canal, in lateral movements. These drills are compatible with the diameter of each pin used.

The posts were cleaned before cementation with isopropyl alcohol and the silane will be applied for 60s Silane (PROSIL- FGM Produtos odontológico LTDA – Joinville – SC with micro brushes (Microbrush, Grafton - USA)).

Initially, it was necessary to test the fiberglass posts to adapt them to the prepared channels. Etching with phosphoric acid (Condac 37% FGM, Joinville - Brazil) was carried out inside the channel for 15 s. After this process, irrigation was performed in a disposable syringe with distilled water for 30s to remove the acid. The root canal was dried with absorbent paper cones. The application of the ED Primer adhesive system (Kuraray, Tokyo, Japan) was carried out according to the manufacturer's instructions. The cementation material (Panavia - Kuraray, Tokyo, Japan) was introduced with a lentulum (Dentsply/Maillefer, Ballaigues - Switzerland), the post was inserted into the root canal and the excess material was removed. Light curing was carried out for 60 s (on all sides of the pin) using the

Optilight LD MAX Curing Unit (127V/220V), power – 600m Wcm², (Gnatus, Ribeirão Preto - SP). After this procedure, the exposed part of the fiberglass post was sectioned with a 22 mm double-faced diamond disc (Fava, São Paulo, Brazil), coupled to a straight piece and a micromotor (Kavo, Joinville – SC – Brazil) cooled with air/water spray.

The dental elements were randomly divided into two groups for removal of retainers with ultrasound inserts:

G1 (N = 10) - Removal of the fiberglass post without an operating microscope:

The 25 IRRI S ultrasound insert (VDW; Endo Ultrasonic Files, Endodontic Synergy, Munich, Germany) was connected to a piezoelectric ultrasound operating at 30 kHz (CVDent 1000; CVD Vale, São José dos Campos, SP, Brazil), fixed at power level 2. Subsequently, the fiber post was used to remove it inside the root canal towards the crown – apex and buccolingual laterality, respecting the anatomy of the root canal until reaching 10 mm of the root canal and observed the gutta percha. Visual inspection of the removal of the intraradicular fiberglass post was performed. If a remnant is observed, the ultrasound insert was used again until complete removal is noticed.

G2 (N = 10) - Removal of the fiberglass post with an operating microscope:

The 25 IRRI S ultrasound insert (VDW; Endo Ultrasonic Files, Endodontic Synergy, Munich, Germany) was connected to a piezoelectric ultrasound operating at 30 kHz (CVDent 1000; CVD Vale, São José dos Campos, SP, Brazil), fixed at power level 2. Subsequently contacted the fiber pin to remove it inside the root canal in the coronal direction – apex and buccolingual laterality, respecting the anatomy of the root canal until reaching 10 mm of the root canal and observing the gutta percha. The entire procedure was used with an operating microscope (M 9000 DF Vasconcellos S.A. – São Paulo) at 12.5X magnification. Visual inspection of the removal of the intraradicular fiberglass post was performed. If a remnant was observed, the ultrasound insert will be used again until the total removal is noticed.

All teeth were subjected to longitudinal section in the mesiodistal direction with a 22 mm double-faced diamond disc (Fava, São Paulo, Brazil), joined to a straight piece and a micromotor (Kavo, Joinville – SC – Brazil) and freshened with air spray /Water. Subsequently, this method was used with an operating microscope (M 9000 DF Vasconcellos S.A. – São Paulo) at 12.5X magnification to visualize the remnant of the fiberglass post in the cervical, middle and apical thirds.

Disposal of the materials used in this study were placed in a hospital waste bag (Azeplast Indústria e Comércio Ltda., Santa Catarina – Brazil), made in accordance with ANVISA standards, after completing the laboratory procedures for this research. The hospital waste bag, with biological material, was presented to Fapac/Itpac Porto Nacional's biological hazardous material disposal sector for disposal, in accordance with ANVISA regulations.

Data analysis was performed according to the Content Analysis method represented by tables and/or Excel graphs, duly substantiated according to the literature.

III. RESULTS

After this procedure, an operating microscope at 12.5X magnification was used to verify the rest of the fiberglass post in the cervical, middle and apical thirds. G2 showed better results than G1 in removing the fiberglass post in the three root thirds. (Figura 01 e 02).



Fig.1: Removal of the intraradicular retainer without the microscope

Source: Own authorship



Fig.12: Removal of the intraradicular retainer with the microscope

Source: Own authorship

IV. DISCUSSION

The analyzes of this study demonstrated that the use of ultrasonic devices and a microscope to remove fiberglass posts is of high satisfaction to endodontic professionals. However, Assis (2020) reported in his studies that there are several techniques for removing intraradicular posts available to professionals, and all with the same objective, to be efficient, simple and, especially, to remove the intraradicular post without generating iatrogenic damage. In this study, it was observed that the use of an operating microscope with ultrasound inserts minimized the occurrence of deviations and promoted a better removal of fiberglass posts.

