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FOREWORD

I am pleased to put into the hands of readers Volume-7; Issue-5: 2020 (May, 2020) of "International Journal of Advanced Engineering Research and Science (IJAERS) (ISSN: 2349-6495(P) | 2456-1908(O)", an international journal which publishes peer-reviewed quality research papers on a wide variety of topics related to Science, Technology, Management and Humanities. Looking to the keen interest shown by the authors and readers, the editorial board has decided to release print issue also, but this decision the journal issue will be available in various library also in print and online version. This will motivate authors for quick publication of their research papers. Even with these changes our objective remains the same, that is, to encourage young researchers and academicians to think innovatively and share their research findings with others for the betterment of mankind. This journal has DOI (Digital Object Identifier) also, this will improve citation of research papers. Now journal has also been indexed in Qualis (Interdisciplinary Area) (Brazilian system for the evaluation of periodicals, maintained by CAPES).

I thank all the authors of the research papers for contributing their scholarly articles. Despite many challenges, the entire editorial board has worked tirelessly and helped me to bring out this issue of the journal well in time. They all deserve my heartfelt thanks.

Finally, I hope the readers will make good use of this valuable research material and continue to contribute their research finding for publication in this journal. Constructive comments and suggestions from our readers are welcome for further improvement of the quality and usefulness of the journal.

With warm regards.

Dr. Swapnesh Taterh Editor-in-Chief June, 2020

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DAM as a primary method of structural steel design for stability

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Abstract— Transitioning from a method that does not account for all types of loads, geometric imperfections, and construction flow to a reliable method; the best way is to evaluate their feasibility by design practice. This paper displays a comparative analysis of Effective Length Method (ELM) and Direct Analysis Method (DAM) as the main approaches to stability analysis and design of steel structures. Afterward, the paper detailed the DAM application with second-order analysis to account for P- Δ and P- δ effects, notional load for geometric imperfection, and flexural and axial stiffness reduction to account for inelastic effects. Verification on a 10-story building illustrated DAM to be more comfortable, faster, and ensuring that second-order effects are entirely performed. As the ELM is limited to Δ 2nd order/ Δ 1st order < 1.5, the design analysis check results illustrate that second-order analysis in the DAM leads to a feasibility analysis of ELM.

Keywords— Direct Analysis Method (DAM), Design for stability, Effective Length Method (ELM), Notional loads, Second-order analysis.

I. INTRODUCTION

Stability shall be provided to a structure as a whole and each of its elements. The effects of all the following on the structural stability and its elements shall be considered: (1) flexural, shear and axial member deformations, with all other distortions that contribute to the displacement of a structure; (2) second-order effects (both P- Δ and P- δ effects); (3) geometric imperfections; (4) stiffness reductions due to inelasticity; and (5) uncertainty in stiffness and strength. All load-dependent effects shall be calculated at a level of loading corresponding to LRFD load combinations or 1.6 times ASD load combinations. This paper focuses on the significance of considering second-order effects in structure analysis.

Conducting this study, two preferred methods of structural design for stability: direct analysis method (DAM) and effective length method (ELM) are compared to distinguish one's competitiveness. DAM was found competitive in the various studies as the best method that accounts for both the structural element and the overall frame system stability (M. A. PaL, P. W. Sauer, K. D. Demaree). As it is shown in the results of this paper, in most scenarios, both ELM and DAM show consistent results that adequately capture significant characteristics that control the behavior of a steel frame. This paper proposes that an evaluation of cases in which each one of these methods may not be appropriate has to be conducted. One way to evaluate the feasibility of both methods is simplifying the DAM to second-order analysis method along with the application of notional loads. Section 2 provides the reader with details about ELM and DAM; section 3 discusses the satisfaction of second-order effects; The DAM application detailed in section 5; section 6 comprises the application of the DAM, and section 7 concludes the study.

II. METHODS OF STRUCTURAL DESIGN FOR STABILITY

2.1 Effective length method

Codes of practice rely on an effective length method to assess the stability of multistory frames. The ELM involves isolating a critical column within a frame and evaluating the rotational and translational stiffness of its end restraints, so that the critical buckling load may be obtained. It allows the buckling capacity of a member in a structural system to be calculated by considering an equivalent pin ended column in Euler buckling.

The ELM accounts for the influence of the total frame on the behavior of an individual column. As expected, in many cases, the frame to be analyzed does not comply with all the assumptions listed in the AISC specification regarding ELM, yet designers still use this method to design frame structures. A significant flaw with this method is that for many frame structures to 'fail,' several members within the structure need to fail first. Therefore, the load-carrying capacity for the entire frame is overestimated. In many situations, it makes the ELM too conservative. Thus, tends to counterbalance the effect of inconsistencies between frame behavior and the assumptions that form the basis for this method. Another drawback of this method is its inability to account for the effects of imperfections, which include the out-ofplumbness of the frame.

2.2 Direct analysis method (DAM)

Because the ELM is based on several assumptions on geometry, boundary condition, and material properties of columns, it may not always be appropriate for the design of steel columns, especially for frame configurations in which the conditions of a given column are not consistent with these assumptions. In an attempt to provide a design methodology that would more accurately capture the main factors that affect column behavior, the Direct Analysis Method DAM was introduced into the steel design specifications in 2005 as an alternative to the more traditional ELM [1] [2]. It was upgraded to Chapter C in the 2010 Specification as the primary method to design structures for stability. A significant advantage of the DAM is its ability to account for member and construction imperfections within a frame, which creates additional stresses and reduces the load-carrying capacity of the structure. Therefore, the features of the DAM include P- Δ and P- δ effects, which are accounted for directly through second-order analysis. Geometric imperfections are accounted for, through direct inclusion in the analysis model, or by applying notional loads to displace the structure. Inelastic effects such as distributed plasticity are accounted for in analysis for using flexural and axial stiffness reductions; the best part is that we design using K=1 no more factors.

2.3 The transition from ELM to DAM

Both methods use column interaction equations to estimate the capacity of individual steel columns. The fact that ELM and DAM are different, they will not necessarily produce the same column sizes for a given structural configuration. If the two methods produce substantial differences in size, the adequacy of each method to provide structural members with sufficient capacity to resist the imposed loads becomes a concern. For the many engineers transitioning from the ELM to the DAM, the best way is to learn by practical scenarios. This paper details the design of a 10storey office building to draw out a practical computational example using DAM.

DAM for the design of steel structures is recommended in significant design codes, including EN1993-1-1 [1], CoPHK [2], and ANSI/AISC [3], and has been proven as a reliable method by several researchers. It is a quasi-simulation-based method which employs the Finite-Element (FE) method to capture the actual behaviors of members and structures directly. In the analysis, the significant effects relating to the stability, such as the equilibriums on the deformed shapes, the residual stresses, the initial member out-of-straightness, and the global imperfections, should be comprehensively considered. Therefore, a robust numerical analysis method, being capable of considering these factors, is crucial. [4]

2.4 Comparison between the direct analysis method (dam) and effective length method (elm):

In ELM, notional loads are minimums and negligible, but when the AISC 2010withame out now, ELM requires the use of Notional load according to the specifications. For analysis using ELM, notional is 0.002*gravity loads, and they must be used in combination with the gravity load. Noting that notional load cannot be added to other lateral loads; they are minimums. In case gravity loads combined with notional loads will probably only control of structures with high gravity loads and low lateral loads.

DAM requires explicit consideration of initial geometry imperfections, which is mostly done by applying notional loads to displace the structure. The notional load can be applied as a minimum lateral load acting concurrently with the gravity load for structure second-order effects \leq 1.7; the for second-order greater than 1.7, the notional load must be added to the lateral load and acting in the same direction with the lateral load.

| | Effective Length | Direct Analysis Mothed (DAM) |
|------------------|-----------------------|--|
| | | Method (DAM) |
| Type of Analysis | Second-order or | Second-order or |
| | Amplified First Order | Amplified First Order |
| Member stiffness | Nominal EI & EA | Reduced EI & EA |
| Notional loads | 0.002Yi Minimum | 0.002Yi |
| | | Minimum if Δ_{2nd} |
| | | $_{ m order}/\Delta_{ m 1st~order} \leq 1.7$ |
| | | Additive if Δ_{2nd} |
| | | $_{ m order}/\Delta_{ m 1st~order}$ > 1.7 |
| Column effective | Side-sway buckling | K=1 |

Table 1: Comparison between DAM and ELM

| length | analysis-determine K | |
|-----------------------------------|---|---------------|
| Limitation | $\Delta_{2nd order} / \Delta_{1st order} \le 1.5$ | No limitation |
| AISC 360-10, 16 Specifications | Appendix 7 | Chapter C |

III. SECOND-ORDER EFFECTS

It results from displacement from the structural frame and also from the curvature of the individual members. Equilibrium must be satisfied with deformed geometry of the structure; this includes both system-level effects "P- Δ effect" and member level effects "P- δ effect; In other stability design method b1 and b2 account for these effects. In the DAM, the second-order effects are directly modeled. The P- δ effect is the member level effect, as mentioned, equilibrium must be satisfied with deformed geometry. And the member curvature produces additional moment in the member





When applied to an axial compressive load (P), an additional deflection and momentum result from the axial load acting on the curve moment geometry. Therefore, the total midspan deflection = δ and the total mid-span momentum = $M=FL/4-P\delta$. The $P\delta$ component is the second-order effect. $P-\Delta$ effect: this is an overall system-level effect, again equilibrium must be satisfied on the deformed frame geometry. Gravity displacement produces thrust on the system.



Fig.3: second-order effects

IV. DIRECT ANALYSIS METHOD APPLICATION

4.1 Accurate model frame behavior

It is necessary to accurately model the structure system in order to capture the correct behavior accurately. Thus, it includes correcting: Model geometry, member size orientation, boundary conditions that accurately reflect actual conditions, member properties of stiffness, and incomplete loads, including effects in leaning columns. All seems pretty basic, but the model must represent the actual structural behavior (Fig.4).



Fig.4: Leaning column effects added to the structure model

By leaning columns, it means that gravity columns supporting gravity loads but not parallel lateral load resisting system. Gravity columns lean on the lateral system for stability. It is something missed a lot when analyzing a frame with an isolated 2 D model. Forgetting to add effects of all gravity columns that rely on that frame for support destabilize the frame.

The right column (Fig.4) representing all the gravity columns stabilized by the frame analyzing. As the frame deflects, this column leans on the lateral system for support, and this gravity column also deflects and adds to the overall P- Δ effects. P- Δ effects from this leaning column work to destabilize the frame, so they must be included in the analysis. All loads and conditions that work to destabilize the structure system should be included in the structural model

4.2 Factor all loads (LRFD and ASD)

Loads have to be factored. Even for Allowable Strength Design (ASD) because, when trying to capture the structural behavior of strength limit state, it is remarkable that nonlinear structural behavior can reduce second-order effects as we push to strength limit state. Furthermore, using LRFD, we must factor our loads up to the factored strength limit level. ASD factors all loads by 1.6 then divide the resulting forces by 1.6 again; this accurately captures the structural behavior of the strength limit state. Factoring all loads, include all loads that affect stability, including leaning columns and all other destabilizing loads.

4.3 Consider initial imperfection:

Consider initial frame imperfections, usually by the application of notional loads. It is well clear that all buildings cannot be built perfectly. Initial imperfections such as (1) member out-of-straightness "P- δ effects," (2) story out-of-plumbness "P- Δ effects" resulted from fabrication and rational tolerances increase destabilizing effects that destabilize the structure. Only the initial out-of-straightness (δ_0) effects contribute to the column curves. In the DAM, the story out-of-plumbness (Δ_0) needs to be accounted for an analysis model; this can be done by modeling an out-of-plumbness geometry or by applying a notional load to laterally deflected structure.

The notional load is applied to displace the structure laterally to reduce an initial out-of-plumbness. This notional load needs to be implied at each framing level based on the distribution of gravity loads. Specifications define notional lateral load equal to 0.002*gravity load applied at that level. Notional loads should be applied simultaneously with gravity loads at each level in the direction that most stabilizes the structure.

The 0.002 factor consists of the code of standard practice tolerance HR500 for column or out-ofplumbness. If a little out-of-plumbness tolerance is specified, and assure that the little tolerance will be achieved. Thus, it can reduce the 0.002 factor accordingly to little tolerance. "if relaxed tolerances are allowed or perhaps it is necessary to check an out-of-tolerance condition, then a higher factor should be used based on a larger out-of-plumbness condition.

Initial geometric imperfections are considered by applying "notional loads" or "notional displacements" The specification defines Notional Loads as Ni = 0.002α Yi, where $\alpha = 1.0$ (LRFD), 1.6 (ASD) to make sure that notional loads are factored as the gravity loads. Yi is a gravity load applied at level i. The essence here is that notional loads are factored loads. Ni is added to other

loads to apply in the same direction as the other lateral loads (if the wind load is acting to the right, the notional load acts likewise, and so on). Notional loads are likely to be applied to the direction that requires the most destabilizing effects. Specifications do not have a specific law If $\Delta_{2nd \text{ order}} / \Delta_{1\text{st order}} < 1.7$ (reduced stiffness), or, if $\Delta_{2nd \text{ order}} / \Delta_{1\text{st order}} < 1.5$ (nominal stiffness), then permissible to omit Ni in combinations with other lateral loads.

4.4 Reduced stiffness that contributes to the stability

The consequence of differential cooling rates during manufacturing. Results in earlier initiation of yielding (some sections yield before other sections), thus affecting compressive strength; Lowers member flexural strength and buckling resistance. the stiffness of all members that contribute to stability is reduced, To account for the facts of residual stresses of distributed plasticity. For axial stiffness: (EA* = 0.8EA) and Flexural stiffness (EI* = 0.8 $\tau_b \text{ EI}, \tau_b \leq 1.0$); depending on the magnitude of the Axial load. For lower Axial load when the required strength is lesser than the usual load: $\tau_b = 1.0$ when $\alpha Pr/Py \leq 0.5$.

For high Axial load, τ_b is less than one and is calculated based on the ratio of the required Axial strength to the usual strength, and the resulted flexural stiffness becomes less than 0.8EI. $\tau_b = 1$ when the actual load is lesser than *Py*. $\tau_b = 1$ often wanted for moment frames. The specification offers a simple τ_b Simplification that allows the increase of 0.001 a Yi to notional loads (Ni) so (Ni=0.003 a Yi instead of 0.002 a Yi) then $\tau_b = 1$

- τ_b : $\tau_b = 1.0$ when $\alpha Pr/Py \le 0.5$
- $\tau_b = 4(\alpha Pr/Py)[1-(\alpha Pr/Py)]$ when $\alpha Pr/Py > 0.5$
- $\alpha = 1.0$ (LRFD), 1.6 (ASD)
- $(\tau_b \text{ simplification: } \tau_b = 1.0 \text{ can be used if } 0.001 \alpha \text{Yi}$ added to Ni), (Ni = $0.003 \alpha \text{Yi}$ instead of $0.002 \alpha \text{Yi}$)

4.5 2nd-order analysis

It is necessary to know how a software address $P-\Delta$ and $P-\delta$. For more software packages, it is necessary to mesh the compression element into smaller segments in order to capture $P-\delta$ effects accurately. The number of segments to mesh depends on several factors, including how the software handles the $P-\delta$ and magnitude of secondary effects.



Fig.5: Internally mesh compression elements to capture P- δ effects

(Fig.5) mesh the compression element into four segments. If there is no compression in beams such as in a moment frame like in (Fig.5), there is no need to mesh then since there will not exist significant P- δ effects in those beams. If there exist compression beams, it is necessary to mesh them as well. Some software packages enable to mesh of the frame elements adequately. (Ex: SAP 2000) Make sure about how the software handles secondary analysis in stiffness reductions.

For SAP2000, Reduction factors to EI and EA are assigned after running the design check. Iteration needs to be done as changing member sizes or loads; it is necessary to reduce the cycle of running the analysis performing the design check, then rerun the analysis that calculates the stiffness reductions and then perform the design check again. $\Delta_{2nd \ order} / \Delta_{1st \ order}$ ratio has to be checked After the member sizing:

- If $\Delta_{2nd \ order} / \Delta_{1st \ order} \leq 1.7$ (reduced stiff.) or 1.5 (nominal stiff.), then *Ni* not required in lateral combinations (*Ni* only *required* in gravity combinations)
- If $\Delta_{2nd \ order} / \Delta_{1st \ order} > 1.7$ (reduced stiff.) or 1.5 (nominal stiff.), then include *Ni* in all load combinations.
- Simplification: include *Ni* in all load combinations, then no need to check $\Delta_{2nd \ order}/\Delta_{1st \ order}$ ratio

4.6 K factor and member design

The DA method accounts for both P- Δ and P- δ , and Geometric imperfections considered explicitly. Therefore, no more *K*-factors because K-factor since it is always misapplied. Loss of stiffness under high compression loads will be accounted for during analysis by reducing member stiffness. The net effect amplifies second-order forces to comes close to the actual response. For allowable strength design (ASD), resulting analysis forces should be divided by 1.6 since they were factored by 1.6 for analysis. Keeping in mind that, Since the Analysis is

not linear if any member size or load changes, it is necessary to rerun the analysis and recheck the designs

4.7 Reduced stiffness for serviceability checks

Reduced stiffness is only used in strength analysis. Whereas, unreduced stiffness is used for serviceability checks: vibration and drift limits for wind and seismic are checked using nominal (unreduced) stiffness, and building periods are determined using nominal (unreduced) stiffness.

V. STRUCTURAL DESIGN FOR STABILITY IN SAAP



Fig.6: Accurate model frame behavior

4.8 Gravity Loads

Floor:

- Composite steel deck $(3'' + 3_{1/2}'' \text{ slab}, LWC) = 50 \text{ psf}$
- Superimposed dead load + floor framing = 15psf
- Wall load = 25 psf (over floor area at all levels)
- Live Load = 100psf (reducible)

Roof:

- Same dead loads as floor
- Live Load = 30psf (unreduced)

1.1 Live Load reduction

Applied according to section 1607.10, IBC 2012

$$L = L_0 \left(0.25 + \frac{15}{\sqrt{k_{LL}A_T}} \right) \tag{1}$$

 K_{LL} = Live load element factor: 4 for columnsinterior, exterior w/o cantilever slabs, 2 for beamsinterior, edge w/o cantilever slabs. For beams of moment frames (Table 2)

$$L = 100 \left(0.25 + \frac{15}{\sqrt{2*15*30}} \right) \tag{2}$$

1.2 ASCE 7-05 wind loads

- Basic wind speed, V = 90 mph
- Exposure Type B
- Occupancy Category = II
- Importance Factor, I = 1.0
- Wind directionality factor, $K_d = 0.85$
- Topographic factor, $K_{zt} = 1.0$
- Gust effect factor, G = 0.85
- 1.3 Auto-generation option utilized in SAP
 - ASCE 7-05 seismic loads
 - $S_s = 0.317g; S_1 = 0.106g$
 - Site Class D
 - Occupancy Category II
 - Importance Factor, I = 1.0
 - $S_{DS} = 0.327 \text{ g}; S_{D1} = 0.168 \text{ g}$
 - SDC = C
 - Steel Systems Not Specifically Detailed for Seismic
 - Resistance R = 3; Cd = 3
 - Equivalent Lateral Force Procedure
 - Approximate fundamental period: $T_a=C_th_n^x = 125$ ft
 - For moment frame direction, $C_t = 0.028$, x = 0.8
 - For braced frame direction, $C_t = 0.02$, x = 0.75
 - For $S_{D1} = 0.168$ g, $C_u = 1.564$

Upper limit on period

• T = 2.08 sec for moment frame

T = 1.17 sec for braced frame

1.4 Notional load

•

- Yi (Dead) = 65 psf + 25 psf + 10 psf (partitions) + 10 psf = (vertical framing) = 110 psf
- Yi (Floor Live) = 100 psf
- Yi (Roof Live) = 30 psf
- NDead = 0.002 x 110 psf x 150 ft x 150 ft = 5 kips
- NLive = 0.002 x 100 x 150 x 150 = 4.5 kips
- NLive R = 0.002 x 30 x 150 x 150 = 1.4 kips

Noting that Torsional cases should also be considered. For coupled or correlated systems, Nx & Ny should be applied simultaneously with appropriate directional correlation. (Table 4)

VI. ANALYSIS

1.5 Strength Design Analysis

A second-order elastic analysis is performed, including P- Δ and P- δ effects using reduced member properties. Property modifiers for the analysis: EA*= 0.8EA, and EI* = 0.8 τ_b EI. Assuming that τ_b = 1.0.

1.6 Serviceability Analysis

For serviceability checks, the second-order elastic analysis is performed, including $P-\Delta$ and $P-\delta$ effects using the nominal member properties. (

Table 5, Table 6,

- Table 7)
- ✓ From ASCE 7-05 Table 12.12-1, allowable story drift = 0.020 hsx = 0.020 x 150 in. = 3 in.
 - ✓ Max. story drift = 0.79" (level 9)
 - ✓ Inelastic drift = $3 \ge 0.79$ " = 2.37 in. < 3 in \rightarrow OK

| Levels | Interio | or Colum | n | With 100psf design LL With 75 psf LL | | | | | | Correction in Load | |
|----------|------------------|-----------------------|-----|--|-------------|-------------|--------|--------|-----------|--------------------------|--|
| | Kll = 4 | 4 | | P live | P live * | P live * | P live | P live | P Up | P Upper level | |
| | Tribut reduce | ary area o ed load | of | kips | LLR kips | LLR kips | kips | kips | live kips | (kips) for column LLR | |
| | SF | SF | LLR | | | | | | | | |
| Roof | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Level 10 | 900 | 900 | 0.5 | 90 | 90 | 45 | 67.5 | 67.5 | 22.5 | 22.5 | |
| Level 9 | 900 | 1800 | 0.4 | 90 | 180 | 70.6 | 67.5 | 135 | 58.2 | 35.7 | |
| Level 8 | 900 | 2700 | 0.4 | 90 | 270 | 108 | 67.5 | 203 | 94.5 | 36.3 | |
| Level 7 | 900 3600 0.4 | | 90 | 360 | 144 | 67.5 | 270 | 126 | 31.5 | | |
| Level 6 | 900 | 4500 | 0.4 | 90 | 450 | 180 | 67.5 | 338 | 158 | 31.5 | |

Table 2: Live load reduction

| Level 5 | 900 | 5400 | 0.4 | 90 | 540 | 216 | 67.5 | 405 | 189 | 31.5 |
|---------|-----|------|-----|----|-----|-----|------|-----|-----|------|
| Level 4 | 900 | 6300 | 0.4 | 90 | 630 | 252 | 67.5 | 475 | 221 | 31.5 |
| Level 3 | 900 | 7200 | 0.4 | 90 | 720 | 288 | 67.5 | 540 | 252 | 31.5 |
| Level 2 | 900 | 8100 | 0.4 | 90 | 810 | 324 | 67.5 | 608 | 284 | 31.5 |

| Column Lebel: B-2 | | | | | Area service load | | | | Cumulative factored load | | | | | | Column | |
|-------------------|-------|--------|-------|-----|-------------------|--------|------|--------|--------------------------|--------|-----------|-------------|--------|---------|-----------------|-------|
| | FI. | FI. | Fy of | KLL | Load | Trib. | Load | Trib. | Dead | S-Dead | reducible | Unreducible | Total | Column | Col. Cap (kips) | Pu/Pn |
| | Label | Height | col | | type | Area | type | Area | Load | Load | live load | live Load | load | size | | |
| | | (ft) | | | No. | (ft*2) | No. | (ft*2) | (kips) | (kips) | (kips) | | (kips) | | | |
| No | | | | | | | | | | | | | | | Col. Designer | |
| 10 | Roof | 12.5 | 50 | 4 | 3 | 900 | 2 | 900 | 81 | 16.2 | 0 | 43.2 | 140.4 | W14x30 | 189.8 | 0.74 |
| 9 | 10 | 12.5 | 50 | 4 | 1 | 900 | 2 | 900 | 163.1 | 32.4 | 72 | 43.2 | 310.7 | W14x43 | 357.7 | 0.868 |
| 8 | 9 | 12.5 | 50 | 4 | 1 | 900 | 2 | 900 | 245 | 48.6 | 122.9 | 43.2 | 459.7 | W14x61 | 612.4 | 0.751 |
| 7 | 8 | 12.5 | 50 | 4 | 1 | 900 | 2 | 900 | 327 | 64.8 | 172.8 | 43.2 | 607.8 | W14x68 | 685.8 | 0.888 |
| 6 | 7 | 12.5 | 50 | 4 | 1 | 900 | 2 | 900 | 409.3 | 61 | 230.4 | 43.2 | 763.9 | W14x82 | 628.5 | 0.824 |
| 5 | 6 | 12.5 | 50 | 4 | 1 | 900 | 2 | 900 | 491.6 | 97.2 | 288 | 43.2 | 920 | W14x90 | 1057.7 | 0.87 |
| 4 | 5 | 12.5 | 50 | 4 | 1 | 900 | 2 | 900 | 574.1 | 113.4 | 345.6 | 43.2 | 1076.3 | W14x99 | 1162 | 0.926 |
| 3 | 4 | 12.5 | 50 | 4 | 1 | 900 | 2 | 900 | 656.9 | 129.6 | 403.2 | 43.2 | 1232.9 | W14x120 | 1412.2 | 0.873 |
| 2 | 3 | 12.5 | 50 | 4 | 1 | 900 | 2 | 900 | 739.9 | 145.8 | 460.8 | 43.2 | 1369.7 | W14x132 | 1554.2 | 0.894 |
| 1 | 2 | 12.5 | 50 | 4 | 1 | 900 | 2 | 900 | 823.1 | 162 | 518.4 | 43.2 | 1546.7 | W14x145 | 1732 | 0.893 |
| | | | | | | | | | | | | | 1548.6 | | | |

Table 3: Column load design

4.9 Design analysis check

About the result in

Table 8, $\Delta 2nd$ order/ $\Delta 1st$ order ≤ 1.5 (nominal properties), the design analysis is OK; notional lateral loads are only required with gravity loads. Comparing the Design with ELM: Using the DAM, the drift controlled moment frame had $\Delta 2nd$ order/ $\Delta 1st$ order < 1.5 (

Table 8); therefore, ELM can be used. Whereas, For ELM, analysis is performed using final member sizes, with nominal (unreduced) stiffness. Notional loads are already applied to all gravity only combinations (the same as required for ELM). Shifting to ELM, moment frame K-factors have to be calculated.

Table 4: Notional loads

International Journal of Advanced Engineering Research and Science (IJAERS) <u>https://dx.doi.org/10.22161/ijaers.75.1</u>

| Combo1 | 1.4D + 1.4Nx | Notional |
|---------|---|------------------|
| Combo2 | 1.2D + 1.6L + 0.5Lr + 1.2NDeadx + 1.6NLivex + 0.5NLiveRx | lateral loads |
| Combo3 | 1.4D + 1.4Ny | combined |
| Combo4 | 1.2D + 1.6L + 0.5Lr + 1.2NDeady + 1.6NLivey + 0.5NLiveRy | gravity |
| Combo5 | 1.4D - 1.4Nx | iouus |
| Combo6 | 1.2D + 1.6L + 0.5Lr – 1.2NDeadx – 1.6NLivex – 0.5NLiveRx | |
| Combo7 | 1.4D – 1.4Ny | |
| Combo8 | 1.2D + 1.6L + 0.5Lr – 1.2NDeady – 1.6NLivey – 0.5NLiveRy | |
| Combo9 | 1.2D + 1.6Wx + 0.5L + 0.5Lr | |
| Combo10 | 1.2D - 1.6Wx + 0.5L + 0.5Lr | |
| Combo11 | 1.2D + 1.6Wy + 0.5L + 0.5Lr | |
| Combo12 | 1.2D - 1.6Wy + 0.5L + 0.5Lr | |
| Combo13 | 1.2D + 1.0Ex + 0.5L | |
| Combo14 | 1.2D - 1.0Ex + 0.5L | |
| Combo15 | 1.2D + 1.0Ey + 0.5L | |
| Combo16 | 1.2D - 1.0Ey + 0.5L | |
| Combo17 | 0.9D + 1.6Wx | |
| Combo18 | 0.9D – 1.6Wx | |
| Combo19 | 0.9D + 1.6Wy | |
| Combo20 | 0.9D – 1.6Wy | |
| Combo21 | 0.9D + 1.0Ex | |
| Combo22 | 0.9D – 1.0Ex | |
| Combo23 | 0.9D + 1.0Ey | |
| Combo24 | 0.9D – 1.0Ey | |

| Table 5: Drift for Serviceability Limit State Strength |
|--|
| Controlled Braced Frame Design |

| Level | Deflection 10- | Story Drift 10- | Drift |
|-------|-----------------------|------------------------|--------|
| | yr wind, $\delta(in)$ | yr wind, δ (in) | Index |
| Roof | 0.825 | 0.079 | H/1901 |
| 10 | 0.746 | 0.088 | H/1709 |
| 9 | 0.656 | 0.089 | H/1685 |
| 8 | 0.569 | 0.091 | H/1650 |
| 7 | 0.478 | 0.089 | H/1656 |
| 6 | 0.388 | 0.085 | H/1690 |
| 5 | 0.299 | 0.080 | H/1764 |

| 4 | 0.214 | 0.073 | H/1877 |
|---|-------|-------|--------|
| 3 | 0.134 | 0.073 | H/2058 |
| 2 | 0.061 | 0.061 | H/2451 |

Table 6: Drift for Serviceability Limit State StrengthControlled Moment Frame Design

| Level | Deflection 10-yr | Story Drift 10-yr | Drift |
|-------|------------------|-------------------|--------|
| | wind, δ(in) | wind, δ (in) | Index |
| Roof | 3.43 | 0.13 | H/1174 |
| 10 | 3.31 | 0.21 | H/709 |
| 9 | 3.09 | 0.27 | H/551 |
| 8 | 2.82 | 0.31 | H/483 |
| 7 | 2.51 | 0.35 | H/435 |
| 6 | 2.17 | 0.37 | H/403 |
| 5 | 1.79 | 0.38 | H/390 |
| 4 | 1.14 | 0.40 | H/377 |
| 3 | 1.01 | 0.41 | H/366 |
| 2 | 0.60 | 0.06 | H/249 |

Table 7: Drift for Serviceability Limit State StrengthControlled Moment Frame Design

| Level | Deflection 10- yr wind, $\delta(in)$ | Story Drift 10- yr wind, δ (in) | Drift Index |
|-------|---|---|----------------|
| Roof | 3.12 | 0.127 | H/1178 |
| 10 | 2.99 | 0.211 | H/710 |
| 9 | 2.78 | 0.272 | H/552 |
| 8 | 2.51 | 0.310 | H/484 |
| 7 | 2.20 | 0.344 | H/436 |
| 6 | 1.86 | 0.371 | H/404 |
| 5 | 1.49 | 0.375 | H/400 |
| 4 | 1.11 | 0.385 | H/400 |
| 3 | 0.737 | 0.362 | H/414 |
| 2 | 0.374 | 0.374 | H/401 |

Table 8: Second-Order to First-Order Drift Ratio

| Level | $\Delta 2$ nd/ $\Delta 1$ st |
|-------|------------------------------|
| Roof | 1.23 |
| 10 | 1.29 |
| 9 | 1.34 |

| 8 | 1.38 |
|---|------|
| 7 | 1.42 |
| 6 | 1.45 |
| 5 | 1.47 |
| 4 | 1.47 |
| 3 | 1.47 |
| 2 | 1.49 |

VII. CONCLUSION

It is nearly impossible for a structure member designed using any method to have a capacity equivalent to the assumed loading conditions the structure system may encounter in its service life. Such consideration has been developed in AISC, which resulted in safety factors, load factors, and resistance factors. A method that does not account for all types of loads, including their magnitudes, in addition to ignoring geometric imperfections and construction flow, the same method of analysis provides conservative results. With these facts, a method that offers an unsafe design with failure characteristics, strict boundaries must be specified for its implementation.

In the case study, this paper details the simplicity of DAM by demonstrating with the design of a ten multistory building in Saap software. Furthermore, the following notes are highlighted:

- All loads and conditions that work to destabilize the structure system should be included in the structural model. Forgetting to add effects of all gravity columns that rely on that frame for support destabilize the frame.
- In the DAM, the story out-of-plumbness (Δ_o) needs to be accounted for an analysis model.
- Notional loads are likely to be applied to the direction that requires the most destabilizing effects.
- Reduced stiffness is only used in strength analysis. Whereas, unreduced stiffness is used for serviceability checks.

The result from the design analysis check revealed that the smooth and quicker procedures of the DAM application, including accounting for second-order analysis, prove whether the ELM is feasible.

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Island of Science Laboratory: Scientific Divulgation with Vector for Popularization of Science

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Abstract— The Island of Science Laboratory on the Federal University of Maranhão (UFMA), located in the State of Maranhão, northeastern Brazil is an interactive laboratory of science and technology for training and scientific information, through differentiated, playful and active ways of learning, in which academic discourse and colloquial language are integrated, formal and informal teaching, becoming a permanent learning space of the general public - adult and children (school age or not) - as well as training teachers, training technicians and monitors for new science and cultural centers, developing instructional materials and equipment for science teaching and scientific divulgation, training high school, undergraduate and graduate students. Island of Science Laboratory contributes strongly to scientific education in northeastern Brazil, especially in the State of Maranhão, with expertise in undergraduate education, graduate and high school, focusing on university extension and technological applications. This work presents actions account of the Island of Science Laboratory, especially those performed to bring science and the general public together, with their participation as articulator of the Science and Technology National Week – SNCT to making them the largest event of popularization of science in the State of Maranhão, Brazil.

Keywords—Interactive Science, Science Teaching, Popularization of Science, Scientific Education, Developing of Instructional Materials.

I. INTRODUCTION

The popularization of Science is a multidisciplinary theme that involves different scientific conceptions: Science & Technology, History of Science, Natural Sciences, Health, Education, Media, Linguist, impact of language used in social networks, cultured norm, Applied Social Sciences (L. Massarani,I.C Moreira (2003). In the latter its emphasis is in embryonic phase. We can then foster the activity of scientific divulgation as a complex activity in which scientific and technological knowledge is placed within the reach of the population so that it can use them in their daily activities and decision-making involving the family, the community or society as a whole.

It is noteworthy that in addition to involving different areas of knowledge we also identified in the Brazilian literature an evolution of terminologies such as: scientific divulgation, scientific divulgation, 'scientific vulgarization'¹(L. Massarani and I.C. Moreira, 2002) and more recently the popularization of science was identified even as a line of research (Scientific Divulgation) in National Research Council of Brazil CNPq..

Given the scope the popularization of science is a process of transmission of knowledge of Science and Technology in a language directed to a non-specialized audience. In this context, Leitão and Albagli(P. Leitão, S. Albagli (1997)) treats the popularization of science as a scientific diffusion distinguishing it from communication of science and technology. Thus "scientific divulgation refers to any and all process used for the communication of scientific and technological information". While "The Communication of Science and Technology means the communication of scientific and technological information, transcribed in specialized codes to a select audience formed by specialist".

Our work in the "Island of Science Laboratory" goes beyond the Diffusion and Scientific Communication defined by Albagli, because there we developed Science, Technology of high complexity, we made experiments

¹ National Research Council of Brazil

resulting from undergraduate and graduate research, producing monographs and papers, forming high school, undergraduate and graduate professionals, the latter, in face-to-face form and EAD in different areas of knowledge studying Evolution of Teaching Methods, developing Teaching Projects, Research and Extension (Oliveira, A. J. S., A.M.Nélo, C.C. Costa). For this production we have the financing of the research agencies CAPES, CNPq, FAPEMA, BNB among others in the form of support to research and scholarships. In this aspect we are doing technological communication and promoting Education as a vector of Popularization of Science.

Considering the processes used to transmit scientific and technological information, that is, the popularization of Science is carried out through experiments that demonstrate the laws that govern the Universe, especially physics, in a playful and interactive way, making the junction of Theory and Practice. In addition, these experiments make up a permanent exhibition that is visited Researchers, Professors. Graduate bv Students. Undergraduates, High school and elementary school students and the Society in general. These visits are received by Teachers, Qualified Monitors. On one occasion a Frenchman reflected and mentioned on a visit "it was by visiting science houses like this that he became a PhD".

Our main purpose is to stimulate young people to study science as well as mitigate the distance between Research Centers, the Scientist and society, demystify science, if we have a "Festival like Carnival" why not have a "Science Festival?!" In the laboratory we have done many actions to promote scientific popularization and itinerant education in the State of Maranhão. In the present work we will report the actions of the Ilha da Ciência Laboratory in the triennium 2010; 2011; 2012 especially those executed to bring science and the general public together, as their participation as articulator of the Science and Technology National Weeks – SNCT's of making them the largest event of popularization of Science in the State of Maranhão.

II. HISTORICAL BACKGROUND

UFMA has been actively participating in the National Week of Science and Technology, sometimes as a coexecutor (versions 2004 and 2005), another as director (2006 and 2007), promoting a series of lectures, seminars and interactive workshops in several cities of the State (A.J.S.Oliveira, J.A.S.Oliveira, 2009). From 2007 the SNCT in Maranhão had as one of its goals the interiorization of the Week, a fact that led to the opening of the event the city of Palmeirândia (2007) and the city of Santa Inês (2008), located in the State Center. In these years we had as object to intensify the interiorization, mobilizing the largest number of campuses of UFMA, UEMA, IFMA and Agrotechnical Schools. In 2009, the object of SNCT was to strengthen the process of popularization of Science, Technology and Scientific Divulgation in the State of Maranhão, in a continuous process of joint construction and social inclusion. Thus, the debate between the different areas of knowledge and the access of the Maranhão population, primarily children and young people from high school and elementary school in the state network, who mostly do not have access to Science and Technology.

Our actions are based on the theme chosen by the MCTI to promote the debate of cohesive related themes both in the State in correspondence with the National theme. In 2010 the debate was on "Science for Sustainable Development". That year it was very peculiar because we held a forum to promote the debate of public policies and the holding of the "I State Conference of Science, Technology and Innovation in Maranhão with the theme "Inovar para a Desenvolvimento Sustentável – 2010", in Portuguese, which subsidized the proposal of the State of Maranhão for the 4tha CNCTI.².

In April 2011, the researchers involved with the Popularization of Science promoted a workshop that the debate was very restricted to the city of São Luís and we should expand the debate on environmental and technological education to the State of Maranhão. Considering the size of this State raised the following question: how to overcome the gap mentioned heres, it was decided to launch the "Caravan of Integration of Science, Technology and Education" based on the cities where there were UFMA Campuses to have at least one support base, hence we held "Science Exhibition" scheduling meetings with Educators, Municipal managers aiming that each municipality takes science to the community, preferably to public squares aiming at society to know the potential of existing science, in addition, integrate other people, or scientists so to speak that they are not linked to any Research Institute, that is, "discover their treasures of science", including in this context, the maxim of the Clock Square of USP "in the Universe of Culture the center is everywhere".

In São Luís since 2010 we have been conducting the "Caravan of Voluntary Academic Extension of Science, Technology and Education". In this Caravan, the graduate monitors of public and private Graduate Education

² CNCTI - National Conference on Science, Technology & Innovation.

Institutions trained to hold a workshop on popularization of science and invite them to spend a week living with laboratories in public squares and doing academic circuit visits. These actions justify sharing the experience of three years of work taking "science to where the people are" (Nélo).

Moreira and Massarani (2002) described the historical aspects of scientific divulgation in Brazil, in fact, they held almost a treaty from when Brazilian education was in the hands of the Jesuits until the end of the 20th century. They addressed participation in the way that science museums, periodicals, the importance of television radio including the risk of not turning scientific divulgation into scientific marketing. In this text they address the importance of science museums also gaining interactive form on a national basis.

F.F.S Aguiar (1993) addresses scientific divulgation by presenting the social contribution of the researcher: vices and resistances.

> The public image of the scientist is of considerable prestige, particularly in applied areas. People unrelated to the characteristics of academic and scientific experience think they are the intellectual novelties untouchable and sacred. The scientist remains popularly seen as an eccentric creature, reserved, bowed and provided with special powers. Their findings and findings may have great potential to arouse the curiosity and interest of the general community, but many experts ostensibly despise the possibility of making public their own works or works related to their areas of activity.

In this sense (Oliveira, Nélo and Costa,2012) described the way that knowledge is usually passed on or scientific discoveries as belonging to "privileged minds" or "brilliant" theory dissociated from practice. We often add the specialty of an area or academic reductionism has reached such a way that sometimes understanding is restricted to the small group of scientists.

We do not oppose experts because we are or intend to discard or even devalue their role, more than scientific knowledge should not be restricted to academic boundaries or research institutes, but we advocate that this knowledge be passed on to society, carefully. When we are mentioning that we take science to the streets we lead in these caravans the specialists, our proposal is to make science a popular good.

Of course, this conception is not new is more common to the idea of communication between intellectuals, that is, congresses between experts more between experts and lay people in science or attract/encourage young people to study science is the effort of a small portion of those who hold the power of knowledge.

According to Simone São Tiago (S.S. Tiago, 2010)

In the context of scientific divulgation, teachers play a strategic role, such as educators, opinion makers, multipliers and mediators in the processes of knowledge construction. Education here is understood as processes that result in critical awareness of knowledge, causing changes in attitudes, interests and values. The role of education is to train the citizen able to make decisions and make well-informed choices about all aspects of life in society that affect him. This requires having access to information and also knowing how to process and resignifie it, that is, training enabling an adequate appropriation of information.

But all this effort of popularization of science or diffusion stems from a great effort of researchers has already had its declines as moreira and Massarani reports (2002) of these events many derive from the groups that integrate the Brazilian Society of For the Progress of Science [SBPC]. There are times when this movement expresses opposition to the forms of governments, other communication and popularization of science; the authors report that 1993 was created the young SBPC, more recently a similar initiative for the elderly. In 1998 UFMG, in Belo Horizonte after having organized one of the Meetings of SBPC began to have a great activity for children and young people.

In recent decades, interactive science museums have been increasing where it stimulates the knowledge of the methods of doing science as well as a science in a language in an interactive playful language and transmitted to laypeople, in this sense it is worth emphasizing that science demystify. This movement gains more strength in the State of Maranhão with the advent of the National Week of Science and Technology. In 2004 this event became law and entered the national agenda [SNCT]. For Ildeu de Castro Moreira, 3 this event should promote a greater interaction between science, culture and art, valuing the cultural and humanistic aspects of science; stimulating popular participation in the debate about the impacts resulting from C&T. (...) The activities will only succeed when they bring together HEIs, FAPs, Research Institutes,

³ Secretary of Popularization of the Ministry of Science and Technology, Brazil.

Government in all Brazilian regions, with the aim of disseminating and popularizing science and technology for society in general and, thus contributing to social inclusion (inin S.S Tiago, 2010).

In Maranhão, SNCT is becoming the largest event of Popularization of Science since its conception, but prior to4this fact comes the works of scientific education by the "Island of Science Laboratory", the same longed for the approach of Science with children and begins to develop projects such as "Scientist of Tomorrow" (1992), which had as proposal the Junior Physics Course, educational lecture and visits to different laboratories of UFMA.

In 1998, the space was created for permanent exhibition and a mechanical workshop was incorporated; glassware and refrigeration workshop, called at that time as the "Island of Science Laboratory". Then he created some programs talking to the city he was conducting "Science Shows" and in the neighborhoods where there were drug problems invited expert professors to promote awareness of "No to Drugs" (A.J.S.Oliveira and J.A.S.Oliveira, 2009).

This interactive exhibition receives an average of 850 to 1,000 scheduled visits. In addition to the on-site work, we held Itinerant Science Exhibitions and aimed to promote educational actions of interactive playful science in a daily language in the State of Maranhão. This report somehow integrates the history of popularization of science in Brazil.

However, our purpose is limited to addressing the actions carried out in favor of education and "implementation" of science popularization policies in the last three years. For this purpose, we use as a hub for discussion "Science for Sustainable Development" - SNCT 2010; Climate Change, Natural Disasters and Risk Prevention - SNCT 2011; Green Economy, Sustainability and Poverty Eradication 2011. Our motto is National Week of Science and Technology for several reasons, first the suggested theme should promote the debate between educators and scientists and managers about problems involving the planet, for example measuring the pH of water in 2011. Furthermore, it is made available by the Ministry of Science, Technology & Innovation after it is fertile period in which several institutions are predisposed to form partnerships, in each of these years we carry out different actions and obtained significant results.



Fig.1 - Ph Measurement Map in several municipalities in Brazil. State of Maranhão (MA) located northeast (<u>http://QNIntsbq.org.br/agua/mapa.php</u>)

III. METHODOLOGY OF THE ACTIONS OF THE POPULARIZATION OF SCIENCE

In 2010 we discussed and wrote public policies on science, Technology & Innovation for Social Development one of the axes of the 4th National C&T Conference, for this purpose, we do not carry out alone with the support of SECTEC 5 we request contributions from the Poles of São Luís (A), Imperatriz (B), Açailândia (C),Pinheiro (H), Barra do Corda (D),Caxias (E), Codó (G), Chapadinha (F).



Fig.2 - SECTEC Teaching Centers in Maranhão, Brazil

⁵ Secretary of C&T of the State of Maranhão.

⁴Island of Science Laboratory - UFMA.

These poles as shown on the map represents a radius of approximately 2,096km, meaning that we were already discussing the policies for the sustainable development of the State of Maranhão and inviting the partner institutions to program the actions of SNCT. In April we made the wide popularization to the partner institutions and articulated with the seven UFMA Campuses to carry out the SNCT in their cities. Some testimonials are interesting to record "we have no computer program", that is, we do not have activities to hold C&T Week, we soon realized that the concept of SNCT had not been understood. After holding an on-siteworkshop, the 1st SNCT was held on that Campus/UFMA.

We invited undergraduate students to visit the schools to deliver material about SNCT properly identified in the schools of São Luís to realize that students had opportunities to conduct laboratory experiments, academic circuit visits, environmental lectures etc. Even though they were properly identified, they were barred, we did not even find the presence of those schools in the public square.

Already in 2011 we have evolved a lot, with the realization of the previous SNCT; the 1st State Conference of Science and Technology in 2010, we considered that the event was crystallized for the academic community in the City of São Luís, however the need to visit the schools doing workshop on Science on the Street persisted. Our challenge would be to make the event happen in the cities of the interior of the state. How to overcome this gap? it was decided to launch the "Caravan of Integration of Science, Technology and Education". Therefore, the SNCT/2011 is not restricted to the National agenda from October 17 to 23. Our main goal was to publicize and launch SNCT on UFMA⁶ campuses and its surroundings.

The launch on campuses is not restricted to meetings with Directors, Teachers and Students, it was also invited the municipal managers, Mayor and Secretary of Education. In addition, promote science exhibitionwith itinerant laboratories of the São Luís Campus together with local laboratories promote environmental education, education and the importance of Science and Technology for sustainable development

Considering education as a fundamental vector for Maranhão to extinguish the rates of poverty, the SNCT represents a small stage that should represent a sequence of other stages of the education and training program of professionals in the State of Maranhão. In 2011, the popularization of the Science and Technology Week with lectures and science shows reached a radius of 2,770/km in the State of Maranhão, events from the actions of the Coordinators of the "Island of Science Laboratory" - UFMA.

In 2012 we analyzed the activities carried out in the previous biennium and carried out the following records: the science exhibition was promoted with itinerant laboratories of the Campus/Ufma de São Luís together with the local laboratories promoted environmental education, education and the importance of Science and Technology for sustainable development. Considering education as a fundamental vector for Maranhão to abandon the rates of poverty, the SNCT represents a small step between a sequence of other stages of the education and training program of professionals in the State of Maranhão. The fact of visiting municipalities and their surroundings at the launch of SNCT resulted in a significant number of events.

IV. ANALYSIS OF THE RESULTS OF THE SNCT

One of the great achievements of the SNCT realization in the State of Maranhão was the Law that instituted the Science and Technology State Week of in our State by Governor Roseana Sarney Murad published in DOEMA on 16/03/2012 p. 07.

SNCT in Maranhão is growing significantly according to the illustration of the graphs below. The activities performed were illustrated and described through photographs, where we can observe the interaction between exhibitors, schools and the general public.

In the records contained in the MCTI website, Maranhão: in the Northeast ranking occupies the 1st place and in the national ranking 5th place, Figure 3. However, there is much to be developed since so far, we have only reached 30 municipalities and the state has 217. It means that partner institutions have to make efforts to bring "science to where the peopleare", the ranking represents symbolic information, but the main work still to be done: promoting education to eradicate poverty and achieving sustainable development.

⁶Campus I - St. Louis; Campus Empress II, Campus III Bacabal; Campus IV Codó; Campus V Pinheiro; Campus VI Chapadinha; Campus VII Saint Bernard and Campus VIII Grajaú.



Fig.3-Number of activities at SNCT by State of the Northeast Region of Brazil



Fig.4 - Number of activities at SNCT in all Brazilian States

It can be stated that the 2012 SNCT exceeded our expectations reaching approximately 150,000 people directly and indirectly.

We cannot fail to note that the Science and Technology National Week of is the largest event of popularization of Science in the State of Maranhão according to the illustration of the graph that Figure 4.

V. CONCLUSION

After these actions, a mobile science unit was incorporated into the Island of Science Laboratory to transport researchers and material for actions in the city of São Luís and in the interior, a mobile digital planetarium with capacitade for 40 people and various telescopes for astronomical observations. It was also obtained a space in the largest local newspaper "Jornal o Estado do Maranhão", with a circulation of 15,000 copies a day, for a Column of Science called Vida Ciência, *in portuguese*, and its publication always takes place in the last week of the month. With these actions, scientific divulgation actions have grown considerably.

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Food Supply Chain Management using Blockchain

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Abstract— Food adulteration is an expanding matter because of multilevel food supply networks together with tampering of information on the merchandise product packaging. Within the current technique, the meals bundles don't include the appropriate specifics as meals compounds, manufacturing date, supplier details, along with expiry day. Thus, the end-user or maybe the buyer doesn't have some understanding of that particular item's origins. So as to stop this particular, as well as a computer, monitor the quality of the meal together with a rise inside the transparency of administered information, this particular food resource chain control device is suggested to develop a tamper-proof electronic data source of the meals bundles in every amount. Thus, that suggested method presents the idea of Blockchain engineering, placing ahead the use of Blockchain technologies containing info protection on the food supply chain as well as evaluating it together with the conventional source chain program using Radio Frequency Identification (RFID). We have achieved the accuracy level on comparing with existing system.

Keywords—Food supply, Application Access, RFID, Block chain, QR code.