In addition, the studies by Gesi et al., (2018), conducted a study to determine the effectiveness and efficiency of various removal techniques for fiberglass posts, using ultrasound as one of the removal methods. They concluded that diamond tips and ultrasound need more time to remove the pins, however, their effectiveness in removing debris inside the canal was greater than in other techniques. In the present study, the 25 IR S ultrasound insert was used, which was effective in removing the intraradicular retainers in the root canals. However, the group that used an operating microscope promoted greater removal of fiberglass posts in the root walls in all thirds.

Cruz and Salomão (2020) evaluated the effectiveness and efficiency of different removal techniques, using kits in a different group of pins from manufacturers, with diamond tips with a Peeso drill. They found that the two techniques were effective in removing the chucks, but more effective in the group where the diamond tips and the Peeso drill were connected. For Baltieri (2020) the use of diamond tips, clinical microscope and ultrasound in the removal of pins showed a variation between 03 and 20 times of efficiency.

For Lira et al., (2017), the use of ultrasound and an angled diamond tip allowed a better visual in the operative phase, which would not be possible with high rotation and is a technique that has been used in several studies and researches for treatment endodontic and as a facilitator of the execution of certain methodologies, including the removal of fiberglass posts. Corroborating the studies mentioned above, Silva et al., (2019) emphasize that the non-surgical retreatment in endodontics is effective if compared directly with the technique of removal of all material connected with the root canal systems filled and, when the tooth has an intraradicular pin, so it needs to be removed with care.

Assis (2020) emphasizes that to remove intraradicular pins, techniques that offer low risks of perforation and fractures, which are easy to perform and

simple are needed. Thus, the author indicates the use of ultrasound for this type of removal as it preserves the remaining tooth structure. Menezes et al., (2019) describe the ultrasound technique for use in all teeth, confirming the minimal loss of the possibility of occurrence of perforations, tooth structure and root fractures. Remembering that the ultrasonic energy is transmuted to the root retainers, breaking the cement line between the wall of the root canal and the post.

Freire (2018) corroborates the authors' preference for the ultrasonic system due to efficiency and safety, as it does not require mechanical force against the walls of the tooth root, preventing fractures and the leverage effect. Cruz and Salomão (2020) demonstrates that ultrasonic devices fall into two classes, magnetostriction, transforming electromagnetic energy into mechanical energy, generating intense heat, and piezoelectric, using a crystal that transmutes the volume when an electrical charge is used. Also according to the author, the crystal is deformed and converted into mechanical oscillation, causing a minimal amount of heat, and that the piezoelectric class is the most recommended in endodontics, offering greater efficiency and effectiveness in energy transformation, reducing the unwanted impacts of the process and generating less heat.

Silva et al., (2019) say that the use of ultrasound with a microscope, as it is electronic, can offer some disadvantages and affect its efficiency, as they are subject to failures. In the studies by Cruz and Salomão (2020), the best existing ultrasonic devices, tested in their research, was the ENAC® (Osada Electric Co, Japan) due to its easy use and good efficiency. Another factor is that this equipment has an ST 09® tip, which is used in the removal of intraradicular retainers and comes with the equipment.

In the view of Lira et al., (2017), one way to assess the efficiency and effectiveness of removing fiberglass posts is the ultrasound with a microscope and the diamond tips with a longer period, removing all debris and emptying the channel compared to other employed techniques and protocols.

V. CONCLUSION

It is possible to conclude that the removal of the intraradicular retainers with ultrasound and microscope offer better results.

REFERENCES

- [1] ASSIS, Diogo Sabugueiro de. **Considerações clínicas no momento da remoção e um pino intrarradicular**. Artigo de