I. INTRODUCTION

As foodborne illnesses consistently raise, numerous customers are becoming much less dependent on meals, therefore producing a dependence on much more comprehensive info on meal generation. Great importance was attached by the government to food security problems and also implemented a bunch of reaction methods, but attaining results that are significant. This product proposed the Blockchain technology and Radio frequency identification (RFID) that offers a cutting-edge alternative for attaining the goals: Firstly, it offers a lasting history for every transaction sector that is classified directly into specific blocks as well as can't be tampered with. Next, it is able to change lengthy standard papers monitoring manual monitoring system and systems, in order to stop the standard means on the supply chain by struggling with the incorrect effect. Quite simply, provide chain monitoring is a great degree to safeguard foods security, advertising food items brilliance as well as foods accreditation. Within the current technique, the meals bundles don't include the appropriate specifics including components, packers specifics, producing day, along with expiry day, etc.. Thus, the end user or maybe buyer doesn't have some understanding of the merchandise specifics. Real-time keeping track of on the foods quality in addition to exposure of that particular quality list would stop the outbreak of foodborne health problems, economically encouraged adulteration, toxic contamination, food wastage because of myth on the marked expiry dates, along with losses as a result of spoilage, which happen to have wide impacts along the foods protection. Within the suggested method, Blockchain originated as a result of bitcoin, a technological innovation that is a sent out data source along with the constantly improving files viewed as blocks. Furthermore, it's always expanding as brand new blocks are put by miners to it (every ten minutes) to capture the newest transactions. Some papers are surveyed for pointing out the issues in the next section.

II. RELATED WORK

Real-time keeping track of on the quality of the food in addition to the exposure of that particular quality list would stop the outbreak of foodborne health problems, economically encouraged adulteration, toxic contamination, food wastage because of myth on the marked expiry dates, along with losses as a result of spoilage, which happen to have wide impacts along with the protection of the food [1] [2]. To be able to enhance the brilliance and stop food wastage, contemporary IoT based solutions have to keep track of the meal's quality as well as boost the presence of monitored information. You will find a selection of IoT

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based monitoring as well as tracing infrastructures, like electric content surveillance (EAS), (RFID), along with QR codes [3] that are largely highly targeted for automated package level monitoring. Nevertheless, the job of the solutions is restricted to determining the meals program plus it doesn't supply some info pertaining to the express on the quality of the food. This particular limitation stops the fast removal associated with defective merchandise by attaining better degrees of the FSC. For instance, whenever a good management lapse is determined together with the FSC, airers4you is made to remember all of the food treatments inside a particular period frame resulting in enormous financial damage that could be mitigated with the accessibility of specific foods deal quality info leading to specific recalls [4]. Within the literature, a selection of realizing methods suitable for current monitoring as well as tracing infrastructure are suggested for checking food items solutions. These receptors could be noninvasive or invasive within overseeing the chemical or physical qualities of meals, for example, ph. [5], conductivity [6], as well as permittivity [7], or maybe the product packaging atmosphere, like climate [8], moisture [9], dampness [10], or maybe fragrance [11]. Generally, the receptors are targeted to stop defective goods by achieving customers. In addition, the receptors assist within determining crucial bottlenecks within the FSC to enhance the complete effectiveness. Presently, small labor continues to be completed in combining the receptors with the monitoring & tracing infrastructures. Furthermore, the gathered up monitoring in addition to realizing information tends to be more centralized and selectively utilized by certain entities of the FSC. The customers need to believe in the caliber of the merchandise according to the created and printed expiry particular date with no extra understanding of the current quality of it. To go beyond an income-centric or traceability-centric to a value centric source chain, a far more decentralized method is required in the terminology of information revealing[12]. Nevertheless, a tradeoff prevails concerning giving adequate info on the customer concerning a private product or service and also simultaneously protecting the functional secrecy on the FSC. Blockchain has emerged being a decentralized public opinion process that provides and also records transactions of activities that are immutable and also can't be falsified [13].

III. PROPOSED APPROACH

So as to stop wastage and adulteration, contemporary RFID based solutions have to keep track of

the quality of the meal as well as boost the transparency of monitored information. Realizing methods suitable for current monitoring as well as tracing infrastructure are suggested for checking food items solutions. These receptors could be non-invasive or invasive within overseeing the chemical or physical qualities of meals like Permittivity, conductivity, or pH or maybe the product packaging atmosphere, for example, heat, aroma or moisture. Generally, the receptors are targeted to stop defective goods via achieving customers. This may be accomplished by including many specifics as vendors, components, particular date of producing within the blockchain. Blockchain technologies was suggested to enhance the traceability of a food product or service and also most of all, making use of RFID, set aside sensor ID. Each packaged food scanner by having a lodged sensor ID journeys through a number of phases of transactions during various terminals beginning with product packaging via commuter routes, storage space and lastly to a customer for purchase. An information obstruct is produced that contains info around the package deal at every appropriate transaction. When the transaction is confirmed, the transaction on the sensor ID is switched right into an obstruct of info and then appended to its pre-existing details blocks as a result, developing a chain of info blocks.

The provider specifics are obtained out of the provider as well as saved as a POJO type. After the transaction between the manufacturer and the supplier happens, the specifics are published into the blockchain. Via there, you will find three locations in which the info is going to be published towards the blockchain (supplier manufacturer, distributor, and then consumer). As soon as all of the specifics are published into the blockchain, the buyer is able to check the QR code as well as see the info on the provider, maker, and then distributor. When the item is unique, the specifics will likely be returned to the client. On scanning an innovative device, pop in place will seem to showcase the expiry day. When the item is duplicated, subsequently the specifics won't be gotten through the buyer, preferably merely a plain cover will probably be shown. The maker goes into the variety of items that are now being constructed within that particular batch. After the quantity of items talked about by the producer is used up, not one other merchandise below that particular product id may be bought. In case a product with exactly the same id is seen, we are able to realize that identical items are being designed. This throws lighting about the criminal stream.



Fig. 1. Architecture Diagram

Evaluate the barcode number according to API:

For every item, it has the barcode quantity in which quantity is transferred in the foods API and after that materials have got utilizing barcode quantity. The very first action is registration. The registration type will get all of the provider specifics. The next thing is to log in. The provider offers the created items on the producer. In fig.1, we can see the step by step process.

The manufacture transmits merchandise specifics to Block chain:

The maker at first generates the bank account. They are going to analyze the raw substances and also the producer will ask for the variety of raw substances on the provider. After that vendors are going to accept the petition from raw material and the manufacturer is going to be put into the producer listing. The manufacture is going to send the merchandise ID, expiry day, quantity of packets, and so on the blockchain after which the produced item is going to be put into the maker's shipment. By the blockchain, the producer is going to retrieve the service.

Distributer getting the product:

The very first action is registration, which includes all of the distributer specifics. The next thing is to log in. The distributer views the item inside the producer cart after which the item is purchased through the distributor. This particular transaction is going to be put into the blockchain.

QR is able to scan code verification & bank account interfacing:

First of all, the person registration is completed. The registration type includes pc user specifics. After that customer's login. The item coming from the distributor is purchased by the consumer. The customer browses the QR scan by utilizing the movable app then see the merchandise information on the movable that includes production day, packing day, and so on. The customer is going to check the item also they will purchase the item through internet transaction. Last but not least, operator transaction ID, item title as well as the expense will additionally be put into the block chain.

IV. EXPERIMENTAL RESULTS

The experiments are performed using the TOMCAT 7.0 and MYSQL 5.0 version. The computations are performed using Toolbox that is readily available in TOMCAT. In Fig. 2, Product details according to the QR code or EPC screenshot, here users can see the details with temperature and supply chain environment created using the proposed system. Fig 3 is a distance and tag orientations that was created to test the computation response. Every application access was scheduled with security terms. Every result was satisfied using the program and tested with back end process. We can see the clear comparison.

| Pro | duct History | | | | | v |
|---------------------------------|---------------------|-------------------|--------|---------------|---------------|---|
| No | Record Datetime | EPC | Name | Location | Business Step | |
| 1 | 2018-06-10 10:04:59 | 0000000.030241.15 | Kimchi | Producer | Receiving | |
| 2 | 2018-06-11 09:35:29 | 0000000.030241.15 | Kimchi | Producer | Shipping | |
| 3 | 2018-06-11 09:40:13 | 0000000.030241.15 | Kimchi | Transporter 1 | Shipping | |
| 4 | 2018-06-11 16:19:40 | 0000000.030241.15 | Kimchi | Distributor 1 | Receiving | |
| 5 | 2018-06-12 09:33:29 | 0000000.030241.15 | Kimchi | Distributor 1 | Shipping | |
| Pro | ducer Cold Storage | | | | | v |
| 5.0 4.5 4.0 3.5 3.0 | | h | s. | M | | - |

Fig.2: Product According to Electronic Product code (EPC)



Fig.3: Success Rate and Signal Quality



Fig. 4: Accuracy level

Fig. 4 shows the Accuracy level. The data are then trained with a proposed scheme which is widely used for all techniques. Some databases are kept for training and the rest are kept for testing the proposed schemes. Hence the result satisfies the expected output, achieved the Accuracy level on comparing with the existing model.

V. CONCLUSION

The evolved food supply chain control process is designed to improve traceability and transparency inside the food-producing industry. Advertising the blockchain is really worth know-how for supporting the federal government monitor, computer monitor as well as audit the meals supply chain as well as supporting makers to capture the transactions in authenticity. Not merely this particular know-how may benefit the consumers, companies and also the supervision departments but additionally enhance the effectiveness of the food supply processing as well as blood circulation. Nevertheless, the solutions continue to remain in an idea, not adding directly to training. This makes it possible for the customer to determine the lifecycle on the item and stop foods adulteration as well as tampering.

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Determinants of labor unrest in the Bangladesh readymade garments industry

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Abstract— The purpose of this study is to Determinants of labor unrest in the Bangladesh readymade garments industry. The readymade garment (RMG) sector has been playing an important role in the overall economic Development of Bangladesh.

Due to the labor unrest there has been huge loss of production and some of the garments factories were ruined by protesters, several laborers were killed and lots of injured and arrested.

It is said that there were legitimate demand of the laborers which should have been addressed by the owners. But these demands were not addressed which created the grievance the laborers. In course of the time these grievance bolstered the unrest.

In this connection, this study tried to find out the factors behind the unrest in the ready-made garment industry of Bangladesh and identifies some measures to improve the situation. In this study, 545 workers were interviewed from the different garment factories located in Savar, Gazipu and, Narayanganj district of Bangladesh. Data were analyzed with factor analysis, correlation analyzed, and regression model and by using other suitable statistical tools. The results show that the main causes of labor unrest include Health and hygiene, safety problem, working hours and leave, wages and payment, Labor union and owner's relations, political violence effect. If the policy makers of Bangladesh consider these causes and make policies to overcome the problems the labor unrest in garment sector may be minimized. Data analyzed using SPSS 23.0.

Keyword— Labor unrest, Readymade garments sector in Bangladesh.

I. INTRODUCTION

The readymade garments (RMG) sector is the oxygen of Bangladesh economy. At present in Bangladesh has 4.56 thousand garments factory but garments worker don't get legitimate rights. Most export revenue in Bangladesh from RMG sector in Bangladesh but garments worker don't get their expected opportunity from RMG sector, that's why on occasionally happened labor unrest in RMG sector. The RMG sector is leading foreign currency earner of the country that received more than three fourth (about 81.32%) of total export earnings (Bangladesh Bank, 2017). This RMG sector is connected with the world economy through export, import and commodities marketing. The RMG sector circulates the Bangladesh economy. After the liberation period, Bangladesh economy depended on raw jute and jute products, when jute industry fallen then RMG sector come in first place by replacing jute industry. Bangladesh first exported RMG goods

US\$ 69,000 (Latifi, 2015) these industry played the vital role in employment generation and proper distribution of income. Labor unrest is the major complicated problem in RMG sector in Bangladesh. Labor unrest means measure how the workers are dissatisfied toward job and working environments. When the workers are mentally, physically, economically and socially dissatisfied the garments sector can be exaggerated from them. Many components are involved to dissatisfied of workers, if would be properly implemented, workers will be satisfied and can be reduce labor unrest in garments sector. It is also related to the co-worker, management, attitude, working conditions, work policy, wages, holiday and so on. Bangladesh is labor intensive country, where the low labor wage comparing with other exporting countries per month BDT 8000 (Bangladesh Govt's additional Gazette, 2018). In Bangladesh there are 4222 garments factories and about 4

to USA in 1978; then Reaz Garments exported only

million employees engaged in RMG sector, 85 percent of which is women. According to BGMEA, 30 percent capacity of RMG sector is unutilized due to lack of skilled labor force. Since 2005 employment in RMG sector increases from 2 million to 4 million in FY 2014. As well as number of active factories increases from 4107 to 5600 in 2012-13 (Bangladesh Bank, 2015). According to S.M Akterujjaman and Md. Herok (2016) the RMG sector has many dissatisfaction issues to increase labor unrest in this sector. Its possible reduce worker dissatisfaction by taking appropriate action.

II. LITERATURE REVIEW

S.M. Akterujjaman and MD. Herok Ahmad (2015) found that RMG sector of Bangladesh got remarkable development in the world, though the wages payment and others facilities were not satisfactory to the employees. Though most of the employees are women but they are working in the bottom level management such as helpers, machinists and less frequently as line supervisor and quality controllers, whereas most of the man are working in the top management.

Kamrul Hasan, Ashraful Islam, Md. Arifuzzaman(2015) aimed to identify of dissatisfaction of the service and employment, wage problem, communication gap, medicine and medical care problem, force to worker, political violence effect, emergency exit problem, discrimination problem and hygienic water& sanitation problem and labor union & garments owners relations problem. Labor unrest has been a common phenomenon in the RMG industry of Bangladesh. Workers are being embroiled in clashes frequently; they call strikes often to make their demand home. It causes enormous loss to the owners, cripples the economy and tarnishes the image of the country aboard. It also makes foreign buyers reluctant to render future orders. In addition the industry is losing competitive edge for this. In July 2009, due to massive labor unrest, Hameem Group, a leading garment manufacturing factory incurred a loss of around 100 crore taka and two workers died with resultant loss of 2000 jobs [3,4]. The long-standing grievance of the workers is the first cause for labor unrest. The growth of RMG industry of Bangladesh much depends on hard work of the labor force. But unfortunately they are deprived of minimum facilities. They are to live a sub-standard life in city slums for years. The wage they get is low. Very often they do not get their salary, overtime bills and bonus in time. Their recruitment system is hiring and firing as they do not get any appointment letter and identity card of the factory and at any time they can be

anything about their job contract. Being maltreated by owners and mid-level officers, working long hours in congested environment without sufficient rest, lack of nutritious foods, medicine, right to legitimate protest against ruthless exploitations etc. are their daily destiny. They don't have any access to the decision making process. Factory building collapse, fire accident, stampede render many dead and injured. Nevertheless, if any worker protests against owners or management, he/she is threatened by various types of harassment such as dismissal, arrest or even physical assault by the hired hooligans of owners. Most of the labor force of this sector are uneducated, unskilled and have come from rural area simply in search of livelihood. They have to work hard in return for a very poor salary [3, 4]. Khatun&Shamsuzzaman (2015) focused on the job satisfaction of RMG industry in Bangladesh by reviewing on working conditions of employees and failure of existing labor laws. The study found that the workers in AKT group are satisfied with working environment, health facilities, female workers, and overtime benefits. On the other hand, workers are dissatisfied with wages, environment of present residence, and behavior of immediate superior and so on. Ahamed (2013) in his study found that the working conditions of RMG sector in Bangladesh are poor and facing challenges regarding social compliance. These include RMG sector's inadequate application of labor standards, and labor rights, law and enforcement, effective bargaining facilities. His study revealed that fair labor practices and government and entrepreneurs' role in the decent work implementation is necessary. Farhana, et al. (2015) studied about wages level, age group, gender, family life, living standard, and working hours of worker's in the RMG industry of Bangladesh. Having high demand the garments of Bangladesh in the international market and to capture this market, improvement is needed in some areas like labor wages, business climates, trade logistics, improvement compliance, and skills of workers.

dismissed by owners for any reason. They don't know

Chowdhury &Ullah (2010) depicted the conditions of female workers from social and economic perspectives and recommended that to achieve female workers satisfaction improvement in the prevailing socio-economic facilities is highly needed, which will bring ultimate success of RMG sector in Bangladesh. Alam& Kamal(2006) studied to measure the overall job satisfaction of female Workers and to identify factors contributing to job satisfaction or dissatisfaction in the garment factories in Dhaka city. As a result export performance of RMG sector in Bangladesh is decreasing which emphasis on the Failing to get expected sustain of the economy and increasing labor unrest.

III. HYPOTHESIS AND CONCEPTUAL FRAMEWORK

Based on the framework and objectives of research, the present study seeks to test the following hypothesis. Referring to relevant literatures and using typical variables, this study will try to test the following 6 theoretical hypothesis, which could demonstrate the determinants of labor unrest and also their relationships in Bangladeshi readymade garments industry sector.

H1: Health and hygiene has a positive significant relationship with Labor Unrest

H1: Safety and health has a positive significant relationship with Labor Unrest H2:

H3: Working hours and leave has a positive significant relationship with Labor Unrest

H4: Wages and payment has a positive significant relationship with Labor Unrest

H5: Labor unions and owners relations (management and worker Relation has a positive significant relationship with Labor Unrest

H6: Political violence effect has a positive significant relationship with Labor Unrest.



Fig.1: Conceptual framework
IV. DATA COLLECTION

We collect the data by using questionnaire .The questionnaire have two parts. The first part was create to understand the personal information of respondents using nominal scale. The second part consists the perceptions of respondents regarding the constructs of the model. All constructs were measured using multiple items by a five point Likert-type scale (1= strongly disagree, 2= disagree, 3= moderately agree, 4= agree, and 5= strongly agree).For this research we collected dada by using simple random sampling. Data are collected from 545 randomly selected garments workers at different location of Bangladeshi readymade garments sector using a questionnaire consisting of 33 questions.

V. ANALYSIS AND RESULT

Here we will provide the profile of the sample and results of the data analyses. All the scales showed satisfactory levels of internal consistency, with α value greater than .7. Finally, the hypotheses developed were tested through regression analysis in IBM SPSS. The results show that all hypotheses were supported.

5.1. Factor analysis

To investigate the appropriateness of factor analysis Kaiser-Meyer-Olkin (KMO) and Bartlett's test Statistic was used which were shown in above table. If, the KMO value is greater than 0.6 is considered as adequate [8]. From our analysis we found that the value of Kaiser-Meyer-Olkin

Measure of Sampling Adequacy is 0.810 that is greater than 0.6 indicates the value of Kaiser-Meyer is acceptable and the value of Bartlett's Test of Sphericity is also statistically significant and acceptable.

Factors names are working hours, and leave, wages and payment, Labor union and owner's relations, Labor unrest, political violence effect Health and hygiene, safety problem, ,. Factor1 is combination of 4 variables WHL1, WHL2, WHL3, and WHL4 and had loading 0.742, 0.749, 0.656, and 0.703 respectively. Factor2 is combination of 4 variables WP1, WP2, WP3, and WP4 and had loading 0.884, 0.828, .0.727, 0.846 respectively. Factor3 is combination of 4 variables loading LOR1,LOR2,LOR,3,LOR4 and had 0.754. 0.719,0.781, 0.687 respectively.Factor-4 is combination of 4 variables LU1,LU2,LU3,LU4 and had loading 0.821, 0.824, 0.792, 0.917 respectively. Factor5 is combination of 3 variables PV1, PV2, PV3 and had loading 0.886, 0.900, and 0.851 respectively. Factor6 is combination of 5 variables HH1, HH2, HH3, HH4, HH5 and had loading 0.587, 0.557, 0.613, 0.887, 0.870 respectively. Factor7 is combination of 3 variables SP1, SP2, SP3 and had loading 0.704, 0.756, and 0.768 respectively.

To check multidimensionality of labor unrest, coefficient alpha was computed separately for all variables identified, indicating good consistency among the items variables.

| | Component | | | | | | | |
|-----|-----------|---|---|------|---|------|------|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| LU1 | | | | .821 | | | | |
| LU2 | | | | .824 | | | | |
| LU3 | | | | .792 | | | | |
| LU4 | | | | .917 | | | | |
| HH1 | | | | | | .587 | | |
| HH2 | | | | | | .551 | | |
| HH3 | | | | | | .613 | | |
| HH4 | | | | | | .887 | | |
| HH5 | | | | | | .870 | | |
| SP1 | | | | | | | .704 | |
| SP2 | | | | | | | .756 | |

Table 1. Rotated Component Matrix^a

| SD3 | | | | | | | 769 |
|-------------|-------|-------|-------|-------|-------|-------|-------|
| 513 | | | | | | | ./08 |
| WHL1 | .742 | | | | | | |
| WHL2 | .749 | | | | | | |
| WHL3 | .656 | | | | | | |
| WHL4 | .703 | | | | | | |
| WP1 | | .884 | | | | | |
| WP2 | | .828 | | | | | |
| WP3 | | .726 | | | | | |
| WP4 | | .846 | | | | | |
| LOR1 | | | .754 | | | | |
| LOR2 | | | .719 | | | | |
| LOR3 | | | .781 | | | | |
| LOR4 | | | .687 | | | | |
| PVE1 | | | | | .886 | | |
| PVE2 | | | | | .900 | | |
| PVE3 | | | | | .851 | | |
| Reliability | 0.792 | 0.709 | 0.822 | 0.824 | 0.784 | 0.852 | 0.809 |

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

5.2. Correlation analysis

Correlation analysis is applied to test the correlation between variables. Only when the correlations are significant, it is meaningful to test the casual relationship between these variables. We use the following table-3 to show the correlation test results. Results show that the correlations between these variables are very significant (all the sig values are lower than 0.05). It means, the casual relationship between variables could be explored.

| 7 | able | 2. | Correl | lations |
|---|------|----|--------|---------|
| | | | | |

| | LU | HH | SP | WHL | WP | LOR | PVE |
|-----|-------|-------|-------|-------|-------|-------|-------|
| LU | 1.000 | | | | | | |
| HH | .359 | 1.000 | | | | | |
| SP | .494 | .434 | 1.000 | | | | |
| WHL | .550 | .447 | .772 | 1.000 | | | |
| WP | 138 | .082 | .130 | .090 | 1.000 | | |
| LOR | .442 | .238 | .419 | .495 | .008 | 1.000 | |
| PVE | .023 | 027 | .040 | .047 | .096 | .072 | 1.000 |
| | | | | | | | |

| Descriptive Statistics | | | | | | |
|-------------------------------|---------|----------------|-----|--|--|--|
| | Mean | Std. Deviation | Ν | | | |
| LU | 16.3358 | 3.99346 | 545 | | | |
| HH | 7.7284 | 3.63748 | 545 | | | |
| SP | 4.6826 | 2.46001 | 545 | | | |
| WHL | 6.6495 | 3.15006 | 545 | | | |
| WP | 5.3835 | 2.30044 | 545 | | | |
| LOR | 6.1890 | 3.15399 | 545 | | | |
| PVE | 13.9486 | 2.52144 | 545 | | | |

Table 3. Mean and std. Deviation

5.3. Regression Analysis

Here we used the following regression model $LU{=}\alpha{+}\beta{1}X1{+}\beta{2}X2{+}\beta{3}X3{+}\beta{4}X4{+}\beta{5}X5{+}\beta{6}X6{+}e$

Where, LU = Labor unrest

X1= Health and hygiene

X2= Safety problem

X3= Working hours and leave

X4=Wages and payment

X5= Labor union and owner's relations

X6= political violence effect

Table 4. ANOVA

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|-----|-------------|--------|-------------------|
| 1 | Regression | 3234.539 | 6 | 539.090 | 53.304 | .000 ^b |
| | Residual | 5441.013 | 538 | 10.113 | | |
| | Total | 8675.552 | 544 | | | |

a. Dependent Variable: LUL

b. Predictors: (Constant), PVE, HH, WP, LOR, SP, WHL

| | | Ι | able 5. Coefficie | nts | | | |
|-------|------------|----------------|--|------|--------|------|--|
| | | Unstandardized | Unstandardized Coefficients Standardized | | | | |
| Model | | В | Std. Error | Beta | t | Sig. | |
| 1 | (Constant) | 21.890 | .871 | | 25.140 | .000 | |
| | HH | .127 | .043 | .116 | 2.994 | .003 | |
| | SP | .186 | .089 | .114 | 2.091 | .037 | |
| | WHL | .371 | .073 | .293 | 5.113 | .000 | |
| | WP | 160 | .060 | 092 | -2.651 | .008 | |
| | LOR | .285 | .050 | .225 | 5.708 | .000 | |
| | PVE | .100 | .055 | .063 | 1.829 | .068 | |

a. Dependent Variable: LU

VI. DISCUSSION

This research showed that Health and hygiene, safety problem, working hours and leave, wages and payment, Labor union and owner's relations, political violence effect are the key factors which are representing labor unrest in readymade garments sector of Bangladesh. This study finds working hours and leave and Labor union and owner's relations both have significant positive impact on labor unrest in readymade garments sector of Bangladesh. This result is consistent with finding of other scholars [9, 10]. Generally, working hours and leave is the vital predictor of labor unrest, but this research establishes working hours and leave has great impact on labor unrest simultaneously with Labor union and owner's relations. Again, the study results show safety problem has the mediating role between working hours and leave, Labor union and owner's relations and labor unrest. It implies that working hours and leave and Labor union and owner's relations both have indirect impact on labor unrest through safety problem, which is similar to the other studies [11]. This outcome also offers implications for garments industry in Bangladesh.

Health and hygiene and political violence effect also have positive effect on labor unrest. Safety problem have significant positive impact on labor unrest. In the readymade garments sector,

Safety problem is a functional factor in determining whether a working hours and leave is of Labor union and owner's relations or not [12].We also give contribution to parties, individual or organizations. Hence the current research can be as reference for further research in future, especially those researches related to that Health and hygiene, safety problem, working hours and leave, wages and payment, Labor union and owner's relations, political violence effect. Readymade garments sector in Bangladesh need to consider their that Health and hygiene, safety problem, working hours and leave, wages and payment, Labor union and owner's relations, political violence effect and review their industry strategy. Finally, managerial implication of this research will help garments industry owners to evaluate their workers satisfaction strategies and upgrade their strategy to face new others industry workers opportunity by attracting more workers satisfaction.

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The Role of Nursing in identifying the early Diagnosis of Cervical Cancer in Primary Care: Integrative Literature Review

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Abstract— Objective: to identify scientific evidence in databases on the identification of the early diagnosis of cervical cancer carried out by nurses, between the years 2012 and 2018. Method: Consists of a descriptive study, with a qualitative approach developed through the Integrative Review of Literature (RIL). Method: for data analysis, the IraMuTeQ software was used, which prepared the Dendrogram with the most used words and divided into classes described below: 1) The role of nurses in the promotion and prevention of cervical cancer; 2) The actions developed in the Primary Care services for early identification of cervical cancer; 3) Factors that make it difficult for women to perform the PCCU exam. Results / discussion: after analysis, it was concluded that most women are unaware of the problems related to cervical cancer and Pap smear. Conclusion: This fact may be related to the lack of information, fear and shame when performing the exam.

Keywords—HPV. Neoplasia. Cervical cancer. Prevention. Nursing.

I. INTRODUCTION

Infection with human papillomavirus (HPV), in general, affects young people at the beginning of sexual activity and most of these infections are asymptomatic and transient. Few cases progress to invasive carcinoma of cervical cancer, with the virus and its persistence as important factors for differential biological behavior.

However, there are additional risk factors for the development of cancer lesions, such as: multiparity,

smoking, concomitant presence of other sexually transmitted infections, mainly *Chlamydia trachomatis*, herpes and human immunodeficiency virus (HIV) [1].

For Bortolon et al. [2], due to the high incidence and mortality in the Brazilian female population, CC is a public health problem, it can be avoided when precursor lesions, which are not cancer, are diagnosed and treated early. According to the National Cancer Institute José Alencar Gomes da Silva [INCA] (2015) [3], in Brazil, control of cervical cancer is a priority, using the Pap smear as a screening strategy, with the objective of guaranteeing its access by women aged 25 to 64 years, assessed as being at higher risk, and qualify or diagnose and treat cancer precursor lesions.

For Correa and Russomano (2012) [4] the primary prevention of CC is associated with a reduced risk of infection by the virus, as transmission occurs mainly through sex, the use of condoms during sexual intercourse with penetration protects, however in a way partial. The vaccine has more evidence of protection and is indicated in cases where there was no contact with viruses.

According to Rodrigues and Sousa (2015) [5] the transmission can be done by any individual who has injuries caused by HPV, and can be in direct contact with the infected skin with micro cuts or by micro trauma common in any sexual relationship, which is the main form of transmission of the virus, including anal and oral sex.

In view of the above, nurses play an extremely important role in care, education and research activities. Because this professional plays an important role in health and disease, because it works at different levels of prevention Preventive actions should not be isolated, but form a continuous link with the female and male population. Although the cytological examination requires intimate exposure, it is an embarrassing procedure, nurses have a fundamental role to be able to break the prejudice of a simple, painless examination, but full of benefits to promote women's health (Moura, Nunes, Rodrigues & Nobrega, 2016) [6].

Given the importance of the theme, this study aimed to identify the scientific evidence in the databases on the identification of the early diagnosis of cervical cancer performed by nurses in primary care, from 2012 to 2018.

II. METHOD

This study consists of a descriptive study with a qualitative approach of the type Integrative Literature Review (RIL). To perform the RIL, the following steps must be followed: 1) Establishment of a hypothesis or

research question; 2) Sampling or searching the literature; 3) Categorization of studies; 4) Evaluation of the studies included in the review; 5) Interpretation of results; 6) Synthesis of knowledge or presentation of the review.

Initially, the research topic was delimited on the role of the nurse in identifying the early diagnosis of cervical cancer. Based on the problem and the object of study, the following research question is raised: what are the actions taken by nurses for the early diagnosis of cervical cancer and what are the main difficulties faced by women in Basic Health Units to perform the Pap test?

This study was carried out through a careful electronic search in a database specialized in health and nursing. The following databases were used: Database in Nursing (BDENF), Electronic Scientific Online Library (SCIELO), Latin American and Caribbean Literature in Health Sciences (LILACS). The controlled descriptors used in this study, obtained from Decs (Health Sciences Descriptors), involved "HPV", "neoplasm,", "cervix", "prevention", "nursing" and "diagnosis". As uncontrolled descriptors (keywords), the following were used: "human HPV" and "prevention and diagnosis".

The following inclusion criteria were used: articles published in Portuguese, English and Spanish; surveys available in full and online; articles published from 2012 to 2018 available electronically and in full for consultation. The following were excluded from this study: editorials, letters to the editor, reflective studies and studies that do not address the relevant topic for the purpose of the study.

At the end of data collection, 3,663 records were found in the databases. The articles were selected according to the title of the article, authors, year and database, type of study and publication, objective and sample of results. At the end of this stage, the final sample, consisting of 12 publications, in which they met the established criteria, as shown in Table 1, below.

| ARTICLE TITLE | AUTHORS / YEAR / DATABASE | STUDY TYPE / PUBLICATION OF COUNTRY | OBJECTIVE | SUMMARY OF RESULTS |
|---|--|---|---|--|
| Knowledge and practice of women attending the Family Health Unit on the Pap smear. | Thatiany Rodrigues Santiago, Magna Santos Andrade, Patricia Gilvânia Passion birth. 2014. BDENF | Study cohort cross. Brazil | Describe the knowledge and practice of Pap of women between 25 and 59 years served by the Strategy of the Family Health. | The study showed that most of the women had adequate practice regarding the Papanicolaou. However, the prevailing ignorance about the purpose of the collection for the Pap smear. |
| Epidemiological profile of women with HPV attended at a basic health unit. | Thulium Felipe Vieira de Melo, Héllyda Bezerra de Souza, Dany Geraldo Kramer Cavalcanti Silva, Richardson Augusto Rosendo da Silva. 2016. BDENF | Study document. Brazil. | To describe the epidemiological profile of women with HPV treated at a Basic Health Unit. | The epidemiological profile was characterized by women aged 19-30 years, married, white, with incomplete secondary education, income up to one minimum wage, first intercourse between 15- 17 years and a partner. |
| Access to health services for the control of cervical cancer in primary care. | Magna Maria Pereira da Silva, Maria Teresa Cicero Lagana, Clelia Albino Simpson, Ana Michele Farias Cabral. 2013 BDENF | Cross-sectional study. Brazil | Analyze the control of cervical cancer from the access to the health service approach. | Late diagnosis is related to the difficulty of access of women to health services. |
| Nurse training for the prevention of cervical cancer. | Magda Rogéria Pereira Viana, Maria Eliete Batista Moura, Benevina Maria Vilar Teixeira Nunes, Claudete Ferreira de Sousa Monteiro, Eliana Campelo Lake. 2013. LILACS. | Cross-sectional study. Brazil | Analyze nursing education for the prevention of cervical cancer in the context of family health strategy. | It was observed that the nurse's performance is important to the implementation and development of lifelong learning policy to meaningful learning and the possibility of transforming professional practices and hence the care reality. |
| Coverage and adequacy of the Pap test for cervical states in the South and Northeast of Brazil. | Michele Correa da Silva, Denise Silva da Silveira, Fernando Siqueira Vinholes, Luiz Augusto Facchini Roberto Piccini Xavier, Elaine Thume, Elaine | Cross-sectional study. Brazil | Analyze the coverage and adequacy of the frequency of cervical screening cervical in women who gave birth in the last two years before the study, residents in areas | The study found to be necessary to expand and strengthen preventive measures offered by the health services, especially for subgroups of more vulnerable women and enhance the situations that |

Chart 1 - Identification of selected articles.

| | Tomasi. 2017. LILACS. | | covered by Basic Health Units (BHU) in the South and Northeast Brazil. | require use of health services. |
|--|---|--|---|--|
| Prevalence of preventive screening of cervical cancer in Rio Branco, Acre, Brazil, and factors associated with non-examination. | Maria Fernanda de Sousa Oliveira Borges, Leila Maria Geromel Dotto, Rosalina Jorge Koifman, Aquino Margaret Cunha Pascoal Torres Muniz. 2014. LILACS. | Cross-sectional study. Brazil | To estimate the coverage of preventive screening for cervical cancer in the city of Rio Branco, capital of Acre, Brazil, in the previous three years to research and evaluate factors associated with non- examination. | It was statistically evident the absence of the examination in women 18- 24 years and 60-69 years old, single, with low income and low education levels, indicating greater need for intervention in the group of women more vulnerable to the incidence and mortality from cervical cancer uterus. |
| everyday knowledge of women about prevention of cervical uterine cancer. | Leidinar Cardoso Nascimento, Inez Sampaio Nery, Antonia Oliveira Silva. 2012. LILACS. | Qualitative study of social representations. Brazil | Apprehend the social representations made by 64 women in the city of Teresina during the months of October and November 2009, on the prevention of cervical cancer of the uterus, as well as analyze how these representations influence the conduct of the examination prevention. | Social representations constitute as forms of contribution to the prevention of cervical cancer and enable early diagnosis. For women, submission to the Pap test and the result of the expectation arouse feelings that may negatively influence the practices related to the prevention of cervical cancer. |
| Knowledge of women about HPV and cervical cancer after nursing consultation. | Aline Ferreira De Souza, Lucia Helena Rodrigues Coast. 2015. LILACS. | Cross-sectional study. Brazil. | Understanding the assimilative capacity of women undergoing pap smears about human papillomavirus and its relationship with cervical cancer, through the information and / or guidance during the past consultation by nurses. | The study shows ignorance of users about HPV infection and its direct relationship with cervical cancer the same womb after nursing consultation |
| Inadequate practice of women about Pap. | Elainy Fabrícia Galdino Dantas Malta, Fabiane do Amaral Gubert, Camila Moreira Teixeira Vasconcelos, Emilia Soares Chaves, João Marcos Ferreira de Lima Silva, Eveline Pinheiro Bezerra. | Cross-sectional study. Brazil | Identify the factors related to inadequate practice of the Pap test in women inside the Brazilian Nosdeste | Has been identified as factors related to inadequate exam practice: inadequate knowledge, unmarried women up to 29 years are more likely to present inadequate practice compared those with upper and married age and the lack of material is still touted as |

| | 2017. SCIELO. | | | difficulty. |
|--|--|-------------------------------------|---|---|
| Barriers to the exam / Pap prospects users and professionals of the Strategy Health City Of Family In Vitoria Da Conquista - BA | Rebeca Aguilar Pinheiro, Daniela Soares Arruda. 2015. SCIELO. | Cross-sectional study. Brazil | Knowing the barriers that lead women of childbearing age in the city of Vitória da Conquista - BA not to perform pap smears, from the perspective of the women themselves and health professionals. | Insufficient knowledge of women about Pap smear, negative feelings before the exam, lack of attitude, issues related to health services and the inclusion of women in the labor market constituted barriers to the realization of Pap smears. |
| Knowledge and practice of women about cervical cancer. | Maria Fernanda Leite, Fabiana Cristina Frigieri of Vitta, Leticia Carnaz, Marta Helena Souza de Conti, Sara Nader Marta, Marcia Aparecida Nuevo Gatti, Sandra Fiorelli de Almeida Penteado Simeon Alberto Vitta. 2014. SCIELO. | Cross-sectional study. Brazil | Assess the level of information about the examination of cervical uterine cancer and its association with sociodemographic variables among women in a health facility in the city of Bauru, São Paulo, Brazil. | Women have insufficient information on proper Pap smear practice, knowledge about the exam, the risk factors and ways to prevent the disease. |
| The role of the Health Strategy nurse of the family in the prevention of cervical cancer. | Andressa Lima Ramos, Danila Pacheco da Silva, Gracyanne Maria Oliveira Machado, Eliany Nazareth Oliveira, Danyela dos Santos Lima. 2014. SCIELO. | Cross-sectional study. Brazil | Check the performance of nursing in the Health Strategy Parnaíba municipality of Family-ESF for prevention of Cervical Cancer. | It was evident the need of additional actions and activities with women, since these actions take place, but rather systematically and without a proper routine. |

Source: research authors, 2019.

After the selection and synthesis of the articles, they were analyzed using the IraMuTeQ *software* (Interface Analysis for multidimensional analysis of texts and questionnaires), developed in France by Pierre Ratinaud (2009). The program is anchored in the R software and allows different forms of statistics on textual corpus and average word tables (Moura et al., 2014) [7].

From this, a textual corpus was created with the data found in the results of the selected studies and reproduced

in a single text file, readings, corrections and coding of fixed variables were performed. IraMuTeQ does a vocabulary search and reduces words, based on their roots (stemming), the dictionary was created from reduced forms and identified as active and supplementary forms (Moura et al., 2014) [7].

For this study, the Descending Hierarchical Classification (CHD) method, adopted by Reinert (1990), was used, in which the texts are classified according to their vocabularies and the set of them is divided by the frequency of the forms used. From matrices that cross texts and words (repeated tests X²), the CHD method is applied to obtain a stable and definitive classification (Camargo & Justo, 2013).

III. RESULTS AND DISCUSSION

IraMuTeQ prepared the Dendogram through the CHD where the words that obtained frequency equal to or greater than the average frequency were registered and each class was represented by the most significant words and their respective associations with the class.

After analyzing the identification of textual domains

and interpreting meanings, we sought to name their respective meanings in classes described below: 1) The role of nurses in the promotion and prevention of cervical cancer; 2) Actions performed in the Primary Care services for early identification of cervical cancer; 3) Factors that hinder women in carrying out the PCCU. Figure 1 shows Hierarchical Descending Classification (CHD) - Dendogram.



Fig.1: Dendrogram.

Source: research authors, 2019.

Class 1 - The Role of the Nurse in the Promotion and Prevention of Cervical Cancer

According to Nascimento, Nary & Silva (2012) [9], it is necessary that the health professional, especially the nurse, must act together with the guidelines for adherence and follow-up to the preventive exam, as well as the dissemination of the ways of preventing this cancer, since behavioral actions can minimize the risks to which patients are exposed. However, Souza and Costa (2015) [10], affirms that the nursing consultation in the preventive exam generally focuses only on exams and routine information not focusing on listening, on communication, much less on the needs of women.

In addition, Melo, Bezerra, Silva and Silva (2016) [11], explain who more than offering the exam alone, it is necessary to recognize that women, especially those in adolescence, need clarification about the importance of the exam for the early detection of CC, as well as information on the etiology of the disease, focused on the risks of exposure to STDs, including HPV. It is essential to involve the protagonists in the educational process that promotes a better quality of life.

According to Silva, Lagana, Simpson and Cabral (2013) [12], for planning activities and strategies, they must be considered and respected as regional peculiarities, involvement of community leaders, health professionals, women's movements and the media.

For Ramos et al. (2014) [13], the diagnosis of CHD

The early work performed by nurses is due to their participation in control activities, through the clarification of doubts, prevention of risk factors, gynecological consultations to the preventive exam, influencing to better meet the demand, implementation of a quality registration system and intervention for proper referral.

However, for Aguilar and Soares (2015) [14], the nurse must act beyond the environment of the health unit, must go in search of users of health services, making visits to homes in a comprehensive and humanized way, guiding each procedure collection, thus helping to provide good care to women in the Basic Health Unit.

Class 2 - Actions performed in the Primary Care services for early identification of cervical cancer

According to Corrêa et al. (2012) [15], the most adopted strategy for screening cervical cancer is the periodic cytopathological examination. The high coverage of the target population is the most important component used in basic health units to combat mortality from cancer in the womb. For this, according to Ramos et al. (2014) [13], this strategy should be complemented with information related to the exam during routine consultations and educational actions, such as those given in lectures, conversation circles and individual guidance, with awareness of the importance of performing the Pap smear at the beginning of this woman's sexual life, in addition to encouraging users to attend the health unit constantly. However, these actions are carried out only sporadically.

For Alves, Alves & Assis (2016) [22], other active learning strategies should be used in health units as educational practices. As an example, the participation of professionals in some religious events; increase in the offer of hours for the exam; conduct joint efforts to conduct the examination; approach of the multidisciplinary team on the topic with women and the community during home visits and also in the waiting room; and carrying out popular health education activities in schools and community events, based on dialogue and exchange of experiences.

However, Ramos et al. (2014) [13], emphasizes the need for greater dissemination of these activities provided by health units and different approaches, considering socioeconomic and cultural aspects, favoring the attractions for those who should be encouraged or the interest of women in participating in activities offered, and consequently multipliers of information acquired during this process.

Class 3 - Factors that hinder women in carrying out the PCCU

According to Souza and Costa (2015) [10], many women are unaware of the HPV virus and its relationship with cervical cancer, as well as ways of transmission and prevention strategies. In contrast to this finding, the study by Silva et al. [17], states that the level of knowledge about the disease was considered satisfactory among the women studied, as it presents much of the knowledge about the use of the test. However, knowing the importance of the exam is not a decisive factor for the exam.

For Santiago et al. (2014) [16], one of the factors that hinder the marital situation, which was found that single women and with a multiplicity of sexual partners are more likely to perform the exam inadequately. In addition, there is a multiparity in which the high number of children presents itself as a difficulty to perform the Pap smear, as it influences self-care in relation to women's health, contributing to the late detection of CC. On the other hand, Silva et al. (2018) [17] assumes that married women

they have a more active sex life when compared to single and widowed women, emphasizing the importance of periodic Pap smear tests in this population.

According to Malta et al. (2017) [18], in relation to the socioeconomic factor and schooling, it was identified that women with low education and unfavorable socioeconomic condition have less knowledge about the purpose of the exam, therefore, they do not seek health services to perform it, influencing not preventive exam. Other authors point out that this factor results in difficulties related to prevention and promotion measures for women's health, since the lower the level of education, the greater the difficulty in understanding health maintenance, focused on preventive and health measures. control (Carvalho, Falavigna, Silva & Frazilli, 2015) [21].

According to Aguilar and Soares (2015) [14], the insertion of women in the labor market, as an intervening factor for the non-performance of the Pap smear, due to the overlap of work activities associated with caring for the

family that burdens the woman, or that hinders adherence to preventive practices. Likewise, in a study by Ramos et al. (2014) in the city of Parnaíba-PI, it was observed that the times and days for the collection of material for examination are carried out on equal days in the basic health units, which is an obstacle for women who work during the operation period of the unit.

Aguilar and Soares (2015) [14], explain the intrinsic difficulties of women in performing the Pap smear, such as the feelings prior to the exam, for example: shame and fear due to the need to expose mainly the genitals to male professionals , in addition to the lack of information on female anatomophysiology, restrictive experiences in the area of sexuality, experience of violence, lack of access and lack of communication about the exam. These factors are reaffirmed by Nascimento et al. (2012) [9], who show that Pap smears arouse negative feelings, related to sexuality that reflect on actions and the way of living, which can interfere with the woman's adherence to the exam. Thus, the result is the same that causes expectation and fear due to the possibility of being positive for cancer.

According to Leite et al. (2014) [19], there are still obstacles related to the structuring of health services. The most evident difficulties were the problems related to accessibility and the offer of vacancies and the unmet health needs of women. There are also problems related to the work overload of professionals, which reduce the offer of places to serve the population. Other reasons are geographical barriers, such as the location of the health service that may be distant from users, transportation difficulties, in addition to organizational barriers, such as bureaucracy, delayed service and time spent to make an appointment.

This finding is similar to the results of other studies, which show that only half of the basic health units in Brazil have an adequate structure for the screening of cervical cancer and only 30% of the health teams were classified with an adequate work process. (Tomasi et al., 2015) [20].

IV. CONLUSION

In this study, the most used databases were LILACS and SCIELO. The years of most publication of the articles are between 2012 and 2015. Most of the articles aim to describe the nurse's actions in the prevention and diagnosis of cervical cancer, the barriers that interfere in the Pap smear by women and the epidemiological profile the same.

In this study it was noticeable that most women are unaware of the problems related to cervical cancer. The lack of knowledge may be related to the lack of communication between the health professional and the assisted women. Educational practices should seek the participation of health professionals and women in the discussion on the topic and clarify how to prevent and control actions.

Some factors prevent women from having a Pap test, such as: lack of knowledge of the importance of preventive tests, fear of being positive for cervical cancer and shame. It was also observed that some women only perform the gynecological exam when there are signs and symptoms of pathology.

Therefore, the nurse must always remain up-to-date and active to raise awareness and provide health education for the female population on the prevention of CC. This professional has a crucial role for the prevention and early diagnosis of this cancer and for the Pap smear, in order to reduce the prevalence of this neoplasm.

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Arteries of Pelvic member in Tucanuçu (*Ramphastos toco albogularis* – Cabanis , 1862)

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Abstract— This study is an anatomic description of pelvic limb vascularization of Tucanuçu (Ramphastos toco albogularis). For this, 8 specimens donated by "Centro de Triagem de Animais Silvestres de Catalão – CETAS" were used. In four specimens, arterial system was injected with latex art red stained glue and dissected. Another four, arterial system was injected with vinyl acetate (vinilite) and subjected to corrosion in nitric acid, resulting molds for analise and description. Results were compared with pertinent citations in domestic birds, compiled from classical works of veterinary anatomy. The project was approved by ethical committee in animal experimentation of Federal University of Uberlândia (CEUA/UFU) under number 067/12. The present work work shows unprecedentedly discovered about Tucanuçu, indicating basic arterial pattern of pelvic limb and showing similarities to domestic birds, however, slight differences may be noted, especially regarding the describe arterial branches in domestic birds that are not present in Tucanuçu.

Keywords— Circulatory System; Arteries; Wild Animals; Toucan.

I. INTRODUCTION

Studies applied in animal anatomy are essential for descriptions, comparisons and preservation of species, especially when comes to wild animals. In addition, these studies help clinical diagnoses, treatment and surgical approaches for veterinary medicine [1].

Tucanuçu, also known as Toco Toucan (Ramphastos toco albogularis), has specific characteristics such huge orange beak with a black spot on the end, black plumage on back and belly, around the eyes there is a border of bare yellow skin. The eyelids are blue, crop is white and plumage under tail is reddish. It is included in Piciformes order and belongs Ramphastidae family [2,3], is not in extinction and is considered the largest species among members of family [18, 4]. Tucanuçu can measure 56 centimeters in length and can weigh 540 grams [5]. Despite its size, beak is very light due to its internal cavity structure, which is used as food capture instrument [6, 7]. Using its beak end, as were tweezers, Tucanuçu capture small fruits and other foods, throwing them upwards, opening its beak and swallowing [7].

According to Fecchio (2011), Tucanuçu has a wide distribution in brazilian territory, where is a typical inhabitant of fields and more forested areas in east, southeast and south of Brazil, as well Paraguay, Bolivia and Argentina northern. It is a bird of exotic and rare beauty and ends up being desired by many people and being an animal linked to traffic of wild animals [9].

According to Castro et al. (2002), ranfastids are classified as canopy frugivores, but complement diets with eggs and chicks of other birds or small vertebrates [10, 11, 12].

As they are large birds, Tucanuçu explore vast territories, covering great distances in food search, a behavior that is intensified in dry seasons [15]. In tropical forests, the most important dispersion syndrome is zoocoria, when seeds of nearly 75% of plant species have seeds dispersed, very important factor for forest regeneration and 20 - 50 % diet of birds and mammals [13, 14].

Ramphastos toco albogularis is considered a typical example of avian diversity in South American

continent. However, may come to threatened, mainly by human actions, including trafficking of wild animals that ends in death of many specimens [12, 16, 17]. Furthermore besides Tucanuçu is not included in red list of endangered species, is know that diseases, of most varied etiologies and anthropic actions on environment have severely affected brazilian wild fauna, causing mortality rates wild birds, including Tucanuçu [18, 19].

On the other hand, knowledge of circulatory system anatomy in wild animals has been sought by scientists from all world, dealing organs or specific segments of the body. In this sense descriptive anatomical studies of species are essential to acquire data on its biology and importance for ecosystem. To date, there is a great lack of studies on arterial vascularization of Tucanuçu (*Ramphastos toco albogularis*) [12].

Thus, taking into account the importance of circulatory system, this study aimed investigate and describe arteries of pelvic limb of Tucanuçu (*Ramphastos toco albogularis* - Cabanis, 1862) in order to provide different areas grounds of knowledge, contribute as support for actions in programas of species preservation and contribute with diagnoses, clinical and surgical conduct applied in veterinary medicine.

II. METHODS

This study is an anatomic description of aorta caudal part orientate to pelvic limb vascularization of Tucanuçu (*Ramphastos toco albogularis*). For this, 8 adult specimens with no defined age, donated by "Centro de Triagem de Animais Silvestres de Catalão – CETAS", were used. Considering descriptive approach of this work, statistical analysis is not necessary. All procedures were conducted in accordance with ethical principles and were approved by the Institutional Ethics in Research Committee at the Federal University of Uberlândia (CEUA/UFU n° 067/12).

The specimens were plucked in boiling water and then, in four specimens the arterial system was dissected and inject with Latex Artecola, colored with red pigment Wandalar trought aortic arch or sciatic artery in abdominal cavity. Behind thre hours, was made a fixation with aqueous 10 % formaldehyde solution to conservation, staying for one week. Another four, arterial system was injected with vinyl acetate (vinilite) and after 12 hours was subjected to corrosion in 30% nitric acid aqueous solution, resulting molds for analise and description

The preparation of anatomical pieces was performed under consecrated techniques in macroscopic

anatomy and description nomenclature adopted is according the Handbook of Avian Anatomy: Nomina Anatomica Avium (1993) and/or Nickel, Shummer, Seiferle (1977) [21, 22]. The Cyber Shot 7.2 megapixels digital camera was used to photographical documentation.

III. RESULTS

The blood supply to pelvic member of Tucanuçu is charge of two major arteries, branches of Abdominal Part of Aorta: *External Iliac Artery and Sciatic Artery*.

External Iliac Artery - The first major branch of aorta. Contributes to supply pelvic limb, however, is not exclusive to limb and supplies other regions. Arises from lateral face of aorta, caudally to origin of Cranial mesenteric a., next to ventral face of Synsacrum, runs laterally, crossing kidney, in the space between middle and cranial renal lobe. Along its path, through kidney, it does not emit any collateral branch, either to kidney or other tissues, although has an intimate relationship with it and lumbar plexus, which is located ventrally. After leaving lateral border of kidney middle lobe, the *External Iliac A*. emits two branches: one caudal branch, is *Pubic Artery* and other cranial, the *Deep Iliac Circumflex* (Figure 1-c, e).

The *Pubic A*. borns through caudal surface of *External Iliac A*., follows in a caudal direction, close to lateral edge of Synsacrum Bone, providing branches for caudolateral part of abdominal wall. The cranial branch is *Deep Iliac Circumflex A*.. In turn, divides into several branches destined to caudal part of chest and cranial wall of abdomen. Continuation of *External Iliac* is *Femoral A*.. It goes in a lateral direction, close to lateral edge of Synsacrum Bone, penetrating the posterior thigh muscles. It perforates posterior thigh muscle group and already on lateral part, it crosses ventrally, from cranial to caudal, to *Ischiatic A*., ending in caudolateral muscles of thigh and gluteal region.

Sciatic Artery - The largest branch of aorta. Arises from lateral surface of aorta and becomes caudolateral, between middle and caudal lobes of kidney. Along kidney emits branches to caudal lobe and eventually, to middle lobe. When leaving pelvic cavity crossing to dorsal face of synsacrum, in lateral direction, emits *Obturator A.*, which crosses obturated foramen, from dorsolateral to ventromedial, together internal obturator m., which supplies branches and iliac muscle. This path emits *Gluteal A.*, destined to muscles of gluteal region.



Fig.1- Ventral view of abdomino-pelvic cavity of Tucanuçu (Ramphastos toco albogularis) - Branches of aorta; b- external iliac A.; c- deep iliac circumflex A.; d- femoral A.; e- pubic A.; f- sinsacral aA; g- ischial A.; h- caudal renal A.; i- internal iliac A.; j- caudal mesenteric A.; k- obturator A..



Fig.2- Vascular mold abdomino-pelvic region of Tucanuçu (Ramphastos toco albogularis): a- aorta; b- celiac A.; c- deep iliac circumflex A.; d- cranial mesenteric A., e- femoral A.; f- pubic A.; g- external iliac A.; h- right caudal renal A.; i- left caudal renal A.; j- ischial A.; k- sacral part of aorta; l- caudal mesenteric A.; m- left internal iliac A.; n- right internal iliac A.; o- poplítea A.; p- genicular middle A.; q- crural A.; r- tibial caudal A.; s- cranial tibial A..

After leaving pelvis, *Ischiatica A*. follows deeply lateral thigh muscles, up popliteal fossa, always closely to caudal proximity with homonymous nerve and cranially to homonymous vein.

After crossing almost entire length of thigh, without emitting any branches, *Ischiatic A*. enters popliteal fossa and is named *Popliteal A*.. The first branch of *Popliteal A*. borns caudally, is *Sural Caudal A*. (Deep Femoral), whose distribution occurs in superficial caudal muscles of leg. Next, a smaller artery born in the same sense, is *Sural Cranial A*., whose branching occurs in deep sural muscles. A muscular branch, destined for lateral distal region of thigh borns from *Sural A*..

Poplítea A. continues its path to caudal face of Tibiotarso bone, where emits *Caudal Genicular A*.. Follows distally a short distance, bending sharply, in distal direction as a single *Tibial A*., in most cases, but in two cases (20%), it divides into *Tibial Cranial A*. and *Tibial*

Caudal A.. Both tibial arteries run distally, inside anterolateral muscles of tibia. The Tibial A. reaches Tibiotarsometatarsal articulation, supplying posterior leg muscles, while cranial tibial goes to the foot.

Tibial Cranial A. emits a branch cranially, the Genicular A., and crosses leg bones, in craniocaudal direction, passes in a space between tibia and fibula, which is not completely merged, enters fascial compartment craniolateral of leg, crossing it, from proximal to distal, between anterolateral muscles of leg, descends in Tibiotarsian region, up to ankle. At this point, crosses cranial face of Tibiotarso-tarsus-metatarsal joint, caudally to retinaculum of cranial tibial m. and medially to tendon. From this point, cranial face of Tarsometatarsal bone gains, following Tarsometatarsiana Α. until Tarsometatarsophalangeal articulation, emiting a branch medially, destined to sole of the foot and a lateral branch that divides to caudal toe and toe side. Then emits a branch to medial finger following as Digital Middle A. middle for homonymous finger.



Fig.3- Vascular mold of abdomino-pelvic region of Tucanuçu (Ramphastos toco albogularis): a- aorta; b- cranial renal A.; c- external iliac A.; d- deep iliac circumflex A.; e- pubic A.; f- femoral A.; g- renal middle A.; h- right caudal renal A.; iischial A.; j- crural A.; k- cranial genicular A.; l- genicular middle; m- cranial tibial A.; n- tibial caudal A.; o- obturator A.; p- internal iliac A.; q- caudal mesenteric A..



Fig.4- Arterial vascularization of thigh and leg in Tucanuçu (Ramphastos toco albogularis): a- gluteal A.; b- ischial A.; c- sciatic n.; d- femoral A.; e- Cranial femorals mm.; f- cranial genicular A.; g- crural A.; h- crural caudal A.; i- cranial crural A.; j- genicular middle A.; k- popliteal A.; l- tibial caudal A.; m- caudal genicular A.; n- cranial tibial A.; tibial bone.



Fig.5- Arterial vascularization of leg in Tucanuçu (Ramphastos toco albogularis): a- tibial caudal A.; b- cranial tibial A.; c- tibiotarsometatarsal articulation; d- cranial tibial m. (folded); e- tendon of cranial tibial m.; f- retinaculum of cranial tibial .; g- metatarsal bone; h- metatarsian A..



Fig.6- Arterial vascularization of Tarsometatarsus and stump foot in Tucanuçu (Ramphastos toco albogularis): atibiotarsometatarsal articulation; b- tibiotarsometatarsal network; c- cranial tibial A.; d- tendon of cranial tibial m.; emetatarsal bone; f- metatarsal A.; g- plant A.; h- digital IV A.; i- digital I A.; j- digital III A.; k- digital II A..

IV. DISCUSSION

Specific literature on circulatory system of birds is scarce and sometimes inconsistent. Thus, relevant citations are limited to Nickel; Schummer; Seiferle (1977) and Baumel in Sisson; Grossman (2008), beyond include citations from other authors, in books and treatises on Veterinary Anatomy, which are repetitive and related to referred authors. Therefore, this presente paper discussion is limited to these [22, 23].

According to Nickel; Schummer; Seiferle (1977), pelvic limb of birds is supplied with blood from *External Iliac* and *Ischial Aa.*, in agreement with the findings in Tucanuçu. Baumel in Sisson; Grossman (2008) states that blood supply to pelvic limb of birds is guaranteed by the last branches of abdominal part of aorta, constituting *External* and *Ischial Iliac Aa.*. Our observations in Tucanuçu reveal these same vessels, however, they are not the last branches of aorta [22, 23].

Nickel; Schummer; Seiferle (1977) and Baumel in Sisson; Grossman (2008) state do not have a *common iliac artery*, in agreement with observations in Tucanuçu. For Baumel in Sisson; Grossman (2008), the first large blood vessel for pelvic limb is *External Iliac A.*, which arises from lateral aspect of aorta, caudally to origin of *Cranial Mesenteric A.*, runs laterally between cranial and middle lobes of kidney, without emitting any branches in this path. Nickel; Schummer; Seiferle (1977) cites an origin at level of Sincraco ventral surface. In Tucanuçu, with regard to referred vessels, the findings are in agreement with the referred Authors [22, 23].

The first branch of *External Iliac A.*, is *Femur Circumflex A.*, whose origin occurs at hip articulation level,

proceeding distally to cranial surface of thigh, supplying extensor muscles and knee articulation (NICKEL; SCHUMMER; SEIFERLE, 1977). Baumel in Sisson; Grossman (2008) states, already pelvic wall, *External Iliac A.*, caudally, emits *Public A.* or *Internal Pelvic A.*, which supplies abdominal wall and peritoneum. In Tucanuçu, after leaving lateral edge of kidney, *External Iliac A.* emits a caudal branch, *Publc A.*, which runs caudally and close to edge of sinsacral bone, providing branches for abdominal wall. At the same time *Deep Iliac Circumflex A.* borns cranially, bound for caudal region of chest and cranial wall of abdomen [22, 23].

Nickel; Schummer; Seiferle (1977) do not comment about *pubic a.*, but indicate a compatible artery, which was called *pelvic a.*, since its origin and path are similar, while Baumel in Sisson; Grossman (2008) do not comment [22, 23].

According to Nickel; Schummer; Seiferle (1977) *femoral a.* down to Knee flexors mm. where becomes *genicular a.*. Baumel in Sisson; Grossman (2008) states that *femoral a.* is the continuation of *external iliac artery a.*. It branches in ventrolateral wall of abdomen, pre-acetabular region and craniolateral region of thigh. The observations in Tucanuçu are partially in agreement with Baumel in Sisson; Grossman (2008), since *femoral a.* is the middle branch of *external iliac a.*, course which runs sideways along edge of sinsacral bone to posterior thigh muscles, already lateral face, ventrally crosses *aciatic a.* from cranial to caudal, ending in the caudolateral muscles of thigh and gluteal region [22, 23].

Still in according to Baumel in Sisson; Grossman (2008), *femoral a.* emits *circumflex of thigh a.*, emitting

cranial femoral a. that supplies cranio-proximal region of thigh. Nickel; Schummer; Seiferle (1977) do not mention this branch from *femoral a.*, neither is not present in Tucanuçu [23, 22].

Ischiatic a. in birds, according to Nickel; Schummer; Seiferle (1977), and Baumel in Sisson; Grossman (2008), originates from aorta, at level of hip articulation and traject between lower and middle lobes of kidney, considering the main artery of pelvic limb of birds, in accordance with the findings in Tucanuçu [22, 23].

Still inside *pelvis a*, the *ischiatic a*. emits branches to middle and caudal lobes of kidney and leaves pelvic cavity through sciatic foramen in company of eponymous nerve (NICKEL; SCHUMMER; SEIFERLE, 1977; BAUMEL in SISSON; GROSSMAN, 2008), as is verified in Tucanuçu [22, 23]. Tucanuçu *sciatic a.*, after crossing sciatic foramen, emits a *obturator a.*, whose distribution occurs in obturator structures and circumferences, in accordance with Baumel in Sisson; Grossman (2008) [23].

Nickel; Schummer; Seiferle (1977) and Baumel in Sisson; Grossman (2008) are unanimous in citing that *ischiatic a.* leaves pelvic cavity through homonymous foramen, as seen in Tucanuçu. Through sciatic foramen, *ischiaticus a.* emits *gluteal a.*, intended for muscles of gluteal region, in agreement with Nickel's citation; Schummer; Seiferle (1977). Baumel in Sisson; Grossman (2008) do not refer *gluteal a.* in birds [22, 23].

In Tucanuçu, after crossing sciatic foramen *sciatic a*. follows its course deeply into lateral thigh muscles, without emitting collateral branches, up popliteal fossa, always in close relationship of caudal proximity with sciatic n. and cranial with homonymous v., in disagreement with Nickel's citation; Schummer; Seiferle (1977) when state that *ischiatic a*., after leaving ischial foramen, emits muscle branches and *trochanteric a*. as well, with Baumel in Sisson; Grossman (2008) who cites *trochanteric a*. and one *caudal femoral a*., like branches of *ischiatic* [22, 23].

When entering popliteal fossa, *isquiatic a.* from Tucanuçu is called *popliteal a.*, according to Nickel's citations; Schummer; Seiferle (1977) and Baumel in Sisson; Grossman (2008) [22, 23].

Observations in Tucanuçu show that *popliteal a*. emits, *sural caudal a*. (caudally) and *cranial sural a*. (cranially), in agreement with Baumel in Sisson; Grossman (2008). However, this same author citate *sural a*. before popliteal fossa. Nickel; Schummer; Seiferle (1977) in turn, cites *deep femoral a*., one *caudal femoral* and one *tibial a*. with branches of *popliteal a*. [23, 22]. According to Baumel in Sisson; Grossman (2008), popliteal a. emits proximal genicular a. and distal nutritia of femur and distal part gives rise to medial tibial a., which emits genicular medial a. and follows inside gastrocnemius m. as medial crural a.. When leaving distally to popliteal fossa is divided into tibial caudal and cranial tibial a.[23].

Literary citation on branches of *popliteal a*. are confused, using different terminologies, apparently, to name same structures. Nickel; Schummer; Seiferle (1977) cites *deep femoral a*. and *tibial medial a*. as branches of *poplítea a*., then *caudal femoral a*., one *medial tibial a*. and one *cranial tibial a*. [22].

In Tucanuçu there is a relatively simpler disposition when *popliteal a*. issues two *surais*, *cranial* and *caudal Aa*, responsible for almost entire blood supply of leg, continuing close to caudal face from tibiotarsus bone proximal part, emitting *caudal genicular a*..

For Nickel; Schummer; Seiferle (1977), *cranial tibial a.* follows a distal course within gastrocnemius m. to form a tarsometatarsal network. *Caudal tibial a.* follows between caudal muscles of leg to tarsometatarsian network articulation [22].

Baumel in Sisson; Grossman (2008) states that *cranial tibial a.* is a continuation of *popliteal a.*, emitting *fibular a.* which crosses tibio-fibular interosseous foramen and enters extensor compartment of leg, without reaching tibiotarsometatarsal articulation [23].

In turn, Nickel; Schummer; Seiferle (1977) cites that *fibular a.* arises from *popliteal a.* and enters dorsal compartment of leg. After releasing all these branches, *popliteal a.* divides into middle third of leg in *Cranial Tibial* and *Lateral Tibial a.*, smaller, both forming *Tarsometatarsian* network [22].

In Tucanuçu, popliteal a. continues on caudal face of tibiotarsal bone, after issuing surais Aa., emits caudal genicular a. following as *unique tibial a.* to tibiotarsometatarsal articulation, since caudal tibial branches into caudal structures of leg. After Tibiotarsometatarsiana articulation, the cranial tibial a. passes under retinaculum of cranial tibial m.. Medially to tendon of cranial tibial m., gaining cranial face of metatarsal bone, going to foot like metatarsal a.. Baumel in Sisson; Grossman (2008) states that opposite to proximal end of Tarsometatarsus, cranial tibial a. becomes common metatarsodorsal a., responsible for foot vascularizing. Citations agree with observations in Tucanuçu, but in disagreement with Nickel; Schummer; Seiferle (1977) when affirming that the referred artery branches in the middle part of tarsometatarsus in dorsal and lateral metatarsals [22, 23].

Baumel in Sisson; Grossman (2008) states that at level of metatarsophalangeal articulation, borns *pulvinar Aa.* to metatarsal pads which form a plantar arterial arch. The digital arteries can come from *plantar arterial arch* or from *metatarsian a.* [23].

According to Nickel; Schummer; Seiferle (1977), cranial tibial a. follows its distal course to tibiotarsometatarsal articulation when crosses under tendon of cranial tibial m., becoming *dorsal metatarsal a.*, which forks into third distal of metatarsus to form *dorsal* and *lateral metatarsals Aa.*, which reach interdigital spaces. In Tucanuçu *metatarsal a.* is unique and goes from cranial face of metatarsus to metatarsophalangeal articulation, when emits medially, an *plantar a.* and *digital a.* laterally, for two medial fingers and then emits a *digital a.* to the side finger, following like *digital a.* for middle finger [22].

V. CONCLUSION

The present study shows unprecedentedly relates about arteries of pelvic member in Tucanuçu (*Ramphastos toco albogularis*), showing that with regard to referred vessels, the findings are in agreement with the referred authors. The observations in Tucanuçu shows particular findings, since *femoral a*. is the middle branch of *external iliac a*., the course of which runs sideways along edge of sinsacral bone to posterior thigh muscles, already lateral face, ventrally crosses *sciatic a*. from cranial to caudal, ending in caudolateral muscles of thigh and gluteal region. Thus, this work shows great similarity with domestic birds and particularities about this specie, contributing to anatomical description and understanding of an important blood vessel in Tucanuçu.

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Dynamic decoupling in reinforced concrete columns in structural core shape and applied to bridges

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> Abstract—Bridges that are designed to transpose large valleys generally show low stiffness to the lateral bending and, therefore, it is not convenient to use the static modeling of the wind actuation. In this context, due to the large volume of concrete required for the molding of the pillars, it is fitting to design them with a cross section composed of thin walls, in order to confer economy, and with one of the faces open and braced by lintels to guarantee greater stiffness to the deformation by bending due to the performance of the shear forces. Such dynamic modeling of the pillars activates bending-torsion and presents stiffness to the structure bending divided into two matrices: [J] and [S]. Due to the structural stiffness not being bonded in a single matrix, Rayleigh's proportionality in the damping matrix assembly [C] does not apply. Thus, the formulation for such an assembly of [C] is proposed in this paper via the first three vibration modes of the structure. It models, with examples of application, a bridge with a deck backed on three pillars shaped as structural core braced by lintels and of thin-walled sections. Such pillars, with axes referenced in the torsional center of each, are inclined of β in relation to the global referential of the bridge coordinates, in order to apply the decoupling process of the differential equation system that governs the phenomenon and the resulting referential transformations. The vibration modes are verified by modeling with the ANSYS 2019 R1 software academic version.

Keywords—Dynamic decoupling, Bridge pillars, Wall panels, Proportional damping, Bending-Torsion.

I. INTRODUCTION

In the dynamic analysis of the usual structures, it is convenient to model the stiffness of the elements that compose them and group them into the unique stiffness matrix [K] of the structure in the global coordinate reference. As for the pseudo-force due to the inertia that the structure exhibits when moving during the dynamic load, it is computed in the product of the mass matrix [M] by the acceleration vector of the linear and angular displacements $\{\ddot{D}\}$. Finally, the viscous damping of the structure is modeled by a damping matrix [C] proportional to the others, where such proportionality is determined by modal analysis and the resulting first two vibration modes. Thus, it is carried out following the example of Blume [1], and Fleming and Romualdi [2].

On the other hand, the analysis of the pillar with cross section composed of thin walls results in two stiffness matrices. The first [J] refers to the portion of the bending

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stiffness resulting from the pillar itself, and the second [S] relates to the bending stiffness of the lintels that promote the pillar bracing along the height at the open end of the cross section. When highlighting the equation of the mentioned Wall Panels, Smith and Taranath [3] and also Stamato and Mancini [4] are mentioned. In such analyses, the static imposition of the loading is done. However, in the dynamic analysis, which will be carried out here, the inertial pseudoforce portion is added to the motion, and so the Partial Differential Equations system (PDE's) is constituted by three matrices and, to that end, the proportionality procedure for the assembly of the damping matrix [C] of the thin wall pillars is proposed. For such a proposition, the decoupling of the PDE system based on Rosman [5] and necessary transformations of referential via Glück [6] are used. Finally, the wind effect is adopted as a function of two variables q(x, t), in terms of the height x of the bridge pillar and under variation over time g(t). To that end, the positioning of the center of mass is needed for such

equation, as inspired by Hart [7], Vaicaitis [8], Laier [9] and Awruch [10].

The modeling of the wind action in the structures is processed, in the majority, from the perspective of the imposition of static loads. However, for the case of highsection thin-walled pillars (in works of art), lateral rigidity is reduced, making dynamic analysis of such a request important. This article proposes the systematization of the dynamic analysis of such requests in the pillars, thus providing a tool for manual calculation or even a mechanism of verification of the results obtained by modeling by commercial software.

II. THE WALL PANEL THEORY

The bridge pillar, considered of cross section made of thin and open walls, is conveniently analyzed through the Wall Panel Theory. Such technique consists of subdividing the core-shaped pillar into several walls and equating the balance of forces and moments for the internal forces and compatibilizing loads at the intersections of said walls. Finally, the differential equations of deflections and deformations are used. See Figure 1.



Fig. 1: Wall panels: (a) Drawing dimension notations, (b) Wall referential transformation

Such equation results in Ordinary Differential Equations (ODEs) in terms of the rotation v', third derivative from the displacements v, and the shear forces $\{V_f\}$ generated by external loads. The referred equations are written in terms of the center of gravity (*CG*) referential as:

$$-[J].\{v_{CG}^{\prime\prime\prime}\} + [S].\{v_{CG}^{\prime}\} = \{V_f\}$$
(1)

where: [J] - Bending stiffness matrix of the Wall Panels; [S] - Lintel bending stiffness matrix; { v_{CG} } - Vector of linear displacements: v (towards y), ω (towards z) and angulars φ (rotation around axial axis *x*); $\{V_f\}$ - Vector of shear forces generated by external loading. The matrices [*J*] and [*S*], as well as the vector $\{V_f\}$ are found in Melo [11].

III. DYNAMIC FORMULATION

The static analysis of the Wall Panels, presented in equation (1), is expressed with reference in the center of gravity (*CG*). However, in the dynamic analysis, the inertial pseudo-force plot [M]. { \ddot{v} } is, in terms of mass, distributed *m* at the height *H* of the pillar, with reference in the center of mass (*CM*). In addition, the mass distribution modeling under acceleration \ddot{z} is shown in Figure 2.



Fig. 2: Distributed mass subject to acceleration **Z**

The aforementioned pseudo-force is expressed as:

$$F = \int_{-\infty}^{n} (m, \ddot{z}) dx \qquad (2 a)$$

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$$m = \frac{M}{H} \tag{2 b}$$

where: m – distributed mass; M – total column mass; H – column height.

For the tridimensional structure, there is:

$$\{dF\} = [M]. \{\ddot{v}\} = \begin{bmatrix} m & 0 & 0 \\ 0 & m & 0 \\ 0 & 0 & I_p \end{bmatrix} . \begin{cases} \ddot{v} \\ \ddot{\omega} \\ \ddot{\phi} \end{cases}$$
(3)

where: I_p – Column inertia moment; [M] – Mass matrix in the *CM*.

Because the dynamic plot expressed in equation 3 is referenced in the center of mass (CM) and the static plot in the center of gravity (CG), the coordinate transformation of the (CM) into the (CG) turns necessary. See Figure 3.



Fig. 3: Mass and gravity centers: (a) Positioning, (b) Referential transformation of the CM into CG

The relation of the displacements in the Center of mass to the detriment of the Center of gravity is worth:

 $v_{CM} = v_{CG} - d_{z_{CMCG}} \cdot \phi_{CG} \tag{4 a}$

 $\omega_{CM} = \omega_{CG} + d_{\mathcal{Y}_{CMCG}} \phi_{CG} \tag{4 b}$

 $\phi_{CM} = \phi_{CG} \tag{4 c}$

Matrically, the equations (4), expressed as law of coordinate transformation of the Center of Mass into the Center of Gravity, are expressed as:

where: $\{v_{CM}\}$ – Vector of displacements in the Center of mass; $\{v_{CG}\}$ – Vector of displacements in the center of gravity; $[\overline{T}_M]$ – Matrix of linear transformation from *CM* into *CG*.

Resulting from the transformation Law expressed in equation (5), the Wall Panel movement plot of equation (3) is rewritten as:

$$\{dF_{CM}\} = [M].\{\ddot{v}_{CM}\} = [\bar{T}_M]^T.[M].[\bar{T}_M].\{\ddot{v}_{CG}\}$$
(6)

Deriving equation (1) and adding equation (6), results in the ODE's system that governs the dynamic problem of the Wall Panels, expressed by:

$$-[J].\{v_{CG}^{\prime\prime\prime\prime}\}+[S].\{v_{CG}^{\prime\prime}\}+[\overline{M}].\{\overline{v}_{CG}\}=\{V_{f}^{\prime}\}$$
(7)

where: $[\overline{M}] = [\overline{T}_M]^T . [M] . [\overline{T}_M], [\overline{M}] - Matrix of referenced mass in the$ *CG* $, and: <math>V'_{ext} = 2 . D_1 . x + D_2;$ $D_2 = -q_1; D_1 = -\frac{q_2}{2.H}; \{V'_f\} = V'_{ext}. \{A^*\}; V_{ext} = D_1 . x^2 + D_2 . x + D_3; D_3 = Q + q_1.H.$

IV. DYNAMIC DECOUPLING

The first procedure is to rewrite the system of ODEs (equation 7) in the main frame of the bending pillar stiffness

 $[J^*]$ by linear transformation by rotation matrix [Re]. Then, $[J^*]$ is transformed into $[J^{**}]$ which is equivalent to the matrix Identity [I] via pre-multiplication and multiplication by $[J^*]^{-1/2}$ in order to maintain the symmetry of the other matrices and guarantee subsequent modal orthogonality and be able to use transposed matrices instead of inverse matrices. Finally, $[M^{**}]$ and $[S^{**}]$ are diagonalized through an iterative process until all terms outside the main diagonals of the matrices become of inferior module at a determined tolerance ε . The set of decoupled PDE's in the generalized referential, for the nondamped Wall Panels is expressed as:

$$-q_{j}^{\prime\prime\prime\prime\prime}(x,t) + s_{j}, q_{j}^{\prime\prime}(x,t) + m_{j}, \ddot{q}_{j}(x,t) = V_{f_{j}}^{0}(x,t)$$
(8)

where: s_j is the j^{-th} element of the main diagonal of the stiffness matrix of the diagonalized lintel bending [s]; m_j is the j^{-th} element for the diagonalized mass matrix [m]; and j is the j^{-th} vibration mode of the structure.

In the second procedure, the term of the damping [C]. { \dot{v}'''' } is added with the damping matrix [C] constituted in terms proportional to the other matrices. Thus, the PDE system of viscously damped vibration for the Wall Panels is expressed by:

$$[\overline{M}].\{\vec{v}_{CG}\} + [C].\{\dot{v}_{CG}^{''''}\} + [S].\{v_{CG}^{''}\} - [J].\{v_{CG}^{'''''}\} = \{V_f'\}$$
(9)

where: $[C] = \alpha_M \cdot [\overline{M}] + \alpha_S \cdot [S] - \alpha_J \cdot [J]$, [C] – Viscous damping matrix.

In the present decoupling, three referential transformations are made, where: the first transformation consists of diagonalizing the mass matrix $[\overline{M}]$ referenced in the *CG* by means of diagonalization routine (for example the Jacobi Method); in the second transformation, $[m^*]$ becomes the identity matrix [I] by pre-multiplication and multiplication by $[m^*]^{-1/2}$; and finally, in the third transformation, a looping process is applied for the joint diagonalization of $[S^{**}]$ and $[J^{**}]$ up to a certain tolerance adopted ε_S and ε_I . See Flow Chart shown in Figure 4.

And resulting as a set of decoupled PDE's, expressed as:

$$\ddot{q}_{j}(x,t) + c_{j}.\dot{q}_{j}^{\prime\prime\prime\prime}(x,t) + s_{j}.q_{j}^{\prime\prime}(x,t) - j_{j}.q_{j}^{\prime\prime\prime\prime}(x,t) = V_{f_{j}}^{0}(x,t)$$
(10)



Fig. 4: Dynamic decoupling flowchart via Procedure 2

V. MODAL ANALYSIS

The ODE is written in the space x and temporal in t by means of the PDE's resolution by the Method of Modal Superposition for the nondamped vibration as:

$$j_j . u'''(x) - s_j . u''(x) - \omega_j^2 . u(x) = 0$$
(11 a)

$$\ddot{g}(t) - \omega_i^2 g(t) = 0$$
 (11 b)

where: q(x,t) = u(x) g(t), ω_j is the j^{-th} vibration frequency of the structure.

The analysis of equation 11 (a) is carried out in order to determine the vibration modes and correlate s_j and j_j . Then, $u(x) = e^{\alpha \cdot x}$ is applied and the characteristic equation is expressed by:

$$j_{j} \, \alpha^{4} - s_{j} \, \alpha^{2} - \omega_{j}^{2} = 0 \tag{12}$$

Where the roots of the characteristic equation, equation (12), α_1 and α_2 , and the relation j_j and s_j in terms of the j^{-th} vibration frequency of the structure expressed by:

$$\alpha_{1} = \sqrt{\sqrt{\left(\frac{s_{j}}{2.j_{j}}\right)^{2} + \frac{\omega_{j}^{2}}{j_{j}}} + \frac{s_{j}}{2.j_{j}}}$$
(13 a)

$$\alpha_{2} = \sqrt{\sqrt{\left(\frac{s_{j}}{2.j_{j}}\right)^{2} + \frac{\omega_{j}^{2}}{j_{j}} - \frac{s_{j}}{2.j_{j}}}}$$
(13 b)

$$j_j = \frac{s_j \cdot \alpha^2 + \omega_j^2}{\alpha^4} \tag{13 c}$$

The solution of the displacements u(x) is expressed as:

$$u(x) = C_1 \cdot sinh(\alpha_1 \cdot x) + C_2 \cdot cosh(\alpha_1 \cdot x) + C_3 \cdot sin(\alpha_2 \cdot x) + C_4 \cdot cos(\alpha_2 \cdot x)$$
(14)

Adopting the nondimensionalization of the roots α into λ , via $\lambda_1 = \alpha_1 \cdot H$ and $\lambda_2 = \alpha_2 \cdot H$, roots λ_1 and λ_2 are correlated by:

$$\lambda_1^2 - \lambda_2^2 = \lambda^2 \tag{15 a}$$

$$\lambda = H. \sqrt{\frac{s_j}{j_j}} \tag{15 b}$$

Also, by applying the nondimensionalized roots α_1 and α_2 in the form of λ_1 and λ_2 and multiplying the latter, the frequencies of the structure are expressed as:

$$\omega_j = \omega_j^* \cdot \frac{\sqrt{j_j}}{H^2} \tag{16 a}$$

$$\omega_j^* = \lambda_1 \cdot \lambda_2 \tag{16 b}$$

The pillar analyzed here is of the fixed-in-the-base type, therefore, with displacement u (x = 0) = 0 null and rotation u'(x = 0) = 0 also null. At the top, the end is free and, at a subsequent moment, bending and stress are shear and null, thus applying: u''(x = H) = u'''(x = H) = 0, respectively. Applying such boundary conditions in equation (14), after due nondimensionalization, the linear equation system results in:

$$\begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & \lambda_{1} & 0 & \lambda_{2} \\ \lambda_{1}^{2} \cdot \cosh(\lambda_{1}) & \lambda_{1}^{2} \cdot \sinh(\lambda_{1}) & -\lambda_{2}^{2} \cdot \cos(\lambda_{2}) & -\lambda_{2}^{2} \cdot \sin(\lambda_{2}) \\ \lambda_{1}^{3} \cdot \sinh(\lambda_{1}) & \lambda_{1}^{3} \cdot \cosh(\lambda_{1}) & \lambda_{2}^{3} \cdot \sin(\lambda_{2}) & -\lambda_{2}^{3} \cdot \cos(\lambda_{2}) \end{bmatrix} \cdot \begin{bmatrix} C_{1} \\ C_{2} \\ C_{3} \\ C_{4} \end{bmatrix} = \{0\}$$

$$(17)$$

The nontrivial solution of the system, shown in equation (17), leads to the transcendental equation:

$$f_1 \cdot \cosh(\lambda_1) \cdot \cos(\lambda_2) + f_2 \cdot \sinh(\lambda_1) \cdot \sin(\lambda_2) = -1 \quad (18)$$

with:
$$f_1 = \frac{2 \cdot \lambda_1^3 \cdot \lambda_2^3}{\lambda_1 \cdot \lambda_2^5 + \lambda_1^5 \cdot \lambda_2}, \quad f_2 = \frac{\lambda_1^2 \cdot \lambda_2^4 - \lambda_1^4 \cdot \lambda_2^2}{\lambda_1 \cdot \lambda_2^5 + \lambda_1^5 \cdot \lambda_2}$$

Highlighting that, the period will be:

$$T_j = \frac{2 \cdot \pi}{\omega_j} = T_j^* \cdot \frac{H^2}{\sqrt{j_j}}$$
(19 a)

$$T_j^* = \frac{2.\pi}{\lambda_1 \cdot \lambda_2} \tag{19 b}$$

In Figure 5, the change in the elastic line in the first four vibration modes is presented for $\lambda^2 = 0$. Figure 6 shows the ANSYS modeling, evidencing some vibration modes of the column with open cross section and thin walls.



Fig. 5: The first four vibration modes of the Pillar m with fixed-at-the-base core

Now, through the relation between the nondimensionalized roots λ_1 and λ_2 , constant in equation 15 (a), and in the substitution of the harmonic and hyperbolic terms for the Taylor Series with 11 terms, the vibration modes j = 1 to 7 are expressed by $\lambda = 0$, see Table 1.

Table. 1: Vibration modes of the Core Column by $\lambda^2 = 0$

| | Mode |
|-------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | <i>i</i> = 1 | <i>i</i> = 2 | <i>i</i> = 3 | <i>i</i> = 4 | <i>i</i> = 5 | <i>i</i> = 6 | <i>i</i> = 7 |
| λ_1 | 1.87510 | 4.69409 | 7.85483 | 9.08911 | 10.02092 | 11.68901 | 14.62618 |
| λ2 | 1.87510 | 4.69409 | 7.85483 | 9.08911 | 10.02092 | 11.68901 | 14.62618 |
| $\boldsymbol{\omega}_{i}^{*}$ | 3.51600 | 22.03448 | 61.69835 | 84.61192 | 105.97714 | 136.63295 | 213.92514 |
| T_i^* | 1.78703 | 0.28515 | 0.10184 | 0.07606 | 0.05929 | 0.04599 | 0.02937 |



Fig. 6: Vibration modes by modeling with the ANSYS 2019 R1 software academic version

VI. PROPORTIONAL DAMPING

Procedure 2 of diagonalization of the PDE's system presented in equation(9) results in:

$$c_j = \alpha_M \cdot 1 + \alpha_S \cdot s_j - \alpha_I \cdot j_j \tag{20}$$

The analysis of the PDE shown in equation (10) and subsequent application of $u(x) = e^{\alpha x}$ and $g(t) = e^{\omega t}$, results as a characteristic equation of the damped free vibration:

$$\omega^2 + (c_j, \alpha^4) \cdot \omega + (s_j, \alpha^2 - j_j, \alpha^4) = 0$$
(21)

The resolution of the characteristic equation, equation (21), with the imposition of critical damping and subsequent u of the damping ratio ξ_i implies c_i^0 equals to:

$$c_i^0 = 2.\,\xi_j.\,\omega_j\tag{22}$$

where: ξ_i – damping ratio of the ^{J-th} vibration mode.

Equations 13 (c) and 15 (b) with due nondimensionalization of the roots $\lambda_1 = \alpha_1 \cdot H$ and $\lambda_2 = \alpha_2 \cdot H$, result in s_j and j_j in terms of the frequency ω_j , as:

$$j_j = \frac{\omega_j^2}{(\lambda_1^4 - \lambda_1^2, \lambda^2)} \tag{23 a}$$

$$s_i = \lambda^2, i_i \tag{23 b}$$

Finally, since it is only desired to establish proportions of the matrices $[\overline{M}]$, [J] and [S] that form the damping matrix [C], the application of equations (22) and (23) in the condition expressed in equation (20) and using the frequency ω_j^* instead of ω_j , since it is only desired to establish proportions of the matrices results in :

$$\xi_j = \frac{\alpha_M}{2.\,\omega_j^*} + \frac{\alpha_S.\,s_j}{2.\,\omega_i^*} - \frac{\alpha_J.\,j_j}{2.\,\omega_j^*} \tag{24}$$

Imposing the first three vibration modes j = 1, 2 and 3 in equation (24), a system of equations is built, whose solution is:

$$\alpha_{M} = \frac{2 \cdot [\omega_{1}^{*} \cdot \xi_{1}(j_{2} \cdot s_{3} - j_{3} \cdot s_{2}) + \omega_{2}^{*} \cdot \xi_{2}(j_{3} \cdot s_{1} - j_{1} \cdot s_{3}) + \omega_{3}^{*} \cdot \xi_{3}(j_{1} \cdot s_{2} - j_{2} \cdot s_{1})]}{j_{1} \cdot (s_{2} - s_{3}) + j_{2} \cdot (s_{3} - s_{1}) + j_{3} \cdot (s_{1} - s_{2})}$$
(25 a)

$$\alpha_{s} = \frac{2 \cdot [\omega_{1}^{*} \cdot \xi_{1}(j_{3} - j_{2}) + \omega_{2}^{*} \cdot \xi_{2}(j_{1} - j_{3}) + \omega_{3}^{*} \cdot \xi_{3}(j_{2} - j_{1})]}{j_{1} \cdot (s_{2} - s_{3}) + j_{2} \cdot (s_{3} - s_{1}) + j_{3} \cdot (s_{1} - s_{2})}$$
(25 b)

$$\alpha_{J} = \frac{2 \cdot [\omega_{1}^{*} \cdot \xi_{1}(s_{3} - s_{2}) + \omega_{2}^{*} \cdot \xi_{2}(s_{1} - s_{3}) + \omega_{3}^{*} \cdot \xi_{3}(s_{2} - s_{1})]}{j_{1} \cdot (s_{2} - s_{3}) + j_{2} \cdot (s_{3} - s_{1}) + j_{3} \cdot (s_{1} - s_{2})}$$
(25 c)

In percentual terms there are:

$$\mu_M = \frac{\alpha_M}{\alpha_M + \alpha_S + \alpha_J} \tag{26 a}$$

$$\mu_S = \frac{\alpha_S}{\alpha_M + \alpha_S + \alpha_J} \tag{26 b}$$

$$\mu_J = \frac{\alpha_J}{\alpha_M + \alpha_S + \alpha_J} \tag{26 c}$$

a) Center of Mass Positioning

For the reinforced concrete, cross, and thin-walled open section, the determination of the center of mass coordinates (CM) is made necessary. To this end, the following definitions are used:

$$x_{CM}^* = \frac{\sum_{i=1}^n x_{CM_i}^* m_i}{\sum_{i=1}^n m_i}$$
(27 a)

$$y_{CM}^{*} = \frac{\sum_{i=1}^{n} y_{CM_{i}}^{*} \cdot m_{i}}{\sum_{i=1}^{n} m_{i}}$$
(27 b)

where: $x_{CM_i}^*$ and $y_{CM_i}^*$ – coordinates of the canonic center of mass *i* in relation to a generic referential x^* and y^* defined in the cross section; m_i – canonic element mass i;n – number of canonic masses that formed in core; and x_{CM}^* and y_{CM}^* – the center of mass coordinates of the cross section in core shape in relation to referential x^* and y^* .

The adoption of the subdivision presents in Figure 7, the concrete specific mass $\rho_{CS} = 2400 \ kg/m$ steel $\rho_S = 7860 \ kg/m^3$ results in:

$$x_{CM}^{*} = \frac{x_{CM_{1}}^{*}.m_{1} - x_{CM_{2}}^{*}.m_{2} - x_{CM_{3}}^{*}.m_{3} - x_{CM_{4}}^{*}.M_{4} + x_{CM_{5}}^{*}.M_{5}}{m_{1} - m_{2} - m_{3} - M_{4} + M_{5}}$$
(28 a)



Fig. 7: Geometry of decomposition into canonic format masses

Finally, the distances between the centers of mass (CM) and that of gravity (CG) are valid, according to what is shown in Figure8:



Fig. 8: Positioning of the CG and CM in the cross section

$$d_{y_{CMCG}} = y_{CM}^* - y_{CG}^* \tag{29 a}$$

$$d_{z_{CMCG}} = x_{CM}^* - x_{CG}^* \tag{29 b}$$

VII. REFERENTIAL TRANSFORMATION

a) Transfer from the center of gravity CG to the torsional center D

According to the compatibilization of the rotations ϕ_D (in the torsional center) and ϕ_{CG} (in the center of gravity), the displacements $\omega_D \text{via } \omega_{CG}$, and projection of the distance $d_{y_{CGD}}$ from the center of gravity to the torsional center parallel to z axis, procedures are the same for v_D with v_{CG} and $d_{z_{CGD}}$. See Figure9.



Fig. 9: Transformation of the referential in the CG for D: (a) translation, (b) rotation

The matricial format of the displacement balance is:

$$\{v_{CG}\} = [\bar{T}_D].\{v_D\}$$
(30 *a*)

$$\begin{cases} v_{CG} \\ \omega_{CG} \\ \phi_{CG} \end{cases} = \begin{bmatrix} 1 & 0 & -d_{z_{CGD}} \\ 0 & 1 & d_{y_{CGD}} \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{cases} v_D \\ \omega_D \\ \phi_D \end{cases}$$
(30 b)

b) Transfer from the torsional center D for the source of the coordinates 0_s

Analogously as in (a) of this item, and considering the rotation β between the referential (y_{DL}, z_{DL}, x_{DL}) in the torsional center and the global referential (y_g, z_g, x_g) , see Figure 10, there is:



Fig. 10: Transformation of the referential in the torsional center D for the source O_s .

$$v_D \cdot \cos\beta + \omega_D \cdot \sin\beta = v_g - d_{z_{DOs}} \cdot \phi_g \tag{31 a}$$

$$-v_D \sin\beta + \omega_D \cos\beta = \omega_g + d_{y_{DO_s}} \phi_g \tag{31b}$$

$$\phi_D = \phi_g \tag{31 c}$$

Matrically, the balance is expressed as:

$$\{v_D\} = [\bar{T}_S]^{-1} \cdot [\bar{T}_G] \cdot \{v_g\}$$

$$\begin{cases} v_D\\ \omega_D\\ \phi_D \end{cases} = \begin{bmatrix} \cos\beta & \sin\beta & 0\\ -\sin\beta & \cos\beta & 0\\ 0 & 0 & 1 \end{bmatrix}^{-1} \cdot \begin{bmatrix} 1 & 0 & -d_{z_{DO_S}}\\ 0 & 1 & d_{y_{DO_S}}\\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{cases} v_g\\ \omega_g\\ \phi_g \end{cases}$$

$$(32 \ b)$$

Combining equations (30) and (32), direct transfer from *CG* to O_s is as follows:

$$\{v_g\} = [\bar{T}_S]^{-1} . [\bar{T}_G] . [\bar{T}_D]^{-1} . \{v_{CG}\}$$
(33)

VIII. RESULTS AND DISCUSSIONS

In this section, a bridge with a deck backed over three pillars, each with a cross section composed of thin walls will be analyzed. See Figure 11.All in compliance with the Technical Standards NBR 7188 [12] and DIN 1055 [13].

The material used is reinforced concrete of resistance class C-40, complying with NBR 6118 [14]. Therefore, the modules are of longitudinal elasticity E = $3.54175 \ x \ 10^7 \ kN/m^2$ and of cross elasticity G =1.47573 x 10⁷ kN/m^2 , as well as Poisson's coefficient v =0.20. On the basis of the loading conditions of the bridge, two scenarios are analyzed: in the first scenario, the sole actuation of the wind on the structure (See Example 1) and, in the second scenario, the traffic performance with a focus on braking (See Example 2).

EXAMPLE 1: In this first analysis, the bridge is subject to the sole actuation of the lateral wind in the form of three loadings along the height of the pillar, namely: $q_1 = 20 \ kN/m$, $q_2 = 30 \ kN/m$ and $Q = 10 \ kN$. See Figure 12.



Fig. 11: Bridge backed over three thin-walled pillars: (a) lateral view, (b) drawing configuration of the pillars



Fig. 12: Angles formed between the external shear forces $V_{ext_{P_1}}, V_{ext_{P_2}}, V_{ext_{P_3}}$ and axes y_{DL} defined in the torsional centers of each of the three columns

$$\begin{aligned} V_{ext_y} &= -\frac{q_{2y}}{2.H} \cdot x^2 - q_{1y} \cdot x + (Q_y + q_{1y} \cdot H) \\ q_{1y} &= q_1 \cdot \cos(\theta_D) \; ; \; q_{2y} = q_2 \cdot \cos(\theta_D) \; ; \; \; Q_y \\ &= Q \cdot \cos(\theta_D) \\ q_{1z} &= q_1 \cdot \sin(\theta_D) \; ; \; q_{2z} = q_2 \cdot \sin(\theta_D) \; ; \; \; Q_z = Q \cdot \sin(\theta_D) \end{aligned}$$

$$V_{ext_z} = -\frac{q_{2z}}{2.H} \cdot x^2 - q_{1z} \cdot x + (Q_z + q_{1z} \cdot H)$$

The shear force, over time, will be governed by a harmonic sinusoidal function $V_g(t) = sin(\overline{\omega}.t)$, with frequency $\overline{\omega} = 3 rad/s$. In addition, the PDE system of equation (9) is expressed for the pillars and referenced in the center of gravity as:

$$\begin{bmatrix} 7870.65 & 0 & 387.78 \\ 0 & 7870.65 & 1506.08 \\ 387.78 & 1506.08 & 319.73 \end{bmatrix} \cdot \begin{bmatrix} \ddot{\nu} \\ \ddot{\omega} \\ \ddot{\phi} \end{bmatrix} \\ + \begin{bmatrix} 120073 & 0 & -18909 \\ 0 & 99853 & 5459 \\ -22378 & 0 & 174899 \end{bmatrix} \cdot \begin{bmatrix} \dot{\nu}''' \\ \dot{\omega}''' \\ \dot{\phi}'''' \end{bmatrix} \\ + \begin{bmatrix} 0 & 0 & 6939 \\ 0 & 10919 \\ 0 & 0 & -12427 \end{bmatrix} \cdot \begin{bmatrix} \nu'' \\ \omega'' \\ \phi'' \end{bmatrix} \\ - \begin{bmatrix} 240146 & 0 & -44757 \\ 0 & 199706 & 0 \\ -44757 & 0 & 336224 \end{bmatrix} \cdot \begin{bmatrix} \nu''' \\ \omega''' \\ \omega'''' \\ \phi'''' \end{bmatrix} = \{V_f\}$$

The same PDE system, with the proportionality coefficients of the matrices $[\overline{M}]$, [J] and [S] to compose the viscous damping matrix [C], is expressed as: $\alpha_M = 0$; $\alpha_S = -3.80 \times 10^{16}$; $\alpha_J = -3.80 \times 10^{16}$; $\mu_M = 0$; $\mu_S = 0.5$; $\mu_I = 0.5$.

And the set of decoupled PDE's presented in equation (10) are:

$$\begin{split} -q_1^{\prime\prime\prime\prime}(x,t) &+ 0.03385. \ddot{q}_1(x,t) + 0.49519. \dot{q}_1^{\prime\prime\prime\prime}(x,t) \\ &- 0.00962. q_1^{\prime\prime}(x,t) = V_{f_1}^0(x,t) \\ -q_2^{\prime\prime\prime\prime}(x,t) &+ 0.04038. \ddot{q}_2(x,t) - 0.13363. \dot{q}_2^{\prime\prime\prime\prime}(x,t) \\ &- 1.26726. q_2^{\prime\prime}(x,t) = V_{f_2}^0(x,t) \\ -q_3^{\prime\prime\prime\prime}(x,t) &+ 0.00003. \ddot{q}_3(x,t) + 0.50243. \dot{q}_3^{\prime\prime\prime\prime}(x,t) \\ &+ 0.00498. q_3^{\prime\prime}(x,t) = V_{f_2}^0(x,t) \end{split}$$

In the set of EDP's presented in equations (34), the first mode of vibration (mobilizing the lintels) is verified by crossing the equation (15 b) and the Figure 13.



Fig. 13:Column C in concrete C - 40, vibration modes activating the lintels for flexion: (a) 1st mode ($\omega_1 =$ 1,91493 rad/s), (b) 2nd mode and (c) 3rd mode via modeling in ANSYS

so, with the parameters $s_j = -0,00962$ and $j_j = -1$, and through equation (15 b) the parameter is determined $\lambda = H \cdot \sqrt{\frac{s_j}{j_j}} = 100 \ [m] \cdot \sqrt{\frac{-0,00962}{-1}} = 9,81$, using Table 2 with the value immediately above λ , then: $\omega_1^* = 2,54634 \ rad/s$ (for $\lambda = 10$).

Table. 2: Vibration modes of the Core Column by $\lambda = 10$

| | Mode -------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|-----------|
| | <i>i</i> = 1 | <i>i</i> = 2 | <i>i</i> = 3 | <i>i</i> = 4 | <i>i</i> = 5 | <i>i</i> = 6 | i = 7 |
| λ ₁ | 3,25746 | 5,50391 | 8,42839 | 9,64266 | 10,43138 | 11,87014 | 14,61565 |
| λ_2 | 0,78169 | 4,50478 | 7,81267 | 9,10938 | 9,94051 | 11,44116 | 14,26945 |
| $\boldsymbol{\omega}_{i}^{*}$ | 2,54634 | 24,79389 | 65,84820 | 87,83870 | 103,69321 | 135,80821 | 208,55730 |
| T_i^* | 2,46754 | 0,25342 | 0,09542 | 0,07153 | 0,06059 | 0,04627 | 0,03013 |

Finally, in Figure 13 (a) the first vibration mode of a single C-shaped pillar and braced with lintels is presented under the same distribution as this example, hence the reason for comparison, with an approximation of 2.24 %. The frequency adjustment determined via TMC is used by the coefficient $\alpha = \frac{1}{1,3}$, whose functionality is based on Diziewolski [15].

$$\Delta(\%) = \frac{|\omega_{ANSYS}^* - \omega_{TMC}^*|}{\omega_{TMC}^*} \cdot 100 \% =$$
$$= \frac{|1,91493 - 1,95872|\frac{rad}{s}}{1,95872\frac{rad}{s}} \cdot 100 \% = 2,24 \%$$

The shear force V_f functions in the initial referential are presented in Table 3, as well as V_f^0 in the generalized referential, and both for the columns P_1 , P_2 and P_3 .

| Table. 3: Functions | of the | shear force | per Column |
|---------------------|--------|-------------|------------|
|---------------------|--------|-------------|------------|

| | ColumnP ₁ | ColumnP ₂ | ColumnP ₃ |
|-------------|---|--|--|
| V_{f_1} | $89.77 . x^{2} + 11969.20 . x - 1196926.12$ | $-48.87 \cdot x^2$ - 6515.63 \cdot x + 651565.87 | $-147.66 \cdot x^2$ - 19687.64 \cdot x + 1968773.75 |
| V_{f_2} | $120.17 . x^2 + 16023.05 . x - 1602313.28$ | $-141.82 . x^{2}$ - 18.908.90 . x + 1809899.76 | 26.41 . <i>x</i> ² + 3520.92 . <i>x</i> - 352093.65 |
| V_{f_3} | 332.19. <i>x</i> ² | $-180.83 . x^{2}$ | $-546.40 \cdot x^2$ |
| | + 44291.71. <i>x</i> | -24110.90 . x | - 72853.59 · x |
| | - 4429193.40 | +2411102.23 | + 7285395.07 |
| $V_{f_1}^0$ | $0.18 \cdot x^2$ | $-0.10 \cdot x^2$ | -0.30.x ² |
| | + 24.43 \cdot x | - 13.30 \cdot x | -40.17.x |
| | - 2442.55 | + 1329.69 | +401750.64 |
| $V_{f_2}^0$ | $0.27 \cdot x^2$ | $-0.32.x^{2}$ | 0.06 . x ² |
| | + 35.85 \cdot x | - 42.31.x | + 7.88 . x |
| | - 3585.47 | + 4231.26 | - 787.97 |
| $V_{f_3}^0$ | 0.59.x ² | $-0.32 \cdot x^2$ | $-0.96 \cdot x^2$ |
| | + 78.21.x | - 42.57 \cdot x | - 128.64 \cdot x |
| | - 7820.51 | + 4257.22 | + 12863.63 |

For the first vibration mode, the displacement function, u(x) and g(t), and the generalized and initial referential are, respectively:

$$\begin{split} u_1(x) &= 0.36275 \cdot \{ cosh(0.01983 \cdot x) \\ &\quad - cos(0.01713 \cdot x) \\ &\quad + 0.92535 \cdot [-\sinh(0.01983 \cdot x) \\ &\quad + 2.41421 \cdot sin(0.01713 \cdot x)] \} \\ g_1(t) &= 4.543 \cdot 10^{10} \cdot sin(3.476 \cdot 10^{-3} \cdot t) \\ &\quad - 8.928 \cdot 10^8 \cdot sin(3 \cdot t) \end{split}$$

$$\begin{split} u_1(x) &= 6.098 \cdot 10^{-4} \cdot \{ \cosh(1.847 \cdot 10^{-3} \cdot x) \\ &\quad -\cos(7.65 \cdot 10^{-4} \cdot x) \\ &\quad + 1.556 \cdot 10^{-3} \cdot [-\sinh(1.847 \cdot 10^{-3} \cdot x) \\ &\quad + 4.048 \cdot 10^{-3} \cdot \sin(7.65 \cdot 10^{-4} \cdot x)] \} \\ g_1(t) &= 7.637 \cdot 10^7 \cdot \sin(5.843 \cdot 10^{-6} \cdot t) \\ &\quad - 1.501 \cdot 10^6 \cdot \sin(3 \cdot t) \end{split}$$

Then, returning to the initial referential, the vector of displacements $\{v_{CG}\}$ for the mode of larger deformations is written as:

$$\{v_{CG}\}_1 = [\Phi_R]. \{q\} = [\Phi_R]. \{u_1(x). g_1(t)\}$$

where: $[\Phi_R] = [Re] [J^*]^{-\frac{1}{2}} [\varphi_1] [\varphi_2] [\varphi_3] (...) [\varphi_{n-1}] [\varphi_n].$

And, finally, the rotation function $\phi_{CG}(x)$ is expressed as:

$$\phi_{CG}(x) = u_1(x) \cdot g_1(t) + u_2(x) \cdot g_2(t) + u_3(x) \cdot g_3(t)$$

The relation between rotation $\phi_{CG}(x)$ and the BimomentB(x), originating from the Bending-Torsion Theory yields:

$$B(x) = E.I_{\omega}.\phi_{CG}''(x) = E.I_{\omega}.\frac{d^{2}[\phi_{CG}(x)]}{dx^{2}}$$

After applying the referential transformations, we have the Bimoment in the Base and in the Top for the *CG*, *D* and O_s . See Table 4, as well as the rotation in Table 5.