- revisão bibliográfica. Faculdade de Medicina Dentária. Universidade do Porto. Porto, 2020.
- [2] BALTIERI P. Fundamentos essenciais na remoção de pinos pré-fabricados não metálicos: onde a magnificação faz a diferença In: Murgel C, Ferreira CA, Worchech C. **Microodontologia: visão e precisão em tempo real**. Editora Dental Press, 2020, 482p.
- [3] BERBERT F, CRISCI F, BERBERT A, BONETI FILHO I, VAZ L. Efeito do desgaste da linha de cimento, da vibração ultrassônica e da associação de ambas sobre a força de tração empregada na remoção de pinos intrarradiculares. **Rev Odontol UNESP** 2012; 31(2):215-29.
- [4] CRUZ, Jeane Sousa; SALOMÃO, Marcos Botelho. A utilização do ultrassom na endodontia. **Revista Cathedral**, v. 2, n. 3, p. 75-83, 2020.
- [5] FERREIRA, HLJ, PAULA, MVQ, GUIMARÃES, SMR, GONÇALVES, RCL. Avaliação radiográfica de obturações de canais radiculares. **Revista Odonto Ciência**. Porto Alegre, v. 22, n. 58, p. 340-345, 2010.
- [6] FIGUEIREDO FED, MARTINS-FILHO PRS, FARIA-SILVA AL. Do Metal Post–retained Restorations Result in More Root Fractures than Fiber Post–retained Restorations? A Systematic Review and Meta-analysis. **JOE**. 2003; 41(3): 309-16
- [7] FREIRE, Ângelo Menezes. Tratamentos. 2018. Disponível em: <https://www.angelfreireendodontia.com.br/tratamentos/remocao-de-pinos.html>. Acesso em: 08 de set de 2021.
- [8] GARRIDO A, FONSECA T, ALFREDO E, SILVA--SOUZA Y, SOUSA-NETO M. Influence of ultrasound, with and without water spray cooling, on removal of posts cemented with resin or zinc phosphate cements. **J Endod** 2009; 30 (3):173-6
- [9] GESI A, MAGNOLFI S, GORACCI C, FERRARI M. Comparison of two techniques for removing fiber posts. **J Endod**. 2018. 29(9):580-2.
- [10] GIL, Antônio Carlos. **Métodos e técnicas de pesquisa social**. 5. Ed. São Paulo: Atlas, 2010.
- [11] IZZELI, N.; BERGANTIN, E.; ALOVISI, M.; PASQUALINI, D.; BERUTTI, E. Evaluation of a simplified fiber post removal system. **Journal of Endodontics**, v.39, n.11, p.1431-4, 2020.
- [12] LIRA, L. B. A. de et al. ULTRASSOM E SUAS APLICAÇÕES NA ENDODONTIA: Revisão de literatura. **Rvacbo**, [s.l.], v. 27, n. 1, p.80-89, 2017. Disponível em: <www.rvacbo.com.br/ojs/index.php/ojs/article/view/370/440>. Acesso em: 20 set. 2021.
- [13] MARCONI, M.A, LAKATOS, EM. **Fundamentos de metodologia científica**. 5.ed. São Paulo: Atlas,2011.
- [14] MARQUES, J. N.; GONZALES, C. B.; SILVA, E. M.; PEREIRA, G. D. S.; SIMÃO, R. A.; PRADO, M. Análise comparativa da resistência de união de um cimento convencional e um cimento autoadesivo após diferentes tratamentos na superfície de pinos de fibra de vidro. **Rev Odontol UNESP**. 2012;45(2):121-126.
- [15] MELO S. Pinos estéticos: qual o melhor sistema? **Arqu bras odontol**. 2015; (3):179-84.
- [16] MENEZES, M. M. et al. O uso do ultrassom na remoção de retentores intraradiculares com diferentes tipos de retenção. **Revista Odonto Ciência**, v. 24, n. 1, p. 45-48, 2019.
- [17] NAWMAN M, YAMAN P, DENNISON J, RAF- TER M. Fracture resistance of endodontically treated teeth restored with composite posts. **J Prosthet Dent** 2012; 89(4):360-7
- [18] NEWBRUN, E. **Cariology**. 2nd ed. Baltimore: Williams & Wilkins, 1988.
- [19] PELOTAS, R. Complications of endodontically treated teeth restored with fiber posts and single crowns or fixed dental prostheses-a systematic review. **Clinical Oral Investigations**, v.20, n.7, p.1449-57, 2016.
- [20] SARKIS-ONOFRE R.; JACINTO R de C, BOSCATO N.; CENCI M. S.; PEREIRACENCI T. Cast metal vs. glass fibre posts: a randomized controlled trial with up to 3 years of follow up. **J Dent**, v. 42, n. 5, p. 582-7, 2014.
- [21] SILVA MR, BIFFI JCG, MOTA AS, FERNANDES NETO AJ, NEVES FD. Protocolo para remoção dos pinos de fibra de vidro: revisão de literatura. **ROC**, v.3, n.1, p 30-36, 2019.
- [22] SOARES J A. Influence of luting agents on time required for cast post removal by ultrasound: an in vitro study. **J Appl Oral Sci** 2019;17(3):145-9.
- [23] WEST, J D.B. Cleaning and shaping the root canal system. In: COHEN, S; BURNS, R. C. (Edit.) **Pathways of the pulp**. 7 ed. St. Louis: Mosby, 2016. p.203-257.