 Table. 4: Bimoment values per Pillar in the CG and D, and

 the set of pillars in O_s

| (x 10 ⁷) | In the Center of Gravity | | In the Torsional Center | | | 0 _s | |
|----------------------|-----------------------------|------------------------|----------------------------|-----------------------|-----------------------|-----------------------|---------|
| KN. <i>m</i> - | <i>CG</i> ₁ | <i>CG</i> ₂ | CG ₃ | D ₁ | D ₂ | D ₃ | |
| B(x=0) | -3.99422 | 2.17432 | 6.56993 | -3.99422 | 2.17432 | 6.56993 | Idem |
| B(x) = 50m | - 4.00790 | 2.18176 | 6.59242 | - 4.00790 | 2.18176 | 6.59242 | per |
| B(x = H) | - 4.04993 | 2.20464 | 6.66156 | - 4.04993 | 2.20464 | 6.66156 | Pillar. |

Table. 5: Rotation values per Pillar in the CG and set ofpillars in O_s

| rad | In the (| 0 | | | |
|---------------|-----------------|------------------------|-----------------|----------------------|--|
| Tuu | CG ₁ | <i>CG</i> ₂ | CG ₃ | \boldsymbol{U}_{s} | |
| $\phi(x=0)$ | 0 | 0 | 0 | Idem | |
| $\phi(x=50m)$ | - 57.42669 | 31.26114 | 94.45877 | per | |
| $\phi(x=H)$ | - 233.82458 | 127.28615 | 384.60827 | Pillar. | |

EXAMPLE 2: In this second analysis, there is the braking force of the traffic and lateral cargo at the top. Thus, the shear force under the configuration shown in Figure 14 is presented as:



Fig. 14: Angles formed between the external shear forces activated by braking in each Pillar and the axes y_{DL}in each of the three columns

Adopting the same frequency $\overline{\omega} = 3 rad/s$ for the shear force, the values of the Top and Base Bimoments are expressed in Table 6.

| Tab. | 6: | Values of Bimoment for the actuation of the | ? |
|------|----|---|---|
| | | braking force of the vehicles | |

| $(x \ 10^5)$ | In th | In the Center of Gravity | | In the Torsional Center | | | 0 _s |
|----------------|-----------------|-----------------------------|-----------------|----------------------------|-----------------------|-----------------------|------------------------|
| KN. m - | CG ₁ | CG ₂ | CG ₃ | D ₁ | D ₂ | D ₃ | |
| B(x=0) | - 4.96373 | 2.70209 | 8.16464 | - 4.96373 | 2.70209 | 8.16464 | |
| B(x) = 50m) | - 4.98075 | 2.71135 | 8.19264 | - 4.98075 | 2.71135 | 8.19264 | Idem per Pillar. |
| B(x = H) | - 5.03302 | 2.73980 | 8.27860 | - 5.03302 | 2.73980 | 8.27860 | |

where the loadings are: $q_1 = q_2 = 0 \ kN/m$, $Q = 10 \ kN$; the Top Bimoment $B_H = 10 \ kN.m^2$; and the torsional moment at the top is null $M_{tH} = 0 \ kN.m$.

IX. CONCLUSION

In this paper the implementation of the dynamic plots of acceleration and damping in the Wall Panel Theory was carried out, in order to promote the dynamic analysis of bridge pillars under the effect of Bending-Torsion and to provide the noncoincidence of the center of gravity with the torsional center, as a result of the geometry in thin-walled cross section. Moreover, the PDE system that governs the vibration of said Wall Panels has two bending stiffness matrices, being: [J] for the pillar itself and [S] for the lintels that promote bracing of said pillar. Thus, the Rayleigh proportional [C] damping matrix assembly considers only a single stiffness matrix. At this point, an unpublished formulation is made for such a composition. Two procedures of diagonalization of the PDE system and transformations between the reference points of the center of gravity (CG), the center of torsion (D) and a global origin (O_s) are discussed.

Such analyses encourage the of high columns in reinforced concrete subject of wind actuation, due to the large volume of concrete required for the molding of the pillars. It is fitting to design them with a cross section composed of thin walls, in order to confer economy, and with one of the faces open and braced by lintels.

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New bar finite element for modeling massive columns with linearly variable rectangular section

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> **Abstract**—In this article, the stiffness matrix of a column with linearly variable rectangular cross section along the longitudinal axis is obtained. As it is well known in structural analysis, the stiffness matrix can be obtained by inversion of the flexibility matrix. So, the terms of this matrix for variable section beam are obtained via the energetic method of the principle of virtual works. Parameters called α_i , α_f , β_f and ε are obtained and they are valid only for sections with variable dimensions. The stiffness matrix is then obtained in function of these parameters, from de inversion of the flexibility matrix.Finally, the modal analysis of the abutment is carried out for the case of the support of a bridge 100 meters high, whose numerical validation of the new bar finite element is performed by means of an exact solution by the Continuous Medium Technique (CMT) and by modeled finite elements in Ansys academic version.

Keywords—New Bar Finite Element, Massive Columns, Stiffness Matrix, Vibration modes.

I. INTRODUCTION

In the structural analysis, the Method of Displacements is relevant, which consists of resolving the structure by obtaining the initial deformations and, following these deformations, it is necessary to draw the diagrams of the internal forces of the beam that make up the structure (SUSSEKIND, 1978) [1]. The incognitos of the problem are: the angle of rotation and the linear displacements at each node to be properly constrained from the displacements. This should be considered for the various columns.

As illustrated in Kassimali [2], the advantage of using the Method of Displacements over the Method of Forces is based on the fact that there is no difficulty in choosing the incognitos, since the fundamental problem is only one per structure. Thus, the definition of hypergeometric grades emerges, which is the number of displacements (linear and angular) that can occur at the nodes of a given structure. For a high-length Bridge Pillar, it is economically relevant to adopt a variable cross section, with a more robust base than the top.

Thus, by adding such a taper in the column shaft it is constructively more feasible that such a variation is linear, which motivates this article with exact attainment of the Stiffness Matrix of a beam element with rectangular linearly variable cross section along the axial axis x. In the field of approximate solutions in such determination, Luo et al. [3] and Brown [4] are quoted. Thus formulating a New Bar Finite Element.

II. NEW BAR FINITE ELEMENT FOR LINEARLY VARIABLE RECTANGULAR SECTION

a) Method of Forces

Also called Flexibility Method and developed by James Clerk Maxwell in 1864, in order to determine deflections in trusses with beam links by labeled joints. To this end, the internal energy activated only by the normal effort was used [5]. Still, based on Timoshenko [5], when promoting the temporal delimitation of contributions in structural analysis in 1874, Otto Mohr's technique arises in response to the problem of nodes (beam joining) of trusses formed by two or more rivets,making the connections no longer labeled and, therefore, the need to compute the deformation internal force energy with all the internal forces. In equation 1 (a), the calculation of deflections is verified by the Maxwell formulation for labeled trusses. On the other hand, in equation 1 (b), the same occurs, however, for connections with two or more fixations per node, according to Mohr's formulation.

$$\delta_{i0} = \int_{\Omega} \frac{(N_i \cdot N_0)}{E \cdot A} \, dx \tag{1 a}$$

$$\delta_{i0} = \int_{\Omega} \frac{(N_i \cdot N_0)}{E \cdot A} dx + \int_{\Omega} \frac{(M_i \cdot M_0)}{E \cdot I} dx + \int_{\Omega} k_c \cdot \frac{(V_i \cdot V_0)}{E \cdot A} dx \quad (1 b)$$

with: δ_{i0} = Nodal deflexion to the *i* node; N_i , M_i , V_i = Axial load, Flexion moment, Bending moment and Shear force for the real load of the structure; and N_0 , M_0 , V_0 = Axial load, Bending moment and Shear force for the virtual load via P.V.W. acting on Node *i*.

Yet, in Charlton [6], Maxwell's publication entitled: "On reciprocal figures, frames and diagrams of forces" it is evident. In the work of the same author, page 83, Mohr's publication entitled: " Beitrag Zur Theorie Du Bogenfachwerk träger " can be seen. In 1886, Heinrich Müller - Breslau postulated the systematization of the Method of Forces defined earlier by Maxwell and Mohr (KINNEY, 1957) [7]. The publication of such "Die systematization is: neue methoden der baukonstruktionen". The fundamental basis of the Method of Forces is the compatibilization of the angular and linear displacements of the extracted connections in order to establish extra equations and make the system of equations of the problem linearly independent and, therefore, make it solvable.

The compatibilization of the displacements due to the connections extracted via definition of said method will be adopted from the positive convention for linear displacements in the positive direction of the x and y axes and rotation with vector notation in the same direction as the positive z axis. Thus, using a formulation present in Kiseliov [8], the system of displacement compatibility equations is written in matrix notation as:

$$\{d\} = [F].\{X\} + \{\delta\} + \{\delta^T\}$$
(2)

with: $\{d\}$ = Vector of displacements in the initial hyperstatic structure; $\{\delta\}$ = Vector of displacements in the fundamental problem; $\{\delta^T\}$ = Vector of displacements in the thermal problem; $\{X\}$ = Vector of incognitos for the Method of Forces; and [F] = Flexibility Matrix.

In order to assemble the Flexibility Matrix [F], just consider the derived systems to become, in the background, both the fundamental problem responsible for the analysis of the actual and active load in the initial structure and the

thermal problem. In addition, the vector $\{\delta\}$ is neglected in this analysis, since it is only desired to obtain the Flexibility Matrix. Such Systems derived from a fixed-fixed beam are shown in Figure 1 as much as the Main System.



Fig. 1: Method of Forces: (a) Main System, (b) 1st. Derived System, (c) 2nd. Derived System, (d) 3rd. Derived System

At the initial node there is the Degree of Freedom θ_i . The final node is characterized by the degree of freedom also in rotation θ_f and, finally, δ_f in linear displacement for the final node. The system of equations is expressed by:

$$\begin{cases} \theta_i \\ \theta_f \\ \delta_f \end{cases} = \begin{bmatrix} \alpha_i & \varepsilon & 0 \\ \varepsilon & \alpha_f & 0 \\ 0 & 0 & \beta_f \end{bmatrix} \cdot \begin{cases} M_i \\ M_f \\ N_f \end{cases}$$
(3)

with: α_i, α_f = Angular displacement for the initial and final node of the beam, respectively; ε = Angular displacement in a node contrary to where α_i and α_f occur; M_i, M_f = Flexion moment along the beam with unitary moment imposition; V_i, V_f = Shear force along the beam with unitary and vertical load imposition; and N_f = Axial load of the beam with unitary and horizontal load imposition.

b) Obtaining the displacements α , β and ε via PVW

The Principle of Virtual Works (PVW) was postulated by John Bernoulli in 1717 and is based on the Principle of Energy Conservation. This principle was also linked to the concept of virtual displacement. In virtual displacement, when the material point is in equilibrium, real displacement cannot occur. And for a particle to be in equilibrium, the condition of nullity to the work of all external forces must be satisfied (STAMATO, 1983) [9]. Figure 2 shows the linear and angular displacements β_f , and α_i , α_f and ε , respectively, as:

$$\alpha_i = \int_0^L \frac{(M_i, \overline{M}_i)}{E.I_z(x)} \, dx + \int_0^L k_c \cdot \frac{(V_i, \overline{V}_i)}{G.A(x)} \, dx \tag{4 a}$$

$$\alpha_f = \int_0^L \frac{\left(M_f \cdot \overline{M}_f\right)}{E \cdot I_z(x)} \, dx + \int_0^L k_c \cdot \frac{\left(V_f \cdot \overline{V}_f\right)}{G \cdot A(x)} \, dx \tag{4 b}$$

$$\varepsilon = \int_{0}^{L} \frac{\left(M_{i} \cdot M_{f}\right)}{E \cdot I_{z}(x)} dx + \int_{0}^{L} k_{c} \cdot \frac{\left(V_{i} \cdot V_{f}\right)}{G \cdot A(x)} dx \qquad (4 c)$$


Fig. 2: Internal Force Diagrams: (a) $M_i \equiv \overline{M}_i$, (b) $M_f \equiv \overline{M}_f$, (c) $V \equiv \overline{V}$, (d) $N_f \equiv \overline{N}_f$

For the beam element of length L and dimensions in the cross section $H_y(x)$ and $H_z(x)$, as shown in Figure 3, the cross section area A (x) and the Moment of Inertia $I_z(x)$ around the z axis, is written as:



Fig. 3: Beam Element with dimension in the linearly variable cross section along the axial axis x

 $I_z(x) = k_1 \cdot x^4 + k_2 \cdot x^3 + k_3 \cdot x^2 + k_4 \cdot x + k_5$ (5 a)

$$A(x) = k_6 \cdot x^2 + k_7 \cdot x + k_8 \tag{5 b}$$

where: $k_1 = A.C^3$; $k_2 = C^2.(3.A.D + B.C)$; $k_6 = A.C$; $k_3 = 3.C.D.(A.D + B.C)$; $k_5 = B.D^3$; $k_8 = B.D$; $k_4 = D^2.(A.D + 3.B.C.D)$; $k_7 = A.D + B.C$; $B = b_z$; $D = b_y$; $A = \frac{h_z - b_z}{L}$; $C = \frac{h_y - b_y}{L}$.

with: b_z , h_z -Cross section dimensions, parallel to axis *z*, in the initial and final section, respectively; b_y , h_y -Cross section dimensions, parallel to axis *y*, in the initial and final section, respectively; *E* -Longitudinal Elasticity Module; *G* - Cross Elasticity Module; $I_z(x)$ - Variation along the axial axis *x* of the inertia moment surrounding axis *z*; A(x) - Variation along axial axis *x* of the cross section area; k_c - Shape factor and *L* - Beam length. Analysing the Area Static Moment Q(x) for a rectangular section with dimensions $H_y(x)$ and $H_z(x)$, characterized in Figure 4, results in:



Fig. 4: AreaStaticMoment

$$A'(x) = \left[\frac{H_z(x)}{2} - z(x)\right] \cdot H_y(x) \tag{6 a}$$

$$I_z(x) = \frac{H_z(x) \cdot H_y^3(x)}{12}$$
(6 b)

$$\bar{z}'(x) = \frac{A'(x)}{2.H_y(x)} + z(x)$$
(6 c)

$$Q(x) = A'(x).\bar{z}'(x) = \frac{H_y(x)}{2}.\left[\frac{H_z^2(x)}{4} - z^2(x)\right] \quad (6 d)$$

Proceeding the calculation of the shape factor k_c , after transforming the integration in area A into along the length, there is:

$$k_{c} = \frac{A(x)}{I_{z}^{2}(x)} \int_{A} \frac{Q^{2}(x)}{H_{y}^{2}(x)} dA$$
$$= \frac{A(x)}{I_{z}^{2}(x)} \int_{-\frac{H_{z}(x)}{Q}}^{\frac{H_{z}(x)}{2}} \left[\frac{Q^{2}(x)}{H_{y}^{2}(x)} \cdot H_{y}(x) \right] dz$$
(7)

When applying equations 6 (a - d) in equation (7) and carrying out the integration in z and consequent simplifications, we conclude that the shape factor k_c remains unchanged along axis x with the following value:

$$k_c = \frac{5}{6} \tag{8}$$

Finally, when applying the equations (5), 6 (a - d) and (8) in equations 4 (a - d), the flexibility coefficients α_i , α_f , ε and β_f are attained, expressed by:

$$\blacktriangleright \quad \underline{ifA.D \neq B.C:}$$

$$\alpha_{i} = \frac{12}{E \cdot \eta_{3}} \cdot \left[\eta_{1} - \eta_{2} \cdot \ln\left(\frac{B + A \cdot L}{A}\right) + \eta_{2} \cdot \ln\left(\frac{B}{A}\right) + \eta_{2} \cdot \ln\left(\frac{D + C \cdot L}{C}\right) - \eta_{2} \cdot \ln\left(\frac{D}{C}\right) \right] + \frac{k_{c}}{G \cdot \eta_{4}} \cdot \left[\ln\left(\frac{B + A \cdot L}{D + C \cdot L}\right) - \ln\left(\frac{B}{D}\right) \right]$$
(9 a)

$$\alpha_{f} = \frac{12}{E \cdot \eta_{7}} \cdot \left[\eta_{5} + \eta_{6} \cdot \ln\left(\frac{B + A \cdot L}{A}\right) - \eta_{6} \cdot \ln\left(\frac{B}{A}\right) - \eta_{6} \cdot \ln\left(\frac{D + C \cdot L}{C}\right) + \eta_{6} \cdot \ln\left(\frac{D}{C}\right) \right] + \frac{k_{c}}{C \cdot \pi} \cdot \left[\ln\left(\frac{B + A \cdot L}{D + C \cdot L}\right) - \ln\left(\frac{B}{D}\right) \right]$$
(9 b)

$$\varepsilon = \frac{12}{E \cdot \eta_{10}} \cdot \left[\eta_8 + \eta_9 \cdot \ln\left(\frac{B + A \cdot L}{A}\right) - \eta_9 \cdot \ln\left(\frac{B}{A}\right) - \eta_9 \cdot \ln\left(\frac{D + C \cdot L}{C}\right) + \eta_9 \cdot \ln\left(\frac{D}{C}\right) \right] + \frac{k_c}{G \cdot \eta_4} \cdot \left[\ln\left(\frac{B + A \cdot L}{D + C \cdot L}\right) - \ln\left(\frac{B}{D}\right) \right]$$
(9 c)

$$\beta_f = \frac{1}{E} \cdot \left[\frac{\ln\left(\frac{B+A.L}{D+C.L}\right) - \ln\left(\frac{B}{D}\right)}{(A.D - B.C)} \right]$$
(9 d)

$$\succ \quad \underline{ifA.D} = \underline{B.C.}$$

$$\alpha_i = \alpha_f = \frac{4.L}{E.B.D^3} + \frac{\kappa_c}{G.B.D.L}$$
(9 e)
-2.L k_c

$$\varepsilon = \frac{2.D}{E.B.D^3} + \frac{\kappa_c}{G.B.D.L} \tag{9 f}$$

$$\beta_f$$

$$=\frac{L}{E.B.D}\tag{9 g}$$

where A, B, C and D are parameters linked to geometrical dimensions of the cross section. And yet, list yourself: $\eta_1 = L.(A.D + B.C).(2.B.D + 3.A.D.L - B.C.L);$

$$\begin{aligned} \eta_{3} &= -2.D^{2}.L^{2}.(A.D + B.C)^{3}; \ \eta_{4} &= L^{2}.(A.D + B.C); \\ 2.\eta_{8} &= -L.(A.D - B.C).(2.B.D + A.D.L + B.C.L); \\ \eta_{5} &= -L.(A.D - B.C).(2.B.D - A.D.L + 3.B.C.L); \\ \eta_{2} &= 2.D^{2}.(A.L + B)^{2}; \ \eta_{6} &= 2.B^{2}.(C.L + D)^{2}; \\ \eta_{7} &= 2.L^{2}.(C.L + D)^{2}.(A.D - B.C)^{3}; \\ \eta_{10} &= D.L^{2}.(C.L + D).(A.D + B.C)^{3}; \\ \eta_{9} &= B.D.(A.L + B).(C.L + D). \end{aligned}$$

c) Method of Displacements

Such method consists of resolving the structure by initially obtaining the deformations by means of the internal forces on the beams that make up the structure, while in the Method of Forces, extra bonds are extracted to structural staticity and stability. In the Method of Displacements, the locking of the bound nodes of the structure is promoted in order to attain the connection of the beams by means of embedments. In matrix notation, the system of equations of equilibria of the unbalancing forces by nodes is expressed as follows:

$$\{M\} = [K].\{D\} + \{\gamma\} + \{\gamma^T\}$$
(10)

where: $\{M\}$ = Vector of unbalancing forces; [K] = Stiffness Matrix; $\{D\}$ = Vector of incognitos in the Method of Displacements; $\{\gamma\}$ = Vetor of unbalancing forces in the fundamental problem fundamental; $\{\gamma^T\}$ = Vector of unbalancing forces in the thermal problem; and k_i, k_f, a, r_f = Stiffness coefficients.

Using the definitions in Kassimali[2] and Kiseliov [8], the Stiffness Matrix [K] will be the inverse of the Flexibility Matrix [F]. The terms of stiffness are concluded, such as:

$$[K] = [F]^{-1} = \begin{bmatrix} \alpha_i & \varepsilon & 0\\ \varepsilon & \alpha_f & 0\\ 0 & 0 & \beta_f \end{bmatrix}^{-1} = \begin{bmatrix} k_i & a & 0\\ a & k_f & 0\\ 0 & 0 & r_f \end{bmatrix} \quad (11 a)$$

$$k_i = \frac{\alpha_f}{\alpha_i \cdot \alpha_f - \varepsilon^2} \tag{11 b}$$

$$k_f = \frac{\alpha_i}{\alpha_i \cdot \alpha_f - \varepsilon^2} \tag{11 c}$$

$$a = \frac{-\varepsilon}{\alpha_i \cdot \alpha_f - \varepsilon^2} \tag{11 d}$$

$$r_f = \frac{1}{\beta_f} \tag{11 e}$$

The present formulation was proposed by George Alfred Maney in 1915, and was also denominated Rotation-Arrow Method. See [10]; [11] and [12].

III. MATRIX CONDENSATION

Based on Paz [13] and the application in the calculation of natural frequencies in Alves Filho (p. 200) [14], matrix condensation consists of rewriting the system of equations in terms of some of its variables. In Figure 5 shows a pillar with n subdivisions and (n + 1) nodes, as well as the resulting degrees of freedom (δ and θ) and nodal forces, in order to exemplify such a condensation procedure.



Fig. 5: column subdivision by finite elements of bar

The ODE's system remaining, for the non-damped vibration, expressed by:

$$\begin{bmatrix} [M_{\theta\theta}] & [M_{\theta\delta}] \\ [M_{\delta\theta}] & [M_{\delta\delta}] \end{bmatrix} \cdot \begin{cases} \{\ddot{\theta}\} \\ \{\breve{\delta}\} \end{cases} + \begin{bmatrix} [K_{\theta\theta}] & [K_{\theta\delta}] \\ [K_{\delta\theta}] & [K_{\delta\delta}] \end{bmatrix} \cdot \begin{cases} \{\theta\} \\ \{\delta\} \end{cases} = \begin{cases} \{M\} \\ \{F\} \end{cases}$$
(12)

with:
$$\{\theta\}^{T} = \{\theta_{1} \ \theta_{2} \ \theta_{3} \ \dots \ \theta_{n-1} \ \theta_{n}\};$$

 $\{\delta\}^{T} = \{\delta_{1} \ \delta_{2} \ \delta_{3} \ \dots \ \delta_{n-1} \ \delta_{n}\};$
 $\{M\}^{T} = \{M_{1} \ M_{2} \ M_{3} \ \dots \ M_{n-1} \ M_{n}\};$

$$\{F\}^T = \{F_1 \ F_2 \ F_3 \ \dots \ F_{n-1} \ F_n\}.$$

.

The submatrix $[M_{\theta\theta}]$ presents the terms of rotational masses, with little representativeness (in magnitude) in relation to translational masses (included in the submatrix $[M_{\delta\delta}]$). From this statement, sub-matrices $[M_{\theta\delta}]$ and $[M_{\delta\theta}]$ are also disregarded, and equation is rewritten (12) as:

$$\begin{bmatrix} \begin{bmatrix} 0 & \begin{bmatrix} 0 \\ 0 \end{bmatrix} & \begin{bmatrix} M_{\delta\delta} \end{bmatrix} \cdot \begin{pmatrix} \{\theta\} \\ \{\delta\} \end{pmatrix} + \begin{bmatrix} K_{\theta\theta} & K_{\theta\delta} \end{bmatrix} \cdot \begin{pmatrix} \{\theta\} \\ \{\delta\} \end{pmatrix} = \begin{pmatrix} \{M\} \\ \{F\} \end{pmatrix}$$
(13)

Expressing equation (13) in the form of a matrix equation system, we have:

$$[K_{\theta\theta}].\{\theta\} + [K_{\theta\delta}].\{\delta\} = \{M\}$$
(14 a)

$$[M_{\delta\delta}].\{\ddot{\delta}\} + [K_{\delta\theta}].\{\theta\} + [K_{\delta\delta}].\{\delta\} = \{F\}$$
(14 b)

In order to express the displacements { δ }, the rotation vector { θ } is isolated in equation (14 a) and applied to eq. (14 b), concluding:

$$[M_{\delta\delta}].\{\ddot{\delta}\} + [K_{\delta\theta}].([K_{\theta\theta}]^{-1}.\{M\} - [K_{\theta\theta}]^{-1}.[K_{\theta\delta}].\{\delta\}) + [K_{\delta\delta}].\{\delta\} = \{F\}$$
(15)

rearranging, there is:

$$[M_{\delta\delta}].\{\ddot{\delta}\} + [K^*].\{\delta\} = \{F^*\}$$
(15 *a*)

with:
$$[K^*] = [K_{\delta\delta}] - ([K_{\delta\theta}] \cdot [K_{\theta\theta}]^{-1} \cdot [K_{\theta\delta}]);$$

 $\{F^*\} = \{F\} - ([K_{\delta\theta}] \cdot [K_{\theta\theta}]^{-1} \cdot \{M\}).$

and: $[K^*]$ the condensed stiffness matrix. and $\{F^*\}$ the condensed vector of transverse forces.

Condensed ODE for proportionally dampened vibration($[C^*] = \alpha_m \cdot [M_{\delta\delta}] + \alpha_k \cdot [K^*]$) is expressed by:

$$[M_{\delta\delta}].\{\ddot{\delta}\} + [C^*].\{\dot{\delta}\} + [K^*].\{\delta\} = \{F^*\}$$
(16)

IV. VERIFICATION OF (FEM) MODELING VIA (CMT)

Through the dynamic analysis of the pillar by the Continuous Medium Technique (CMT) processed in Melo [15], the differential equation of the problem is written, as:

$$-[J].\{v''''\} + [S].\{v''\} + [M].\{\ddot{v}\} = \{V_f'\}$$
(17)

Based on the WallPanels Theory (WPT), the differential equation of the dynamic request of the massive column shown in Figure 6 is expressed, through equation (17), as:

$$-[J]. \{q''''(x,t)\} + [S]. \{q''(x,t)\} + [M]. \{\ddot{q}(x,t)\}$$

= $\{V_f'(x,t)\}$ (18)

with: [J] is the column stiffness matrix; [S] is the lintel stiffness matrix (and for the massive pillar, modeled in this item of the thesis, it will be null); [M] is the mass matrix of the abutment and q(x, t) is the function of the displacements dependent on space and time. Through the harmonic analysis of equation (18) and imposing the procedure for the separation of variables, it is written:

$$\frac{-j.u'''(x)}{u(x)} = \frac{-m.\ddot{g}(t)}{g(t)} = -\lambda_a^2$$
(19)

with: q(x,t) = u(x).g(t). The characteristic equation of ODE written in space is expressed, via equation (19), as:

$$j.\,\omega^4 - \lambda_a^2 = 0 \tag{20}$$

and by equation (20) solution is expressed:

$$\omega = \frac{\sqrt{\lambda_a}}{\sqrt{j}} \tag{21}$$

By calculating the stiffness, where j = E.I, together with Pfeil (p. 211) [16], concludes by the rigidity of the column shown in Figure 6, the following:

$$j = E \cdot I = E \cdot \beta \cdot I_{z_{topo}}$$

= 4,67 x 10⁴ Pa \cdot 1,2793 \cdot \frac{10 m \cdot (5 m)^3}{12}
= 6,22326 x 10^{12} \frac{N}{m} (22)

As presented inDziewolski[17]followed by the adjustment of the column stiffness using the coefficient $\alpha = \frac{1}{1.5}$ (for simple structures) and is expressed via equation:

$$\sqrt{\sqrt{j}} = \sqrt{\sqrt{\frac{j}{H^2}}} \cdot \alpha$$
$$= \sqrt{\sqrt{\frac{6,22326 \times 10^{12} \frac{N}{m}}{(100 \, m)^2}}} \cdot \frac{1}{1,5} = 105,29633 \qquad (23)$$

Applying to equation (23) in equation (21) the first vibration frequencies of the bridge pillar, shown in Figure 6, are written as:

$$\omega = \frac{\sqrt{\lambda_a}}{105,29633} \tag{24}$$

V. COLUMN MODELING IN 5 FE APPLIED TO MODAL BRIDGE ANALYSIS

In order to exemplify the use of the linearly variable rectangular section stiffness matrix in bridge pillars (See Figure6), cross-sectional dimensions at the base $b_y = 12.5 m$ and $b_z = 25 m$ and, at the top, $h_y = 5 m$ and $h_z = 10 m$, and the modes of vibration are obtained through modal analysis [18], modeling via five finite elements [19] and general formulation for *n* mass presented in Warburton [20] and matrix condensation [21]; and [22]. The material used in the bridge is reinforced concrete of resistance class C - 40 [23]. Therefore, the Longitudinal Elasticity Module will be $E = 35 \times 10^9 Pa$ and the Poisson Coefficient will be v = 0,20.In order to validate the example, modeling is performed using the ANSYS academic version software. It should be noted that for the vibration modes, the dimensions adopted for the cross section become irrelevant.



Fig. 6: Bridge with linearly variable section columns

From this analysis, the coefficients for the generation of the column stiffness matrix and vibration frequencies ω_i and autoversors λ_i^2 , via the nullity of the determinant $|[K] - \lambda.[M]|$, are obtained in Table 1, as follows:

$$\lambda_1^2 = 6.16906 \ x \ 10^5 \left(\frac{rad}{s}\right)^2; \ \lambda_2^2$$
$$= 7.14143 \ x \ 10^5 \left(\frac{rad}{s}\right)^2;$$

$$\begin{aligned} \lambda_3^2 &= 7.83961 \ x \ 10^5 \left(\frac{rad}{s}\right)^2; \ \lambda_4^2 \\ &= 8.34502 \ x \ 10^5 \left(\frac{rad}{s}\right)^2; \\ \lambda_5^2 &= 8.71653 \ x \ 10^5 \left(\frac{rad}{s}\right)^2 \\ \omega_1 &= \sqrt{\frac{\lambda_1^2}{H^2}} \equiv 7.85434 \ \frac{rad}{s} \equiv 1.25006 \ Hz; \end{aligned}$$
(25. *a* – *e*)

$$\omega_2 = 8.45070 \frac{rad}{s}; \quad \omega_3 = 8.85415 \frac{rad}{s};$$
$$\omega_4 = 9.13511 \frac{rad}{s}; \quad \omega_5 = 9.33624 \frac{rad}{s} \quad (26.a - e)$$

Table.1: Parameters for the generation of the stiffness matrix of the linearly variable section column

| Bar Finite Element | 1 | 2 | 3 | 4 | 5 |
|--|---------|---------|---------|---------|---------|
| A (ADM) | - 0.015 | - 0015 | - 0.015 | - 0.015 | - 0.015 |
| B (m) | 25.000 | 22.000 | 19.000 | 16.000 | 13.000 |
| C (ADM) | - 0.075 | - 0.075 | - 0.075 | - 0.075 | - 0.075 |
| D (m) | 12.500 | 11.000 | 9.500 | 8.000 | 6.500 |
| $\alpha_i \equiv \alpha_f \ (x \ \mathbf{10^5})$ | 6.540 | 4.430 | 2.890 | 1.799 | 1.050 |
| $k_i (x \ 10^{13}) [\text{N.m}]$ | 2.274 | 1.364 | 0.759 | 0.382 | 0.166 |
| $k_f (x \ 10^{13}) [\text{N.m}]$ | 2.261 | 1.356 | 0.754 | 0.379 | 0.165 |
| a (x 10 ¹³) [N.m] | 1.134 | 0.680 | 0.378 | 0.190 | 0.083 |

When considering the five finite elements, the Stiffness [*K*] and Mass [*M*] Matrices for the pillar are worth:

| [<i>K</i> |] | | | | | |
|------------|---------------------------|--------------------------|-------------------------|-------------------------|--------------------------|--------------------|
| | [1.701 x 10 ¹³ | $7.634 \ x \ 10^{11}$ | $3.178 \ x \ 10^{10}$ | ⁰ 1.196 x 1 | 0 ⁹ 3.891 x 1 | ן 10 ⁷ |
| | 7.634×10^{11} | 1.019 x 10 ¹³ | 4.241 x 10 ¹ | ¹ 1.596 x 10 | 5.193 x | $10^8 _N$ |
| = | 3.178×10^{10} | $4.241 \ x \ 10^{11}$ | $5.666 \ x \ 10^{12}$ | 2 2.132 x 10 | 6.939 x | $10^9 \frac{1}{m}$ |
| | 1.196 x 10 ⁹ | 1.596 x 10 ¹⁰ | 2.132×10^{12} | ¹ 2.848 x 10 | 9.270×1^{12} | 0^{10} |
| | 13.891×10^7 | $5.193 \ x \ 10^8$ | 6.939 x 10 ⁹ | 9.270 x 10 | 1.238×1^{10} | .012 |
| [<i>M</i> | [] | | | | | |
| | [1.955 x 10 ⁷ | 9.995 x 10 ⁵ | 0 | 0 | ן 0 | |
| | $9.995 \ x \ 10^5$ | $1.227 \ x \ 10^7$ | 6.761 x 10 ⁵ | 0 | 0 | |
| = | 0 | 6.761 x 10 ⁵ | 7.281 x 10 ⁶ | $4.374 \ x \ 10^5$ | 0 | kg |
| | 0 | 0 | $4.374 \ x \ 10^5$ | $4.030 \ x \ 10^{6}$ | 2.685×10^5 | |
| | L 0 | 0 | 0 | $2.685 \ x \ 10^5$ | $1.984 \ x \ 10^{6}$ | |
| | | | | | | |

a) Validation via ANSYS

Figure 7 shows a group of vibration modes, for the massive column of the bridge shown in Figure 6, modeling in the ANSYS software. 62,468 nodes and 13,635 finite elements were used, producing a mesh with 93.99%.

The validation of the first vibration frequency f_1 (using equation 26 a) is processed and results in:

$$f_1 = \frac{\omega_1}{2\pi} = \frac{7.85434 \frac{rad}{s}}{2\pi} = 1.25005 \, Hz \tag{27}$$

Comparing the first vibration frequency by modeling in ANSYS, see Figure 7, with the value presented in equation (27), an approximation of:

$$\Delta(\%) = \frac{(1.25005 - 1.23300) Hz}{1.25005 Hz} . 100\% = 1.36\%$$
(28)

Fig. 7: Vibration modes in bridges with linearly variable section columns: (a) 1st mode, (b) 2nd mode, (c) 3rd mode

The 1.36% discrepancy between the first vibration frequency, via manual calculation by finite bar elements and by modeling in the ANSYS software, is due to the small number of bar elements used in manual modeling. However, the formulation present here is quite satisfactory to verify the order of magnitude of the results obtained via modeling in commercial software.

b) Validation via CMT

Using the first root of the polynomial presented in equation (25a), the first vibration frequency of the abutment (via CMT) is expressed as:

$$\omega_1 = \frac{\sqrt{6.16906 \, x \, 10^5} \, rad/s}{105.29633} = 7.45927 \, \frac{rad}{s} \qquad (29 \, a)$$

and in fundamental frequency, there is:

$$f_1 = \frac{\omega_1}{2\pi} = 1.18718 \, Hz \tag{29 b}$$

concluding by divergence in relation to the modeling performed in ANSYS, see Figure 7, the following:

$$\Delta(\%) = \frac{|f_{TMC} - f_{ANSYS}|}{f_{TMC}} .100\%$$
$$= \frac{|1.18718 - 1.233| Hz}{1.18718 Hz} .100\% = 3.87\% \quad (29 c)$$

It is observed that the percentage difference by the CMT was greater than by the bar FEM, this due to the interpolation performed in the coefficient β of equation (22). As well as, it is verified the use of the adjustment coefficient α in equation (23). While in equation (28) the analysis is processed by the finite element method, eliminating the imposition of such a coefficient α . Even so, it is possible to satisfactorily validate the modal analysis of the column shown in Figure 6, both by FEM and CMT.

VI. CONCLUSION

In this article, the terms of the Flexibility Matrix for a variable section were obtained through the internal energy activated by the internal forces acting on the beam element for the Derivative Systems. The contribution of this publication is the obtention of the stiffness matrix by parameters easily obtained from the flexibility matrix which takes into account the variation of the dimensions of the element cross section. When analyzing the shape factor k_c , it was found to be a constant value according to the section shape. After determining the terms of the Flexibility Matrix, the terms of the stiffness matrix are obtained as shown in this work.

Finally, it is made explicit that the expressions presented here for α_i , α_f , ε and β_f are valid only for cases of variable cross-section along the longitudinal axis of the pillar. In case of a constant section, one should resort to the expressions widely postulated in technical texts, under penalty of mathematical indetermination by these explicit expressions for α , β , ε and β_f .

This contribution emphasizes the achievement of the exact stiffness matrix for such a cross-section configuration, and the application of such a matrix is performed in the calculation of the vibration frequencies of the pillars of a bridge with a tray positioned at 100 meters, this relative to the base, of the mentioned columns.

For the first vibration frequency, with the column being subdivided into five finite bar elements, an approximation of 1.36% is concluded. Such an approximation is excellent, due to the number of finite elements used in the discretization of the 100meters high column, the validation resulting from modeling in ANSYS.

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Analysis of lettuce (*Lactuca sativa*) production in different substrates in an aquaponic system using an IBC container

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Abstract—Aquaponics is amethod of food production that integrates two types of cultivation in one unique place. Fishes and plants can be cultivated in this system, where the fish are maintained in recirculating aquaculture system and the plants in hydroponics (cultivation of vegetables without soil). In order to demonstrate that aquaponics is an alternative for the cultivation of vegetables and also a possibility of water treatment, the objective of the present study was to evaluate the water quality of an aquaponic system composed by lettuces (Lactuca sativa) and lambari fishes (Astyanax bimaculatus). Additionally, we evaluated which is the best civil construction residue (gravel, brick and expanded clay) for lettuce cultivation. The microbiological and physical - chemical monitoring of the system was carried for 42 days, and water from the fish tank was analyzed every 15 days, in the decanter, in the sump tank and in the cultivation bed. The microbiological analyzes consisted in total and thermotolerant coliforms and heterotrophic mesophilic count. For physical – chemical parameters, we analyzed pH, Dissolved oxygen (DO), Toxic Ammonia and Nitrite. Additionally, the development of lettuce in the three different civil construction residues was determined by the average total weight, average leaf mass and average root mass of the plants. We concluded that there was total and thermotolerant coliforms in all the stages of the collection. There was a better growth of the lettuce in the substrate of broken brick, followed by expanded clay and finally by crushed stone.

Keywords—Aquaponics, Astyanax bimaculatus, Civil construction residue, Sustainability.

I. INTRODUCTION

The Food and Agriculture Organization of the United Nations (FAO) defines aquaculture as the cultivation of aquatic organisms including crustaceans, fish and molluscs. Such activity can be developed in both fresh and salt water, but it must always be under controlled conditions. This type of farming is currently one of the most important forms of production, being responsible for half of fish and seafood consumed by the world population (SEBRAE, 2015). Hydroponics, on the other hand, is the cultivation of plants without the use of soil, in which the necessary nutrients for plant growth are provided through an aqueous solution (BEZERRA NETO, 2017).

The union of the Aquaculture x Hydroponics activities results in a new technology named Aquaponics. A modality of food production with low water consumption and high utilization of the organic waste generated (CARNEIRO et al., 2015). Such activity, owing to characteristics of sustainability can be framed as a solution for traditional methods of agriculture, which shows high environmental impacts (HUNDLEY, 2013).

Water recirculation systems provide a substantial advantage by drastically reducing the required area for aquatic organisms. Despite this, the high densities of storage normally present a disadvantage related to production of large volumes of organic waste, which must be removed (CARNEIRO et al., 2015; PINTO, 2015).

According to EMBRAPA (2018), aquaponics can reach 90% economy of water regarding conventional agriculture, due water utilization be cyclical. Because it is an integrated culture where later stages benefit from previous stages, aquaponics presents a series of benefits for itself and the environment. Hundley (2013) comments that with increasing restrictions on water use and costs, rural producers have been looking for cheaper and more efficient alternatives for food production.

In conventional aquaculture, all excretions from aquatic organisms remain in the water, causing their accumulation and increasing the toxicity of the environment. In aquaponics, with the presence of bacteria that fix nitrogen, the fish excrement will be transformed in nitrate and nitrite, assimilable by plants (SEBRAE, 2015).

The success of aquaponics depends on the quality of water supply, quality and quantity of the food supplied, the residence time of the effluent within the systems, the selected species, the stocking density and the biomass of the organisms (OAK et al., 2017). According to Tonet et al. (2011), one of the precautions that must be taken in relation to aquaponics is microbiological contamination, since fish excrements are used as nutrients, which can contaminate water and vegetables.

According to Ferreira (2013) aquaponics is a biosystem of food production that fits as a polyculture, since the waste produced in one of the biological systems is consumed in a second. As a result, all waste is minimized, making the production able to be self-sustainable, allowing healthy, sustainable and profitable production to reach large urban centers.

The objective of this study was to evaluate the water quality of an aquaponics system composed by lettuces (*Lactuca sativa*) andlambari fishes (*Astyanax bimaculatus*), and to evaluate which is the best civil construction residue (crushed stone, brick and expanded clay) for lettuce cultivation. Our results may assist in the development of cultivation protocols that reduce water consumption during food production, aiming to reduce the impacts that this production causes to the environment.

II. MATERIALS AND METHODS

2.1 Aquaponics System

The Aquaponics pilot system, built at the Institute of Technological and Exact Sciences (ICTE) for the Scientific Initiation Research of Stefan Cardoso and Pedro Bianchini (CARDOSO et al., 2019) was used. The entire system was adapted based on a review of the EMBRAPA (Brazilian Agricultural Research Corporation) literature. Figures 1 - 4 in the next topic, represents the scheme of the system.

In this project, three types of beds from different cultures were used: the first bed was made of crushed stone, the second of broken brick and the third of expanded clay. These selected substrates are waste from the civil area and are generally discarded in the environment.

2.2 Microbiological analysis of the water in the fish tank, sump and rhizospheric filter

Four samples of water from the aquaponic system were analyzed with collections carried out every two weeks, all taken at 08:00a.m. Brasília time, totaling 42 days of sampling. Such samples were taken from the fish tank, decanter, sump and the culture bed. The water was collected in sterile bags, so as not to interfere with the results.

Analyzes of total coliforms (37° C), thermotolerant coliforms (45° C) and Heterotrophic Mesophilic Count were performed. They all were done in duplicate according to the methodologies described by Silva et al. (2010).

For water, the count of total and thermotolerant coliforms wasperformed using the Most Likely Technique. Five tubes with a Durhan tube containing Lauryl Sulfate Tryptose broth (LST) were used. Later, after the samples were positive, they were incubated in a tube with Bright Bile Green at 37° C and medium EC broth (EC) at 45° C for 24-48 hours.

The counting of heterotrophic mesophiles was done using the Pour Plate technique. Three serial water dilutions were prepared, and one ml of each dilution was placed into a sterile Petri dish. Approximately 20 ml of Plate Count Agar agar was added. The plates were incubated at 37° C for 48 hours.

2.3 Physical-chemical analysis

The analyzes were conducted according to the official methodology of FUNASA (National Health Foundation, 2006), as follows:

2.3.1 pH

The phmeter was used. The device was turned on and it was expected to stabilize. The device was calibrated with standard solutions (pH 4 and 7), then the electrode was introduced into the sample to be examined and read.

2.3.2 Dissolved Oxygen (DO) and Temperature (in the field)

For the determination of DO and temperature, a digital oximeter of the brand Hach (model HQ40d) was used. The probe was immersed in the collection points of the

aquaponic system (fish tank, decanter, sump and rhizospheric filter outlet).

2.3.3 Toxic ammonia

To evaluate the toxic ammonia present in the system, a colorimetric test was used from the LABCONTest brand. For each sample of the system, 8 drops of reagent solution 1 (Phenol, sodium nitroprusside, isopropyl alcohol and distilled water) were dripped, the beaker was capped and stirred. Then 4 drops of reagent solution 2 (sodium hydroxide, sodium hypochlorite and distilled water) were dripped, the beaker was capped and stirred.

After three minutes (time for reaction), the reading was done.

2.3.4 Nitrite

To evaluate the presence of nitrite in the system, a colorimetric test of the LABCONTest brand was used. For each sample of the system, 2 drops of reagent solution 1 (sulfanilic acid, acetic acid and distilled water) were dripped, the beaker was capped and stirred. Then 2 drops of reagent solution 2 (Alpha-naphthylamine and ethyl alcohol) were dripped, the beaker was capped and stirred. After ten minutes (time for reaction), the reading was done.

2.4 Analysis of lettuce growth

Lettuce (*Lactuca sativa*) productivity was evaluated as follows: for each different substrate, three plants of lettuce were randomly chosen. The plants were weighed using a semi-analytical balance, where the average total weight (ATW), average leaf mass (ALM) and average root mass (ARM) were determined.

III. RESULTS AND DISCUSSION

3.1 Aquaponics Pilot System

The first barrel, with decanter function, receives water from the fish tank through an entrance on the bottom. The barrel has a round shape, and because of this, it was installed in the entrance of water one 90° elbow. In this way, the water can enter tangentiating the wall of the recipient, creating a circular movement inside (Figure 1 and 4). This movement is responsible to the process of decantation where the solids are retained in the bottom (CARDOSO et al., 2019).



Fig. 1: Disposal of tank and barrels. 1. Fish tank; 2. Decanter; 3. Sump tank

As well as the grow bed, which has the main function of rhizospheric filtration, three similar structures with smaller size and volume were built. These structures had the same functioning of the first, but with different objectives. Because the first structure is part of the filtration process, *Xanthosoma sagittifolium* (taioba) was planted. In the other three, *Lactuca sativa* (Lettuce) was planted (Figures 2 and 3) (CARDOSO et al., 2019).



Fig. 2: Disposition of the lettuce grow beds. 1. Rhizospheric filterwith Xanthosoma sagittifolium; 2.Grow bed with stone gravel; 3. Grow bed with expanded clay; 4. Grow bed with broken bricks.



Fig. 3: Disposition of the lettuce grow beds and rhizospheric filter.



Fig. 4: Disposition of fish tank, decanter and sump tank.

3.2 Water microbiological analysis

In the interval of 15 days of water collection in the four tanks, there was an increase in the Standard Count in plate, i.e. an increase of the heterotrophic mesophilic microorganisms in the water. This was already expected, because there was an increase in the size of the fish, thus increasing the amount of feces and probably the formation of biofilms in the tanks(Figure 5).



Fig. 5: Standard Count plate results in the water collected in the fish tank (1), in the decanter (2), in the sump tank (3) and in grow bed (4) of four collects.

Total and thermotolerant coliforms counted in all four tanks resulted in amounts of > 1.600 MPN / ml (Most Problably Number / ml) of analyzed water, in all collected samples. In the aquaponics process, the water used contains leftover food and fish waste, which are used as a nutrient for plants, thus its coliform contamination is more evident.

These results were compatible with those found by Tonet et al. (2011), where 100% of their samples showed contamination by total and thermotolerant coliforms in aquaponics cultivation water.

3.3 Physical-chemical analysis

3.3.1 pH

Potential for Hydrogen (pH) is one of the critical parameters in an aquaponics system. This is because it has at least three distinct organisms (fish, plants and bacteria) in the same system. According to EMBRAPA (2015), nitrifying bacteria have an optimum pH in the range of 7.0 to 8.0. In contrast, in hydroponics, plants show their greatest growth in pH ranges from 5.5 to 6.5. For lambari fishes (*Astyanax bimaculatus*) grown in aquaponics, pH is in the range of 7.0 to 9.0.

Through the data obtained (Figure 6), it is possible to determine that, in the experimental system, bacteria and fish were subjected to excellent conditions, but the ideal range for plants was not reached. Thevalues were similar to results obtained by Kuhnen et al. (2016), who found pH in the range of 7.5 to 7.9.

The pH value = 6.5 has an acid character, which is beneficial for the plant, because when the pH of the substrate is basic, the ions would precipitate and the plants would not be able to absorb them. The pH in the present system has not been manipuled, but we believe that a reduction could lead to improvements in the aquaponic production as a whole.