Pedagogical Project of undergraduate Courses and Teacher Education

Bruno Cezar Silva, Lucia Marisy Souza Ribeiro de Oliveira, Marcia Bento Moreira

Universidade Federal do Vale do São Francisco, Rua Rio de Janeiro, 32 João xxiii Juazeiro BA CEP 48900 330

Universidade Federal do Vale do São Francisco, Praça da República, 33. Bairro Dom Tomaz, CEP 48907-180 Juazeiro – Bahia

Universidade Federal do Vale do São Francisco, Rua Santa Inês, 121. Vila Eulália. CEP 56.331-100 / Petrolina – Pernambuco

Received: 19 Oct 2021,

Received in revised form: 08 Nov 2021,

Accepted: 18 Nov 2021,

Available online: 30 Nov 2021

©2021 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— *Course Pedagogical Project;
Resume; Interdisciplinarity; Teacher
Training; Teaching-Learning; Autonomy.*

Palavras Chave— *Projeto Pedagógico de
Curso; Currículo; Interdisciplinaridade;
Formação Docente; Ensino-Aprendizagem;
Autonomia.*

Abstract— *This article reflects on the Pedagogical Course Project of Higher Education Institutions, pointing to it as a normative document that contains the technical aspects, the conceptions of man and society, in addition to the professional profile that one wishes to achieve, having as a priority function to guide and intentionally conduct the pedagogical process in the daily life of the classroom. Its organization is based on the Federal Constitution; in the LDB – Law of Guidelines and Bases for National Education; in the National Curriculum Parameters and in the Institutional Development Plan – PDI of each HEI – Higher Education Institution, with a view to training critical, reflective subjects committed to social change. Therefore, it emphasizes the importance of continuing teacher education, considering that the role of the teacher today is to be a facilitator in the teaching and learning process, helping the student to think, question, read the reality of the world and build their own opinions, valuing the collective process, which consists of learning with other students, with other professors from other areas and with non-academic professionals, extending the learning environment to society in general, experiencing interdisciplinarity.*

Resumo— *Este artigo traz reflexões sobre Projeto Pedagógico de Curso das Instituições de Ensino Superior, apontando-o como documento normativo onde consta os aspectos técnicos, as concepções de homem e de sociedade, além do perfil profissional que se deseja atingir, tendo como função prioritária orientar e conduzir intencionalmente o processo pedagógico no cotidiano da sala de aula. A sua organização se fundamenta na Constituição Federal; na LDB – Lei de Diretrizes e Bases da Educação Nacional; nos Parâmetros Curriculares Nacionais e no Plano de Desenvolvimento Institucional – PDI de cada IES – Instituição de Ensino Superior, na perspectiva de formar sujeitos críticos, reflexivos e comprometidos com as transformações sociais. Para tanto, ressalta a importância da formação continuada docente, considerando que na atualidade o papel do professor é ser um facilitador no processo de ensino e aprendizagem, ajudando o aluno a pensar, a questionar, a ler a realidade do mundo e a construir opiniões próprias, valorizando o processo coletivo, que consiste em aprender com outros alunos, com outros professores de outras áreas e com profissionais não acadêmicos,*

estendendo o ambiente de aprendizagem para a sociedade de modo geral, vivenciando a interdisciplinaridade.

FUNDAMENTALS AND PRINCIPLES

The Pedagogical Course Project is a normative document that presents the conception and structure of the course and its internal regulatory elements. In it, normative technical aspects, conceptions of man and society must be present, in addition to proposing the profile of the professional that one seeks to train. According to the Brazilian Forum of Graduate Deans (ForGRAD, 1999), its priority function is to intentionally guide and lead the pedagogical process, being organized based on considerations about the purposes of academic-professional activities and, mainly, about the concept of education and its relationship with society, that is, it is an element that, at the same time that it expresses several elements arising from educational policies for higher education, also guides the daily organization of the classroom. Its organization in HEIs began with the Law of Guidelines and Bases for National Education - LDB (9,394/96).

As for its relationship with the training process, the PPC has a strong impact on its operationalization, outlining the general lines for the didactic, pedagogical and thematic procedures of a given course, seeking support in the Federal Constitution, in the LDB, in the National Curriculum Parameters and in the institutional PDI.

For the construction of the curriculum matrix analysis plan, two issues must be considered: a) understanding the curriculum matrix as an organized whole of disciplines, determined by elements intrinsic to the course and extrinsic to the institution; b) clarity that the disciplines have different statuses within the course and each one ends up assuming a uniqueness according to the course to which it belongs. Although they have specific features, they include knowledge, skills and abilities around the structuring axes, regardless of the format that each discipline wants to adopt. Professional practice refers to the previous determinations regarding the contexts in which the student must be inserted in order to prepare professionally, including mandatory internships express the specific professional practices that are prescribed to be carried out during the course, considering that the function of education is to develop and emancipate the citizen, critically analyzing knowledge and deconstructing it when necessary. Educating and learning are phenomena that involve all dimensions of the human being and, when this stops happening, it produces alienation and loss of social and individual meaning in living. Therefore, it is necessary to overcome the forms of fragmentation of the pedagogical process in which the contents do not relate, do not integrate

and do not interact, so that the PPC in the HEI is drawn up in a democratic way, facing challenges, tracing its goals and building its identity, placing the institution as a good for everyone and everyone who attends it.