Fig. 6: Results of variation of pH in the water collected in the fish tank (1), in the decanter (2), in the sump tank (3) and in grow bed (4) of four collects.

3.3.2 Dissolved Oxygen (DO)

The dissolved oxygen values increased gradually and following a pattern in each study Station (Figure 7). For Stations 1 and 2 the values are practically identical because in the fish tank (Station 1), although there was a good oxygenation mechanism, the breathing of fish consumed oxygen. For the decanter there was no oxygenation mechanism.

In Station 3 the fall of water from Station 2 provided a destabilization on the surface, providing the insertion of

DO by diffusion, thus explaining the highest concentrations. The lastStation, related to the cultivation bed (Station 4), had its OD levels lower than in the previous Station, probably due to consumption by nitrifying bacteria. The DO concentration over time in each Station has increased, which is beneficial for the aquaponic system. The dissolved oxygen values were higher than 5mg/L, which isrequired by the CONAMA (National Environment Council) resolution. Values above 5mg/L allow adequate aeration for fish (BARBOSA, 2011)



Fig. 7: Dissolved oxygen (DO) in fish tank (1), decanter (2), sump tank (3) and grow bed (4) of four collects.

According to EMBRAPA (2018), for aquaponics in a tropical climate, the amount of DO in water must always be higher than 3 mg/L. This parameter is monitored looking for the welfare of the organisms that inhabit that environment. During our study, the values obtained were always above the minimum concentration cited.

3.3.3 Temperature

Jordan (2011) defines the ideal temperature of 26°C for an aquaponics system. This temperature favors the fattening of fish and meets the requirements of other organisms present in the system. During our study, the recommended temperatures were reached only in the last week of experiments (Figure 8).

In the absence of an equipment that could control this parameter, the experiment had the local climate as a determining factor. However, as all measurements were made in the morning, these temperatures increased during the day.



Fig. 8: Temperature variation in fish tank (1), decanter (2), sump tank (3) and grow bed (4) of four collects.

INMET (National Institute of Meteorology) was consulted with the maximum and minimum temperature data of the station located at UFTM - ICTE 2. This station was used because it is located very close to the experiment and reliably represents the climatic conditions of the study region. The temperatures were organized in Table 1 and show that the measurements were performed accurately, as they are within the Minimum and Maximum interval on the day of each measurement.

Table 1. Variation oftemperature(T) of the region in which the experiments were conducted. Minimum (min) and maximum (max) values.Data from INMET (National Institute of Meteorology), UFTM, ICTE2.

| Date | T min [°C] | T max [°C] |
|------------|------------|------------|
| 26/09/2018 | 20.5 | 34.3 |
| 10/10/2018 | 19.5 | 30.7 |
| 24/10/2018 | 20 | 26.7 |
| 07/11/2018 | 20.4 | 27.4 |

3.3.4 Ammonia and nitrite analysis

Nitrification is a chemical-biological process that allows the formation of nitrate through the metabolism of nitrifying chemosynthetic bacteria. In this process, ammonia (present in fish excreta) is converted into nitrate. When released, nitrates are available for assimilation by plants. This cycle is divided into three stages, nitration, nitration and nitrification (RIBEIRO, 2016).

The concentration profile of toxic ammonia and nitrite followed the expected pattern, starting with a high value and showing a reduction over time. This reduction highlights the absence of toxic ammonia in post-filtering steps (Station 4) (Figures 9 and 10). According to EMBRAPA (2015) the levels tend to stabilize when the colonies of bacteria are formed and mature.

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Fig. 9: Toxic ammonia concentration in fish tank (1), decanter (2), sump tank (3) and grow bed (4) of four collects.

The Stations with the highest concentrations of these two parameters (Figure 8) were the fish tank and decanter, respectively. All levels of toxic ammonia and nitrite concentration were in accordance with the reference values established by the company providing the colorimetric tests, featuring an efficient filtering process and a favorable and pleasant environment for the fish.



Fig. 10: Nitrite concentration in fish tank (1), decanter (2), sump tank (3) and grow bed (4) of four collects.

Graber and Junge (2008) point out that there are ways to optimize nitrification, degradation, denitrification and absorption in this type of system, maximizing production. These processes occur with the degradation of the organic matter excreted by the fish, by the bacteria of the biological filter.

3.4 Analysis of lettuce growth

The grow bed containing broken brick was the one that showed the greatest growth of lettuces, with a total average weight of 74.49g. The grow bed containing expanded clay, obtained an intermediate growth with a total average weight of 30.70g. For crushed stone the total average weight was 17.28g (Figure 11).



Fig. 11: Lettuces in the respective substrates. A. Broken brick; B.Expanded clay; C.Crushed stone.

The results for lettuce leaves followed the previous pattern in relation to different substrates, i.e. 62.52g,24.62g and 14.13g for broken brick, expanded clay and crushed stone, respectively(Figure 12).



Fig. 12: Comparison of leaf growth of lettuces.A. Broken brick; B.Expanded clay; C.Crushed stone.

The results of root growth also followed the pattern of total average weight and leaf growth, i.e. 11.97g for broken brick, 6.08g for expanded clay, and 3.15g for crushed stone (Figure 13).



Fig. 13: Comparison of root growth of lettuces in different substrates.

The best substrate for the cultivation of lettuce was substrate A. The brick fragments are composed of an extremely porous material, which houses greater colonies of nitrifying bacteria. This converts the ammonia into nitrite and later into nitrate, so that the plants can assimilate. This probably contributed to the enablement of the further development of lettuces. The substrate containing crushed stone provided the lowest satisfactory results. This is probably because the gravel is not porous, as explained above.

IV. CONCLUSION

For lettuce (*Lactuca sativa*) growth, better results were obtained in the substrate of broken bricks, expanded clay and crushed stone, respectively. In the substrate of broken bricks, lettuce presented, in addition to a higher growth, a better visual aspect of the leaves.

For the removal of ammonia, the system proved to be extremely efficient, since the highest concentrations were obtained at the beginning of the experiment and over the time these concentrations turned into zero. We can conclude that the filtration system matured during the time of the experiment until reaching its optimum efficiency.

We observed that total coliforms and thermotolerant coliforms were present in all stages of aquaponics, indicating that hygiene procedures before the consumption of vegetables must beperformed, regardless of the cultivation technique.

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Profile of Hospitalizations for Elderly People in the State of Amapá - Brazil, From April 2018 to April 2019

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Abstract—The World Health Organization (WHO) characterizes elderly people who are 60 years old or older in developing countries and 65 years old in developed countries. In Brazil, it is considered elderly from 60 years, based on the Elderly Statute and public policies related to aging (Santa Catarina, 2018). The objective of this study is to analyze the profile of hospitalizations of the elderly in the State of Amapá. Retrospective study with a quantitative approach on the profile of hospitalizations of elderly people in the State of Amapá, from April 2018 to April 2019, as a data source, DATASUS was used. The results show that in the period between April 2018 and April 2019, there were 4,453 hospitalizations. The main causes of elderly people over 60 years of age, representing 10.60% of total hospitalizations. The main causes of hospitalizations are diseases of the circulatory system, with (24%), followed by 14% of diseases of the respiratory system. In addition to finding that 46.4% (2,067) of hospitalizations for pathologies and injuries are in the age range between 60 and 69 years. It concludes that the state of Amapá with its local health system needs to reorganize its hospital structures, with the insertion of indicators that favor actions to improve the quality of care. Evidencing primary care as a gateway for this population, in order to improve the quality of life of these people and reduce the burden on hospital institutions.

Keywords—Elderly, Hospitalization, Chronic diseases, Mortality, Amapá.

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I. INTRODUCTION

With the advent of industrial revolutions and the improvement in the quality of life, the levels of mortality and birth rates have decreased over time. These indicators impacted the population's life expectancy, contributing to population aging and the emergence of new health demands, especially for the care of the four main chronic diseases: cardiovascular diseases, cancers, chronic respiratory diseases and diabetes, resulting in greater cost and time prolonged in health services (Parente, et al, 2018; Melo, 2019).

The World Health Organization (WHO) characterizes the elderly any citizen aged 60 or over in developing countries and 65 years in developed countries. In Brazil, the aging process started in the 1960s and is considered elderly from 60 years old, based on the Elderly Statute and public policies related to aging (Santa Catarina, 2018).

It should be noted that the brazilian scenario has been going through a rapid aging process of its population. According to the Brazilian Institute of Geography and Statistics (IBGE), the life expectancy of brazilians, in 2016, reached an average of 75.72 years. In 2015, there were around 29 million brazilians aged 60 or over, which is equivalent to 14.3% of the total population and projections indicate that, in 2030, this number will surpass that of children and adolescents aged 0 to 14 years about 2.28 million. This scenario in 2050 shows that the elderly population will represent about 30% of the brazilian population (Brasil, 2018).

The demands of public services must accompany this scenario of population growth, associating age with chronic diseases, in order to monitor the health problems of the elderly to ensure functional capacity and autonomy for as long as possible, seeking to reduce hospitalizations, use of medicaments, tests and other procedures. However, the Health Unic System (SUS) demonstrates an overload of the system, with financial impact at all levels and without generating benefits for the user's quality of life, given that the elderly has many diseases and uses hospital health services a lot (National Supplementary Health Agency, 2016).

The high rates of hospitalization of the elderly indicates that these people are aging with low quality of life, and this represents a challenge for health systems to offer good health care, built in the reception and in the entire care process, and should start at the service entrance door and accompany the user throughout their participation in the health system (Brasil, 2018). It is evident that in Brazil, chronic noncommunicable diseases (NCDs) cause 72% of deaths and 75% of health care expenditures in SUS (Wanderley, 2019). This picture reflects that the NCDs that most lead to death among the elderly in Brazil are: diseases of the circulatory system, neoplasms and diseases of the respiratory system, and accounted for 80% of deaths between both sexes (Conte, 2018).

In this perspective, indicators that favor improvement actions such as hospital death, should be inserted, as this is an indicator of a problem in the quality of care provided (Cordeiro & Martins, 2018). In addition, basic care must be expanded in order to be able to be the first level of care, acting as the entrance door of the system. It is necessary to insert instruments that guarantee the improvement of quality and increase in the resolution of care for the elderly (Mendes, 2011 apud Lima, et al, 2018).

Given the relevance of the topic, it is essential to conduct a study that characterizes the profile of hospitalizations of the elderly, in order to know the users who demand health services to help reduce the morbidity and mortality that affects this population. Therefore, this study aimed to analyze the profile of hospitalizations of the elderly in the state of Amapá from april 2018 to april 2019.

II. MATERIALS AND METHODS

A retrospective study was carried out, with a quantitative approach on the profile of hospitalizations of elderly people in the state of Amapá, from april 2018 to april 2019. DATASUS was used as the data source. To analyze the statistical data, word and excel programs were used, the information was displayed in tables and the available literature about the topic was used, based on the data network of the Virtual Health Library (BVS), LILACS (Latin American and Caribbean Literature in Health Sciences), SCIELO (Scientific Electronic Library Online) and Ministry of Health. Certain variables were adopted, such as: county of residence, hospitalizations, sex, age group, color, deaths and injuries.

III. RESULTS

In 2018, the state of Amapá had an estimated population of 829,494 inhabitants, with approximately 53,621 thousand people over 60 years of age, representing 6.46% (IBGE, 2018). This shows that the brazilian state has been aging and needs to get old with quality. According to table 1,41,898 hospitalizations in 2018 occurred in the state of Amapá between april 2018 and april 2019, of which 4,453 hospitalizations for the elderly, representing 10.60% of hospitalizations and 8.30% of total elderly. The municipality of Macapá was the one that most hospitalized the elderly, with 58.80% and the male

population hospitalized in this range in the state of Amapá represents 56.30% and the female 43.70%.

| Table 1: Hospitalizations of elderly people by sex by | |
|---|--|
| county of residence, Amapá, april 2018 to april 2019 | |

| County of | Sex | | | | | |
|------------------------|-------|-------|-------|-------|-------|-------|
| residence | Ma | ıle | Fem | ale | Total | |
| $\downarrow\downarrow$ | f(n) | f (%) | f (n) | f (%) | f (n) | f (%) |
| 1 Macapá | 1.462 | 32,80 | 1.157 | 26,00 | 2.619 | 58,80 |
| 2 Santana | 449 | 10,00 | 336 | 7,60 | 785 | 17,60 |
| 3 Laranjal do Jarí | 254 | 5,80 | 181 | 4,00 | 435 | 9,80 |
| 4 Calçoene | 67 | 1,50 | 57 | 1,30 | 124 | 2,80 |
| 5 Mazagão | 57 | 1,10 | 38 | 0,90 | 95 | 2,00 |
| 6 Oiapoque | 59 | 1,30 | 32 | 0,70 | 91 | 2,00 |
| 7 Vitória do Jarí | 39 | 0,84 | 34 | 0,76 | 73 | 1,60 |
| 8 Amapá | 33 | 0,74 | 34 | 0,76 | 67 | 1,50 |
| 9 Pedra Branca | 15 | 0,34 | 16 | 0,36 | 31 | 0,70 |
| 10 Porto Grande | 24 | 0,62 | 17 | 0,38 | 41 | 1,00 |
| 11 Serra do Navio | 14 | 0,33 | 12 | 0,27 | 26 | 0.60 |
| 12 Tartarugualzinho | 18 | 0,44 | 07 | 0,16 | 25 | 0.60 |
| 13 Ferreira Gomes | 07 | 0,14 | 07 | 0,16 | 14 | 0,30 |
| 14 Itaúbal | 03 | 0,12 | 08 | 0,18 | 11 | 0,30 |
| 15 Pracuúba | 02 | 0,07 | 06 | 0,13 | 08 | 0,20 |
| 16 Cutias | 06 | 0,16 | 02 | 0,04 | 08 | 0,20 |
| Total | 2.509 | 56,30 | 1.944 | 43,70 | 4.453 | 100% |

Note: f(n) = quantitative value; f(%) = percentage value. Source: Ministry of Health - SUS Hospital Information System (SIH / SUS) / DATASUS

Regarding age, it can be seen in table 2 that the male population between the age group of 60 to 69 years old represents 26% of hospitalizations and the female 20% of this, totaling 46% of elderly people in a situation of hospitalization. Over 70 years old, it represents 54%, with the male population also prevailing with 30.60% and the female with 23.40%.

Table 2: Hospitalizations of elderly people by sex according to age group, Amapá, april 2018 to april 2019

| Age group | M | ale | Fen | nale | Tot | al |
|-------------------|-------|-------|-------|-------|-------|-------|
| | f (n) | f (%) | f (n) | f (%) | f (n) | f (%) |
| 60 to 69 years | 1.165 | 26,00 | 902 | 20,00 | 2.067 | 46,00 |
| 70 to 79 years | 827 | 19,00 | 582 | 13,00 | 1.409 | 32,00 |
| 80 years and over | 517 | 11,60 | 460 | 10,40 | 977 | 22,00 |
| Total of elderly | 2.509 | 56,60 | 1.944 | 43,40 | 4.453 | 100% |

Note: f(n) = quantitative value; f(%) = percentage value. Source: Ministry of Health - SUS Hospital Information System (SIH / SUS) / DATASUS

Approaching hospitalizations according to the color pattern, it can be seen in table 3 that 49.50% of the people who are most hospitalized are brown. They also stressed that 31.60% of people over 60 years of age had no record regarding this information. Another relevant factor is that the age group from 60 to 69 years old (22.45%) is the most prevalent among browns.

Table 3: Hospitalizations of elderly people by color according to age group, Amapá, april 2018 to april 2019

| - | | | - | - | |
|-------------------|-------|-------|----------------------|-------|-------|
| Color | 60 | 70 | 80 | To | otal |
| | 69 | 79 | years and over | f (n) | f (%) |
| White | 336 | 196 | 80 | 612 | 14,00 |
| Black | 34 | 36 | 30 | 100 | 2,00 |
| Brown | 1.000 | 711 | 495 | 2.206 | 49,50 |
| Yellow | 55 | 36 | 28 | 119 | 2,70 |
| Indigenous | 03 | 04 | 02 | 09 | 0,20 |
| No information | 639 | 426 | 342 | 1.389 | 31,60 |
| Total | 2.067 | 1.409 | 977 | 4.453 | 100% |

Note: |---| = interval; f(n) = quantitative value; f(%) = percentage value. Source: Ministry of Health - SUS Hospital Information System (SIH / SUS) / DATASUS

Over the years the causes of hospitalizations have been changing as the quality of life improves and in the state of Amapá it is no different from the rest of the country. According to table 4, the main causes of hospital admissions are caused by diseases of the circulatory system, with 24%, among them: brain stroke, acute myocardial infarction and other heart diseases; 14% are diseases of the respiratory system, mainly pneumonia and 34% other pathologies related to other systems. It should also be noted that hospitalizations for neoplasms in the elderly group represent 8% and are in 4th place. In addition to finding that 46.4% (2,067) of hospitalizations for pathologies and injuries are in the age range between 60 and 69 years.

| Table 4: Hospitalizations of elderly people by age group |
|--|
| according to ICD 10, Amapá, april 2018 to april 2019 |

| ICD10 | 60 69 | 70 79 | 80 years and over | Total f (%) |
|----------------------------------|-------------|-------------|----------------------------|----------------|
| Neoplasms | 188 | 117 | 48 | 8,00 |
| Circulatory system diseases | 482 | 379 | 216 | 24,00 |
| Respiratory system diseases | 162 | 203 | 252 | 14,00 |
| Genitourinary system diseases | 279 | 162 | 95 | 12,00 |
| Poisoning and external causes | 127 | 120 | 103 | 8,00 |
| Others | 828 | 428 | 263 | 34,00 |
| Total | 2.067 | 1.409 | 977 | 100% |

Note: |---| = interval; f(%) = percentage value. Source: Ministry of Health - SUS Hospital Information System (SIH / SUS) / DATASUS

According to table 5, it can be seen that the hospital mortality rate in the state of Amapá in the analyzed period was 13.79; being higher in men with 14.23 and in women it represents 13.22. It is observed that these rates increase with age, with a predominance of 21.60 in people aged 80 and over.

Table 5: Mortality rate of elderly people by sex according to age, Amapá, april 2018 to april 2019

| Age group | Μ | ale | Fer | nale | To | otal |
|-------------------|----------|-----------|----------|-----------|-------|-------|
| | f (n) | TR | f (n) | TR | f (n) | TR |
| 60 69 years | 11 9 | 10,2 1 | 77 | 8,54 | 196 | 9,48 |
| 70 79 years | 12 7 | 15,3 6 | 80 | 13,7 5 | 207 | 14,69 |
| 80 years and over | 11 1 | 21,4 7 | 100 | 21,7 4 | 211 | 21,60 |
| Total | 35 7 | 14,2 3 | 257 | 13,2 2 | 614 | 13,79 |

Note: f(n) = quantitative value; TR = mortality rate. Source: Ministry of Health - SUS Hospital Information System (SIH / SUS) / DATASUS

When analyzing table 6, it can be seen that the character of attendance for hospitalizations occurs mainly through urgency with approximately 62% (2,759). 46.4% of these admissions occur in the age group of 60 to 69 years. It is also noteworthy that the mortality rate in the emergency department is twice that of the elective, being 17.07 and 8.44 respectively.

Table 6: Mortality rate by type of care, according to age group and elderly, Amapá, april 2018 to april 2019

| Age group | Male | | Female | | Total | |
|-------------------|-------|-------|--------|-------|-------|-------|
| | f (n) | TR | f (n) | TR | f(n) | TR |
| 60 69 years | 906 | 8,07 | 1.162 | 12,13 | 2.068 | 9,48 |
| 70 79 years | 503 | 10,34 | 906 | 17,11 | 1.409 | 14,69 |
| 80 years and over | 285 | 12,63 | 691 | 25,33 | 976 | 21,62 |
| Total | 1.694 | 8,44 | 2.759 | 17,07 | 4.453 | 13,79 |

Note: f(n) = quantitative value; TR = mortality rate. Source: Ministry of Health - SUS Hospital Information System (SIH / SUS) / DATASUS

IV. DISCUSSION

This study strengthens the reality of brazilian states in relation to hospitalizations for the elderly, given that this scenario started with the advance of technological and industrial revolutions where there was an improvement in the quality of life and a reduction in mortality and birth rates. These indicators favored the life expectancy of the population, contributing to the population aging and the emergence of new health demands, especially regarding vaccines and the assistance of chronic diseases, resulting in a higher cost and prolonged time in health services (Parente, & Parente, & Vieira, 2018; Melo, 2019).

For the World Health Organization (WHO), the elderly are characterized like anyone over 60 years of age or older in developing countries and 65 years in developed countries. In Brazil, based on the Elderly Statute, this citizen is considered to be elderly from 60 years (Santa Catarina, 2018). According to data from the 2010 census, people aged 65 and over already represent 7.4% of the brazilian population favoring the widening of the top of the age pyramid, moving from a young society to a scenario of people with complex and more costly illnesses to the state, typical of the most advanced age groups (Schenker & Costa, 2019). Projections indicate that, in 2030, this number will exceed that of children and adolescents aged 0 to 14 years. In 2050, the elderly population will represent about 30% of the brazilian population (Brazil, 2018).

The modification of the epidemiological transition has been altering the profile of morbidity and mortality in Brazil, also favoring an overload of infectious diseases, Chronic Noncommunicable Diseases (NCDs) and an increase in external causes, and in this health context, the elderly tend to enjoy more from health services, with higher rates of hospitalizations compared to other age groups. The main causes of Brazilian hospitalization are brain-cardiovascular diseases, chronic respiratory diseases, neoplasms and external causes (Rossetto, 2019).

The high rates of hospitalizations of the elderly population, demonstrate that these people are aging with low quality of life and this reflects in the health system in offering quality care, starting with the reception and in the whole care process, and should start at the entrance door service and accompany the assisted person throughout their stay in the health system (Brazil, 2018). As a consequence of this scenario, in 2020, NCDs represented 78% of deaths worldwide, which may increase as a result of epidemiological events, in addition to generating great demand for drugs and rehabilitation (Rossetto, et al, 2019). It is a fact that chronic noncommunicable diseases are also the ones that lead most deaths to elderly brazilians, being affected by the same pathologies of the world profile, but they represented 80% of deaths between both sexes (Conte, 2018).

Intervention strategies must start with the expansion of primary care, in order to be able to be really the first level of care, acting as a gateway to the system. In addition to the insertion of instruments that guarantee the improvement of the quality and resolution of care for the elderly (Mendes, 2011 apud Lima & Oliveira, & Esteves, 2018).

The bases of health policies must meet the demographic profile of society with adaptations of the health system to the population, with guaranteed quality of access, ease of use of health services and home care. These implementations indicate the reformulation of health tools that include new forms of care favoring disease prevention. The relationship between aging and access to care represents, as a consequence, less physical willingness of the elderly to seek health services; socioeconomic variations; quality of life and low level of knowledge about health are determinants in the use of services and their frequency and, this, can determine difficulties of access to health services for the elderly population (Cruz, et al, 2020). The Family Health Strategy (FHS) is a policy of reorganizing new health practices, which can assist in the approach and encourage active aging. This tool allows the guarantee of comprehensive care for the elderly, in order to promote their social insertion and increase their functional capacities (Damaceno & Chirelli, 2019).

V. CONCLUSION

The state of Amapá has been showing a growth in the elderly population, which in the near future may compromise the local health system, and it is necessary to reorganize its hospital structures, with the insertion of indicators that favor actions to improve the quality of care. It is evident that primary care should act as a gateway for this population, monitoring the diseases and illnesses that most manifest themselves in this age group, in order to improve the quality of life of these people and reduce the burden on hospital institutions.

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Mortality of Coffee Berry Borer, *Hypothenemus hampei* in Field, with Pre and Post Application of Entomopathogenic Fungus *Beauveria bassiana* (Balsamo) Associated to Emulsifiers

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Abstract— The coffee berry borer, Hypothenemus hampei (Ferrari, 1867) (Coleoptera: Curculionidae: Scolytinae) presents a cryptic life cycle, which occurs all within the fruit, which makes its control a difficult task. For this reason, one of the methods that has stood out is the biological control through the entomopathogenic fungus Beauveria bassiana (Balsamo) (Hypocreales: Cordycipitaceae). However, the efficiency of this fungus is conditioned to environmental factors, such as ultraviolet radiation, temperature, humidity, concentration, correct application, among others. Therefore, the objective of the present study is to evaluate the mortality of coffee berry borer, pre and post application of the entomopathogenic fungus Beauveria bassiana associated with emulsifiers under field conditions. The experiments were conducted in three farms in different locations. The fungus isolate used was the PL63, and emulsifiers (Gum arabic and X1) evaluated were gum arabic and X1 (product subject to patent). Two modes of application were performed: pre and post the coffee berry borer release. In the pre-application, the fungi were mixed in with the emulsifiers and the pure, and after thirty minutes, the coffee berry borer was released. In the post-application, it released the insects, and after 24 hours, the fungus was applied with the emulsifiers and pure. All treatments tested showed coffee berry borer mortality; the emulsifying agents (Gum and X1) in admixture with the fungus B. bassiana, did not increase the mortality of coffee berry borer; the application of the fungus B. bassiana before the entry of the drill into the coffee fruit, resulted in higher mortality.

Keywords—Biological control, Environmental factors, Microbial control, Protection.

I. INTRODUCTION

The coffee berry borer, *Hypothenemus hampei* (Ferrari, 1867) (Coleoptera: Curculionide: Scolytinae) is the most important coffee pest in the world (Infante et al., 2012). In Brazil, the losses exceed \$ 300 million (Oliveira et al., 2013). Due to its cryptic life cycle, which occurs all within the fruit, the control becomes a difficult task (Damon, 2000; Vega et al., 2015).

Therefore, one of the control methods that has stood out is the biological through entomopathogenic fungus *Beauveria bassiana* (Bals.) (Hypocreales: Cordycipitaceae), which infects the coffee berry borer all around the world (Monzón et al., 2008; Vega et al., 2009; Wraight et al., 2018). This entomopathogen, naturally occurring, with insect infection levels ranging from 1 to 70% in several coffee producing countries like the Brazil (Costa et al., 2002), Colombia (Posada-Flórez et al., 2008), Nicaragua (Monzón et al., 2008), Puerto Rico (Gallardo-Covas et al., 2010) and Cameroon (Mbang et al., 2012). In most cases, the mortalities were attributed to highly favorable environmental conditions (during rainy seasons or extended periods of high humidity). The most favorable environmental conditions for fungus *Beauveria bassiana* activity in general are moderate temperature, high humidity and low sunstroke (Zimmermann, 2007; Jaronski, 2010; Wraight et al., 2018).

In spite of this microbial agent play an important role in the control of *H. hampei*, its efficiency is conditioned to environmental factors. like ultraviolet radiation. temperature, moisture, altitude, product concentration, correct application, among others (Vega et al., 2015; Aristizábal et al., 2016). The ultraviolet radiation and high temperatures reduce field conidia viability, because this affects its metabolism, changing enzyme production processes, toxins, spore germination, germ tube development, penetration, colonization and reproduction (Alves & Lecuona, 1998; Rodrigues et al., 2016). Besides that, the fungus loses its ability to infect when subjected to direct sunlight for three hours (Alves & Lecuona, 1998; Rodrigues et al., 2016). Which makes these factors, the main obstacles to successful use of entomopathogenic fungi in agriculture (Rangel et al., 2008; Castrillo et al., 2010; Rodrigues et al., 2016).

In this context, the use of agents that may act as fungal protectors against adverse environmental conditions emerges as a possible alternative. Among these, the emulsifiers have received attention, which are very important additives in the food industries, and have excelled in encapsulation techniques, in order to increase the viability of microorganisms (Yáñez-Fernández et al., 2008). Some emulsifiers have been tested in admixture with the Beauveria basssina fungus. For example, 2% castor oil in admixture with Boveril® formulation in the concentration of 3 x 105 conidia/mL, presented mortality of larvae of Plutella xylostella (Linnaeus, 1758) (Lepidoptera: Plutellidae) significantly higher, when compared to using pure fungus (Rondelli et al., 2011). However, few studies evaluate the efficiency of emulsifiers as B. bassiana protective agents in H. hampei mortality under field conditions.

Therefore, the present study aims to determine the mortality of *H. hampei* in the field, pre and post application of the *B. bassiana* in association with emulsifiers.

II. MATERIAL AND METHODS

2.1 Study sites

The study was conducted in three coffee farms, in the months of May and June 2018.

Assay 1. Córrego Fundo site, located in the municipality of Mimoso do Sul (latitude $20^{\circ} 95' 26.05''$ S and longitude $41^{\circ} 60' 57.43''$ W), Espírito Santo, Brazil, altitude of 850 m, *Coffea arabica* cultivar 'Catuaí amarelo', with 15 years, spacing 2.0 x 1.0 m, average temperature of 25 ± 5 °C and relative humidity (RH) of 70 $\pm 10\%$

Assay 2. Experimental area of the Instituto Federal do Espírito Santo, Campus Alegre-ES, located in the Rive district, (latitude 20° 45' 50" S and longitude 41° 27' 25"), Espírito Santo, Brazil, altitude of 290 m, *Coffea arabica* cultivar 'Catuaí amarelo' with 15 years, spacing 2.5 x 1.0 m, average temperature of 26 ± 5 °C and RH of $60\pm 10\%$.

Assay 3. Bom Ver site, located in the municipality of Alegre, (latitude 20° 52' 23,07'' S and longitude 40° 29' 8,76'' W), Espírito Santo, Brazil, altitude of 700 m, *Coffea arabica* cultivar 'Catuaí vermelho' with 12 years, spacing 2.5 x 0.6 m, average temperature of 25 \pm 5 °C and RH of 65 \pm 10%.

2.2 Obtaining the fungus

The *B. bassiana* fungus used in this work was the ESALQ-PL63 isolated. This isolated was obtained in acommercial product, Boveril®, provided by the company Koppert Brasil Ltda.

2.3 Emulsifiers

Two emulsifiers were used. The first one was the Arabic gum, polymer of D-glucuronic acid, L-raminose, D-galactose and L-arabinose, with approximately 5% protein. The second emulsifier was the X1 (product subject to patent), a polyalcohol derived from fruits.

2.4 Obtaining the insects

The *H. hampei* adult females were obtained from stock creation at the Nucleus for Scientific and Technological Development in Phytosanitary Management (NUDEMAFI), Agronomic Sciences Center at the Federal University of Espirito Santo, Alegre, ES (CCAE-UFES). These insects were raised in plastic boxes ($15 \times 30 \times 5 \text{ cm}$), containing fruits, occupying only one side of the box, getting the other side free so the newly emerged coffee berry borer, when leaving the grains. So that they could move to the free extremity, for insect collection. The collection was made with small insect suction, adapted to a vacuum pump (Dalvi & Pratissoli, 2012).

2.5 Solution Preparation

500 mL distilled water was added in a Becker® of 1 L. Right after, a 1.0% (w/v) arabic gum solution was prepared, with subsequent incorporation of 1 g of *B. bassiana* fungus with suspension of 1x1012 conidia.mL-1. In a second Becker®, the same procedure was performed with 1.0% X1 (w/v) and 1 g of *B. bassiana* fungus. The concentration of emulsifiers was obtained from preliminary compatibility tests with the *B. bassiana*. The compatibility was calculated with the formula proposed by Alves, et al. (1998) to classify chemicals according to their toxicity to entomopathogenic fungi in vitro. The *B. bassiana*'s concentration was used according to the manufacturer's recommendation.

2.6 Product application

In each coffee plant, a rosette with ripe fruits was selected, on both sides, leaving five fruits in each. Two application modes were performed: coffee berry borer pre and post release. In pre-application, the conidia were pulverized, with the emulsifiers and pure, on the fruits and after 30 minutes, period for the solution to dry, the rosette was bagged with organza fabric (Fig. 1B), and then the insects were released. In the post application, five coffee berry borer were released on the bagged rosette, and after a period of 24 hours, with the confirmation of the insects that entered the fruit, the conidia were applied with a precompression spray, with 40 lb pressure, on the fruits to the point of dripping (Fig. 1A). After each application, the spray was washed with distilled water.

The experiments were conducted in randomized blocks with five treatments (T1 - Arabic gum + *B. bassiana*, T2 - X1+B. *bassiana*, T3 - Arabic gum +X1+B. *bassiana*, T4 - pure *B. bassiana*) and attestant (Water) with two repetitions per treatment. In each experiment five blocks were used.

The field coffee berry borer mortality evaluations were performed 12 days after the applications (12 DAA). The dead insects were taken to the NUDEMAFI Entomology Laboratory and then they were placed in a humid chamber and incubated in a type Biological Oxygen Demand (B.O.D) at 25 ± 2 °C, $80 \pm 5\%$ of RH and phototase of 12 h, for 10 days, to confirm mortality through pathogen sporulation.

The data were subjected to analysis of variance and the means were compared by Tukey test at 5% significance level in statistical software R (ExDes.pt package) (R Development Core Team 2009).

For collecting precipitation data (mm) and temperature (°C), weather stations were installed in the areas, where the experiments were conducted.

III. RESULTS AND DISCUSSION

Assay 1

The results obtained in this study showed no interaction between the factors, emulsifiers and application pre and post release of the coffee berry borer, in *H. hampei* mortality.

The coffee berry borer mortality occurred in all treatments. However, the treatments showed no significant difference among themselves (Table 1).

In the different application modes of the fungus, prerelease coffee berry borer application (P1) presented higher mortality with 40.62%, differing statistically (F39:32 = 4.19; p>0.005) of the post-release application (P2), which presented a mortality of 29.99% (Table 2).

Assay 2

The factors presented significant interaction, emulsifiers and application pre and post release of the coffee berry borer, in *H. hampei* mortality (F39:32 = 2.99; p>0.005) (Table 3).

The coffee berry borer mortality occurred in all treatments. However, the treatments in both modes of application did not differ statistically (Table 3).

The pre and post coffee berry borer applications presented mortality of *H. hampei*. However, only at T4 there was a statistical difference. In this treatment, the pre-release application of insects, with mortality of 48.88%, differed statistically from post-release application, with 17.77% (F39:32 = 6.01; p>0.005) (Table 3).

Assay 3

The factors presented significant interaction, emulsifiers and application pre and post release of the coffee berry borer, in *H. hampei* mortality (F39:32 = 33.32; p>0.005) (Table 4).

When comparing treatments, within application modes, the significant difference occurred only in the pre-release application, in which mortality in T1 ($4.77\pm1.25\%$) differed, significantly, with lower value of T4 ($30.43\pm12.39\%$) (F39:32 = 38.88; p>0.005) (Table 4).

When comparing application modes, within treatments, the significant difference occurred only in T1, in which the post-release application of insects with mortality of 23.91%, differed, significantly, of the pre-release application, with 4.77% (F39:32 = 0.30; p>0.005) (Table 4).

The emulsifiers (Arabic gum and X1), in mixture with *B. bassiana* fungus, did not show better coffee berry borer mortality rates in relation to the pure *B. bassiana* fungus. These results suggest that the Arabic gum and X1 did not increase the viability of conidia, through adverse environmental factors, mainly UV radiation, since the factors temperature and humidity were in favorable conditions for the development of the fungus. The UV light is one of the determining factors in the viability of conidia (Rodrigues et al., 2016; Wraight et al., 2018). Laboratory studies with pure conidia subjected to different radiation times, showed that in five minutes of exposure to UV light, with an irradiance of 6153.3 mW.m-2 or 22.15 kJ.m-2.h-1, the germination was 52%, while, that in control (without

radiation) was 94%. At 10 minutes this rate dropped to 11%. At 15 minutes, dropped to 1,0% (Rodrigues et al., 2016).

Unprotected conidia of *Beauveria* are unable to survive a few hours of direct exposure to solar radiation (Edgington et al., 2000). Another factor that may have influenced the survival, without emulsifiers, was the fungal activity. In the case of conidia, this action can be delayed, once, the germ tube needs to break the emulsifier barrier, which leads to slower action (Rodrigues et al., 2016).

The mode of application of the fungus is one of the determining factors for the success in the control of H. *hampei*. This is due to the cryptic behavior of the insect. Because, it spends most of the life cycle inside the fruit; and only mated females go out to seek new fruit (Dalmon, 2000).

The results, obtained in the present study, indicate that in general the application of the fungus pre-release of the coffee berry borer, presented higher mortality when compared to post-release application. In the field, the contamination of the insect by *B. bassiana*, when the body is partially inside the fruit, it must to the presence of conidia in the fruit (Mota et al., 2017). The mortality of *H. hampei* in the post-release application of the insect, may have occurred due to the behavior of the coffee berry borer, that right after making the hole in the fruit, back to the surface to deposit the drilling material (Samuels et al., 2002).

IV. FIGURES AND TABLES

Table 1. Corrected mortality (%) of Hypothenemus hampei in Beauveria bassiana fungus applications associated with emulsifiers and pure. Córrego Fundo Site, municipality of Mimoso do Sul - ES, average temperature of 25 ± 5 °C, RH of 70 ± 10 % and altitude of 850 m.

| Treatments | Averages |
|--|--------------|
| T1 (Arabic gum + B. bassiana) | 39.58±16.13a |
| T2 (X1+B. bassiana) | 36.45±19.91a |
| T3 (Arabic gum +X1+ <i>B. bassiana</i>) | 31.87±14.33a |
| T4 (Pure B. bassiana) | 33.33±17.15a |

*Averages represented by the same lowercase letters do not differ from each other at 5% probability level by Tukey test. Table 2. Corrected mortality (%) of Hypothenemus hampei in Beauveria bassiana fungus applications associated with emulsifiers and pure, pre (P1) and post (P2) adults release. Córrego Fundo Site, municipality of Mimoso do Sul - ES, average temperature of 25 ± 5 °C and RH of 70 ±10 % and

altitude of 850 m.

| Application mode | Averages |
|-------------------------------------|--------------|
| P1 (coffee berry borer pre-release) | 40.62±17.59a |
| P2 (coffee berry borer pos-release) | 29.99±14.05b |

*Averages represented by the same lowercase letters do not differ from each other at 5% probability level by Tukey test.

Table 3. Corrected mortality (%) of Hypothenemus hampei in Beauveria bassiana fungus applications associated with emulsifiers and pure, pre (P1) and post (P2) adults release. Experimental area of the Instituto Federal do Espírito Santo, Campus Aleone, FS, guarage temperature of 26 + 5

Santo, Campus Alegre - ES, average temperature of 26 ± 5 °C, RH of $60 \pm 10\%$ and altitude of 290 m.

| | Application mode | | | | | |
|---|------------------|---------------|--|--|--|--|
| Treatments | P1 (pre- | P2 (post- | | | | |
| | release) | release) | | | | |
| T1 (Arabic gum + <i>B</i> . <i>bassiana</i>) | 37.77±18.59Aa | 28.88±9.93Aa | | | | |
| T2 (X1+B. bassiana) | 28.88±12.66Aa | 33.33±7.85Aa | | | | |
| T3 (Arabic gum +X1+ <i>B. bassiana</i>) | 35.55±12.17Aa | 28.88±18.59Aa | | | | |
| T4 (Pure B. bassiana) | 48.88±9.93Aa | 17.77±14.90Ab | | | | |

*Averages followed by the same letters, uppercase in the column and lowercase in the row, do not differ from each other, at 5% probability level by Tukey test.



Fig.1. A - Beauveria bassiana fungus application associated with emulsifiers on the fruits; B - Coffee berry borer release after product application; C - Bagged fruits with organza fabric.

Table 4. Corrected mortality (%) of Hypothenemus hampei in Beauveria bassiana fungus applications associated with emulsifiers and pure, pre (P1) and post (P2) adults release. Sítio Bom Ver Site, municipality of Alegre - ES, average temperature of 25 ± 5 °C, RH of 65 ± 10 % and altitude of 700 m.

| | Application mode | | | | | |
|--|------------------|-------------------|--|--|--|--|
| Treatments | P1 (pre-release) | P2 (post-release) | | | | |
| T1 (Arabic gum + B. bassiana) | 4.77±1.25Bb | 23.91±10.87 Aa | | | | |
| T2 (X1+B. bassiana) | 15.75±4.70ABa | 23.91±13.31Aa | | | | |
| T3 (Arabic gum +X1+ B. bassiana) | 19.12±10.09ABa | 21.51±12.11Aa | | | | |
| T4 (Pure B. bassiana) | 30.43±12.39Aa | 18.18A±10.02Aa | | | | |

*Averages followed by the same letters, uppercase in the column and lowercase in the row, do not differ from each other, at 5% probability level by Tukey test.

V. CONCLUSION

All treatments tested showed mortality from coffee berry borer.

The emulsifying agents (Arabic gum and X1) in mixture with *Beauveria bassiana* fungus, did not increase coffee berry borer mortality.

The application of the *B. bassiana* fungus, in the prerelease of the coffee berry borer, increased the mortality.

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Nursing Assistance in Humanized Children

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Abstract— The Program for the Humanization of Prenatal and Birth (PHPN), created in 2000, aims to qualify prenatal care in terms of access and coverage, but also to improve attention to the processes of childbirth itself and puerperal. This bibliographic review work aims to present and discuss the assistance provided by nursing professionals who direct nurses in the practice of humanized birth, proving the importance of knowledge of the procedures involved in this practice. To this end, the following keywords were used: nursing, childbirth and humanization, between the years 2015 to 2019 in Portuguese, which addressed the concepts and policies of humanization and the relationship and perception of nurses in this context. Virtual Health Library (VHL), Scielo, Lilacs. The nursing professional is of great importance in assisting the parturient and the newborn, promoting health, preventing and diagnosing pregnancy complications during the prenatal period, must be an integral part of the health team in comprehensive care provided to women. The care model for humanized childbirth is still a challenge and requires efforts by managers, health professionals, society and institutional support, adhering to public policies, encouraging the qualified formation of the team as a whole and performing its role in changing the model and performance committed to the ethical and legal precepts of the profession. it must be an integral part of the health team in comprehensive care provided to women. The care model for humanized childbirth is still a challenge and requires efforts by managers, health professionals, society and institutional support, adhering to public policies, encouraging the qualified formation of the team as a whole and performing its role in changing the model and performance committed to the ethical and legal precepts of the profession. it must be an integral part of the health team in comprehensive care provided to women. The care model for humanized childbirth is still a challenge and requires efforts by managers, health professionals, society and institutional support, adhering to public policies, encouraging the qualified formation of the team as a whole and performing its role in changing the model and performance committed to the ethical and legal precepts of the profession.

Keywords—nursing, childbirth and humanization.

I. INTRODUCTION

In the scope of health services, Humanization is a term that applies to characteristics that are usually both subjective and complex when applied to health care.

Thus, the issue of humanized care has been widely discussed, since the emergence of the National Humanization Policy (PNH) of the Ministry of Health, effectively seeking to put into practice the principles of the Unified Health System (SUS) in the daily care services. health, respecting the privacy of those involved in this process and creating a welcoming and comfortable service environment (FIGUEIREDO et al, 2018; POSSATI et al in 2017).

Since birth is a natural event, it is indisputable that it is a mobilizing phenomenon, which even the first civilizations added to this event, cultural meanings that have undergone transformations through generations, but still have birth as one of the most remarkable facts of life. thus, it is essential for the humanization of childbirth the ideal preparation of the pregnant woman for the moment of birth, and this preparation must be started during prenatal care (NASCIMENTO et al, 2017).

In Brazil, the concept of humanization, according to the Program for the Humanization of Prenatal and Birth (PHPN), created in 2000, aims to qualify prenatal care regarding access and coverage, but also to improve the attention to the delivery and puerperal processes (POSSATI et al in 2017).

Humanized childbirth is a succession of procedures and attitudes that encompass a very broad concept, which can be approached in several dimensions and in complementary ways, aiming at the promotion of healthy birth and birth and the prevention of perinatal morbidity and mortality (NASCIMENTO; SILVA; VIANA, 2018).

Thus, the attitudes on the part of professionals in obstetric care and must consider the rights of women for a humanized delivery with respect to the woman's desire to have a companion for her; know the identity of the professional; to be informed by professionals about the procedures that will be performed with her and her child (NASCIMENTO et al, 2017).

It is essential that the nursing team develop, supported by pertinent instruments and permanent education, a way of caring for themselves, essential in the assistance to humanized childbirth, offering relevant information for the parturient about the evolution of childbirth (NASCIMENTO; SILVA; VIANA, 2018).

The care provided by obstetric nurses to the parturient demands patience or tolerance and is a construction based on sharing, which involves the nurse and the woman in an existential movement that favors the authentic care that enables the confidence that the woman has in the nurses and the medical team involved (NASCIMENTO; SILVA; VIANA, 2018).

At delivery, there are many difficulties in providing humanized assistance to women, the main one being the need for trained professionals to do so; the availability of technological resources and adequate infrastructure of the institution; and finally, the physiological and psychological conditions of the woman at the time of delivery, which needs attention and emotional support. Even pointing out these difficulties, the obstetrical nurse occupies an extremely important place in assistance with the ability to direct the multidisciplinary team towards humanized care (NASCIMENTO; SILVA; VIANA, 2018). Given the above, the objective of this research is to present and discuss the assistance provided by nursing professionals who direct nurses in the practice of humanized childbirth, proving the importance of knowledge of the procedures involved in this practice.

II. METHODOLOGY

This is an exploratory bibliographic research, with a qualitative approach, using as keywords: nursing, childbirth and humanization, whose context was relevant to the theme addressed. The Virtual Health Library (VHL), Scielo, Lilacs were used as database. According to Lima (1997, p. 5) "bibliographic research is the activity of locating and consulting different sources of written information, to collect general or specific data about a topic".

The articles were researched within the period from 2015 to 2019 in Portuguese, which addressed the concepts and policies of humanization and the relationship and perception of nurses in this context; excluding theses, dissertations and monographs.

III. DEVELOPMENT

1. General aspects of the National Humanization Policy

In the scope of health services, Humanization is a term that applies to characteristics that are usually both subjective and complex when applied to health care.

The humanization process appears with the aim of rethinking the care practices provided to the patient, where the technological aspects present in the ICUs, essential to the maintenance of life, become mere instruments if the aspect of care itself is not focused on the need of patients RIBEIRO et al, 2017).

To meet this need, in 2003, the National Policy for the Humanization of SUS Care and Management (PNH / Humaniza SUS) was launched, which refers to humanization as valuing the different characters inserted in the health production process (users, workers and managers) proposing guidelines for improving patient care and optimizing conditions for team performance (RIBEIRO et al, 2017; POSSATI and al in 2017).

Thus, the issue of humanized care has been widely discussed, since the emergence of the National Humanization Policy (PNH) of the Ministry of Health, effectively seeking to put into practice the principles of the Unified Health System (SUS) in the daily care services. health, respecting the privacy of those involved in this process and creating a welcoming and comfortable service environment (FIGUEIREDO et al, 2018; POSSATI et al in 2017).

The bases that make up the National Humanization Policy are the transversality of assistance, that is, the expansion of the degree of communication between those involved (users and health service providers); the inseparability between attention and management, that is, the intrinsic relationship between modes of care and modes of management; and the affirmation of protagonism and autonomy in the development of co-responsibility attitudes in health production (SANCHES et al, 2016).

When laying the foundations to be achieved by health services, we value the users, workers and managers involved in the health production process, encouraging their autonomy leading to improvement in working conditions and assistance (RIBEIRO et al, 2017; POSSATI et al in 2017).

2. Humanized Childbirth

Considering all technological advances in the medical field, over the years, the physiological act of giving birth, being born, assumed a certain pathological view, privileging the depersonalized technique, and minimizing the stimulation, support and affection to the woman who experiences this experience, in this way, a change of perspective is observed, evidenced by the changes proposed in this assistance, including the rescue of natural childbirth, with the encouragement of the performance of the obstetric nurse in the assistance to pregnancy and childbirth (NASCIMENTO et al, 2017; ALMEIDA; GAMA; BAHIANA, 2015).

Since birth is a natural event, it is indisputable that it is a mobilizing phenomenon, which even the first civilizations added to this event, cultural meanings that have undergone transformations through generations, but still have birth as one of the most remarkable facts of life. thus, it is essential for the humanization of childbirth the ideal preparation of the pregnant woman for the moment of birth, and this preparation must be started during prenatal care (NASCIMENTO et al, 2017).

The World Health Organization attributes the humanization of childbirth assistance the objective of providing a healthy process associated with the prevention of maternal and perinatal mortality, involving careful and specific interventions, avoiding the excessive use of technological resources, considering that childbirth is a remarkable experience for women, being that it can leave both positive and negative memories, such as suffering, fear of becoming pregnant again and depression (NASCIMENTO et al, 2017; ALMEIDA; GAMA; BAHIANA, 2015; POSSATI and al in 2017).

In Brazil, the concept of humanization, according to the Program for the Humanization of Prenatal and Birth (PHPN), created in 2000, aims to qualify prenatal care regarding access and coverage, but also to improve the attention to the delivery and puerperal processes (POSSATI et al in 2017).

According to the PHPN, humanization encompasses a dignified welcome to the woman-babyfamily triad based on ethical and solidary conduct, bringing numerous recommendations for clinical practices and therapeutic approaches based on scientific evidence, such as the insertion of a free companion. choice of women, the qualification of interpersonal relationships between professionals and parturients, the production of spaces for the construction of knowledge and information, and the participation, autonomy and greater decision-making control of women over their bodies (POSSATI et al, 2017).

Therefore, according to PHPN, humanization involves welcoming the mother-child binomial as well as the parturient's family with the application of ethical and solidary actions, with the organization of the institution being extremely necessary, providing a peaceful and welcoming where practices that escape the traditional isolation imposed on women prevail (SILVA, et al, 2019).

Humanized childbirth is a succession of procedures and attitudes that encompass a very broad concept, which can be approached in several dimensions and in complementary ways, aiming at the promotion of healthy birth and birth and the prevention of perinatal morbidity and mortality. (NASCIMENTO; SILVA; VIANA, 2018).

Humanizing childbirth does not mean just having a normal birth, performing procedures or not, but making the woman the protagonist of that moment and not an object of it, giving her freedom of choice in decisionmaking processes. Humanized delivery includes respect for the physiological process and the dynamics of each birth, in which interventions must be careful, avoiding excesses and using the available technological resources. (NASIMENTO; SILVA; VIANA, 2018; SILVA et al, 2019).

We have as unnecessary interventions the trichotomy, a practice performed with the justification of reducing the infection and facilitating the suture technique, when episiotomy is necessary or in case of laceration; the enema being justified to reduce the duration of labor and the contamination of the perineal region, however, the literature reveals that there is no definitive scientific

evidence on the effectiveness of these procedures (POSSATI et al in 2017).

It is important to highlight that the humanized mode of delivery comes against the growing number of caesarean sections, sometimes precipitated and unnecessary, associated with an incorrect influence of the myths about exacerbated pain during natural childbirth, the fear of permanent bodily changes related to natural childbirth , and with regard to the child's safety comfort (PEREIRA et al, 2016).

It is noteworthy that cesarean delivery is a procedure performed to resolve obstetric risk situations, but which started to be used in an abusive manner, with the justification of being safer in relation to normal delivery; cesarean delivery is defined as the extraction of the fetus through an incision in the abdominal wall (laparotomy) and uterine wall (hysterectomy), performed when labor is contraindicated or when vaginal delivery is unlikely to be performed safely . (PEREIRA et al, 2016;ALMEIDA; GAMMA; BAHIANA, 2015).

Thus, the attitudes on the part of professionals in obstetric care and must consider the woman's rights for a humanized delivery with respect to the woman's desire to have a companion of her choice; know the identity of the professional; to be informed by professionals about the procedures that will be performed with her and her child (NASCIMENTO et al, 2017, SILVA et al, 2019).

With regard to respect for women and their families, it should be encouraged that she identifies and connects to each member of the health team (by the name and role of each one), be properly informed in advance about the different procedures to which she will be submitted., providing a welcoming, clean, comfortable and quiet environment, these are relatively simple attitudes and require little more than the goodwill of the professional (NASCIMENTO et al, 2017).

At delivery, there are many difficulties in providing humanized assistance to women, the main one being the need for trained professionals to do so; the availability of technological resources and adequate infrastructure of the institution; and finally, the physiological and psychological conditions of the woman at the time of delivery, which needs attention and emotional support. Even pointing out these difficulties, the obstetrical nurse occupies an extremely important place in assistance with the ability to direct the multidisciplinary team towards humanized care (NASCIMENTO; SILVA; VIANA, 2018).

Therefore, humanized delivery is understood as a delivery that mainly involves respecting the act itself, in

which the team involved recognizes the value of that moment for the mother, father and son and is willing to help, performing only the procedures necessary, in a pleasant environment, where the woman is surrounded by solicitous, qualified professionals and a person of trust (PORTO; COSTA; VELOSO, 2015).

3. Performance of the Nursing Professional in Humanized Delivery

Obstetric nursing has changed in recent years, it has been recognized for its performance and for the improvement of its knowledge. Since the late 1980s, nurses have been conquering their space in childbirth care, specialization in obstetrics is only allowed for doctors and nurses (ALMEIDA; GAMA; BAHIANA, 2015).

Care, in addition to the principle of nursing care, needs to be the institution's philosophy, allowing the indispensable conditions to develop it and these conditions are qualified human resources, full access to materials and technology, as well as the appropriate physical structure; the care process should not be based only on the identification of clinical signs and symptoms, but on the changes that occur in the person receiving this care, including the psychological and emotional aspects (NASCIMENTO et al, 2017).

The process of giving birth is a period of pain and suffering where the nursing team acts as a facilitator of this experience, being the fundamental basis for obstetric care. The nurse must be alert to complaints and other manifestations that may indicate some type of complications, informing the pregnant woman about the birth evolution, guiding the parturient in the conducts to be taken during the child's dilation and release period (NASCIMENTO et al, 2017).

The provision of humanized assistance to women, which culminates in delivery itself, begins in pregnancy through prenatal and postpartum consultations, which are also the nurse's duties. The nursing team has a decisive role since it is the professionals who are closest to the parturient. (NASCIMENTO; SILVA; VIANA, 2018).

It is essential that the nursing team develop, supported by pertinent instruments and permanent education, a way of caring for themselves, essential in the assistance to humanized childbirth, offering relevant information for the parturient about the evolution of childbirth (NASCIMENTO; SILVA; VIANA, 2018).

The care provided by obstetric nurses to the parturient demands patience or tolerance and is a construction based on sharing, which involves the nurse and the woman in an existential movement that favors the authentic care that enables the confidence that the woman has in the nurses and in the medical team involved (NASCIMENTO; SILVA; VIANA, 2018).

The obstetric nursing professional uses technologies that promote the comfort and empowerment of women during childbirth, considering the perspective that pregnancy, childbirth and births are natural events in human life, not intervening in the physiological processes involved, but acting as supporting role, facilitator of this experience (NASCIMENTO; SILVA; VIANA, 2018).

When informing the parturient about the various procedures to which she will be submitted, the nursing professional collaborates greatly by offering a warm and comfortable environment. The moment of childbirth is extremely important in a woman's life, of great emotional burden, with consequences that can profoundly affect women, babies and families (PEREIRA et al, 2016).

Thus, during labor, liquids should be offered, in addition to emotional support, offering information about the procedures performed, simple measures such as encouraging the lying position, giving freedom of position and movement to the parturient, controlling pain by non invasive and non-pharmacological, such as relaxation techniques, massages, among others, bring to the parturient the perception that the birth of her child is an act that is part of life, which is understood in its greatness and difficulty, and not just a medical procedure . (PEREIRA et al, 2016;POSSATI et al in 2017).

Are alsonursing actions requests for exams, guidelines and application of vaccines. The guidelines should address the discomfort typical of the gestational period and ways to relieve it, emotional aspects, relaxation exercises, adequate nutrition, weight gain, sexuality, among others, all of which are carried out within an appropriate environment, with respect and ethical posture. , favoring the natural course of the gestational period and consequently the delivery itself (PORTO; COSTA; VELOSO, 2015;POSSATI e al in 2017).

This emotional support is extremely important since women feel insecure, incapacitated and have difficulty in making decisions about the type of delivery and the techniques to be used during the parturition process because they do not know the technical issues raised by professionals in the area of obstetrics, this support must be extended to the home, in order to adapt to the new maternal role, which is usually a time when doubts, difficulties and insecurity arise in her performance as a mother (PEREIRA et al, 2016).

The perception of nursing professionals regarding humanized birth was assessed in a 2017 study by BRAGA

and SANTOS where the authors performed a quantitativequalitative, descriptive research carried out with 30 professionals from the nursing team who worked in the pre-delivery, delivery and postpartum sectors at the Hospital da Mulher Mãe Luzia in Macapá, in the State of Amapá.

The professionals who participated in this study demonstrate knowledge of the importance of providing assistance to humanized childbirth, that this procedure is of paramount importance for the health of the parturient and the newborn, and agree with the companion's permanence together to women, which leads to the conclusion that nursing professionals understand that women must be the main character during childbirth, always taking into account that humanized childbirth aims at physiology alone, without unnecessary interruptions or procedures (BRAGA and SANTOS, 2017).

Another study, carried out by POSSATI et al in 2017, corroborates these observations; the authors also conducted a descriptive qualitative research, carried out with nurses from a teaching hospital, located in southern Brazil.

The humanization of childbirth was understood by the research participants as a set of practices and attitudes based on dialogue, empathy and welcoming; providing guidance; valuing the uniqueness of the parturient; the performance of procedures proven beneficial to maternal and child health and the constant professional updating, however, the humanization of childbirth still represents a challenge in professional practice (POSSATI et al in 2017).

SOUZA et al, in 2016, analyzed the practices adopted in deliveries in Belo Horizonte and observed that even in institutions involved in the adoption of the change in the obstetric care model, practices that reproduce the technocratic model are observed.

A similar result was observed by VARGENS; SILVA; PROGIANTI, in 2017, when they studied humanized childbirth practices by obstetric nurses inserted in two public hospitals in Rio de Janeiro, emphasizing that this is a process still in progress.

In one study carried out in a Municipal Hospital of the State of Tocantins, RIBEIRO et al, in 2019 they observed that about 80% of the professionals do not have specialization / courses in obstetrics, but that they have training to welcome and care for pregnant women in labor and that nursing professionals use non-invasive technologies to care for pregnant women 100%, and also perform invasive techniques. Some difficulties in the effective implantation of humanized childbirth are related to a change in the hospital culture, with the organization of assistance really focused on the needs of women and their families, involving changes in the physical structure, making the hospital space for childbirth a more welcoming and favorable to the implementation of humanizing care practices, as well as institutional practices that favor the performance of nursing professionals and staff in general thinking about the physiological aspects of childbirth, not encouraging unnecessary intervention, recognizing the social and cultural aspects of childbirth and birth, and offering the necessary emotional support to the woman and her family (PORTO; COSTA; VELOSO, 2015).

The effective implementation of the humanization proposal for childbirth care is then directly influenced by the organizational model, the institutional mission, the involvement and adherence of managers to the proposal, the training and sensitivity of the professionals involved (PORTO; COSTA; VELOSO, 2015, SILVA et al, 2019).

IV. CONCLUSION

The nursing professional must become aware of its importance in assisting the parturient and the newborn, teaching, promoting health, preventing and diagnosing pregnancy complications during the prenatal period, the nursing team must be an integral part of the health team in comprehensive care provided to women, through their technical scientific knowledge associated with professional ethics and human life, providing dignified and quality care.

The nursing professional is of paramount importance during labor and must act as an advocate for women, supporting their choices and respecting each decision, when appropriate, understanding all the efforts and feelings involved in this moment of the parturient and her family, transmitting security, technical knowledge and dedication for the arrival of new life.

The transformation of the humanized childbirth care model is still a challenge and requires efforts by managers, health professionals, society and institutional support, adhering to public policies, encouraging the qualified formation of the team as a whole and performing its role in changing the model and performance committed to the ethical and legal precepts of the profession.

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Clinical-Epidemiological profile of Patients who acquired Pneumonia Associated with Mechanical Ventilation in an ICU inside the State of Rondônia

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Abstract— Infections in the hospital environment are a serious problem in the intensive care unit environments. Mechanical ventilation-associated pneumonia (VAP) is the second most frequent infection in American and European Intensive Care Units (ICUs). This project aimed to outline the clinicalepidemiological profile of patients admitted to an Intensive Care Unit. It is descriptive, documentary, with a quantitative approach. Data were collected using a specific form, directly from the patients' medical records and, afterwards, underwent a quantitative analysis process. Information was collected from 17 patients, through their medical records, who developed VAP in an Intensive Care Unit from January to December 2018, with two patients developing the infection twice. Thus, 100% of patients who developed VAP in the period were surveyed. The incidence density of VAP during the period in the studied unit was 5.6 cases for every 1000 mechanical ventilators / day. At the outcome of the clinical course of patients hospitalized with VAP, the mortality rate was 41% due to VAP, however, 24% of the patients died of other complications, 35% were successful in the treatment and management of VAP. Knowledge about these data is of great importance in the creation of assessment instruments in nursing care, gaining gains in the evolution of the clinical condition of patients, providing nurses with better planning of their health care actions.

Keywords— Pneumonia associated with mechanical ventilation, ICU, Epidemiologicalclinical profile.

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PERFIL CLÍNICO-EPIDEMIOLÓGICO DOS PACIENTES QUE ADQUIRIRAM PNEUMONIA ASSOCIADA À VENTILAÇÃO MECÂNICA EM UMA UTI NO INTERIOR DO ESTADO DE RONDÔNIA

Resumo— As infecções no ambiente hospitalar constituem um grave problema nos ambientes de unidade de terapia intensiva. A pneumonia associada à ventilação mecânica (PAV) é a segunda infecção mais frequente em Unidades de Terapia Intensiva (UTIs) americanas e europeias. Este projeto teve como objetivo traçar o perfil clínico-epidemiológico dos pacientes internados em uma unidade de Terapia Intensiva. É de caráter descritivo, documental, com abordagem quantitativa. Os dados foram coletados por meio de formulário próprio, diretamente do prontuário dos pacientes e, após, sofreram um processo de análise quantitativa. Foram coletadas informações de 17 pacientes, através de seus prontuários, os quais desenvolveram PAV em uma Unidade Terapêutica Intensiva no período de janeiro a dezembro de 2018, sendo que dois pacientes desenvolveram a infecção por duas vezes. Assim, foram pesquisados 100% dos pacientes que desenvolveram PAV no período. A densidade de incidência de PAV no período na unidade estudada foi de 5,6 casos para cada 1000 ventiladores mecânicos/dia. Ao desfecho do curso clínico dos pacientes internados com PAV, a taxa de mortalidade foi de 41% por PAV, entretanto, 24% dos pacientes evoluíram a óbito por outras complicações, 35% tiveram êxito no tratamento e conduta da PAV. O conhecimento sobre esses dados é de grande importância na criação de instrumentos de avaliação na assistência em enfermagem, adquirindo ganhos na evolução do quadro clínico dos pacientes, proporcionando, ao enfermeiro, planejando melhor suas ações ao cuidado em saúde.

Palavras-chave— Pneumonia associada a ventilação mecânica, UTI, Perfil clínico epidemiológico.

PERFIL CLÍNICO-EPIDEMIOLÓGICO DE PACIENTES QUE ADQUIRIERON NEUMONÍA ASOCIADA A VENTILACIÓN MECÁNICA EN UNA UCI DENTRO DEL ESTADO DE RONDÔNIA

Resumen— Las infecciones enel entorno hospitalariosonun problema grave enlos entornos de unidades de cuidados intensivos. La neumoníaasociada a la ventilaciónmecánica (VAP) es la segunda infección más frecuenteen las Unidades de Cuidados Intensivos (UCI) estadounidenses y europeos. Este proyectotuvo como objetivo esbozarel perfil clínico-epidemiológico de los pacientes ingresados en una Unidad de Cuidados Intensivos. Es descriptivo, documental, conun enfoque cuantitativo. Los datos se recopilaron utilizando unformulario específico, directamente de los registros médicos de los pacientes y, posteriormente, se sometieron a unproceso de análisiscuantitativo. Se recopilóinformación de 17 pacientes, a través de sus registros médicos, que desarrollaron VAP en una Unidad de Cuidados Intensivos de enero a diciembre de 2018, y dos pacientes desarrollaron la infección dos veces. Por lo tanto, se encuestó al 100% de los pacientes que desarrollaron VAP enel período. La densidad de incidencia de VAP enel período estudiadoen la unidadfue de 5,6 casos por cada 1000 ventiladores mecánicos / día. Enel resultado del curso clínico de los pacientes hospitalizados con VAP, la tasa de mortalidadfuedel 41% debido a VAP, sin embargo, el 24% de los pacientes fallecieron por otrascomplicaciones, el 35% tuvieronéxitoeneltratamiento y manejo de la VAP. El conocimiento sobre estosdatos es de granimportanciaen la creación de instrumentos de evaluaciónenel cuidado de enfermería, ganando ganancias en la evoluciónde la condición clínica de los pacientes, brindando a las enfermeras una mejorplanificación de sus acciones de atención médica.

Palabras clave— Pneumoníaasociada a ventilaciónmecánica, UCI, perfil clínico epidemiológico.

I. INTRODUCTION

Hospital infection, also defined as health carerelated infection (HAI) is that acquired during the patient's stay in the unit, which can be attributed to some type of procedure performed and present his symptoms even after the patient's discharge.

Mechanical ventilation-associated pneumonia (VAP) is the second most frequent infection in American

and European Intensive Care Units (ICUs). In Brazil, even with the absence of national and multicenter data, individual tests also show VAPs as the most constant infections within ICUs (MORAES et al., 2013).

Hospital pneumonia is defined as pneumonia that occurs within 48 hours of the patient's admission. It is often associated with the use of mechanical ventilation (MV) and is called Pneumonia Associated with Mechanical Ventilation (VAP). Pneumonia associated with mechanical ventilation is associated with an increase in the hospitalization period, increased mortality and increased hospital costs (MILLER, 2018).

In the Intensive Care Unit, prolonged hospitalization and the complications of this hospitalization may be related to the clinical epidemiological profile of patients who use the service. Basic diseases, length of stay, as well as the use of invasive devices can contribute to increasing the susceptibility of patients to Health Care Related Infections (COSTA et al., 2016; COSTA; MOTTA; AFRADIQUE, 2018; BAHLIS, 2018).

Patients submitted to the care of an intensive care unit are continuously susceptible to pneumonia associated with mechanical ventilation during their hospital stay. The factors that can lead to the development of VAP can be classified as modifiable and non-modifiable. Unmodifiable factors are: age, severity score when the patient enters the ICU and presence of comorbidities, heart failure, chronic obstructive pulmonary disease, diabetes, neurological diseases, neoplasms, trauma and postoperative surgeries. The modifiable factors are related to the environment (microbiota) of the ICU itself. It is estimated that VAP has an incidence of 9 to 27% with a mortality rate of 25 to 50% (PERUGINI et al., 2015; MACHADO, 2018).

This study is justified by the need to know the epidemiological clinical profile of patients who acquired nosocomial infection in intensive care, as well as on the risk factors for VAP, to interfere in the decision-making for the control and prevention of the disease. Knowledge about the profile of patients who acquire VAP helps to improve the care provided, with intensive care professionals who seek knowledge for quality care, including the education of health professionals in the care provided to the patient. This information will enable better targeted and effective actions to prevent this event, based on the principle that knowledge is the first step towards improving health care. (RUAS et al., 2018). The perspective is that these data will collaborate with health services, thus having a better assistance to critically ill patients, reducing, among others, mortality and hospital infection rates.

The study aimed to identify the clinicalepidemiological profile of patients diagnosed with Pneumonia Associated with Mechanical Ventilators in an ICU in the interior of the State of Rondônia, from January to December 2018.

The results of this study contribute to support the results of research on VAP, and can serve as a comparison with rates of other health facilities. This research tends to obtain relevant and specific data on patients who developed VAP, such as invasive procedures, and to analyze whether patients who acquired such infection have a longer period of use of mechanical ventilator and stay in the ICU, emphasizing the importance of developing techniques for Infection control.

II. MATERIALS AND METHODS

The project was submitted for evaluation by the Ethics and Research Committee of the Faculty of Biomedical Sciences of Cacoal - FACIMED, being approved under CAAE 12638919.9.0000.5298, under the opinion 3.349.685. Then, the data collection was authorized by the Direction of the Regional Hospital of Cacoal and Management of Teaching and Research of the institution. Data collection took place from August 1 to September 5, 2019. The research to be developed is descriptive, transversal, documentary, with a quantitative approach.

This study was developed according to the steps determined in the schedule. We searched for scientific articles for theoretical reference, where we selected the articles that contained epidemiological analyzes similar to the one studied at work, data regarding the relation of VAP, sex, age, clinical history, discharge / death.

The data were collected from the Hospital Infection Control Commission (CCIH) and the Medical and Statistics Archive Service (SAME) of the institution, in order to identify the clinical-epidemiological profile of patients diagnosed with Pneumonia Associated with Mechanical Ventilators during hospitalization. in the ICU. For data collection, a questionnaire prepared by the authors themselves was used, containing 12 open questions and 8 closed questions, based on the objectives of the study.

The sample consisted of the total population of medical records of patients who acquired Pneumonia Associated with Mechanical ventilation during admission to the adult ICU, which is composed of ICU I and ICU II, from January to December 2018, making a total of 17 medical records.

VAP incidence density was calculated, patients were grouped by age group, gender, clinical history, inhospital mortality rate, mean age, mean length of stay in the ICU, mean intubation time, outcome in the clinical case, length of stay of the Orotracheal Intubation device, Tracheostomy and Mechanical Ventilation.

For the calculation of the incidence of VAP, we use the recommendation of Brasil (2017), which states that the incidence density is the number of new cases of a

disease, divided by the number of people at risk, and the calculation must be performed using if the formula:

 $\frac{\text{DI in PAV} =}{\frac{\text{N}^{\circ} \text{ of new cases of PAV in the surveillance period}}{\text{N}^{\circ} \text{ of MV patients} - \text{ day in the surveillance period}} X 1000$ DI - Incidence Density.

PAV - Pneumonia Associated with Mechanical Ventilation.

VM - Mechanical ventilation.

III. RESULTS AND DISCUSSION

Information was collected from 17 patients, through their medical records, who developed VAP in an Intensive Care Unit from January to December 2018, with two patients developing the infection twice. Thus, 100% of patients who developed VAP in the period were surveyed.

The incidence density of VAP during the period in the studied unit was 5.6 cases for every 1000 mechanical ventilators / day. According to Dalmora (2013) apud Costa (2018), VAP rates in different units are extremely discrepant, ranging from 6% to 50% of incidence, representing, according to studies, 27% and 47% of all hospital infections and 9% to 40% of infections acquired in the ICU environment. Data on the epidemiology of the incidence of VAP vary widely and depend on the type of patient admitted to the Intensive Care Unit, the demographic characteristics of the location, the infrastructure offered by the hospital, the infection control systems of the hospital and the donation of protocols to prevent this condition. Hospitals with effective surveillance and a hospital infection control program have a frequency of pneumonia 20% lower than those that do not.

The 17 studied patients who had received VAP notification were separated according to sex, which demonstrated that there was a predominance of male patients, 58% men and 42% women, as shown in Figure 1. In this study, patients were also separated according to the age group, determining that the patients affected in the studied hospital unit have an average age of 47 years, with a range between 18 and 78 years of age. Despite having a higher incidence among men, there is no statistical data to prove the data presented in this study, evaluating gender as an indifferent factor regarding the risk of contracting the disease (COSTA; MOTTA; AFRADIQUE, 2018).



Fig.1 - Distribution of patients with VAP according to sex. Cacoal, 2018. **Source**: Graph extracted from the questionnaire developed by the authors, 2019.

Women with VAP have an average age of 53.5 years, while men have an average age of 45.9 years. Thus, the survey obtained a percentage of 59% of patients who acquired VAP who are between 46 and 78 years of age, characterizing, therefore, a condition that affects individuals of adult life and advanced age. Researchers indicate that there is a higher incidence of VAP in elderly patients than in young patients. Justifying the higher incidence in elderly patients due to their greater susceptibility to infection due to a weakened immune system, with a body with less capacity and cardiorespiratory reserves, less kidney function, sometimes accompanied by a series of chronic diseases that aggravate their condition. health and by the physiological aging process itself, which decreases the capacity for faster recovery, so young people have the fastest recovery performance (COSTA; MOTA; AFRALDIQUE, 2018).

The average age of the patients who constituted this mortality rate is 56.2 years, while the average age of those who had therapeutic results was 36 years. This study demonstrated that there is a higher mortality among patients who are older. However, MOTA et al. (2017) say that the age factor, by itself, has restricted representativeness when seen in isolation, placing older patients in a broader context, one can assess age as a predisposing factor, but not in isolation.

The reason that led the patients to be hospitalized were post-surgical cases, trauma, CRF + hypoglycemia, ischemic stroke, with that, the patients had complications, requiring intubation due to their general condition. Coincidentally, a longer period of exposure to mechanical ventilation and a longer prolongation in the ICU environment influence an increase in the risk of contracting VAP. In general, they are patients coming from surgical clinics, post-surgical, who had more cases, where more cases of VAP were observed.

The reason that led patients to admission to the Intensive Care Unit in the period was 18% of cases in the post-surgical period, 18% due to a lower level of consciousness, 11.7% due to a traffic accident causing trauma, 11.7% due to dyspnea associated with ARDS. All other causes had 5.8% each, with CRF + Surgical Hypoglycemia, chronic alcoholism, aggression, pesticide poisoning, Ischemic Stroke and Seizure Crisis (Table 1).

| Table 1 | - Relative a | and absolute | distribution d | of patients wit | h VAP | according | to the reason | for h | ospitalization. | Cacoal, 2018 |
|---------|--------------|--------------|----------------|-----------------|-------|-----------|---------------|-------|-----------------|--------------|
| | | | | | | 0 | | | | , |

| Reason for hospitalization | Amount | % |
|-------------------------------------|--------|-------|
| Post-surgical | 3 | 18% |
| Lowering the level of consciousness | 3 | 18% |
| Trauma | 2 | 11,7% |
| SARA-associateddyspnea | 2 | 11,7% |
| IRC + Hypoglycemia | 1 | 5,8% |
| Surgical | 1 | 5,8% |
| Chronicalcoholic | 1 | 5,8% |
| Aggression | 1 | 5,8% |
| PesticideIntoxication | 1 | 5,8% |
| Ischemicstroke | 1 | 5,8% |
| ConvulsiveCrisis | 1 | 5,8% |
| Grand total | 17 | 100% |
| | | |

Source: Graph extracted from the questionnaire developed by the authors, 2019.

In basic diseases, we obtained a result of 59% of patients who had SAH, 29.4% did not have any type of basic diseases, with 5.8% AIDS, 5.8% Epilepsy. Within these cases, 23.5% of the patients had more than one underlying disease, they are, one case of Slender Carcinomatosis and SAH, one case of COPD and one case of Diabetes Mellitus and SAH, one case of Sigmoid Adenocarcinoma. Recent studies show that the final sample patients with 49% have COPD, SAH, DM, that is, most of the time the patients are already diagnosed with some type of underlying disease (BAHLIS, 2018).

After the date of intubation, we obtained an average of 17 days until the date of diagnosis of the infection, with the shortest time of infection in 2 days, and the longest time of 68 days. Therefore, the data related to

the permanence time of the Orotracheal Intubation, Tracheostomy and Mechanical Ventilation device were analyzed. Figure 2 shows the distribution of patients with VAP according to the length of stay, with the average permanence of the devices in patients with VAP being 35 days. Patients lack a certain length of hospital stay and, on average, remained hospitalized for 60.7 days. In the research, the longest stay recorded was 195 days, and the shortest stay was 10 days. Some authors point out that there is a statistical basis in relation to the increased permanence of VAP. The disease has a favorable relationship to a longer duration of ventilatory support, in addition, they declare that a longer period of need for MV entails a greater risk of contracting VAP (SÃO PAULO, 2019).


Fig.2 - Distribution of patients with VAP according to length of stay. Cacoal, 2018

Source: Graph extracted from the questionnaire developed by the authors, 2019.

Regarding the outcome of the clinical course of patients hospitalized with PAV, the mortality rate was 41% due to PAV, however, 24% of the patients died of other complications, 35% were successful in the treatment and management of PAV and underlying pathology that led patients to need hospitalization in an intensive care setting, which can be seen in figure 3. It is important to note that, even having acquired PAV, this was not the cause of death in all cases, some cases were for other complications such as, multiple organ failure, septic shock, stroke.



Fig.3 - Distribution of the studied patients according to the clinical outcome in general. Cacoal, 2018.

IV. FINAL CONSIDERATIONS

Through this study it was possible to conclude that the ICU is an important unit for the local health system, where critically ill patients are admitted who, mainly, are hospitalized due to accidents or surgical specialties. The incidence of VAP analyzed in the Intensive Care Unit was 5.6 cases per 1000VM-day, which can be considered within the normal range, using several studies as reference. The mortality rate of VAP comprises 41%, being linked to patients with a more advanced age group and a longer time in the ICU and with MV.

Among other conclusions that can be drawn from this research is that there is a need to include technologies to provide diagnostic tools that are further improved and provided for in the main diagnostic protocols, which would include data on the epidemiological profile and a strengthening of patient care. In addition, it is understandable that there is a need in accordance with the rules for providing VAP for the adoption of prevention bundles, which are practices that have been proven to prevent VAP. Based on this epidemiological profile, it is believed that these indexes can be used in the preparation of health and class indicators in patient care in the ICU, in addition, outlining tactics for the prevention and treatment of this very serious condition affecting a large number of people.

We concluded that the objectives of this project were achieved, leading researchers and readers to understand the importance of the epidemiological clinical profile of patients who acquired VAP in a hospital unit, improving the quality of patient care, helping with strategies for treatment and prevention.

Therefore, this study can contribute to the creation of assessment instruments in nursing care, gaining gains in the evolution of patients' clinical condition, reducing mortality and hospital infection rates. However, we suggest the development of new similar studies, with new data, thus expanding on the impact on the care process in Intensive Care Units.

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Conceptual Approach on Effect of Various Concrete Grade in Outrigger and Wall Belt Supported System: A Perceptional Review Mohammad Bilal Rasheed¹, Sagar Jamle²

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Abstract— This paper briefs concerning purpose the effect of different grades of concrete which is used in building where outrigger and wall belt supported system with the help of analytical method by design software. In this paper also brief the effects of earthquake and non-earthquake actions of multistory building with different grades of concrete discussed in connection with outrigger and wall belt support system. The major principle of the review work is to study the effect of different grades of concrete in outrigger and wall belt support system multistory buildings in the view of various researchers. The study can also be useful for low as well as high seismic prone areas as well. The software analysis also been referred for the analysis in the research field. This study deals with the comparative analysis of the research trend on the current topic and after the survey, comprehensive outcomes are provided in conclusions that forms the objectives of the further upcoming study. Keywords— Concrete grades, Outrigger, Perceptional review, Seismic analysis, Wall belt supported system.

I. INTRODUCTION

In this era there are many multistory buildings that are constructed throughout the world. In the current circumstances of excess numbers of people and growing trend of lavish and attractive way of life in the quick rising nation, the structure sector faces new challenges gradually particularly the structural engineers to accomplish the dreams. To complete such type of require a variety of researchers have ended a lot of job and a lot fresh techniques are developed for every new generated trouble comprise of bracings, outriggers, RC shear wall and shear core, steel plate shear walls, box systems, base isolation, dampers, seismic invisibility cloak, rocking frame, etc. One of the answer adopted for our study for such type of troubles is outrigger system or we can say the appliance of this system i.e. use of shear wall belt at best height to make the construction competent of managing lateral loads developed due to seismic forces or may be due to wind effects in case of high rise building or twin tower or skyscrapers as per the need of hour. Here to face a lot of study work is done in the field of lateral load resisting system where a variety of such kinds of systems are analyzed next to a variety of constraints unconnectedly for specific circumstances and limitations. Shear wall and shear core both are optimized within the building against a variety of parameters but the use of shear wall as shear wall belt like outrigger beam system is not analyzed till now.



Fig.1: Multistory Building



Fig.2: Multistory Building

II. MULTISTOREY BUILDINGS

The paper is concerning various analytical approach for multistory building by consider seismic and non-seismic performance on multistory buildings. Also to find out the effect of different grades of concrete in outrigger and wall belt support system multistory buildings, till now, the design software has been used in the analysis. By using this scheme and analysis we can effortlessly find out the effect of different grades of concrete in outrigger and wall belt support system multistory buildings. it is actually vital analysis for multistory buildings because a lot of the multistory building are constructed in earthquake zones and several exclusive of earthquake zones so this analysis is significant for both. And it also can compact the expenditure of manufacture by knowing its consequences.

Outriggers:

Outriggers are the combination of members of beams or plates linked from the core to external columns in both the directions that hold the structure and act as frame connections. The core provided such as shear wall core holds the whole construction resolutely that accepts the loads and transmit the loads uniformly to the external columns. This system provides more rigidity to the structure than conservative frame systems.

Belt supported system:

The mainly proficient system used in high rise building is the bracing system moreover it is wall belt or truss belt system. This system is the link of the members to the nodes of the construction. It is called as belt supported system because the belt usually made up of trusses or shear wall, connects the outside edge columns of the construction. The load moves from each member spread to the connected construction equally.







Fig.4: Structure with Wall Belt

III. LITERATURE REVIEW

In this paper researcher analyze the stability of twins floor of 12th floor and its effects on twins tower buildings during seismic effect. It is so significant to verify all probable seismic loadings and performance of reinforced concrete Because of it help to design the construction system and also to oppose seismic effects. Seismic load effects have also a significant factor in all type of usual building counting skyscrapers (Neeraj Patel et. al.).

The paper briefs about structure using shear core outrigger, wall belt and truss belt systems. Base Shear show smallest amount response value other than common construction which seems very proficient under seismic result is Regular structure with shear core. Overall revision said that Wall belt system is more efficient than truss belt system which has seen in this exertion (Archit Dangi et. al.).

The paper state that In the This study is based on the use of shear belt at optimum height in multistory building. By exploring many research papers, it is highly recommend increasing lateral load handling capacity when considering tall structures. Expected conclusion to optimum height in multistory building with using shear belt (Neeraj Patel et. al.).

This paper includes use of response spectrum in with and without opening dual configuration multistoried building also comparing with five other different building to analyze efficiently it is found from study that when there will be excess use of opening beyond the 20% limit, the stiffness of the structure will be less and the structural component will be fail (Prafoolla Thakre et. al.).

Shear walls provide strength to the structure. Because of its importance we used it in high rise buildings. The buildings are of different-different shapes and differentdifferent sizes which affect its strength with respect to seismic loads. Therefore a study and analysis is done on the safety of buildings against seismic loading and how shear wall helps to resist the seismic loads (Prafoolla Thakre et. al.).

From the review of this paper 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 (Prafoolla Thakre et. al.).

Now days to improve the strength of concrete there are many methods and new techniques available. Use of waste material is one of them silica fume, fly ash, blast furnace, steel slag is one of them. They also used as additional cementitious materials. The most popular and successful material is silica fume because of its property to increase the strength of concrete. It improves concrete tensile and flexural strength. In this research the cement is replaced by silica fume and many tests is done to find out the strength of concrete (Prabhulal Chouhan et. al.).

It is necessary now to strengthen concrete for the construction work. The concrete should be high in strength and durability. To increase its strength and durability a research has been done. In this research cement is replaced by polyethylene glycol-400 at different-different

percentage and the results show that it gives more strength than concrete (Prakash Mandiwal et. al).

Researcher state that for improving the concrete using PEG-400. It shows, it gives more strength than concrete. Determine the tensile strength & durability of concrete using PEG-400. To conclude the results of tensile strength & Durability of conventional concrete & self-curing concrete (Prakash Mandiwal et. al).

The researcher state that their studies analyzed with the different parameters of design software model with different grades like stresses displacements base shear etc in longitudinal and transverse direction. After this, the most efficient grading will be analyzed after all parameters. There are total 5 grades of structure multistoried building at medium soil condition under seismic forces for earthquake zone III exist (Mahendra Kumawat et. al.).

This paper summarizes that it is really important to use analytical methods before construction of multistory buildings in seismic and non-seismic areas. By reviewing all the papers we can easily understand the importance of analytical methods. We can easily calculate the effect of seismic loading by using the software's like Staad pro and E-tabs before construction of multistory buildings. Calculation and modeling is the main purpose of the conclusion (Abrar Ahmad et. al.).

IV. CONCLUSIONS AND OUTLINE OF PROPOSED WORK

As per the conduction of literature survey, following conclusions are evolved:-

- 1. This paper state that the importance of different grade of concrete for the enhancement of performance of concrete structure.
- 2. This paper also summarizes that the outrigger and wall belt support system is making efficient structure by using the technology.
- 3. The effect of different grade of concrete in outrigger and wall belt supported system should also consider.
- 4. Dual structural system should make an extra effort in making the grade change of concrete.
- 5. The structural efficiency should also been taken into account.

The main focus is to check the dual system with different grades of concrete in Outrigger and Wall Belt Supported System that has going to be a major study for upcoming proposed work.

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Characterization of silicon-manganese iron slag for employment in base and sub-base layers for highway

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Abstract— The impact generated by the waste from the steel industry has prompted a series of discussions about the most environmentally friendly forms of final destination, such as reuse of byproducts resulting from the process of metal alloy generation. This is even more relevant after the environmental disaster in the state of Minas Gerais, Brazil, in 2015, when a tailings dam broke, causing widespread destruction of towns and pollution of rivers. To mitigate these problems, this paper presents the results of ongoing studies for the characterization of siliconmanganese iron slag and its potential application in mixtures with soil for the construction of base and subbase layers of highway pavement. Some methods used are traditional, such as measurement of granulometry, bulk density, absorption and Los Angeles abrasion. Others have more recently been applied to characterize aggregates, like scanning electron microscopy (SEM) and aggregate image measurement (AIM). Complementarily, due to the vitreous appearance the slag, ductility results are reported, obtained according to degradation after Proctor compaction testing and determination of shock loss in a Treton apparatus. Finally, the results already obtained, along with those of studies with the same material for rail ballast and asphalt concrete, show that siliconmanganese iron slag presents geotechnical properties compatible with those established in the specifications for use in base and subbase layers of highways.

Keywords—base and subbase layers, highway, pavement, silicon-manganese iron slag.

I. INTRODUCTION

Road construction is an activity in which natural resources are more often used in comparison with other sectors of civil engineering. Large amounts of natural materials such as gravel, rock and sand are used to build and repair roads and highways. In this sense, sustainable development requires more efficient management of waste for preservation of the environment [1].

In recent years, investment in solutions for industrial waste recycling has been intensifying in many countries. Several companies have been investigating technology to reuse industrial waste to enhance the efficiency of production systems [2].

This article characterizes the silicon-manganese iron slag produced in electric furnaces for use in road pavement layers, in the region of the state of Minas Gerais (Brazil) known as the "Iron Quadrilateral", composed of the municipalities of Santa Bárbara, Mariana, Ouro Preto, Congonhas and Itabirito. This is done by reporting technical parameters obtained through testing, as defined by the current standards from Brazilian and foreign institutes

II. LITERATURE REVIEW

Initially, some definitions should be described. According to Law 12,305 [3], solid waste is material that still has some value for use, through available and economically feasible technology, even for a purpose different from that originally planned. Tailings, on the other hand, are characterized as solid wastes which, after exhausting all possibilities of treatment and recovery by available and economically feasible technological processes, present no possibility other than the final environmentally appropriate disposal. Therefore, using the definition of [4], which treats slag as solid waste from the melting of metals or from the combustion of certain materials, it can be concluded that the elements resulting from steel processing can sometimes be classified as waste and at others as tailings. The waste material analyzed here is slag, which results from a process where the combination of metal and non-metallic compounds is heated to the melting point. Some efforts have been made to reuse it, in particular as layers for road paving.

Many companies are engaged in turning materials classified as byproducts - compounds produced as a waste during the production process - into co-products, that is, materials characterized as desirable secondary goods that are generated during the manufacturing process and can be sold or reused profitably [5]. Co-products of the steel industry have been studied extensively by the world's largest steel producer, China Steel Corporation [6]. The applications vary according to the generation of slag, but the residues are basically used in the composition of cement and concrete, bricks, road construction and landfill cover [7]. In Europe, besides these uses, there are also applications in hydraulic engineering, fertilizers, and internal use in metallurgical processes [8]. Studies in Germany for use of byproducts of steel production as raw materials in road construction [9] have found technical advantages such as avoidance of emission of pollutants and climate impact by use of slag in road construction. In France, [10], in a doctoral thesis, studied slag from the production of siliconmanganese alloys for various potential uses. In Australia and Asia, interesting options have been tested, such as for making rock wool, drains for groundwater treatment and geopolymers [11]. In Japan, slag has also been used for highway paving, cement, soil stabilization and concrete aggregates, among others [12]. In the United States, slag has also been used as railroad ballast, for levee construction, erosion control and containment structures, among other solutions [13].

In Brazil, studies such as those by [14], [15], [16], [17] and [18] have shown possible uses as artificial aggregate in engineering structures such as highways and railroads, as well as in the production of cement.

According to the [19], pavement is a structure built after the embankment and destined to resist and distribute to the subgrade the vertical forces generated by traffic; improve rolling conditions for convenience and safety; and resist the horizontal stresses acting on it, making the rolling surface more durable [19]. In this paper, the objective is to characterize silicon-manganese iron slag to verify, in addition to other parameters, its resistance, i.e., the ability of the slag to compose the pavement structure to resist the loads from traffic applied on it.

[15] reported mechanical characteristics of asphalt mixtures using manganese ferroalloy slag from the Simões Filho region (Bahia) as an aggregate. Initially, the slag was characterized physically, mechanically and chemically, as described in the specification standards of the National Department of Roads and Highways (DNER) in the standards DNER-ME 260/94 and DNER-ME 262/94. As complements, scanning electron microscopy (SEM) and Xray dispersive energy (EDS) tests were carried out to determine the shape and chemical composition of the materials. In addition, the environmental impacts were analyzed through solubility and leaching tests. Finally, due to the known problem of slag expansion, testing was performed according to the Pennsylvania Test Material standard (PTM 130). Once characterized, the material was mixed with crushed stone powder and CAP 50/60 (now CAP 50/70) for the manufacture of hot-rolled bituminous concrete. In addition to the test specimens produced in the laboratory, samples were analyzed in the field by using the mixture on Avenida Dom João VI, in collaboration with the Salvador municipal government. The technical results validated the use of manganese ferroalloy slag for asphalt coating, and environmental tests showed that the slag is classified as Class II - not inert.

[17] carried out the physical, mechanical, chemical, mineralogical, environmental and electrical characterization of silicon-manganese iron slag for application as an aggregate in railway paving in state of Minas Gerais. The material analyzed presented higher values than the minimum limits prescribed by national and international technical standards, showing that silicon-manganese iron slag is a good substitute for the rock materials used for rail ballast.

The consolidation of the use of slag as a co-product is shown through the standards created to standardize its use: NBR 5735/1991 - Portland cement from blast furnace; DNIT-113/2009 - Road Paving - Artificial Aggregate -Evaluation of the expansion potential of steel slag; DNIT 114/2009 and DNIT 115/2009, which deal with the use of slag in the base and subbase structures; DNIT 406/2017 -Road paving – Base granulometrically stabilized with Açobrita®; and DNIT 407/2017 - Road paving - Subbase stabilized granulometrically with Açobrita®.

The silicon-manganese iron slag analyzed here is produced in the region of the city of Barbacena, Minas Gerais, located near to the "Iron Quadrilateral". It is the residue of a ferroalloy, an essential input used in the steel industry, both in the basic processes and in refined aggregation to produce special steels [17]. Ferroalloys are iron alloys with other metals, in which the content of other metals is higher than the iron content. The purpose is to impart certain properties to the steel. The other metals used are nickel, manganese, chromium, tungsten, niobium and titanium. Manganese, added in the form of ferroalloy, assists in the refinement of the grain structure, increasing the mechanical strength and improving the temperability and the ductility of the steel [20]. The slag is generated during the production of the ferroalloy in submerged arc electric furnaces. Removal of the slag is intended to remove impurities from the furnace. It occurs throughout the process, since during the smelting and refining steps, some of the scarified impurities tend to return to the alloy [17]. There are two types of slag formed by the described production processes: rich slag, which is acidic, has high Mn content (greater than 40%); and poor slag, which is basic, has low manganese content (MnO <20%) and about 30% Si. The latter is produced during the upgrading the standard alloy by adding silicon waste, and is discarded at the end of the ferroalloy production process [17].

This study presents technical parameters to evaluate the possibilities of using silicon-manganese iron slag in road pavement structures.

III. METHODOLOGY

The material studied is produced by a steel company located in the city of Barbacena, state of Minas Gerais, Brazil. Currently, this residue is stored in piles at the mill, and comes from the process of making ferroalloy. To perform the experiments, samples were collected in sufficient quantities for the physical, mechanical and chemical characterization in the laboratories of the Military Institute of Engineering (IME), in the city of Rio de Janeiro.

For the evaluation of the material, the main methods specified in Brazilian standards for validation of employment in road structures were applied, such as particle size analysis (DNER-ME 083/98), determination of absorption and bulk density (DNER-ME 081/98), and Los Angeles abrasion determination (DNER-ME 035/98). These tests were carried out at the Soil Laboratory of the Military Engineering Institute. In addition, complementary tests were carried out, such as mineralogical composition through energy dispersive spectroscopy (EDS) and scanning electron microscopy (SEM), both at the Materials Laboratory of the IME. Shape, texture and sphericity were determined by an aggregate image measurement system (AIMS) in Laboratory of Federal University of Rio de Janeiro. Due to the vitreous aspect of the material, tests of the degradation index after Proctor compaction (DNER-ME 398/99) and determination of shock loss in a Treton apparatus (DNER-ME 399/99) were performed at the IME Pavement Laboratory.

3.1 Granulometry

Granulometry is the size and weight distribution of the particles that compose an aggregate. This distribution is

ascertained when the sample is passed through a series of sieves, whose meshes are standardized, and the result of this process is represented graphically through the granulometric curve. This curve is then compared with intervals called sieve ranges, which have the objective of determining the resistance through interlocking of the grains. In the present study, the material was processed using the standard series of sieves: 19 mm, 9.5 mm, 4.8 mm, 2.4 mm, 1.2 mm, 0.60 mm, 0.30 mm and 0.150. Due to the crushing cost, the material had been produced with large aggregate diameters, since the purpose of the company is only to store this material in piles. Equations (1) and (2) were used in this test, as shown below:

$$\% Retained = \frac{Retained weight}{Total weight of sample}$$
(1)

%Passed = 100% - % Retained Acumuled (2)

3.2 Bulk density of coarse aggregate and absorption

The bulk density of the aggregate, obtained by the relation between the weight of the dry aggregate and its volume, is the parameter used as reference for the weight of the material, to be used either in asphalt mixtures or in base and subbase layers. In turn, absorption is determined by the increase in weight of the aggregate due to the filling of its permeable pores (voids) by water, allowing analyzing the porosity of the aggregate, both to verify its resistance and to measure the consumption of binder (e.g., paving asphalt cement), when used as aggregate in asphalt mixtures.

According to standard DNER-ME 081/98, equation (3) defines the bulk density:

$$D_b = \frac{W_s}{W_h - \nu} \tag{3}$$

 D_b is bulk density;

 W_s is weight, in air, of the aggregate dried in drying oven, in g;

 W_h is weight, in air, of the aggregate in the dry surface saturated condition, in g;

v is the scale reading corresponding to the submerged aggregate - hydrostatic weight, in *g*.

For Absorption, the expression (4) used is:

$$a = \frac{W_h - W_s}{W_s} \times 100 \tag{4}$$

a is absorption, in percentage.

3.3 Determination of Los Angeles Abrasion Value

The Los Angeles abrasion is a measure of the resistance to surface wear of the aggregate grains when subjected to friction. Thus, the assay measures the aggregate's ability to remain unchanged when handled. The test consists of depositing a certain weight of aggregate, with known granulometry, inside a cylindrical drum together with cast iron balls.

The drum is then revolved at the rate indicated in the standard, and after being removed from the drum, the material is washed through a 1.7 mm sieve and then dried in an oven. Finally, the dried sample is weighed.

For this study, Grade A was used the standard DNER-ME 035/98 - Determination of Los Angeles Abrasion Value.

3.4 Mineralogical Analysis

For mineralogical analysis, X-ray dispersive spectroscopy (EDS) was used, consisting of microanalysis to obtain qualitative and quantitative (in micrometers) chemical information, obtained by the detection of X-rays resulting from the interaction between the primary beam and the sample. In EDS analysis, a semiconductor material is used to detect X-rays and a multi-channel analyzer, which converts X-ray energy into an electronic output, resulting in a spectrum representative of the chemical analysis of the sample. The equipment used was the a JEOL 5800LV.

3.5 Scanning Electron Microscope (SEM)

For the analysis of the microstructure, scanning electron microscopy (SEM) was used, in which images with up to 8000x magnification were generated. The results of this test allow analyzing the shape and size of the grains and voids, as well as their arrangement on the surface of the sample. The use of EDS together with MEV is of great importance in the petrographic characterization and petrological study in geosciences, since the first one allows the identification of the elements that compose the sample and the second provides clear images of the microstructure

3.6 Aggregate Imaging System (AIMS)

The aggregate imaging system (AIMS) was developed to capture images and analyze the shape of a wide range of aggregate types and sizes, including those used in asphalt mixes, hydraulic cement concrete, and unbound layers of pavements [21]. This system is used to analyze the shape, texture and angularity of aggregates, leading to a new aggregate classification based on the distribution of the shape characteristics.

Angularity (or roundness) measures the difference between a particle's radius in a certain direction and that of an equivalent ellipse. The equivalent ellipse has the same aspect ratio as the particle, but it has no angularity. Sphericity – or particle form [22], or shape [23] – is the parameter that classifies the aggregates as by their shape. This is a dimensionless parameter that varies between 0 and 1, whereby aggregates with indexes close to 1 have optimal sphericity and aggregates with indexes close to 0 have low sphericity, that is, they are more layered than spherical [24]. Surface texture is used to describe the surface irregularity at a scale that is too small to affect the overall shape or angularity [23].

Table 1 shows the limit values and classification for aggregate shape properties:

| Property | Limit values / Classification | | | | | | |
|--------------------|-------------------------------|----------------|---------------|------------|-----------|--|--|
| Sphoricity | <0,6 | 0,6 - 0,7 | 0,7 - 0,8 | > 0,8 | - | | |
| (coarse aggregate) | Flat Elongated | Low sphericity | Moderate | High | - | | |
| | | | sphericity | sphericity | - | | |
| Angularity | < 2100 | 2100 - 4000 | 4000 - 5400 | > 5400 | - | | |
| (fine and coarse | Rounded | Sub Rounded | Sub Angular | Angular | - | | |
| | | | | | - | | |
| Texture | < 165 | 165 - 275 | 275 - 350 | 350 - 460 | > 460 | | |
| (coarse aggregate) | Polished | Smooth | | Moderate | High | | |
| (| ronsneu Sinootii | | Low Roughness | Roughness | Roughness | | |

Table 1: Limit values and Classification for Aggregate Shape Properties. Adapted from [28]

Degradation index after Proctor compaction and shock loss in Treton equipment

The Proctor compaction degradation index (ID_p) and the shock loss determination in the Treton device are used analyze the characteristics regarding toughness, abrasion resistance and hardness of aggregates. The indications of these tests as well as limit values adopted for them were obtained from a study conducted by the Road Research Institute (IPR-DNER), as reported by [25]. Although the value found for the silicon-manganese iron slag was satisfactory for the abrasion test, we considered it important to validate the results by other analyses due to the vitreous aspect of part of the material, and its microstructure similar to cleaved planes.

The Proctor compaction degradation index is measured by washing and oven drying the sample at a temperature of 100 to 105 °C and then determining the weight of the particles from specimens used in the Proctor compaction test. After 24 hours, the material is passed through the same standard series of sieves, and weights the material retained are measured. The index is calculated by expression (5):

$$ID_p = \frac{\sum D}{4} \tag{5}$$

 ID_p is Index of Degradation

D is difference between Avarage of samples and Original Granulometry

Shock resistance is an index used for the differentiation of materials used as ballast in train tracks, since this material is subject to large forces during the passage of the train. Since this work is aimed at evaluating the use of silicon-manganese iron slag in road paving, the reference value for this test presented by the Road Research Institute (IPR) for validation of material is used. Using the Treton apparatus, about 20 grains make up the sample, whose diameter is between 16 and 19 mm. They are subjected to 10 strikes by a hammer weighing 16 kg at a height of 380 mm. The loss of mass is calculated with equation (6):

$$T = \frac{M_r}{M_i} x 100 \tag{6}$$

T is loss to shock (Treton), expressed as a percentage;

 M_r is weight of the material retained in the sieve 1.7mm, in g;

 M_i is initial weight of the material, in g.

IV. RESULTS

4.1 Granulometry

As a reference, "Range A" of the Brazilian National Department of Transport Infrastructure - DNIT (Granulometrically Stabilized Base - DNIT 141/2010) was used. This is shown in the graphs of Figure 1 by the two continuous lines, called DNIT Max and DNIT Min. As can be observed, the composition of the material presents predominantly large grains, consistent with the policy adopted by the company generating the waste of reducing cost of crushing. If a form of grain reduction is not feasible, an option for the use of this material would be for mixture with soil. The results are shown in Figure 1.



Fig. 1 – Result of Granulometry of Sample 01, 02 and 03

4.3 Bulk density of coarse aggregate and absorption

The density of the aggregate found was $2.94 \text{ g} / \text{cm}^3$ and the absorption was 0.44%. This density is very close to that (2.96 g / cm³) of the silicon-manganese iron slag studied by [17], whose material was obtained from the same company generating the slag analyzed here, but at a mill located in another city in Minas Gerais. The value is also close (2.92 g / cm³ for granulometry from 0 to 3/8 ") to that found by [15], who analyzed manganese ferroalloy slag for use in asphalt coating.

Finally, when compared with granite gneisses from the state of Rio de Janeiro analyzed by [26], where values of 2.62 and 2.64 g / cm³ were found, the material has a value higher than natural aggregate. However, silicon-manganese iron slag has lower density when compared to steel slag, whose values are above 3.0 g / cm³, according to [14].