The pedagogical proposal, when built collectively, listening to all actors, allows its members to master their path, awareness of their limits, better use of opportunities and, above all, courage to take risks and confidence in solving the problems encountered, in addition to create an environment of solidarity and cooperation, where the greatest commitment is to train students, in order to make them capable of adequately facing the challenges of a complex and globalized society.

From this perspective, the teacher, as one of those responsible for the information during the learning process, needs to know the pedagogical theories and expectations of learners, motivating them to act socially in a reflective and responsible way, not just by living with the collective, but to transmit in a systematic way the knowledge accumulated by humanity. As reported by Moses (2011):

“(…) competent is the teacher who, feeling political committed to its student, knows and uses it properly the resources capable of providing them with real learning and full of meaning. Competent is the teacher who does everything to make your student a critical and well-informed citizen, in condition to understand and act in the world in which he lives”.

Focusing on the articulation between teaching, research and extension has been one of the ways of discussing pedagogical practice in higher education, which has been facing many challenges in today's society, because these challenges imposed on teaching practice are related to the possibilities of integrating the two main didactic actions – teaching and learning, in the context of the classroom. In this regard, Masetto (2013) suggests replacing the emphasis on teaching with an emphasis on learning, given that, as education is a public service of a political nature, it is important to offer apprentices the opportunity to learn to be autonomous and to be subjects of rights. Therefore, the HEI

must unite everyone around common goals, but also around the diversity that characterizes it and its own contradictions, contemplating creativity, dialogue and consensus, which are not always easy to obtain. Therefore, it is in the classroom, in everyday life, that the exercise of dialogue should be practiced, learning to live with one's own culture and respecting the different cultural manifestations, in a democratic and citizen way. Educating for citizenship is fighting prejudice and discrimination, helping others to believe in their potential to transform the world into a better place to live.

In the words of Gadotti (1994), every project presupposes ruptures in the present and promises for the future. Therefore, if the HEI's intention is to train critical, reflective subjects, committed to social transformations, the PPC can contribute to achieving these purposes, as it clearly explains its intentions. In this logic, the PPC involves a set of learning, reflections, actions and relationships that, added to the pedagogical work, form a theoretical, philosophical and political framework that requires strategies to be put into action. Valuing education professionals is another important principle of the PPC. As suggested by Gondin (2000):

You cannot change reality as quickly as you grant change. They are continuous and successively carried out actions that build the greatest change over time. Thus, a democratic and participatory pedagogical practice is established from simple but organic actions and strategies, with a very clear direction (GONDIN, 2000).

It is important to highlight that the improvement of the professional qualification of teachers will also depend on policies that aim to:

- a. The consolidate the academic and professional characteristics of the faculty;
- b. Establish a system of continuous professional development;
- c. Adapt the institutional infrastructure, especially with regard to bibliographic and technological resources;
- d. formulate, discuss and implement a periodic evaluation system;
- e. and. define career plans compatible with professional practice.

The LDB, in its Article 13, says:

“Teachers will be responsible for: 1. Participating in the elaboration of the teaching establishment's pedagogical proposal; 2. Develop and comply with a work plan, according to the teaching establishment's pedagogical proposal; 3. Ensure the students' learning; 4. Establish recovery strategies for low-income students; 5. To administer the established school days and class hours, in addition to participating fully in the periods dedicated to planning, evaluation and professional development; 6. Collaborate with the school's articulation activities with families and the community.”

As can be seen, this article in the LDB presents the teacher as the one responsible for ensuring the student's learning - including those with different learning paces, taking as a reference, in the definition of their professional competences, the student's right to learn, which reinforces their responsibility with the pedagogical proposal of the course, enabling the learner to relate to the object in its entirety, in a dynamic movement between theory-practice, practice-theory, developing cognitive, affective and psychomotor skills related to intellectual work, always articulated, but not reduced to the world of work and social relations. In fact, the pedagogical practice is only perfected by those who carry it out, based on their life story, expectations and aspirations.

On the subject, Kunzer (2013) states:

Theoretical work, which in turn does not do without practice, will determine the difference between practice as repeated repetition of actions that leave everything as it is and praxis as a process resulting from the continuous movement between theory and practice, between thought and action, between old and new, between subject and object, between reason and emotion, between man and humanity, which produces

knowledge, and therefore revolutionizes what is given, transforming reality”.

The constitutional text also outlines the scope of the act of educating, which translates into an investment in personal and professional development, helping those involved in the educational process to become critical citizens, politicized and committed to the development of society. There is an understanding that it is through education that men and women develop, hence its relevance as a permanent process in the lives of subjects. Teaching, therefore, is to provide the student with knowledge of the existence and handling of as many tools as possible, in order to lead him to build his knowledge.

The teaching posture should not be that of a “teacher” or that of a coach, but that of “being with” the students, working with them, so that teaching becomes something alive and stimulating. Thinking about teaching in this way should stimulate students, but also the teacher, as he too, needs to feel alive, performer of activities that bring him pleasure and personal fulfillment, and not just a follower of the rules of the space where he works or a repeater of methods learned when he was a higher education student (VERAS, 2011).

The university is, according to Demo (1999), a classic thinker of this institution, above all synonymous with mutations, challenges, adversities and confrontations with the real world. Pedagogical training, conceived in academic and didactic terms, appears in a panorama of understanding about the quality of teaching work in the classroom, which is not restricted to knowledge, but to their ability to act in circumstances foreseen or not in their action. Today, the teacher is a facilitator in the teaching and learning process, whose main activity is to help students think, question, read the reality of the world and build their own opinions. He must accept the evidence that he is no longer the only source of information for the student and, thus, explore with him other learning environments, thus valuing the collective process, which consists of learning with other students, with other teachers from other areas and with non-academic professionals, extending the learning environment to society at large. This is called interdisciplinary behavior.

1.2. The Importance of Pedagogical Training for Teaching and Learning

The crisis that has emerged since the 1970s and which occurs in Brazil, especially after the 1990s, redraws the profile of contemporary capitalism, presenting the changes that have taken place in the world of work that affect the entire dynamics of the way of living in society and very strongly in the university public. At that time, the neoliberal

restorative project, in response to the demands of big business, "was summarized in the triple motto "flexibilization" of production and labor relations, "deregulation" of commercial relations and financial circuits and the "privatization" of public assets state government" (NETTO, 2012).

From this perspective, higher education, which is responsible for training professionals to work in society, must adapt to changes in the world of work, imposing new challenges to HEIs in terms of student training, which demands teachers with a more critical training and with capacity for reflection. However, it is important not to lose sight of the fact that good higher education professors do not teach only with a focus on the job market, because there is no way of knowing what this same market will be like when their students graduate. Good professors work to direct the learning of their students through the objectives of the educational institution in which they work, with autonomy to guide them beyond market requirements, always up to date with the events of the contemporary world. Good professors are able to guide their students so that they can position themselves socially and professionally in their careers in the future, and this implies a good pedagogical training.

As reported by Masetto (2013):

(...) university professors have only recently begun to become aware that their role as a higher education teacher, like exercising any profession, requires specific and specific training that is not restricted to having a bachelor's degree, or even a master or doctor, or even just the exercise of a profession. It requires all that, and pedagogical competence, as he is an educator.

In light of this statement, higher education professionals cannot be unaware of the need for transformative education, the institutional or social requirements of the historical moment, and should reflect on their role and function, the limits and possibilities of transformative action. The task of training professionals in different areas to work in society requires the teacher to have specific knowledge of the area, but it also requires mastery of pedagogical processes, an element that mediates between the knowledge of those who teach and those who learn to graduate. good professionals, ethically and technically competent.

If the University trains professionals for society, where knowledge is renewed every day and technological changes permeate all spheres, it must be aware of these changes and incorporate them into the student's education, preparing them to interact and respond to possible obstacles that may arise. The preparation of good professionals has been increasingly demanded of Higher Education Institutions, as they are responsible for defining the concept of teaching and pedagogical practice capable of enabling the transposition of contents into knowledge necessary for professional training (BARROS, 2015). This is a process of innovation for rupture, a movement that requires from the teacher a constant posture of investigation, of openness to new learning and reflection on practice, as part of their professionalization process for teaching.

Pimenta and Anastasiou (2014) also defend that the training of educators at a higher level cannot be left out of political training, where critical and social components must compose this training, as only the construction of subjects who reflect on their doing and on the contextual relationships of its performance can bring about effective changes. Agreeing with this view, Schön, in Nóvoa (2010), also advocates a practice of reflection-in-action, understanding that teacher education must be articulated with the HEI and its projects. Following the same reasoning, Pinazza, in Oliveira-Formosinho et al (2007), observes that teacher education must be directed towards meaningful experiences, since only such experiences have formative value.

On the subject, Nóvoa (2013), understands that this is the model that can bring about real changes in practice, as theoretical studies resonate in everyday reality and serve as support to resolve issues and challenges identified in practice. Corroborating Nóvoa, Imbernón (2010) says that teacher education is the formation of the political agent, above all, the citizen who actively participates in the decisions and necessary reconstructions in their society, thinking like a philosopher, communicating as an educator and managing the his practices as an administrator.

As Kopzinski (2010) reflects, the professor in higher education is the reference of the student as a professional and as a person, hence the importance of humility in modifying habits and attitudes that are no longer consistent with the professor's new posture as a mediator of learning. The Ministry of Education Resolution No. 2, of July 1, 2015 defines the National Curriculum Guidelines for initial training at a higher level and continuing education. This document establishes the principles, foundations, training dynamics and management and regulation procedures, the planning of teaching and assessment

programs and processes in the context of initial and continuing education for teaching professionals. Some of the principles referred to in this Resolution, set out in § 5 of art. 3rd, explain:

- a. The teaching professionals must receive training that prepares them for professional practice that recognizes and values diversity, democracy, justice, inclusion and the emancipation of individuals and social groups;
- b. theory and practice must be articulated in teacher education, that is, technical knowledge and didactic knowledge are inseparable, as well as research and extension;
- c. teacher training must include, in its project, a solid and specific theoretical and interdisciplinary basis;
- d. initial training, continuing training and the different levels and modalities of education are linked together;
- e. and. continuing education is essential for professionalization, it is part of the daily life of the school and its pedagogical project;
- f. teaching professionals are educational agents of culture and have the right to permanente access to information, experiences and cultural updates.