For absorption, the values found by [17] and [15] were higher than 1.0%.

3.7 Determination of Los Angeles Abrasion Value

The value of 25.53% for abrasion is within the limits established by standards DNIT 141/10 - Granulometrically stabilized base, DNIT 406/17 – Base granulometrically stabilized with Açobrita® and DNIT 407/17 - Subbase granulometrically stabilized with Açobrita®, all of which define 55% as the maximum abrasion for an aggregate to be used in pavement layers. In addition, silicon-manganese iron slag is also suitable according to DNIT 115/09 – Base granulometrically stabilized with steel slag - Acerita® and DNIT 114/09 – Subbase granulometrically with steel slag - Acerita® and DNIT 114/09 – Subbase granulometrically with steel slag - Acerita®, which define the abrasion limit as 40%.

3.8 Mineralogical Analysis

There are two types of slag formed by the siliconmanganese iron (FeSiMn) production processes. The first is rich slag, which is acidic, has high Mn content (above 40%) and very low phosphorus content, being recyclable and reused as an input in FeSiMn production. This slag is subject to vitrification, which decreases its resistance and makes it dangerous to handle. The second is poor slag, which is basic, has a low manganese content (MnO <20%) and about 30% Si, produced by upgrading the standard alloy by adding silicon waste from ferrosilicon production, while that from ferroalloy production is discarded [27].

Due to the heterogeneity of the material, the EDS test was performed in two distinct regions of the aggregate, which are indicated by the two rectangles in Figure 5. According to the result obtained, the main elements that form the silicon-manganese iron slag are carbon, oxygen and silicon, followed by calcium, manganese and aluminum (Figure 2). Thermogravimetric analysis (TGA) was performed to ascertain how these elements are grouped into compounds, and thus to define more clearly the mineralogical composition of the slag.



SE MAG: 18 x HV: 30.0 kV WD: 13.7 mm Fig. 2.a: EDS test image result – two areas analyzed







The mineralogical determination is relevant since according to Oliveira (2013), the main problem in the use of slag in pavement is its expansive characteristics, due mainly to the hydration of free lime (CaO) and magnesium oxide (MgO) and the corrosion and oxidation of the residual iron, generating internal stresses that cause cracking and even fragmentation of the material, caused by expansion. Therefore, the determination of the quantity of these elements helps to predict the potential for expansion of the material.

Since [15] also used silicon-manganese iron slag, as referenced by [17], it is possible to adopt the value found according to PTM 130/78 (Pennsylvania Test Method) for the material under study. As can be seen in the graph below, the expansion can be considered to be 0%.

On the possible environmental impact of siliconmanganese iron slag disposal, [17] presented an official letter from Brazilian Institute of Environment (IBAMA) approving the use of silicon-manganese iron as slag as railway ballast. Also, in this work, the silicon-manganese iron slag sample was classified as Class II A (non-hazardous - not inert) because it had solubilized aluminum content above the maximum allowable limit.

3.9 Scanning Electron Microscope (SEM)

The slag studied has distinct characteristics from electric arc furnace slag. The main differences are the greenish color, smooth surface, glassy aspect and the small number of fines. Some of these characteristics can be clearly noticed when comparing images of the microstructures of the two materials, according to the following figures. The quantity of voids is markedly lower in the silicon-manganese iron slag, explaining the more compact appearance of the material. In addition, the material is formed by layers (structure similar to cleavage planes), suggesting that the rupture occurs by shearing. Figure 3 shows the difference between arc furnace slag and silicon-manganese iron slag.



Fig. 3: Macro and microstructure of steel slag (upper), RODRIGUES, 2007 (1000x); Macro and microstructure of silicon-manganese iron slag (lower) (1000x).

3.10Aggregate Imaging System (AIMS)

Graphs 1.a, 1.b and 1.c below show the aggregates shape properties. In the legend, the word *Escoria* means slag.

According to Graph (1.a), the material, in general, can be classified as subrounded, since more than 90% present angularity index greater than 2100, where 52% is classified as moderate.

According to technical specification from the Department of Roadways of São Paulo (ET-DE-P00/008) and the national standard (DNER-ME086/94), the sphericity (shape index) of aggregate should be equal to or greater than 0.50. As can be seen in Graph (1.b), more than 90% of the samples meet this requirement, the exception being the aggregate with 4.75 mm. In addition, the standard recommends that less than 10% should be of lamellar particles, so the aggregate analyzed also meets this specification.



GRAPH 1.a: Angularity Distribuition



GRAPH 1.b: Sphericity Distribuition



GRAPH 1.c: Texture Distribution

The texture (Graph 1.c) is closely linked to the frictional force, and the greater the surface roughness, the greater the resistance to permanent deformation, since the frictional force between the grains will be higher. A granular material is typically rougher after crushing [26]. The results show that more than 70% is greater than 200, and 55% is classified as moderate.

Some studies, such as [26] and [28], have been performed to establish reference parameters for angularity and texture, which are linked to resistance.

4.8 Degradation index after Proctor compaction and shock loss in Treton equipment

The degradation index test was performed after measuring the California Bearing Ratio (CBR) test, the pellet being subsequently passed back through the sieves used for sample separation. As a result, an IDp of 0.26 was obtained, that is, the material degraded in the sieves with larger diameters was retained in the smaller sieves. The results are reported in Table 1:

Table 2: Summary of the results of the ID_p .

| | % Passed | | | | | | | |
|--------|-----------------------|---------------------------------|----------|----------|----------|----------|---------|---|
| Sieves | Original Granulometry | y Granulometry after compaction | | | | | | |
| | | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 | Average | |
| 19mm | 68 | 83 | 78 | 79 | 84 | 86 | 82 | |
| 12,5mm | 64 | 68 | 63 | 67 | 69 | 71 | 68 | |
| 9mm | 62 | 59 | 54 | 57 | 60 | 61 | 58 | |
| nº 4 | 60 | 48 | 44 | 46 | 48 | 50 | 47 | - |
| Sum D | | | | | | | | |
| | | | | | | | IDp | |

Based on the Methods for Testing Mechanical Characteristics and Values for Acceptance of Aggregates of [29], whose limit for ID_p is equal to 6, it is possible to affirm that the material is acceptable.

Graph 2 above shows that, in a relatively proportional way among the samples, the coarse aggregate (between 19 mm and 12.5 mm) assumed smaller grain sizes, from 12.5 mm to 4.8 mm. According to Graph 3, the greatest degradations occurred in the sample with optimal moisture (Sample 5), followed by the samples with lower moisture (Samples 1 and 4), and finally the smallest weight losses occurred in the larger aggregates (Samples 2 and 3). It is interesting to observe that the curve defined by the comparison Moisture x Degradation (Graph 5) presents a shape similar to the compaction curve (Procter moisture content x Maximum density). Finally, the greatest degradation is precisely in the ideal conditions for use in pavement. Therefore, it is prudent to take the necessary precautions to protect the grains when compaction is performed.





GRAPH 2: The graphic (upper) shows the granulometry of aggregates after Proctor compaction. The second graph (lower), shows the relationship between humidity and degradation.

A similar analysis was performed about geotechnical characterization of silico manganese slag for civil engineering applications, where [30] presented the results of silicon-manganese slag granulometry before and after compaction. In that study, the percentage of large particles decreased from 15% to 0%, the sand increased from 84% to 97%, and fines from 1% to 3%.

For the Treton test, shock loss was 8.88%. As reference, the value of 60% is the maximum admissible loss, described by the Institute of Road Research [29] in its Test Methods for determination of mechanical characteristics of aggregates and acceptance values, in the book Asphalt Paving: Basic Training for Engineers [25]. The material tested here is thus acceptable for use in pavements.

V. CONCLUSION

This purpose of this study was to characterize siliconmanganese iron slag, using methods, standards and tests, to analyze the technical feasibility of using this material in road pavement layers.

The granulometry has predominantly coarse grains, so the addition of soil is advantageous to adjust the slag grain size. Bulk density values are similar to those found by others authors, and higher than natural coarse aggregates. The Los Angeles abrasion value is according Brazilian standards for use in base and subbase layers. Regarding mineralogical analysis, the silicon-manganese iron slag is mostly composed of carbon, oxygen and silica, followed by lesser quantities of calcium, manganese and aluminum. Expansion, according [15], is zero. [17] classified the material as Class II A (non-hazardous- not inert). Scanning electron microscopy revealed the structure is more compact than steel slag, and is similar regarding cleavage planes. The AIMS analysis indicates the angularity is rounded; the sphericity is according to the values of Brazilian standard for use in base and subbase layers; and the texture is classified as moderate. Regarding the degradation index after Proctor compaction and shock loss measured by the Treton equipment, both results for silicon-manganese iron slag are within the parameters defined by the Brazilian Institute of Road Research for use in pavement structures.

Finally, in view of the results presented by the tests and methods used, the silicon-manganese iron slag is feasible for use to pave roads.

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Profile of Pregnant Women Served in a family Health Strategy in Belém-Pa, Brazil

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Abstract— Objective: This research aims to monitor the profile of pregnant women attended by a Family Health Strategy (ESF) team. Method: Exploratory, retrospective study of document analysis, with a quantitative approach. Results / discussion: the medical records of 74 pregnant women registered at the FHS in Belém-Pará were evaluated, where it was possible to analyze the general profile of the pregnant women. Conclusion: based on the knowledge of the profile of these pregnant women, health professionals should rethink actions aimed at this target audience, especially in carrying out educational activities that help or develop a healthy pregnancy.

Keywords— Pregnant. Prenatal. Epidemiological profile.

I. INTRODUCTION

One of the most important stages in the life of any woman is the pregnancy that corresponds to the period before birth, that is, the development of the embryo. The gestational period is a moment characterized by physical changes accompanied by physiological and emotional changes.

In view of the above, the Ministry of Health (MS) instituted the Prenatal and Birth Humanization Program (PHPN), through Ordinance / GM No. 569 of 2000, which administers the duty and the right to prenatal care (PN) dignified and qualified throughout the period of childbirth, birth and puerperium¹.

Prenatal care stands out as a key factor for both protection and prevention against adverse events during pregnancy, as it allows the identification and clinical management of timely interventions on potential risk factors for complications of the mother-fetus binomial. The failure or inadequate performance of this assistance is related to high rates of maternal and child morbidity and mortality².

To meet the principles of integrality and improve prenatal care in our country, the Ministry of Health implemented in 2000 the Humanization Program for Prenatal and Birth, which determines that Brazilian municipalities must overcome this challenge and meet the minimum recommendations to offer quality care, through actions such as: establish universal coverage, favor and promote early the initiation of prenatal treatment, implement preventive and curative actions through an integrated health network, hold at least six consultations and guarantee their frequency, perform clinical and laboratory procedures and promote educational activities³.

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The Family Health Strategy (FHS) was created in Brazil, in 2006, as an assistance system with the use of restructuring primary health care. For the FHS to act in line with the fundamentals of the Unified Health System (SUS), it must have a multidisciplinary team. Each ESF team will be responsible for welcoming and accompanying the pregnant woman from her micro-area and the capture of this pregnant woman must occur until the fourth month of pregnancy, by the Community Health Agent (CHA) or by the direct search of the woman with suspected pregnancy, directly accessing the health team⁴.

The importance of knowing the population served by the FHS, such as pregnant women, allows the planning of actions, the definition of priorities and interventions, directing the pregnant woman in the way that best suits the identified profile⁵. Thus, the object of study of the present research is the identification of the profile of the managers attended by a team of the Family Health Strategy in the city of Belém, Pará.

Given the above, this study aims to outline the profile of pregnant women attended by a Family Health Strategy team, in the neighborhood of Guamá, in the city of Belém do Pará.

II. METHOD

This research is an exploratory, retrospective document analysis research with a quantitative approach, which will have the purpose of identifying the profile of pregnant women, carried out in a family health strategy in the city of Belém-Pará, which serves 2,170 inhabitants and has 80 pregnant women enrolled in the prenatal program, the study was carried out in 2018. The research subjects consisted of 74 pregnant women with medical records registered at the FHS of Riacho Doce, who started prenatal care in 2018 and were attended by the teams of this health establishment. Pregnant women with mental illness were excluded from the study and those characterized as high-risk pregnancies.

Qualitative data from the ready-to-use tests were analyzed in the chi-square adherence test⁶. The alpha level = 0.5 (alpha error 5%) was adjusted to reject a null hypothesis. The biostatistical project was carried out in the software dEasygner and the program BioEstat version 5.3 was used for the application of hypothesis tests.

The research was sent to the Ethics Committee of the University Center of the State of Pará, according to the ethical-legal precepts, the research met the norms of Resolution No. 466/2012 of the National Health Council, where it obtained approval from the Ethics and Research Committee from Centro Universitário do Pará. Under opinion nº: 3,189,267 CAAE: 08052318.6.0000.5169. In order to maintain the anonymity of the information collected, the identities of the participants were kept anonymous by using codes such as: A1, A2, A3, A4..., following the order of data collection from the medical records.

Table 1 - General profile of pregnant women attended by a family health strategy team, in the neighborhood of Guamá, inthe city of Belém-Pa, year 2018.

| Feature | Ν | % | p-value |
|-----------------|----|------|-----------|
| Marital status | | | 0.0058 * |
| Married | 17 | 23.0 | |
| Single | 36 | 48.6 | |
| Stable | 17 | 23.0 | |
| SIC | 4 | 5.4 | |
| Family income | | | <0.0001 * |
| Without income | 4 | 5.4 | |
| Up to 1 salary | 38 | 51.4 | |
| 2 to 4 salaries | 17 | 23.0 | |
| > 5 salaries | 0 | 0.0 | |
| SIC | 15 | 20.3 | |
| Age of menarche | | | 0.0330 * |

| 9 | 2 | 2.7 | |
|-----------------------|----|------|-----------|
| 10 | 1 | 1.4 | |
| 11 | 7 | 9.5 | |
| 12 | 8 | 10.8 | |
| SIC | 56 | 75.7 | |
| Number of deliveries | | | 0.7133 |
| No delivery | 28 | 37.8 | |
| A delivery | 23 | 31.1 | |
| Two deliveries | 23 | 31.1 | |
| Family background | | | 0.2332 |
| SAH | 17 | 23.0 | |
| DM | 9 | 12.2 | |
| SAH + DM | 17 | 23.0 | |
| Twinning | 19 | 25.7 | |
| Others | 12 | 16.2 | |
| Gestational trimester | | | <0.0001 * |
| 1st quarter | 41 | 55.4 | |
| 2nd quarter | 29 | 39.2 | |
| 3rd quarter | 4 | 5.4 | |
| | | | |

Source: Prepared by the authors.

Table 1 shows the general characteristics of the pregnant women with an emphasis on marital status, family income, age at menarche, number of births, family history and gestational trimester. The predominant characteristics are related to the marital status, family income and gestational quarter of these women, it was evidenced, respectively, that more than half are single (48.6%), the family income of these women up to 1 salary (51.4%) and started prenatal care in the 1st gestational trimester (55.4%). As for the number of parturitions, (37.8%) they did not have any birth, and those who had one or two parturitions had the same results (31.1%). Regarding the result of menarche age, it was observed that the vast majority of medical records did not have collected information (75.7%).

Regarding marital status, the highest percentage corresponds to single pregnant women (48.6%), this is an important aspect to be considered, since the absence of the father, in general, brings less economic stability to the family and single women who have a three times greater risk of not having prenatal care when compared to those who have a stable relationship. The lack of contact with the baby's father, together with low maternal education, contributed both to not seeking care and to carrying out fewer consultations during pregnancy7.

Regarding family income, it can be said that pregnant women have low economic power, since the majority (51.4%) reported having an income of up to 1 minimum wage and some reported not having any type of income (5.4%). Analyzing this data is important, since it represents a health indicator, since lower economic conditions lead to greater restriction of access to health services and is considered a risk factor for complications during pregnancy. Thus, income is a factor that may influence the planning of pregnancy, as well as the performance of prenatal care8.

With regard to women in the group in relation to the age of menarche, the result was that 75.7% did not have information in the medical record. However, from the results collected, the age of menarche at 11 years old corresponds to 9.5% and at 12 years old to 10.8% of the total.

The lack of information in the data referring to the age of menarche in the medical records analyzed is detrimental to the studies, since the age of menarche is closely related to the beginning of early sexual life. Currently, adolescents are starting their sex life earlier and this results in a significant increase in the risk of acquiring a sexually transmitted infection (STI) and/or an unplanned pregnancy⁹. Regarding the family history of the pregnant women analyzed, the most routine results were: twin pregnancy, Systemic Artistic Hypertension (SAH) combined with Diabetes Mellitus (DM) and only Systemic Arterial Hypertension (SAH), it was shown that, respectively, 25.7% of the pregnant women had twinning cases in the family. It is essential that family history is observed and recorded, since this information indicates a possible risk factor for a predisposition for the development of some harmful diseases in the pregnancy period, such as gestational diabetes and the Specific Hypertensive Syndrome of Pregnancy (SHEG), increased as chances of a high-risk pregnancy¹⁰.

With regard to the beginning of prenatal care, the data show that 55.4% of pregnant women started prenatal care in the first trimester of pregnancy, 39.2% started in the second trimester and 5.4% started in the third trimester. It is noted that 44.6% of pregnant women attended started prenatal care late, which is extremely harmful to the health of the mother-fetus binomial, since prenatal care stands out as an essential factor to promote health maternal and fetal, to track possible adverse events and clinical handling of complications as early as possible. Thus, it has the consequence of decreasing maternal and child morbidity and mortality 11.

III. CONCLUSION

We conclude that it is important to adopt educational measures on the importance of prenatal care, so that improvements in the health of pregnant women can be achieved in the long term, in order to reduce the rates of maternal and child morbidity and mortality.

Therefore, health professionals need to approach pregnant women and the community as a whole in a welcoming and humanized manner, developing activities focused on primary care and health education strategies, with a focus on health promotion and prevention. Consequently, through this study, the aim is to contribute for health professionals to reflect on the importance of the profile of pregnant women in the sphere of public health.

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Basic life support training methods in nursing education: An integrative literature review

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Abstract— Objective: to analyze the evidence available in the literature on the Basic Life Support training methods in nursing education. Method: it is an integrative literature review. The search was carried out in the PUBMED, LILACS and BDENF databases. 69 articles were initially selected for full reading from the inclusion criteria, considering the time frame from 2010 to 2016, of which nine full texts were listed for in-depth reading and synthesis. Results: there were few publications on the topic as well as a multiplicity and heterogeneity of methods and strategies for the training of Basic Life Support in the training of nurses. Large gaps in knowledge were observed, making it necessary to develop research in this field, especially studies that focus on practical theoretical teaching strategies with the use of simulation in view that these are capable of bringing real impacts on the knowledge and skills of professionals. Conclusion: teaching aimed at the individuality and reality of the target audience, taking into account the epidemiological reality and characteristics of the students is fundamental in this process. Despite the variety of information resulting from the studies, multiplicity and heterogeneity in the approaches and forms of evaluation, we conclude that practical theoretical teaching strategies, capable of promoting learning more effectively other available resources.

Keywords— *Teaching. Simulation Training. Cardiopulmonary Resuscitation. Education, Nursing, Baccalaureate.*

I. INTRODUCTION

Basic Life Support (BLS) consists of a set of steps and maneuvers performed sequentially, which include assessment and immediate intervention in each phase of Cardiopulmonary Resuscitation $(CPR)^{(1)}$. Cardiorespiratory arrest (CRP) can be defined as the abrupt cessation of cardiac mechanical activity confirmed by unconsciousness, absence of central pulse and apnea or $(gasping)^{(2)}$. agonized breathing Cardiopulmonary resuscitation is the set of maneuvers performed after a CRP with the aim of artificially maintaining arterial flow to the brain and other vital organs until spontaneous circulation returns⁽³⁾.

Cardiorespiratory arrest remains a major public health problem, gaining worldwide dimension, despite advances in recent years related to its prevention and treatment⁽⁴⁾. Although the potential beneficial effect of cardiopulmonary resuscitation is well established in the global scientific community, less than one in three victims of out-of-hospital cardiopulmonary arrest, and witnessed, receives rescue assistance from а spectator. Approximately 200,000 cases of CRP are estimated per year in Brazil, half of which occur in hospitals, and the other half in out-of-hospital settings⁽⁵⁾.

A qualitative outcome of CPR depends on a logical sequence of procedures that can be summarized in the concept of survival current; mnemonic composed of links that reflect fundamental actions to be developed, whose impacts on survival are significant⁽⁶⁾. The chain of survival emphasizes the need for rapid response through surveillance and prevention, early recognition of cardiorespiratory arrest and emergency services, high-

quality and immediate CPR, early defibrillation, advanced immediate life support and post-cardiorespiratory care^(7,8).

Cardiorespiratory arrest until recently was synonymous with death, since no more than 2% of individuals survived this dramatic event. Today, the survival rate reaches more than 70% if care is early and effective and is directly related to the time between the incident and the beginning of resuscitation, and the technical effectiveness of CPR maneuvers⁽⁹⁾.

Care for cardiorespiratory arrest must be performed quickly, firmly, safely and calmly, in order to avoid panic and mismatch among professionals. However, what is observed is that, in most cases, resuscitation efforts are disruptive, with non-systematic actions that lead to overlapping tasks, culminating in repetitive acts that lead to a loss of crucial time for survival⁽¹⁰⁾.

Nursing professionals are usually the first to respond to a CRP and initiate BLS maneuvers, while waiting for the advanced support team. The immediate, competent and safe application of CPR maneuvers by the team that first intervenes are factors that contribute to the success of the service⁽¹¹⁾. It is described that health professionals and undergraduates do not have satisfactory scientific knowledge, both theoretical and practical, in CRP/CPR. This knowledge deficit is a consequence of academic training, in which approaches to the topic, when they exist, are punctual and superficial, therefore, insufficient to provide the acquisition of solid knowledge necessary for performance in the face of cardiopulmonary arrest^(12,13).

It is considered relevant to early exposure of nursing students to basic support training of life; confirming that these skills should be promoted right at the beginning of the course and reinforced in the following years⁽¹⁴⁾. Training should insert students in realistic contexts, which allows for the acquisition of solid knowledge and skills⁽¹⁵⁾. Several nursing schools include in their curricula content with learning objectives aimed at the BLS. However, most nurses do not feel effectively trained to work in front of a person in cardiorespiratory arrest⁽¹⁶⁾.

One of the objectives of the training is proficiency in BLS, however, there is a great diversity in the form and content focused on the theme, between the different schools, so that the training offered does not meet the criteria described in the resuscitation science consensus⁽¹⁷⁾. Given the above, the objective of this research was to analyze the evidence available in the literature about the Basic Life Support training methods in nursing education.

II. METHOD

It is an integrative literature review, a study that offers quick access to relevant research results and evidence that underlie the conduct or decision making, providing critical knowledge. The following steps were carried out: establishment of the research question, literature review, categorization of studies, evaluation of studies and interpretation of results and synthesis of knowledge ⁽¹⁸⁾.

The research question was constructed using the PICO strategy, which guides the construction of the research question and the bibliographic search and allows the researcher, when having a question or question, to locate the best available scientific information accurately and quickly⁽¹⁹⁾ (Table 1). After using the PICO strategy, the questions consisted of: in nursing education, do teaching strategies provide subsidies for retaining knowledge and acquiring BLS skills and competencies in accordance with the recommendations of the guidelines of resuscitation science? What are scientific evidences available in the literature about Basic Life Support training methods in nursing education?

Table 1: Construction of the guiding question through thePICO strategy.

| P (Patient or problem) | Training methods for undergraduate nursing students | | |
|-------------------------------|--|--|--|
| I (Intervention) | Basic Life Support training methods | | |
| × , | and strategies | | |
| C (Control or | Identification of articles that contain | | |
| comparison) | information about the training methods | | |
| | that demonstrate the best results in | | |

| | BLS training, following the | | |
|--------------|---|--|--|
| | recommendations of the guidelines | | |
| O (Outcomes) | Obtaining the best evidence about | | |
| | learning methods and strategies | | |
| | capable of enabling the acquisition and | | |
| | retention of knowledge and skills to | | |
| | perform BLS according to current | | |
| | international scientific | | |
| | recommendations | | |

Source: own author, adaptation⁽¹⁹⁾

The search for publications was carried out in June 2019, in the following databases: PUBMED, LILACS and BDENF. For the search, the following Boolean descriptors and operators were used: PubMed - (education OR teaching OR knowledge AND retention AND Technological Development) Nursing Education, Baccalaureate AND heart arrest OR cardiopulmonary resuscitation; LILACS and BDENF - education AND basic life support AND baccalaureate in nursing, making it possible to locate 69 articles (38-PubMed, 13-LILACS and 18-BDENF).

The inclusion criteria were: articles in Portuguese and English, published between 2010 and 2016, that addressed the teaching of BLS for undergraduate nursing students, aimed at adults, children and neonates, and full articles in the free version. The exclusion criteria were: articles that addressed BLS teaching for care nurses, other categories of health professionals and lay people in isolation, and articles where only abstracts were available, theses, dissertations, monographs, course completion papers, annals events, editorial letters. An instrument validated by Ursi⁽²⁰⁾ was defined to systematize the articles selected in the search. The analysis of the selected studies was carried out in a descriptive way, making it possible to observe, count, describe, classify and synthesize the data, in order to gather the knowledge produced on the topic. The productions were grouped into two thematic pillars which will be presented and discussed below.

III. RESULTS

Of the articles that constituted this integrative literature review, four aimed at analyzing, evaluating, verifying and investigating knowledge (theory) and skill performance (practice) in cardiopulmonary resuscitation maneuvers using the AED (BLS); two studies sought to develop and evaluate a Virtual Learning Environment aimed at nursing education; one analyzed the knowledge of undergraduate health sciences students in objective tests; and two to compare the impact of CPR training programs in quasi-experimental studies using a beforeand-after teaching-learning strategy. Regarding the year of publication, there were three articles (33.33%) in 2010, three (33.33%) in 2013 and three (33.33%) in 2015. The countries that produced the most studies on the theme it was Brazil with 77.77%, the other 22.22% India and Northern Cyprus.

All articles are original, found in the following databases: four articles in LILACS, four in PubMed and one in BDENF, published in seven different journals, with

the Revista da Escola de Enfermagem da USP being the most published on this theme, with 33.33% of publications. Two articles of applied research on technological development were found (22.22%), two cross-sectional studies (22.22%), two descriptive, exploratory studies with a quantitative approach (22.22%), a quasi-experimental, longitudinal study (11, 11%) and two experimental, prospective studies (22.22%) (Table 2).

| Author. Title. Periodic. Year | Data | Methodolo- | Research Findings |
|---|------------|--|---|
| | Base | gical | |
| | | Procedure | |
| Gonçalves GR, Peres HHC, Rodrigues RC, Tronchin DMR, Pereira IM. Proposta educacional virtual Sobre atendimento da ressuscitação cardiopulmonar no recém-nascido. Rev Esc Enferm USP. 2010 ⁽²¹⁾ | BDE NF | Applied research, technologic al developmen t | Research carried out with undergraduate nursing students. Development of an interactive virtual educational proposal on care for cardiopulmonary resuscitation in newborns. The group work, the quality of the didactic material, the choice of the teaching support platform and the methodology adopted were the determining points for the success of the project. |
| Boaventura AP, Miyadahira AMK, Sugisawa AHR, Gonçalves AAP, Nunes TR. Suporte básico de vida para os alunos do curso de graduação em enfermagem. J Health Sci Inst. 2010 ⁽¹⁰⁾ | LILA CS | Exploratory , descriptive research | Research carried out with 52 undergraduate nursing students (3rd and 4th year), using a form with questions about BLS and use of AED. The general average obtained by the students was less than 85%. Insufficient knowledge on BLS using AED identified in this study. |
| Chandrasekaran S, Kumar S, Bhat SA, Saravanakumar, Shabbir PM, Chandrasekaran V. Awareness of basic life support among medical, dental, nursing students and doctors. Indian Journal of Anaesthesia. 2010 ⁽²²⁾ | PUB MED | Transversa study | Research carried out with 1,054 participants in the health area. None of the participants had complete knowledge about BLS. Only two participants (0.19%) reached 80- 89% of correct answers. The awareness of Basic Life Support among medical, dental and nursing students is insufficient and needs to be improved. |
| Rodrigues RCV, Peres HHC. Desenvolvimento de Ambiente Virtual de Aprendizagem em Enfermagem sobre ressuscitação cardiorrespiratória em neonatologia. RevEscEnferm USP. 2013 ⁽²³⁾ | LILA CS | Applied research, technologic al developmen t | Research carried out with 3 undergraduate nursing students, 2 computer specialists; 1 specialist physician in Neonatology; 3 nurses. The Virtual Learning Environment was perceived as predominantly excellent. The application of virtual learning environments in a coherent, responsible and consistent way to assist traditional teaching has been proving to be an efficient way of building knowledge. |
| Dal U, Sarpkaya D. Knowledge and psychomotor skills of nursing students in North Cyprus in the área of cardiopulmonary resuscitation. Pak J MedSci. 2013 ⁽²⁴⁾ | PUB MED | Quasi- experimenta l, longitudinal study | Research carried out with 83 students of the third year of the undergraduate nursing course. 90.4% of the participants had not received any CPR training before the study. Theoretical information and CPR in practice had a positive impact on the level of knowledge and |

Table 2: Synthesis of articles according to author, title, periodic, year, methodological procedure and research findings

| | | | practical skills of the participants in the following month. However, there was a significant decrease in the level of information and correct practical application of CPR six months after the training. |
|--|------------|---|---|
| Sankar J, Vijayakanthi N, Sankar MJ, Dubey N. Knowledge and Skill Retention of In-Service versusPreservice Nursing Professionals following an InformalTraining Program in Pediatric Cardiopulmonary Resuscitation:A Repeated- MeasuresQuasiexperimental Study. BioMed Research International. 2013 ⁽²⁵⁾ | PUB MED | Experiment al, prospective study | Research carried out with 28 nursing assistants from the intensive care unit and urgency, and 46 nursing students. The training improved nurses' general pediatric CPR competence, but they were unable to maintain competence, even for a short period. In contrast, nursing students due to self-motivation and willingness to learn maintained the skills learned during the training session better than the nurses in care. |
| Kawakame PMG, Miyadahira AMK. Avaliação do processo ensino- aprendizagem de estudantes da área da saúde: manobras de ressuscitação cardiopulmonar. RevEscEnferm USP. 2015 ⁽¹⁴⁾ | PUB MED | Experiment al, prospective study | Research carried out with 84 undergraduate students in the health area. After the lecture strategy with practice demonstration and simulated practical training. It made it possible to infer that both knowledge (theory) and skill (practice) are essential in the construction of the teaching-learning process. |
| Tavares LB, Bezerra IP, Oliveira FR, Sousa LA, Raimundo RD, Sousa ED, et al. Conhecimento de estudantes de graduação em ciências da Saúde em testes objetivos sobre suporte básico de vida, JournalofHumanGrowthandDevelop ment. 2015 ⁽¹⁵⁾ | LILA CS | Observation al, descriptive and cross- sectional study | Research carried out with 664 undergraduate students from the courses of medicine, nursing, physiotherapy, pharmacy, nutrition and occupational therapy from seven higher education institutions in São Paulo. Only one participant achieved a score equal to or greater than 84%. The results implied that efforts must be made so that the actions related to the BLS are introduced in the curricula from the first year of graduation and during subsequent years |
| Silva DV, Jesus AS, Lima AA, Santos MA, Alves SL. Conhecimento de graduandos em Enfermagem sobre suporte básico de vida. Revista Baiana de Enfermagem. 2015 ⁽¹⁾ | LILA CS | Descriptive, exploratory study, quantitative approach | Research conducted with 32 undergraduate nursing students. Theoretical knowledge about BLS among undergraduate nursing students was unsatisfactory for the care of victims of cardiorespiratory arrest, showing that, although the topic is discussed at graduation, it has not been sufficient to build solid knowledge. |

IV. DISCUSSION

Academic education the fundamental foundation and the impact of CPR training programs on the training of nurses

The training of nursing professionals has undergone major changes throughout history, being influenced by the representation that this profession had in society over time. In 2001, however, a great advance was achieved when, through Resolution CNE / CES n° 3, of November 7, 2001, the National Curriculum Guidelines for the Undergraduate Nursing Course were instituted. In summary, the

pedagogical principles elucidated by the national nursing curriculum guidelines are: the pedagogy of competences, the principle of learning to learn, generalist, humanistic, critical, ethical and reflective training; and training centered on the student and the teacher as a facilitator⁽²⁶⁾.

We are convinced that, in the current context, there is a demand for increasingly reflective, critical and opinionforming professionals. Thus, the need for new teachinglearning practices emerges, with the use of didactic and technological resources, encouraging and favoring the improvement and training of nurses, as well as enabling autonomous learning⁽²⁷⁾. In this understanding, what is sought is the training of a health professional from the perspective of complexity and holism, who acts in a multidisciplinary way, meeting the needs of the current health system⁽²⁸⁾.

Much of the success of CPR is due to the nurses' ability to perform qualitative care in this context. Thus, nurses need to know how to act efficiently in the face of these occurrences⁽¹⁾.

A survey carried out with 664 undergraduate students⁽¹⁵⁾ from the courses of medicine, nursing, physiotherapy, pharmacy, nutrition and occupational therapy from seven Higher Education Institutions in São Paulo, found that only one participant reached a score equal to or greater than 84% and the others fell short of this AHA indicator. These results suggest that efforts should be made so that the actions related to the BLS are introduced in the curricula from the first year of graduation and strengthened during the subsequent years, so that knowledge and skills are improved and, in turn, are implemented effectively during professional practice.

A study carried out with 84 students⁽¹⁴⁾ of the undergraduate health course showed that only the theoretical class with demonstration of the practice was not sufficient for the development of the psychomotor skills employed in CPR, and practical training is extremely necessary for the success rate to reach 90%. Simulation strategies are more realistic and meaningful learning, as they allow students to get in touch with practice. Both knowledge (theory) and skill (practice) are essential in the construction of the teaching-learning process. Both complement and become inseparable in the design of the final product, highlighting the importance of theoretical classes associated with practical classes.

Still on this subject, a study conducted with 32 undergraduate nursing students (1), 4 from the last semester and 28 from the penultimate, found a lack of knowledge; since only 25% of the students reached the percentage of correct answers in the BLS questionnaire equal to or greater than 75%, considered in this research as satisfactory. It concluded that the theoretical knowledge about BLS among nursing students was unsatisfactory for the care of victims of cardiorespiratory arrest, showing that, although the theme is discussed at graduation, it has not been sufficient to build solid knowledge.

The academic training of nurses demands the need for theoretical-conceptual and methodological training that enhances competencies for comprehensiveness. Thus, among the essential competencies for the practice of nursing in the emergency, clinical reasoning for decision making and the ability to execute interventions promptly stand out⁽²⁸⁾. The American Heart Association (AHA), assuming that teaching is a planned experience that facilitates learning, states that it is essential to target teaching to the appropriate audience and that a training program represents an ideal opportunity to reach a large number of individuals with knowledge in CPR maneuvers and other BLS interventions⁽⁸⁾.

Educational interventions should be evaluated to ensure that they achieve learning goals reliably. The objective is to ensure that students acquire and retain the skills and knowledge that will enable them to act correctly in the face of real CRP's and improve results with regard to neurologically intact survival⁽²⁹⁾.

Currently we are experiencing the advent of technological innovations, we can emphasize that human beings are immersed in an information society characterized by the development of information and communication technologies (30). The adoption of new information technologies in education has brought significant changes to the traditional educational paradigm, promoting new ways of teaching and learning, inducing new behaviors in teachers and students and new ways of thinking and producing knowledge⁽²³⁾.

Competencies and skills essential to the training of nurses about cardiopulmonary resuscitation maneuvers using the AED (BLS)

The nursing professional is competent in face of a person who has suffered a cardiorespiratory arrest, supported by the Nursing Professional Exercise Law No. 7,498 / 86, which establishes as a private activity of the nurse the direct assistance to the critical patient and the execution of more complex activities and that require knowledge of a scientific basis and the ability to make an immediate decision⁽³¹⁾.

According to AHA⁽⁸⁾, qualified individuals who obtain 84% or more of use in a standard structured questionnaire used for training evaluation are considered qualified. Concerningly, in a survey conducted in the State of São Paulo, Brazil⁽¹⁵⁾ through the application of 664 questionnaires on BLS, answered by students of higher education courses in the health area, similar to the one used by AHA in the BLS course, only one reached grade equal to or greater than 84%.

With regard to the care of victims of sudden cardiorespiratory arrest, little or incorrect knowledge about BLS can compromise the care provided⁽¹⁵⁾. In a similar study on the knowledge of undergraduate nursing students⁽¹⁰⁾, after the application of a form containing 40 objective questions, a high percentage of incorrect answers

was evidenced regarding the use of the AED, in which 80% of the answers were unsatisfactory for simple questions such as the positioning of the device's blades⁽¹⁾. Thus, attention is drawn in this study to the knowledge deficit, especially among nursing professionals, taking into account that the findings showed that the percentage of correct answers was below the expected, according to the correct index established for the BLS course of the AHA.

Nursing students have been the subject of discussions and research that have demonstrated their knowledge about CPR maneuvers. A study carried out with nursing students from the 8th period⁽¹³⁾ found that few students had enough knowledge to work in PCR. This lack of knowledge, among other reasons, may be linked to academic training, which leads to reflect on the teaching-learning process related to the approach of this content in undergraduate courses.

In a research carried out at a private University of Porto (Portugal) with 149 students from the 1st, 2nd, 3rd and 4th years of nursing, it was shown that they had sufficient theoretical knowledge about BLS in adults, since most of them obtained correct answers above 70% in all series. However, it is important to note that this is the reality of a developed country⁽¹⁾.

Successful experiences, in studies before and after, however, demonstrate that the knowledge and skills of nurses and nursing students seem to improve following CPR training. However, in six weeks, knowledge and skills begin to decline, although they remain significantly higher than the initial one. Training programs improve CPR competence, but individuals are unable to maintain the same competence, even for a short period⁽²⁵⁾.

A study with 83 students in the third year of the undergraduate nursing course, in which 90.4% of the participants had not received any CPR training before the study, concluded that theoretical information and practiced CPR had a positive impact on the level of knowledge and skills nurses' practices in the following month⁽²⁴⁾. However, there was a significant decrease in the level of information and correct preservation of practical application six months after training. In this understanding, it is described that BLS knowledge and skills deteriorate in less than three to six months. The use of frequent assessments will identify individuals who need refresher courses⁽²⁹⁾.

Education in basic life support aims to fill the gaps between real and desired performance, and should enable the acquisition of knowledge and skills of self-efficacy to BLS providers, improving their ability to recognize and respond to patients at risk. cardiac arrest; improving resuscitation performance; and ensuring the activities of continuous quality improvement, based on the understanding that ensuring that victims of cardiorespiratory arrest receive care consistent with the current state of scientific knowledge presents itself as a great potential to save thousands of lives^{(32).}

V. CONCLUSION

The study enabled the construction of a synthesis of the scientific knowledge produced about the BLS training methods in nursing education. The results showed great gaps in the knowledge of health professionals, making it necessary to develop research in this field, especially studies that focus on theoretical-practical teaching strategies, using simulation, considering that they are capable of bringing impacts real and significant in the knowledge and skills of professionals.

After the analysis, it was possible to conclude that the nurse is an essential and trained professional to diagnose and attend a cardiorespiratory arrest. The topic addressed in this study is not exhaustive, always deserving updates and scientific productions, in order to be updating and showing the importance of nursing care in the face of cardiopulmonary arrest, and it is essential that nurses are in constant technical and scientific improvements.

There were few publications on the topic, as well as a multiplicity of methods and strategies in teaching BLS. From this perspective, it can be concluded that teaching aimed at the individuality and reality of the target audience, taking into account the epidemiological reality and characteristics of the students, is fundamental in this process. Despite the variety of information resulting from the studies, multiplicity and heterogeneity in the approaches and forms of evaluation, we conclude that practical theoretical teaching strategies with the use of simulation, use of dummies and feedback emerge as more effective strategies, capable of promoting learning more effectively. other available resources.

In this way, we hope to contribute to the development of new studies, which can foster reflections on the teaching of BLS in nursing education, and above all, cooperate with the affirmation of the educational process as the north of professional qualification, therefore, for the improvement of the health work process.

Furthermore, we seek to apprehend the aspects that must permeate the academic education of nurses and, with this, contribute to the elucidation of teaching strategies that facilitate the teaching-learning process, so that through training based on problematizing educational practices, which promote solid knowledge, the nurse can develop the essential skills and abilities for a qualitative performance in the face of cardiorespiratory arrest.

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Orientation for Field Activity Planning: Contributions of P. Ya.Galperin

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Abstract - This work addresses a proposal for guidance for planning field activities based on the Theory of Assimilation by Mental Stages and Formation of Concepts by Galperin. This theory is based on the ideas of Vigotsky and Leontiev, therefore with developmental characteristics. The study presents a discussion on the importance of guidance as a basis for quality learning. It also points out the importance of field classes as a didactic tool that motivates and brings the intercutor closer to knowledge and also as a facilitator for those who have learning difficulties through conventional means. As a suggestion, a didactic proposal will be presented for planning field activities according to Galperin's Theory of Mental Assimilation by Steps and Concept Formation.

Keywords—Action Guiding Base, Engineering Teaching, Field Activity, Galperin, Teaching Plan.

I. INTRODUCTION

The present work presents an educational, pedagogical and didactic context regarding the importance of field classes in higher education institutions, from a perspective of the Theory of Assimilation of Mental Actions by Stages and Formation of P.Ya Concept. Galperin, proposing a model for preparing field classes.

Conceptually, the field activity, as an instrument that composes the teaching-learning process in higher education institutions, is characterized as a means that promotes the development of new knowledge or the implementation of existing concepts.

In the choice of a given teaching method, it is important to analyze some variants relevant to field activity planning, such as objectives, student set profile, management of available resources and understanding of theoretical concepts.

According to Carvalho (2011), the orientation of the teaching process directed to development and learning is a social action project incorporated into the curricular project, as it outlines information contextualizing students and seeking the development of all. This social project should include a "model" of orientation, structured in the form of a document based on theory and methodology, evaluations, materials and methods in a way that allows

directing the learning process with awareness and planning, and that builds indicators for self-evaluation of the teacher.

The orientation, according to Talizina (1984) cited by Carvalho (2011, p. 89), directs to an objective and its preparation must meet not only the "intellectual, cognoscitivos particularities of psychic activity, but all aspects of human personality".

[...] depends on the quality of the execution. All situations in which, according to the teaching plan, this action must be used, assimilate the set of demands presented to the action to be formed and simultaneously, the set of properties that respond to such requirements and that must be formed (GALPERIN, 2001a, p. 24).

The central idea of Galperin's Theory argues that the assimilation of new knowledge and skills occurs by stages, stages, following a social stage for the individual, as Vigotsky (1987) explains, from the interpsychological plane to the intrapsychological plane.

For Galperin (2001a), during the orientation processes it is possible to analyze an unknown situation, verifying the rational or functional meaning of the objects, analyzing the consequences and revisions of the action, establishing new paths and measuring and controlling the use. Given the importance of field activities and their preparation, with such a structure that suggests a didactic use in learning and with that, a better appropriation of knowledge within a given objective, the answer to the following question will be suggested:

How to structure an Action Guiding Base, plan and execute a field activity for higher-level industrial training courses based on P. Ya's Theory. Mr. Galperin?

The article proposes a structured didactic model with an Action Guiding Base for higher education teachers, aiming to plan and execute field activities based on Galperin's Theory of Mental Actions and Concept Formation.

But specifically from this article it will be possible to: a) Classify the Theory of Mental Actions and Formation of Concepts of Galperin and exemplify in the preparation of a field class for higher education; b) Plan a didactic based on the Mental Stages by Stages and Formation of Concepts of Galperin, to plan field activities, as a tool to help the teacher.

II. P. YA. GALPERIN AND THE THEORY OF PLANNED FORMATION OF MENTAL ACTIONS AND CONCEPTS

The orientation is discussed by many authors, with the intention of conceptually defining the importance of quality for the realization of actions and in the assimilation of new knowledge or concepts. According to Carvalho (2011), the orientation of the teaching process directed to the development of learning is an embedded social action project that, consequently, is associated with the curricular project due to its characteristic of schematizing information and contextualization in the students' environment, directed to the development of all.

Considering that the concepts of the various authors are important, the ideas of Fr. Ya Galperin (1979, 2011b) will be used as the main reference for the concept of orientation in this article, according to Carvalho's understanding (2011).

[...] concept of orientation (the one that directs the learning process through), which is the basis for quality learning. Learning conceived as all activity (practical and psychic), resulting from the appropriation of new knowledge (concepts/ skills and habits) by human beings, or the improvement of these by those who possess them [...]. (GALPERIN, 1979 apud CARVALHO, 2011, p. 91).

Piotr Yákolevich Galperin, (1902-1988), born in Ukraine of the then Soviet Union, was professor of the Chair of Psychology of the Moscow State University (EMU), emeritus personality of the Sciences of the RSFSR, head of the Chair of Evolutionary Psychology of the Faculty of Psychology of EMU, therefore the socialist ideas defended by that state influenced the studies. The research developed by Galperin was concerned with Learning Psychology in the school context. Soviet Pedagogical Psychology aims at the integral development of the individual, and is based on experimentation as the main research tool (NÚÑEZ; OLIVEIRA, 2013).

According to Reshetova (2004), Galperin's concern was with learning, development and teaching, and also to Leontiev, Vygotsky's studies on the relationship between teaching and development continued, therefore, the basis of Galperin's theory is in the ideas of Leontev (1988) and Vigotsky (2001, 2005), in the formation of the stages, whose individuals have ways to appropriate knowledge (concepts, habits).

For Vigotsky (2005), internalization occurs at the social (interpsychological) level for the individual (intrapsychological) plane. Thus, mental actions begin at the material external plane and are consciously internalized, in order to obtain the formation of skills and at that moment, constitutive at the mental - internal level. Leontev (1988) explains that this relationship with reality occurs through practical and psychic activity.

"If, for Vygotsky, the main question was what to teach, for Galperin, on the other hand, the focus of attention was on the problem of what to teach and how to teach. "(STEPANOVA, 2003, p. 78).

In Galperin's theory, he considers mental actions as objective actions that begin with the support of external objects, which are manipulated, go through a series of steps. Then these actions are carried out at the mental level and, finally, become part of the psyche, following parameters of quality and development of intellectuality. The development of the individual's intellectual is related to the increase of the intellect with new, qualitatively superior actions (NUÑEZ; RAMALHO, 2017).

2.1 The teaching model proposed by Galperin

Based on Lev Vygotsky's Historical-Cultural Theory, Galperin (1976), he proposed a teaching model which he called "Teaching through a step-by-step formation of mental actions and concepts", which is based on the constructions of step learning in the formation of mental actions, within certain organized learning schemes , which according to Rezende and Valdes (2006, p. 1211- 1212)

This teaching model does not require the learner to memorize concepts and formulas, due to the opportunity to

experimentally experience the concepts and their applications in the solution of a problem situation.

The teaching model proposed by Galperin develops regions of the brain that had not been worked by the traditional teaching model, such as consciousness and automatic application, because from the teaching model proposed by Galperin the apprentice has the ability to analyze specific relationships and structures according to their context and develops the ability to use the knowledge acquired in other contexts and related situations, rescuing the concepts presented by the guiding basis of the action.

Thus, the learning process follows a path that begins in external materials, following a logical organization to end with the mental and abstract internalization of knowledge, starting from the choice of problem situation, the action guiding base, monitoring of the activity and the remodeling of all stages of the process. The main objective is not centered on learning simple concepts, but mainly learning to use the references that will be guiding in the action.

For Talízina (2009), within Galperin's theory, the formation of mental actions and concepts is supported by three central ideas: the definition of a guidance system, the establishment of a system of parameters or characteristics that define the levels of development of action and the stages of the formation of mental action and concepts, thus the formation of mental actions and concepts is guaranteed in a planned way.

For Nuñez (2009), galperin's theory is based on the idea that mental actions are based on external objects that will be worked on in several stages and later, these mental actions will be carried out at the mental level, now composing part of the individual's psyche, for this author galperin's Theory of Mental Stage Assimilation passes through three well-defined moments.

First moment is focused on seeking the proper form of action.

Second moment is centered on finding the material form of representation of the action.

The third moment is to transform this external action into internal.

Within the characteristics of mental actions it is possible to identify two components that have their own well-defined characteristics, the first is the "execution that is associated with the skill level of the individual and is influenced by the conditions imputed to each problemsituation". The second is "orientation", which depends on the subject's intelligence and is influenced by mental concepts available to the individual to assist him in solving a specific problem-situation. According to Galperin (1989b), mental actions constitute, even implicitly, an objective and material content, thus the material and mental contents belonging to a single process that results in the progressive development of material aspects in mental appropriations, providing formations of concepts in the material form (action) and, later, for a definitive and mental (internal) form, which will always be related to practice.

Galperin (1976, 2001b, 2011a) disclosed that the results of his studies on the assimilation of new concepts at different school levels are, in general, very close to each other, as follows (CARVALHO, 2011):

The concepts will be assimilated in stages, will not be assimilated suddenly, and will happen at different times among apprentices.

In the process of learning new concepts, the indicators of scientific concepts combine with the indicators of nonscientific concepts and these for a long time alter the scientific indicators.

There is a time for the generalization of the concept, happening progressively, becoming totally insufficient in students with learning difficulties.

2.2 The subsystems of Galperin's Theory

The Theory of Mental Assimilation by Stages and Formation of Concepts proposed by Galperin organizes the conversion of concepts into mental actions by three indispensable subsystems (GALPERIN, 1976).

- The orientation

- The steps of assimilation

- Qualitative learning indicators (CARVALHO, 2011).

2.2.1 The orientation to the quality of learning

The orientation within Galperin's Theory is highlighted, because it is from it that the individual can determine, among other factors, the quality of learning. This stage was initially called the "stage of formation of the previous representation" and then called "ActionGuiding Base" - A. G. B, it is in the orientation that the necessary actions to be planned and developed are conditioned, directing the learning and development of students, as stated in its article Types of Orientation and types of formation of actions and concepts. (GALPERIN, 1986)

The Action Guiding Base (AGB) is a guidance system that directs the learning process, through a series of actions that will be put into practice through an activity, the organization of this set of operations should prioritize a realization of a previously established objective. Carvalho (2011) shows that Galperin's (1982) investigations compact the numerous forms of orientation into only three types, as follows:

When the individual does not come to form an actionguiding image and the investigator cannot help him, this image is incomplete, and the first type of orientation is obtained;

If the same investigator shows the subject the complete guiding basis of the action and requires an intense investigation of the same, the second type of guidance is obtained;

If the subject constructs a complete guiding image, individually, the third type of orientation is obtained in the task (CARVALHO, 2011. p. 109).

The objective of the ActionGuiding Base is to mediate the material part (represented by the execution components) and the mental part of the action (which covers the components of orientation and execution), facilitating the understanding of the problem situation for assertiveness in decision-making based on concepts that seek the ideal solution (GALPERIN, 1989).