In this sense, the Resolution determines curricular interdisciplinarity and integration to form knowledge that qualify for work and the exercise of citizenship, as well as access to quality research and pedagogical support material and pedagogical dynamics that contribute to critical professional practice, collective and interdisciplinary, creative, innovative and autonomous (BRASIL, 2015). This new conception of professional teacher education also corresponds to what Zeichner (2009) considers as the permanent reconstruction of personal and professional identity in mutual interaction with the institutional culture, with the subjects of the process and with the knowledge accumulated in the field of education. . Articles 16 and 17 of the Resolution, within the scope of continuing education, also advocate training actions and courses for updating, extension, improvement, specialization, master's, doctoral and post-doctoral degrees aimed at new knowledge, practices and pedagogical innovations.

It is impossible not to consider that, in addition to the knowledge and skills listed in this text, the teacher needs to master informational language, know how to use

the means of communication and articulate with the media and multimedia, considering that in contemporary times the increasing incorporation of Information and Communication Technologies (ICT), especially digital ones, interfere in ways of life that are increasingly “dependent” on these tools. Such incorporation affects actions, ways of thinking, ways of knowing, ways of communicating and relationships with others, with the world and with knowledge.

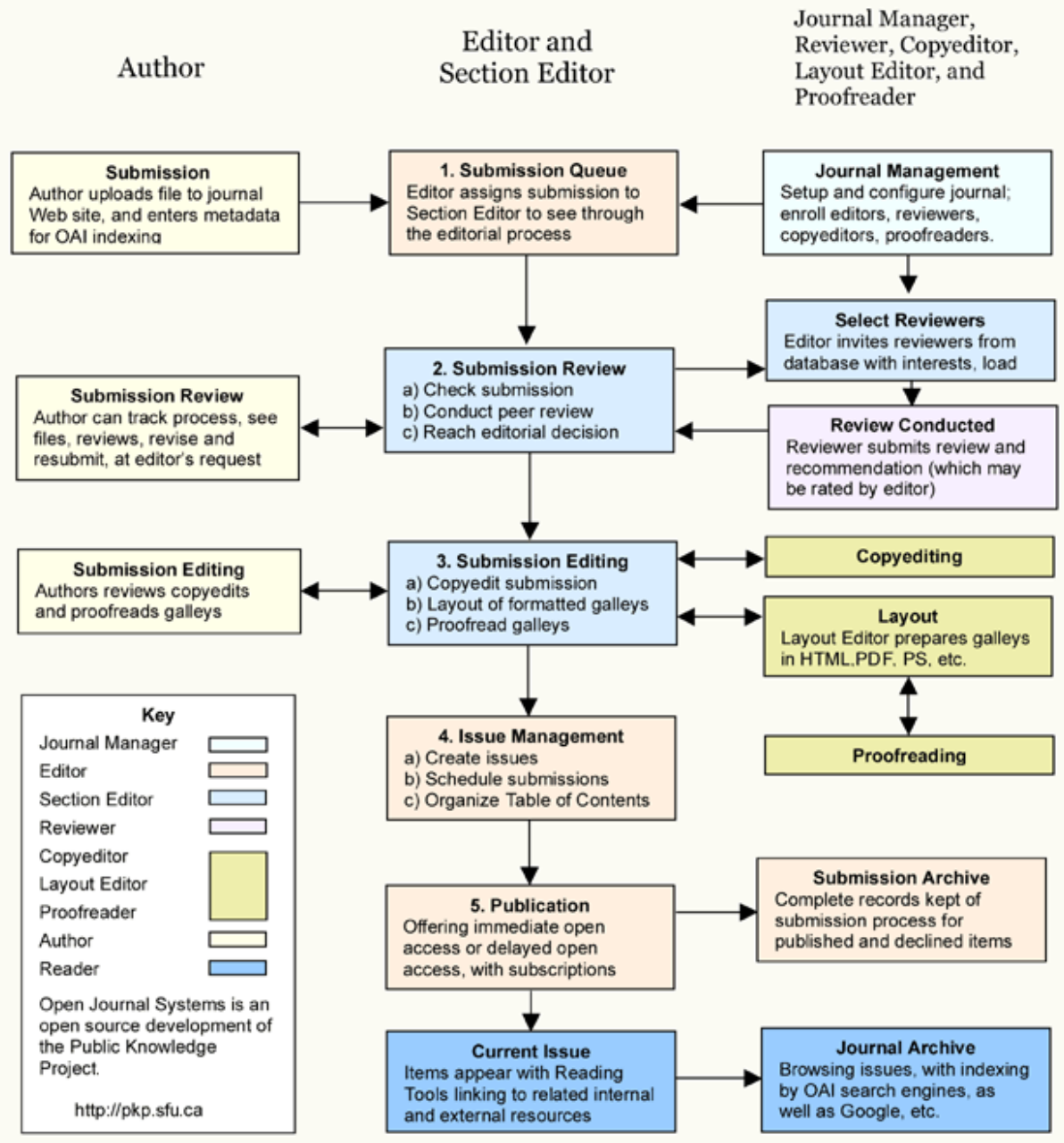
In this context, technology is no longer restricted to computer labs, becoming a condition for the functioning of undergraduate courses. Brought in by students, cell phones with their countless resources are in the classroom; computers and tablets with their infinite possibilities of accessing other worlds. Therefore, it is in this moving world that higher education confronts itself, producing other relationships, connections, learning, meanings that stress traditional ways of organizing and understanding education (BICUDO E BORBA, 2018). Understanding this generation that already brings a hypermedia culture is therefore essential to understand the knowledge produced in the university space.

Given this situation, using ICT to research, carry out academic work, communicate with their professors and colleagues – in short, to learn – means, for students, to establish relationships with others and with themselves. This understanding presents challenges and possibilities for teaching practice in the way of using technological resources in educational processes, since this use involves identity and social aspects.

REFERENCES

- [1] BARROS, Aparecida da Silva Xavier. **Expansão da educação superior no Brasil: limites e possibilidades**. Educação & Sociedade, Campinas, SP, v. 36, p. 361–390, 2015.
- [2] BICUDO, M.A.C; BORBA, M.de C. **Pesquisa Qualitativa segundo a visão fenomenológica**. São Paulo: Editora Cortez, 2018.
- [3] BRASIL. Programa nacional de Educação Ambiental – ProNEA. **Educação Ambiental por um Brasil sustentável** – ProNEA, marcos legais & normativos. Órgão Gestor da PNEA / Ministério do Meio Ambiente e Ministério da Educação. Secretaria de Articulação Institucional e Cidadania Ambiental. Departamento de Educação Ambiental. 4. ed. - Brasília, 2015.
- [4] BRASIL. Lei nº 9.394, de 20 de dezembro de 1996. Dispõe sobre as leis de diretrizes
- [5] e bases da educação nacional. *Diário Oficial da União, Brasília, DF*, 20 dez. 1996.
- [6] DEMO, P. **Educar pela pesquisa**. 03 ed. Campinas, SP: Autores associados, 1999.
- [7] ForGRAD. Fórum de Pró-Reitores de Graduação das Universidades Brasileiras. Do **Pessimismo da Razão ao Otimismo da Vontade**: referências para a construção de Projetos Pedagógicos nas IES Brasileiras, 1999. Disponível: <http://forgrad.com.br/publicacoes.php>
- [8] GADOTTI, M. **Projeto político pedagógico da escola: fundamentos para sua realização**. In M. Gadotti & J. E. Romão (Orgs.). *Autonomia da escola princípios e propostas*. São Paulo: Cortez, 1997.
- [9] IMBERNÓN, Francisco. **A Educação no Século XXI: os desafios do futuro imediato**. 2ª edição. Porto alegre: Artmed, 2010.
- [10] KOPZINSKI, Sandra Difini (org). **Percursos Psicopedagógicos: entre o saber e o fazer**. Novo Hamburgo: Feevale, 2010.
- [11] MASETTO, M. T. **Competência Pedagógica do Professor Universitário**. São Paulo: Sumos, 2013.
- [12] NÓVOA. A. **Desafios do trabalho do professor no mundo contemporâneo**. São Paulo: Sindicato dos Professores de São Paulo, 2010.
- [13] OLIVEIRA-FORMOSINHO, Júlia; KISHIMOTO, Tizuko Morchida; PINAZZA, Mônica Appezzato (org.). **Pedagogia(s) da infância: dialogando com o passado e construindo o futuro**. Porto Alegre: Artmed, 2007.
- [14] PIMENTA, Selma Garrido; ANASTASIOU, Léa das Graças. **Docência no Ensino Superior**. São Paulo: Cortez, 2014.
- [15] KUENZER, Acácia Z. **Competência como Práxis: Os Dilemas da Relação entre Teoria e Prática na Educação dos Trabalhadores**. Boletim Técnico do SENAC, Rio de Janeiro, Vol. 29, nº1. jan/abr., 2013.
- [16] SCHON, Donald A. **Educando o profissional reflexivo: um novo design para o ensino e a aprendizagem**. Porto Alegre: Artmed, 2013.

OJS Editorial and Publishing Process



~JJAERS 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