Talízina (1984, 2009) states that the action guiding base is organized, according to Galperin's (1986) publications, referencing the following criteria: a) Degree of generalization; b) Character of the work; c); Way of obtaining. Carvalho (2011) organized these characteristics according to Table 1:

Table 1 - Action Guiding Base Types (A.G.B.).

| Good Types | Generalized Character | Fullness | Getting Mode |
|---------------|--------------------------|------------|--------------------------|
| Ι | Concrete | Incomplete | Independently elaborated |
| Ii | Concrete | Complete | It is prepared |
| Iii | Widespread | Complete | Independently elaborated |
| Iv | Widespread | Complete | It is prepared |
| V | Widespread | Incomplete | It is prepared |
| Vi | Widespread | Incomplete | Independently elaborated |
| Vii | Concrete | Complete | Independently elaborated |
| Viii | Concrete | Incomplete | It is prepared |

Source: Talizina (1984, p. 89 apud CARVALHO, 2011).

The action guiding base is a proposal of schematic action, one can consider it a model of activity that is associated with the conceptual invariant Talizina (1984). According to Nuñez (2009), the invariant comprises a set of situationsproblems whose characteristics and actions for solution are similar, so it must share all the structural and functional parts of the activity (orientation, execution, control). The solution of the problem situation, based on the action guiding base, will encourage the cognoscitive part by exercising the outside regarding the execution, but primarily the cognoscitive internal part (TALÍZINA, 1984).

2.3 Types of Action Guiding Bases

Galperin (2011a) established eight action guiding bases, however the deepening of investigations and studies limited only three of them, as follows:

a) Type I Action Guiding Base

It does not indicate the actions to be performed or indicates incompletely; Uses isolated indicators at the time of orientation; Disabled; It presents difficulty in differentiating the execution activities in the orientation path; Error test; Formation occurs slowly by the path of disordered differentiation.

b) Type II Action Guiding Base

The teacher presents a guiding basis for the complete action; It explains their objective interrelationships, the meaning of the support points and the way in which the action is executed; The student, in general, remains scattered and ends up ignoring the guidelines, returned to "trial and error".

c) Type III Action Guiding Base

According to Carvalho (2011), it is notably a type of guiding basis for the most complete action, facilitates the formation of the guiding image by the student, from elements provided that allows him to differentiate tasks within an area, this capacity of differentiation presupposes the orientation of the student, according to the author presents the following characteristics

*In general, comparing with the guiding basis of type II action, the assimilation of tasks happens in less time; *Change of the learning process and product; *The action is performed correctly from the beginning of the process *It is the basis for the Theory of Assimilation by Mental Steps and Formation of Concepts; *It consists of tasks; The action is formed faster and more easily.

2.4 Assimilation steps for the internalization of concepts and skills

According to Talízina (1984) and Galperin (2011a, 2011b), there are 5 stages (motivational; preparation of the guiding basis; material material; external verbal language (others); external verbal language (si); mental), necessary for the assimilation of mental concepts and actions, these steps may eventually have been fulfilled by some students of the same group, due to the individual development of each one and its cultural construction so far (CARVALHO , 2011).

According to Galperin (2011b) it is necessary that teachers have the practical knowledge of the steps proposed in Galperin's Theory of Mental Assimilation by Stages, it is important that teachers at some point have experienced these steps, so that communication is favorable (CARVALHO, 2011).

a) Motivational step

Initial stage of the process of assimilation of action, for internalization of concepts and skills was elaborated by Galperin (2011b), the following characteristics are found:

There is not even a type of action related to that which is intended to be taught; *It is not inserting nor a concept; *The Action Guiding Base, A.G.B.; *It is a form of preparation of students for assimilation of new concepts and skills; *Sharpens the sense of curiosity; *Motivating for the actions that will follow in the following steps; *It consists of a first communicative moment between the subject and the object; *At this stage, the ZDP (Nearby Development Zone) is identified; *Time to perform an initial diagnosis of the ability to be formed; *Preparation for the next step.

Galperin (2011a) warns that this motivation will manifest itself differently in the group of apprentices, inherent to the individual personality of each one, their cognitive and affective maturity.

b) Stage of elaboration of the ActionGuiding Base

According to Carvalho (2011), this stage has the following characteristics:

*The objective of the action, its object and the reference point system are presented to the learners; *Establishes direct communication of the teacher with the learner; *Establishes the A.G.B.; *There is no concern of the learners to assimilate the concepts and the action; *It is presented to the apprentices, as should be carried out the operations that are part of the action: orientation, execution and control. c) Material/materialized step.

Carvalho (2011), puts out that this stage has the following characteristics:

They rely on objects or their own representations to deal with the content of the concept (material/materialized); *A new quality is added to the object of study; *In addition the components of the concept; *Creation of the study card; *Comply with the action of material/materialized form; *Realization of the elements of the activity: orientation; implementation; and control of the action; *Awareness of the learner of their role in learning; *Availability of step-by-step detailing regarding the task to be performed; *Control by the teacher and dialogue between student and teacher is already perceived.

d) External verbal language stage (others)

It is when the learner decries with his own voice the content of the action *The action goes through generalization, however it remains not automated and not reduced; *Speech admits a new function; *At the end of this step the action begins to be performed. Oak (2011)

e) External verbal step (itself)

Same as the previous stage, however performed in silence internally; *The action begins to be reduced, automate sanding quickly; *That's when the action begins its final step inclusion process. Oak (2011)

f) Mental stage.

*Use of content internally within your mind; *Accelerated development of action automation; *Held in thought; *Mental action formed. Carvalho (2011),

2.5 Qualitative learning indicators.

Qualitative learning indicators are schemes for quantifying the use of learning (CARVALHO, 2011). These qualitative indicators of learning are related by Galperin (2011a, 2011b): a) - Degree of Generalization; b) - Degree of Consciousness; c) - Degree of Independence; d) - Degree of Solidity; e) - Way of Obtaining.

These indicators will be developed by means of tasks, for Nuñez (2009), it is through these tasks are directly related to the qualifying indicators of learning.

2.5.1Tasks for the formation of the degree of consciousness

For Nuñez and Ramalho (2012) there are two means of forming the degree of consciousness, by the logical conception of the student's structures of the activity he is performing, in addition to the resolution of tasks, but by the reflection of resolution strategies and by the request for written or oral verbalization of the actions he is
developing, forcing the logical translation of actions and concepts.

2.5.2 Tasks for training and updating the degree of independence

It consists of assisting the student in solving problems with different levels of help, to facilitate understanding, for this a commonly used tool are the study cards, Nuñez (2009) and Núñez and Ramalho (2012). Even with external help, Galperin (2011b) cited by Carvalho (2011, p.124) expresses that "the student uses external verbal language which will provide the internalization of new concepts which is impossible to achieve independence without moving through these stages".

2.5.3 Tasks according to how to obtain

These tasks are presented to solve the situation given, according to the stage of assimilation of the external plan with the help of cards, in the plane of external verbal language with support, that is, the mental plane, which transits in different stages. But the difference is that independence can reach or not as a quality of activity, as Nuñez and Ramalho (2012) argues (CARVALHO, 2011, p. 124).

2.5.4 Final control tasks

According to Núñez (2009), it has the purpose of diagnosing the development of students, whether in the formation of concepts, or skills related to what was defined in the objectives, to quantify the use of a heuristic dialogue between the participants.

A theory elaborated by Galperin (2011a) was presented here, which is based on Vigotsky's historicalcultural theory (2005), and which is directed to how to work the concepts. Unlike traditional methods Galperin proposes that the assimilation of concepts happens in welldefined stages associated with the resolution of a determined problem situation, as galperin (1976) explains.

III. A PROPOSAL FOR THE ELABORATION OF FIELD CLASSES IN THE CONTEXT OF THE THEORY OF ASSIMILATION BY MENTAL STAGES

It is the teacher's task to plan and define resources, and to put together a strategy for students to succeed in learning. It is the duty of teachers to know the context of the students in relation to the theme that will be studied, and to value the students' knowledge, in order to awaken credibility and trust among the agents who will participate in the learning process. The contextualization with the reality of the students must be continued. Among some actions that can be performed by educators are: to announce the content to be worked, dialogue with students about the contents, verify the domain that students already have on the subject, write down their perceptions, listen more to students, transform them into co-signatories of activities and use motivating materials such as movies, slides, music, newspapers, magazines, field classes, among others , to forward the implementation of this step.

For Talízina (1984), a good strategy is the use of a problem situation. The intention is to create a situation that will support teaching, from the resolution of the problem situation.

The next step is the establishment of AGB. It is important that the teacher clearly defines to the students the objectives related to each proposed task. It is at this stage that the teacher works in the classroom the content of the concepts, which will serve as references or support points during the field activity. "It presents to them how the three operations that form part of the action are performed: orientation (directing to the accomplishment of tasks); execution (accomplishment of the task by the students); (monitoring and regulation of the task by the teacher)" (CARVALHO, 2011, p 117).

The third step, the material/materialized, is the field activity itself, is the part of the execution of what you had planned. At this stage, students will perform tasks during the field activity, using as a basis the material references (original product) or materialized (references to the representation of the object). The use of the Action Guiding Base will guide the activities to be performed by students and will serve as a guide between the contents, which are being worked during the activity

In this stage, the elements of the activity are executed: orientation, execution and control of the action, initiating the student's awareness within the learning process.

According to Nuñez and Ramalho (2015), it is necessary that during this stage the teacher performs the control of the actions that were planned. It is already possible to perceive, through dialogues with students, the establishment of an exchange between student and teacher. At this stage, the students' development in verbalizing part of the content of the concepts of the object of study is also perceived (CARVALHO, 2011).

The fourth and fifth stages, within the theory proposed by Galperin, refer to the stages of external verbal language and internal verbal language. This stage, within the proposal of field activity planning, according to Galperin's theory is composing the moment of the post-field, which comprises a heuristic conversation with the students or presentations of themes related to field activity, so that they are instructed to verbalize what they have experienced.

The last step is mental, in it the concepts are consolidated. It is at this stage that the student begins to use his/her perceptions in the solution of other problem situations internally for himself (CARVALHO, 2011). According to Galperin (1979, p.13): "almost all real content of the action abandons consciousness, and what you cannot understand correctly unrelated to others." Therefore, it is the product of the Talizina steps (1984).

To illustrate this dynamic of field activity planning, according to Galperin's Theory of Mental Assimilation by Stages, it is proposed in this work that the teacher elaborate a project of teaching-student work in the socio-historical perspective.

| Planning | | Run | Check | Action | |
|---|--|--|--|--|--|
| Motivational | DRAFTING OF THE GOOD | MATERIAL /MATERIALIZED | Language. VERBAL INT. AND EXT. | Mental | |
| Listing of content and objectives; General Objective; Specific Objectives; | 1) Definition of reference points for solving the problem situation | 1). Teaching and student actions for the construction of knowledge with teacher mediation | 1) Definition of the activity of oral exposure by the student of the experience | 1) Student intentions. Manifestation of the new practical posture, | |
| 2) Daily experience of the content: a)What does the student alreadyknow?: vision of totality b) What interests him? | 2) Development of a Type III Action Guiding Base | 2) Human resources and materials | 2) Heuristic Conversation with Students | 2) Student actions. New social practice of content. | |
| 3) Definition of a problem situation: | 4) Dimensioning of the contents to be worked | | | 3) Teacher's self- assessment | |

Table 2 - Student teaching work project in the historical-cultural perspective.

Source: Prepared by the author based on Menegolla and Sant'Anna (2001), Carvalho (2011) and Pavani (2013).

The construction of this teaching-student project, from a socio-historical perspective based on the Theory of Assimilation by Mental Stages and Formation of Concepts proposed by Galperin, generated some reflections and the need to present a proposal that would really facilitate the work of teachers in the task of planning field activities, for students, higher education. For this reason, it is important to demonstrate this practice.

As a proposal for planning a field activity, the concepts already mentioned in this work will be used, which are in line with the Theory of Assimilation by Mental Stages and Formation of Concepts proposed by Galperin. For a better visualization of organizational practice, examples of field activity will be used, as follows:

3.1 Field Activity: Visit to a Wind Farm

3.1.1 Motivational Stage

The motivation of the students, in a field activity to be carried out in a wind farm happens, in part, in a natural way by the simple fact of the displacement to the place and everything that involves an activity carried out in a group outside the walls of higher education institutions.

However, it is still important that the teacher has the ability to expose this type of activity to the students, using texts, videos, newspaper clippings and example cases.

The teacher should remember that this motivation should not be transformed into excitement, even diverting the students' attention from the objective of the activity, (SILVA; CAMPOS, 2015). Then, a small multidisciplinary Didactic System (SD) should be set up. Figure 1 demonstrates a Didactic System for a visit to a wind farm, observing the simplicity cited by Menegolla and Sant'Anna (2001), planning must be intricately linked to the reality of the teacher, students and

educational institution, leaving aside the "embellishments" that may complicate the execution or understanding of it

Figure 1 defines the problem situations proposed for the visit to a wind farm, according to the general objective previously determined.



Fig.1 - Multidisciplinary Didactic System

Source: Prepared by the author.

The didactic sequence presented in Chart 3 details all
the processes that should compose the planning of a fieldactivity, observing the "usefulness" according to
Menegolla and Sant'Anna (2001)

| Title: | Visit to Wind Farm | Reasons: |
|--------------------|---|--|
| Target Audience: | Students of higher education of the electrical engineering course. | The didactic sequence should be planned and organized, observing the "usefulness" according to Menegolla and Sant'Anna (2001) |
| Problem Situation: | What environmental impacts on energy production? How does society behave around a wind farm? What are the market and technological limitations imposed by the world market in the production of wind generators? | Rezende and Valdes (2006, p. 1211- 1212) |
| General Objectives | Identify the main social, economic and environmental impacts involving wind energy production; experience the breadth of this type of investment. | According to Menegolla and Sant'Anna (2001, p. 68) |

Table 3 - Didactic sequence for visit in a wind farm.

| Class | Duration | Specific objectives | Content | Dynamic | |
|-------|----------|--|--|---|--|
| 1 | 01:30 | contextualize, sharpen curiosity, motivate. Present problem situations | Electricity production; Brazilian Energy Matrix; World Energy Matrix; impacts of job and income generation. | Start with the question "where does the energy we are consuming come from?"; texts and video on energy matrix; request research on Brazilian energy development. | AccordingtoGalperin'stheorycorrespondstoMotivationalStage,Galperin (2011b); it isthemomentofinvestigationofstudents'knowledgebasesinordertoshapeactionsutingtheotherLUCKESIprocesses,2001,p.108) |
| 2 | 01:30 | Organize landmarks; prepare routines of the visit to the wind farm. Present AGB type III; | Windenergyproductionandtransmissionprocess;Regulatorystandard for parks | Submitandcommentonrequestedsearchresults; present thedynamicsofpower production | AccordingtoGalperin'stheorycorrespondstoEstablishmentStageoftheA.G.B.,Galperin (2011b) |
| 3 | 04:00 | Present a working wind farm | Society; economy; transmission network; structure; cabling etc, | Field class in a wind farm; monitoring of students' activities; | AccordingtoGalperin'stheorycorrespondstoMaterialIzedMaterialStage,Galperin(2011b). |
| 4 | 01:30 | Deliver field lesson reports | Economic, environmental and technological partners | Provide a heuristic conversation of the multiple views among students | AccordingtoGalperin'stheorycorrespondstoExternal and InternalVerbalStage,Galperin (2011b) |

Source: Prepared by the author based on Galperin (1976), Carvalho (2011) and Pavani (2013).

3.1.2 Preparation of the Action Guiding Base

The next step, foreseen in Galperin's Theory, is the elaboration of the A.G.B. Action Guiding Base, table 4

presents a suggestion of The Orientation Basis of Action type III, for the activity of visiting a wind farm.

| Table 4 - Orientation Basis of Action type III proposed for a visit to a wind farm following the didactics of field activity |
|--|
| planning, following the Theory of Assimilation by Mental Stages. |

| Objective: To visit a wind farm | | | | |
|--|---------------|--|--|--|
| Concept Model | Action Model | Control Model | | |
| | | What are Energy Auctions | | |
| | Economy | What is the businessman's network of relationships | | |
| | | How they are willing and why they have this distribution | | |
| | | Maintenance | | |
| | | Location requirements | | |
| | | Stages of wind farm installation | | |
| | | Employability | | |
| Make a visit to a wind farm observing | | Location | | |
| the indicators of the following | Social | Manpower | | |
| problem situations: Technological limitations imposed by the world | | Reflection in Society | | |
| market; Social impacts; conservation | | Negative impacts (| | |
| or while generators. | Environmental | Applicable Environmental Laws | | |
| | | Visual impacts | | |
| | | Sound impacts | | |
| | | Type of generators | | |
| | | Transmission network | | |
| | Technical | Productive variation in the year | | |
| | | Production Capacity | | |
| | | Cabling | | |
| | | Power of generators | | |
| | | Transformers | | |

Source: Prepared by the author based on Carvalho (2011).

3.1.3 Material/Materialized Step

The next step is the material/materialized. Within the didactic sequence proposed in this work, this stage is contemplated in the third meeting and corresponds to the act of visiting the wind farm.

According to Talízina (1984), the solution of a problem situation using the Action Guiding Base, as a guiding basis in decision-making, will develop the cognoscitive part.

Observations can be made from the moment of displacement to the wind farm, because, in general, it is built in isolated regions, an obligation imposed by law, which preserves sound, visual and environmental harmony.

3.1.4 Internal and External Verbal Language Stage

These stages are contemplated in the fourth meeting, whose activities include the delivery of a written report and the presentation of the students' views, referring to the proposed problems situations.

IV. CONCLUSIONS

This article sought to explain galperin's Theory of Assimilation by Mental Stages and Formation of Concepts, for this, it makes a bibliographic review of the main points of this theory.

The aim of this study was based on the availability of a new perspective in orientation, based on the Theory of Assimilation by Mental Stages and Formation of Concepts of Galperin, which would enable them autonomy in pedagogical practice. Therefore, to be able to aggregate in your school practice implementing your repertoire of knowledge.

It is not intended to impose a new orientation for the action of planning field activities, but rather to suggest a form based on Galperin's theory, which has often been tested in various fields of education and had excellent results.

In this work the concepts of field activity, lesson planning, Galperin's theory, were together in a proposal directing the action to plan field activities according to Galperin's Theory.

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Environmental Public Policies in Coastal Ponds: The Case of Náutico Lagoon – Pernambuco/ Brazil

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Abstract- In the current context, coastal lagoons are ecosystems that suffer major anthropic interference and, in the case of Náutico Lagoon, central focus of this research, these impacts are noticeable, mainly, with the presence of several communities that formed around them and that along of the years have been consolidated. In view of this problem, the present work aims to discuss the current environmental public policies for Náutico Lagoon. Even with so many legal parameters, it is still difficult to implement environmental education policies in Brazil. With this research it was possible to conclude that this lagoon system is in a situation of abandonment and negligence by public agencies, requiring investments and environmental public policies that seek to efficiently develop and structure this environment, highlighting potentialities such as ecological and landscape diversity, tourism and leisure for the population.

Keywords— Environmental degradation; Coastal Pond; Environmental Public Policies.

I. INTRODUCTION

The municipality of Jaboatão dos Guararapes opens a coastal lagoon called Náutico Lagoon (Nautical Lagoon), formerly known as Olho D'água Lagoon (Spring Lagoon). According to Assis (1997), coastal lagoons are ecosystems that suffer major anthropic interference and, in the case of Náutico Lagoon, focus of this research, which is inserted in the urban environment, these interferences are noticeable mainly for being inserted in an urban perimeter and in the presence of several communities that have formed around it and that over the years have been consolidated.

Given the importance of environmental conservation of coastal lagoons and compliance with current legislation, actions aimed at protecting these ecosystems need to be widely disseminated, inspected and debated. According to Leal (2002), coastal lagoons exert a direct influence on the maintenance of the groundwater and on the stability of the local and regional climate. Therefore, the importance of Náutico Lagoon for the municipality of Jaboatão is enormous with respect to local climate issues and biological maintenance for the urban environment.

With this problem in mind, this article has the main objective of discussing public environmental policies in coastal lagoons, and the specific objectives of: debating public environmental policies for Náutico Lagoon supported by the current legislation and to discuss the issue of environmental degradation in this ecosystem. The research has a qualitative character, desk research on the theme were usedas methodological bases, with documentary research and on-site visit to the study area in addition to the current legislative mechanisms for this environment.

There exist several instruments and environmental policies aimed at the conservation of natural environments, especially the hydric ones, as a means of guaranteeing their environmental sustainability (BRAGA, 2009). Nevertheless, even with so many legal parameters, the implementation of environmental education policies in Brazil is still difficult. Many laws, decrees and ordinances are not effectively put into practice, often lacking greater commitment from both society and government with respect to environmental issues and compliance with legislation through actions aimed at protecting these ecosystems.

With this study, it was possible to conclude that this lagoon system is in a situation of abandonment and

negligence bypublic agencies, in need of investments, environmental education projects and public policies that seek to develop this space efficiently and in a structured manner, highlighting both the potentialities, such as an ecological and landscape diversity which set it as a social and tourist asset, and the harmful relationship between the natural ecosystem and local population.

II. THEORETICAL BASIS

2.1 EnviromentalPublic Policies – EPP

According to Salheb et al. (2009, p. 06): "The environmental crisis caused society to mobilize, demanding - from the constituted powers - mitigating and propelling responses to a new societary model". This need promoted the emergence of environmental policies in Brazil and Environmental Public Policies gained strength from the second half of the twentieth century. Over the years, the concern with the possible scarcity of environmental resources impelled Brazil to create, on August 31, 1981, Federal Law No. 6,938 referring to the National Environment Policy (PNMA, Política Nacional do Meio Ambiente in Portuguese), which has as its main focus the environmental preservation, improvement and recovery (MOTTA; PÊGO, 2013).

According to Law No. 6,938 / 81, the PNMA, which comprises of 21 articles, is the Brazilian most important reference regarding environmental protection, where each one of its articles addresses diverse aspects related to the environment and its protection mechanisms. Within that law are the concepts of environment, environmental degradation, pollution, among other themes, taking Brazilian reality into account.

In PNMA, the principles are responsible for regulating and directing actions, the instruments are the tools for the environment preservation and the National Environment System is the set that comprehends the Union, agencies and entities in the federal, state and municipal spheres that work in cooperation to enhance environmental quality and preservation (RODRIGUES, 2010).

2.1.1 Environmental Education

In 1972, the United Nations (UN) held the United Nations Conference on the Human Environment, also known as the Stockholm Conference, which was characterized as the initial step towards debates on the environment. According to Costa (2012), the conference addressed a series of concerns relative to the well-being of society and future generations, such as climate change, which was already being perceived, the heat islands, water management and quality, limitation with regard to the use

of pesticides, the release of heavy materials into nature, among others.

After this conference a series of debates were launched with a focus on environmental preservation, among them is the United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit, Rio Conference, or Rio 92 (in Portuguese, ECO 92) that was held in Brazil, more specifically in Rio de Janeiro. According to Novaes (1992), this conference, as well as the Stockholm one, aimed to reconcile the issue of social and economic development with the environment, promoting sustainability and reducing impacts on the natural environment.

Rio 92 took place 20 years after the Stockholm Conference and addressed more concise debates on the notion of the term sustainable, aiming at a less consumerist growth model, having as its motto the phrase: "think globally, act locally".

The first conference on Environmental Education was held in Yugoslavia (Belgrade Conference) in 1975 and was linked to the Stockholm Conference. Within the Belgrade Conference, principles and guidelines for environmental education were created, accounting for multidisciplinarity and regional disparities based on national interest.

Also in this conference, the Belgrade Charter was formulated, which, according to Reis (2014), asked humanity to rethink the concept of development, where individuals should reconcile their priorities, strengthening the commitment between the environment and society. The second meeting was marked by the Intergovernmental Conference in Tbilisi, initiating, according to UNESCO (1997), the International Environmental Education Program (IEEP), taking into account the interests of the Member States.

The Tbilisi Conference summoned educational authorities to encourage institutions to develop the work of reflection, research and innovation in the environmental education knowledge field, including the Member States in this debate, in order to encourage the exchange of experiences, research, reports and documentation for environmental education to obtain a global focus and an interdisciplinary character. Finally, the third conference, according to Moradillho and Oki (2004, p. 333) "[...], stood out from the others for creating a theoretical and methodological framework for the realization of Environmental Education".

When approaching environmental education, there exista variety of concepts and definitions converging to the same purpose: encompassing man, nature and all the paths that lead to an awareness aiming at the preservation of the natural environment.

According to Law No. 9,795 of April 27, 1999, Environmental Education is characterized by:

Art 1 "[...] the processes through which the individual and the collectivity build social values, knowledge, skills, attitudes and competences aimed at the conservation of the environment, a common use good of the people, essential to the healthy quality of life and its sustainability "(PNEA, 1999, p.1).

According to Dias (1998), the concept of Environmental Education is defined as a set of environmental content and practices aimed at solving concrete environmental problems, by means of an interdisciplinary approach and an active and responsible participation of human being as a society.

Education in general, presents itself as an important instrument that contributes to the development of the nation, in addition to being responsible for the evolution of man within society. Discussing environmental education in the academic sphere, in the school environment and in other social areas contributes to spread the importance of research in this area of knowledge and foster the search for solutions that aim to mitigate the degradation of the environment by man, being of paramount importance to propagate the need for the maintenance and preservation of the natural environment as well as the guarantee of better living conditions for future generations (ZULAUF, 2000).

According to IBAMA (1997), Environmental Education, in relation to its character and function, is responsibility of the whole society and must address all members of the community according to the modalities that meet the needs, interests and motivations of all age groups and socioprofessional categories.

2.2 CoastalLagoons

According to Esteves (1998), in Brazil, coastal lagoons are present in abundance in the territory, ranging from small depressions that are formed by the accumulation of rain or sea water, to perennial water bodies with a large volume of water. Thus, Leal (2002) adds that coastal lagoons directly influence the maintenance of the groundwater and the stabilization of the local and regional climate. This type of ecosystem, despite suffering from anthropogenic pressures, offers important environmental services, among them the regulation of the surrounding temperature and water balance, since they serve to increase the water surplus of canals during periods of intense rain.

Leal (2002), remarks that environmental impacts often result in irreversible ecological degradation of coastal lagoons, making the ecosystem unfeasible for any use and, linked to these impacts, is the landscape degradation of adjacent areas, due to real estate occupation in the lagoons flood zone, which indirectly increases the pressure on the main lagoon. Corroborating this problem, Nascimento (2010. p.28) adds that:

> Most of the times it is in the metropolitan regions that rivers, lakes and lagoonsare landed with solid waste and garbage. Many have their banks invaded by dwellings without any sanitation infrastructure, so the waste produced is dumped into the bed of these bodies, causing thus various forms of environmental degradation.

In this sense, coastal lagoons are extremely fragile ecosystems that need efficient environmental public policies aimed at their protection and maintenance. According to Santos et. al. (2015), these ecosystems are classified among the most threatened worldwide, and this happens mainly due to the geographic factor of location, because it coincides with regions of great occupation and urbanization, rendering these environments subject to anthropic interference.

2.2.1 Municipal Master Plan

With regard to the Municipal Master Plan (Plano Diretor Municipal in Portuguese, or PDM), it is necessary to establish a direct relationship with municipal planning, which are tools that aim at the management and organization of municipalities, thus playing an important role as an instrument for structuring Brazilian cities. The PDM can be understood as a "set of principles and rules that guide the action and the agents that build and use the urban space" (BRASIL, 2002, p.60). With this, it is possible to infer that the PDM acts as an orienting element of decisions that includes the space and activities developed within it.





The urban space is complex and dynamic, so the PDM must present itself with a continuous process, in order to achieve its guidelines and maintain its spatial organization. The Municipal Master Plan is a formal municipal law aimed at urban development and expansion, which includes zoning as a facilitating and indispensable instrument for its execution. With this Moreira (2008) affirms that the role of the PDM is to guide the development policy, aiming at the construction of cities that provide a better quality of life to the population, avoiding the consolidation and creation of illegal settlements in improper conditions.

Since it was instituted for Brazilian municipalities, the PDM is supported by the City Statute and, only through the PDM, it becomes possible to define the social function of the property and the city. In essence, according to Carvalho (2002), the PDM must contain some elements for its implementation, which are the legal instruments such as: Land appropriation, parcel of land and zoning.

As described in the Jaboatão dos Guararapes Master Plan (2013), there is the Citizen Environmental Education Project, which has the objective of promoting environmental education aiming at building a healthier and more pleasant environment, guaranteeing sustainability and affirming citizenship. Based on the reality of the municipality, the city government performs sporadic actions and workshops advising on the proper disposal of solid waste as a means of maintaining and preserving public space, as well as beach cleaning efforts, thematic exhibitions, an ecological handicraft fair and partnerships with universities and colleges.

III. METHODOLOGY

2.3 SearchLocation

The analysis unit for this research is located in Brazil, in the state of Pernambuco, specifically in the municipality of Jaboatão dos Guararapes. According to IBGE (2019), the municipality of Jaboatão dos Guararapes has a population of 702,298 inhabitants, with 630,595 in the urban area and 14,025 in its rural area, spread over a territorial area of 258,724 km², being the second most populous municipality in Pernambuco. It is limited to the north with the municipalities of São Lourenço da Mata and Recife, to the south with the municipality of Cabo de Santo Agostinho, to the east with the Atlantic Ocean and to the west with the municipality of Moreno (Fig. 1).

Geographically, the municipality of Jaboatão dos Guararapes, is inserted in the As' climate according to the Koppen classification. The annual temperature averages for the municipality of Jaboatão vary between 25 °C and 30 °C, not presenting great thermal amplitudes (MANSO et al., 2006).

Jaboatão dos Guararapes contains a coastal lagoon that, according to Ordinary Law No. 135/2002, published in the Municipal Master Plan, is no longer called OlhoD'Água Lagoon and is from there on to be called Náutico Lagoon (Fig. 02). The present lagoon has a perennial regime, being part of the estuary ecosystem of the Jaboatão River, characterized by the formation of sandbanks. Totally inserted in an urbanized area, the ecological balance of the lagoon depends on factors synergistic to this anthropized environment.

Currently, the lagoon is quite silted up, mainly in the South section, in addition to suffering pollution caused by sanitary wastes and garbage from informal settlements located in its surroundings, according to the Final Report of the Participatory Master Plan of the municipality of Jaboatão dos Guararapes, in 2006. Náutico Lagoon is a lagoon system, with 3.7 km², extremely shallow, with two main feeder canals, one to the north, Setúbal Canal, and another one to the south, the OlhoD'Água Canal, making the connection between the lagoon and the Jaboatão River estuary(ASSIS, 1997).



Fig. 2: location of the research unit -Náutico Lagoon.

According to Leal (2002), Náutico Lagoon corresponds to a waterbodyinserted in the fluvial-lagoon plain, which settled between the two marine terraces and may be the remnant of a more peaceful period, probably the bottom of a cove, which corresponds to a pondthat floods a very shallow depression. Originally, the NáuticoLagoon region and its surroundings were inserted in the Atlantic Forest Biome compounded of dense rain forest, mangroves and sandbanks (LEAL, 2002). Nowadays it is still possible to find small fragments of forests, few remnants of sandbank and a larger presence of mangroves due to their resilience.

2.4 Collectand Data Analysis

The research has a qualitative character, desk research on the subject, documentary research and on-site visit to the study areawere usedas methodological bases. The collection instruments that served as the basis for this research were satellite images of the Google Earth Pro tool for the delimitation of the analysis unit and observation of local conditions and, to support the theoretical framework, scientific articles, books, journals and the Master Plan of the municipality of Jaboatão dos Guararapes were used.

Legislative mechanisms were also used, such as Complementary Law No. 17/2013, available on the Internet, Federal Laws such as the National Environmental Policy No. 6.938/81 and the Cities Statute with the Artificial Environment Law and Law 9.795/99 that provides for Environmental Education and institutes the National Environmental Education Policy.

3 ResultsandDiscussions

The focus of this research is Náutico Lagoon, inserted in an urbanized space that historically suffers from the pressure of urban agglomerations. According to Assis (1997), the occupation around the Lagoon occurred irregularly and without infrastructure, generating conflicts between human occupation, the ecosystem and the physical environment. These agglomerations occurred gradually with the predominance of low-income settlements and streets with irregular layout, mostly occupying the lower areas and, therefore, more subject to flooding. (PDP Final Report, 2006).

According to the environmental legislation for the area comprising Náutico Lagoon, there is a federal legislation n° 12.651/2012, which establishes a Permanent Preservation Area (Área de Preservação Permanente, APP in Portuguese) in the areas located around natural lakes and lagoons; and the protection zone with a minimum length of thirty meters, for those located in consolidated urban areas.

For Maglio (2000):

Each sphere of government - Federal, State and Municipal - has different roles with regard to the implementation of public environmental management, which must be based on a management system that lists the institutional, legal and technical aspects to achieve the objectives and goals of the formulated environmental policy. (apud Rodrigues et al., 2012, p.98).



Fig.3: Water bodies Conservation Zone(ZCA) –Náutico Lagoon-PE.

In the Municipal Participative Master Plan itself, rectified in 2013, only the construction of small equipment aimed at supporting the operation of leisure and environmental conservation activities is permitted, in accordance with the restrictions of the permanent preservation area, and the launch of untreated sewage in the lagoon drainage basin is prohibited. In addition, the Urban Zoning published in the Participative Master Plan in 2013, delimits the Waterbodies Conservation Zone (Zona de Conservação Ambiental, ZCA in Portuguese) around the NáuticoLagoon (Fig. 3).

According to the Master Plan of the Municipality of Jaboatão dos Guararapes, the ZCA was established by the

city governmentto promote the conservation and maintenance of the existing waterbodies in the municipality. However, in NáuticoLagoon this delimitation has not been respected by the population.

These legal instruments and public environmental policies aimed at conserving the environment and mitigating environmental impacts, taking the case of Náutico Lagoon as a highlight, have not been efficient in ensuring the conservation of this lagoon ecosystem (ASSIS, 2011). The relationship between NáuticoLagoon and the urban space in which it is inserted is degrading, according to the Final Report of the Participative Master Plan (2006), the lagoon is characterized by an environment marked by the traces of human occupation.

Among the problems present in Náutico Lagoon and its surroundings, it is possible to mention the inadequate disposal of garbage, the lack of basic sanitation and the discharge of sewage without proper treatment, not only from the irregular communities installed in its surroundings (figure 04) but also, according to Leal (2002), from some neighborhoods in the municipality of Jaboatão, such as the neighborhood of Prazeres, Piedade, Candeias, Barra de Jangada, as well as more distant neighborhoods, such as the Boa Viagem district in the City of Recife, through the Canal de Setúbal. (Figure 05). And with this Andrade (2012) contributes that urbanization often expands the use of natural resources, generally compromising environmental and landscape quality.



Fig.4: Irregular occupation in the surroundings of Náutico Lagoon: (a) Satellite Image of the Vila Sotave Community (neighborhood of Prazeres -Jaboatão dos Guararapes);
(b) Inadequate waste disposal and (c) Irregular housing on the west bank of the Lagoon.

Source: (a) Google Earth, 2020; (b) and (c) Rebeka Guedes, 2020.

Náutico Lagoon, as mentioned earlier, is inserted in the urban perimeter of the municipality of Jaboatão dos Guararapes, surrounded by irregular occupations that do not obey the current legislation. Currently, society's relationship with this lagoon system is worrisome. According to Soffiati-Neto (1996, apud Santos, 2008) coastal lagoons are characterized as the Brazilian ecosystems that are most subjected to anthropic impacts and that these impacts have been present since the time of colonial Brazil.



Fig.5: Setúbal Artificial Canal that ends at Náutico Lagoon: (a) Satellite Image of the Setúbal Canal; (b) Water pollution at the mouth of the Setúbal Canal.

Source: (a) Google Earth, 2020; (b) Rebeka Guedes, 2020.

The importance of Náutico Lagoon for the municipality of Jaboatão is enormous with regard to issues of local climate and biological maintenance for the urban environment (TENÓRIO, 2013). Náutico Lagoon has several potentialities that, even with the problems of environmental impact, pollution and disordely occupation, present in its surroundings, it is still possible and necessary to search for alternatives that change the current scenario in which this lagoon ecosystem is found.

Based on the Municipal Master Plan made available by the city government and rectified in 2013, the landscape and biological importance of Náutico Lagoon and its great relevance as a drainage element during rainy seasons in the municipality are recognized, however actions must be put intopractice so that, in fact, Náutico Lagoon becomes a balanced environment with potential that can be used by the population of the municipality.

According to the city government, there exists a project aimed at implementing the Náutico Lagoon Metropolitan Park, whose goal is to highlight the touristic and environmental potential of this ecosystem that is currently greatly weakened by anthropic pressures.

The implementation of this metropolitan park, according to the project made by the municipal management, will result in significant changes in the construction pattern of the area in order to render it compatible with the vocation and potential for tourism and leisure in the coastal area of the municipality, with the qualification of the landscape. The main objectives of the Náutico Lagoon park are:

- i. Recover and structure the management of natural ecosystems;
- ii. Mobilize resources to develop tourism products that increase the generation of work and income for the local population;
- iii. Implement leisure and support areas for needy communities;
- iv. Regulate existing irregular residential areas, lacking basic urban infrastructure and transport.

In short, the project that aims to set up the Metropolitan Park in Náutico Lagoon is very concise and, if put into practice by public agencies, will bring benefits to the local population, thus reversing the situation of abandonment that Náutico Lagoon is currently experiencing.

IV. CONCLUSIONS

The visit to the study area that encompasses Náutico Lagoon and its surroundings was of great importance to comprehend the context and the abandonment situation that Náutico Lagoon currently suffers, implying in the clear difficulty of executing the decrees and rules existing in the Municipal Master Plan and in the National Environmental Policy, in addition to the lack of investment by public agencies in this environment.

The Náutico Lagoon and its surroundings can be used in a positive way, highlighting its potentials such as the ecological and landscape diversity of this lagoon system, the possibility of creating leisure areas for the population and investment in infrastructure works in order to modify the current critical context in which the lagoon is inserted.

Therefore, what is missing for this region are public policies that efficiently seek to develop and structure this space, through the implementation of projects that integrate leisure areas, resulting in social well-being, tourism and a harmonious relationship between the natural ecosystem and the local population.

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Oral Health and Quality of Life in adults living in Northeastern Brazil

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Abstract— *Objective:* To assess the oral health-related quality of life of adult people regarding social, physical and psychological aspects.

Methods: Analytical cross-sectional research conducted with adults living in Northeastern Brazil. Patients were assessed through three questionnaires: Sociodemographic (age, gender, skin color, marital status, education and income); OHIP-14 - instrument that assesses the impact of oral health on quality of life; COHI - Community Oral Health Indicator, which assesses: 1- Masticatory capacity; 2- Oral health injuries; 3- Use of dental prosthesis; 4) Dental visits.

Results: The research was conducted from January to April 2015 in two randomly-selected Primary Health Care centers Participants were 264 people whose age ranged 18-59 years (mean 37.06 years and SD±10.994). Statistically significant differences were found between mean OHIP scores and socioeconomic data: skin color (p= 0.036) and education (p=0.022), oral health status: no visible cavities (p<0.001), sore gums (p=0.005), three or more visible cavities (p<0.001), and soft tissue injuries (p= 0.005).

Conclusion: Quality of life was shown to be influenced by oral health status, although many interviewees reported having a good quality of life.

Keywords— Epidemiology. Oral Health. Quality of Life. Adults.

I. INTRODUCTION

Given the increasing development of public health policies on health promotion and disease prevention, studies on quality of life have been carried out to incorporate positive and negative perceptions of oral health and health outcomes [1, 2]. In this context, the 2nd National Conference on Oral Health [3] considers that "Oral health is an integral and inseparable part of an individual's general health".

In order for people to reach old age with a good oral health, it is necessary that they take care of it throughout their entire life. In adulthood, oral health problems are exacerbated due to the cumulative nature of the sequelae of oral diseases [4].

In a debate held in Rio de Janeiro [5], quality of life was defined as a sense of human satisfaction that is

closely related to the degree of satisfaction found in family, love, social and environmental life and to existential aesthetics itself – which could be considered a cultural synthesis of all the elements that a certain society considers as its standard of comfort and well-being. Authors [6] have emphasized that self-reported symptoms and perceived oral health status and need for treatment are important measurable dimensions of oral health and quality of life. Therefore, good oral health is imperative to general health, well-being and quality of life and brings significant benefits to self-esteem, dignity, social integration, and nutrition in general.

Given that, the importance of oral health for adults is observed when toothache alone interferes with social life and prevents individuals from carrying out their work activities, significantly affecting their quality of life. Therefore, subjective or socio-dental indicators are crucial for raising awareness on the effects of these problems on people [7, 8].

Despite advances and improvement in health care in Brazil after the implementation of its Unified Health System (Sistema Único de Saúde - SUS) in the 1990s, the oral health status of the Brazilian population is still worrisome, especially with regard to older people and adults. Epidemiological surveys conducted in Brazil to assess the number of decayed, missing and filled teeth (DMFT) in the Brazilian population show that in a 24-year period the oral health of adults and older people did not reflect much of the improvement in oral health policies. In these surveys, the mean DMFT in adults (aged 35-44 years) was 22.5 in 1986 (14.96 representing the extracted component), 20.1 in 2003 (13.2 extracted component) and 16.75 in 2010 (7.48 extracted component) [3, 4, 9, 10]. The findings present an alarming situation in which most of the components of the DMFT index in this age group refer to missing or extracted teeth.

Another factor that is particularly present in this age group is the need for dental prosthesis. Findings of the last epidemiological survey revealed that only 26.6% of adults in this age group do not need any type of dental prosthesis [10]. This means that the attack of dental caries is a concern that manifestly affects the good oral health status of this portion of the Brazilian population.

In addition to this problem, tooth loss and poor dental care are common and generate physical, psychic, and/or social problems, as research [11] has demonstrated that chewing disability produces a significant and negative impact on oral health-related quality of life (QoL), and both poor QoL and chewing disability are related with the decrease of the number of natural teeth.

An example of such relationship can be seen in a study that demonstrates that decreased appetite in patients with depression is associated with poor diet and decreased self-esteem [12]. Additionally, another study found that depressive symptoms were associated with the oral discomfort in older people [13].

Thus, it should be said that the comprehensive nature of dental care requires integration with other professionals in order to consider life in all its aspects (e.g., physical, social and psychological). However, the assessment of these conditions requires indicators/indices such as the OHIP (The Oral Health Impact Profile), developed by Slade and Spencer [14], and its shorter version – OHIP [15], which is suitable for assessing oral health-related quality of life.

Therefore, Oral health-related quality of life (OHIP) will be compared using the Community Oral

Health Indicator (COHI). This indicator, developed by Saintrain [16] and validated by Saintrain, Vieira [17], was shown to be very effective in assessing the oral health of research participants included all ages.

In this context, it is important to assess people's satisfaction with their oral health so that dental care can be delivered in a comprehensive and humanized way taking into consideration the capacities and needs of this and other population groups.

Thus, the present study aimed at assessing the oral health-related quality of life of adults with regard to social, physical and psychological aspects, comparing with the actual oral health condition.

II. METHODS

This is a quantitative, descriptive, and analytical cross-sectional research conducted with adults living in the city of Fortaleza, Ceará, Northeastern Brazil. Adults were individuals aged 35 to 59 years according to Brazil's National Policy on Older People's Health, which establishes age 60 as the beginning of old age [18].

The city of Fortaleza is divided into six administrative regions (*Secretarias Executivas Regionais* – *SER*) and has a total of 93 Primary Health Care (PHC) Centers. The research was carried out in two randomly selected PHC centers in each region.

Sample size was determined based on data from DATASUS (Brazil's Unified Health System Database) on the total number of adult inhabitants in the city of Fortaleza in 2012, which showed that the Metropolitan Region of Fortaleza had 1,464,700 adults [19].

A minimum sample size was determined to estimate a population proportion with a maximum expected proportion of 20%, a significance level of 5% (95% confidence interval) and a maximum permissible error of 5%. Thus, the sample size was determined to be 264 adults. Therefore, data were collected from 22 adults from each PHC center – a total of 44 adults from each SER.

The interviewers were previously trained in order to standardize the data collection process. After the training, the patients were assessed through three questionnaires: a) identification form – a semi-structured questionnaire to obtain sociodemographic data (address, age, gender, skin color, marital status, education, and income); b) Oral health-related quality of life - OHIP-14 – a specific instrument containing 14 essential items to assess the impact of oral health on quality of life. Each question is assessed based on the following scale: 0 = 'never', 1 = 'hardly ever', 2 = 'occasionally', 3 = 'fairly often', and 4 = 'very often' [14, 15]; c) COHI – Community Oral Health Indicator [16, 17], which assesses: 1 - Masticatory capacity (number of teeth in the mouth); 2 – Degree of severity (no visible cavities, presence of tartar, one or two visible cavities, three or more visible cavities, soft tissue injuries); 3 - Use of prosthesis; and 4) Dental visits in the previous year.

After collection, data were entered and analyzed using the Statistical Package for the Social Sciences – S PSS version 15 (SPSS Co, Chicago, USA).

Data were analyzed using descriptive and analytical statistics. Significant differences between variables were checked using the Mann-Whitney* U test when comparison involved two categories and the Kruskal-Wallis test** when more than two categories were compared. In order to facilitate understanding of analyses, it should be noted that the higher the mean value for the sum of scores, the lower the quality of life of interviewees.

Inferential analyses with "p" value less than or equal to 0.05 (p<0.05) were considered statistically significant.

The research protocol complied with the ethical precepts of research involving human beings and is in accordance with Resolution 466/12 of the National Health Council. Study participants were guaranteed dignity, respect and protection, and the study followed the four basic reference principles of bioethics: autonomy, beneficence, nonmaleficence and justice. The study was approved by the Research Ethics Committee under Opinion No. P068232/2013.

III. RESULTS

The study was conducted with 264 people whose age ranged 18-59 years, with a mean of 37.06 years and Standard Deviation \pm 10.994.

There was a predominance of single individuals (107; 40.5%), women (193; 73.1%), ages 28 to 37 years (90; 34.09%), white skin color (133, 50.37%), income of up to one minimum wage (147, 55.68%, and complete secondary education (103, 39.01%).

Statistically significant differences were found between the mean OHIP scores and socioeconomic data: skin color (p=0.036) and education (p=0.022). (Table 1).

Regarding oral health status, 213 people (80.68%) had 20 or more teeth in their mouths. Of these, 119 (45.07%) had no visible cavities. Additionally, 209 (79.16%) participants did not use dental prosthesis.

Statistically significant differences were found between the mean OHIP scores and oral health status: no visible cavities (p<0.001), sore gums (p=0.005), three or more visible cavities (p<0.001), and soft tissue injuries (p=0.005). (Table 2).

Table 1 shows the results of the comparative analysis between the sociodemographic data of the adults and the median value of the OHIP-14 index.

Table 2 shows the results of the comparative analysis between the oral health status of the adults and the median value of the OHIP-14 index.

| Variables | Ν | Oral health-related quality of life | | | | | |
|----------------|-----------|-------------------------------------|----------|------|---------|--|--|
| | | Median | Standard | Mean | p value | | |
| | Deviation | | | | | | |
| Age | | | | | | | |
| 18-27 years | 60 | 6 | 9.5 | 8.6 | 0.509** | | |
| 28-37 years | 90 | 7 | 9.0 | 9.2 | | | |
| 38-47 years | 53 | 8 | 7.8 | 9.2 | | | |
| >47 years | 61 | 8 | 9.4 | 10.4 | | | |
| Marital status | | | | | | | |
| Single | 107 | 7 | 9.4 | 9.1 | 0.747** | | |
| Married | 92 | 7.5 | 8.3 | 9.3 | | | |

 Table 1. Distribution and comparative analysis of sociodemographic data versus mean Oral health-related quality of life

 OHIP scores. Fortaleza, Ceará - Brazil.

| Diivorced | 13 | 6 | 8.3 | 9.0 | |
|----------------------------|-------------|-----------------|------------------|------|---------|
| Widowed | 7 | 16 | 13.4 | 14.9 | |
| Other | 45 | 7 | 8.8 | 9.4 | |
| Gender | | | | | |
| Men | 71 | 7 | 8.5 | 8.9 | 0.806* |
| Women | 193 | 7 | 9.2 | 9.5 | |
| Skin color | | | | | |
| White | 133 | 6 | 8.4 | 8.0 | 0.036** |
| Black | 24 | 11 | 9.3 | 11.5 | |
| Pardo | 105 | 8 | 9.5 | 10.7 | |
| Other | 2 | 10 | 2.8 | 10.0 | |
| Employed | | | | | |
| Yes | 189 | 7 | 9.3 | 9.4 | 0.984* |
| No | 75 | 6 | 8.2 | 9.2 | |
| Income | | | | | |
| 1 wage | 147 | 8 | 9.1 | 10.0 | 0.267** |
| 2-5 wages | 62 | 7 | 9.2 | 8.5 | |
| 5 wages or more | 3 | 4 | 2.3 | 2.7 | |
| No income | 52 | 6 | 8.5 | 9.1 | |
| Education | | | | | |
| None | 7 | 5 | 7.3 | 8.7 | 0.022** |
| Incomplete primary | 69 | 9 | 11.2 | 10.9 | |
| Complete primary | 46 | 10 | 8.2 | 11.0 | |
| Incomplete secondary | 12 | 15.5 | 8.8 | 13.9 | |
| Complete secondary | 103 | 6 | 7.6 | 7.8 | |
| Higher education | 27 | 4 | 7.9 | 6.8 | |
| Source: research data * Ma | ann-Whitney | U test; ** Krus | skal-Wallis test | | |

Table 2. Distribution and comparative analysis of Oral Health Status versus mean OHIP scores. Fortaleza, Ceará - Brazil.

| Variables | Oral health-related quality of life - OHIP | | | | | | |
|------------------------------|--|--------|-----------|------|---------|--|--|
| | n | Median | Standard | Mean | p value | | |
| | | | Deviation | | | | |
| Number of teeth in the mouth | | | | | | | |
| None | 8 | 11.5 | 7.2 | 12.1 | 0.273** | | |
| 1-10 teeth | 21 | 8 | 9.8 | 10.3 | | | |
| 11-19 teeth | 22 | 10 | 7.7 | 10.6 | | | |
| 20 or more teeth | 213 | 7 | 9.1 | 9.0 | | | |
| No visible cavities | | | | | | | |

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| Yes | 119 | 4 | 8.9 | 7.7 | < 0.001* |
|-------------------------------------|--------------------|----------------|-------|-------|----------|
| No | 145 | 10 | 8.8 | 10.7 | |
| Presence of tartar | | | | | |
| Yes | 63 | 9 | 8.3 | 9.6 | 0.536* |
| No | 201 | 7 | 9.2 | 9.3 | |
| Sore gums | | | | | |
| Yes | 71 | 11 | 9.2 | 11.7 | 0.005* |
| No | 193 | 6 | 8.8 | 8.5 | |
| One or two visible cavities | | | | | |
| Yes | 90 | 9 | 7.8 | 9.9 | 0.121* |
| No | 174 | 6 | 9.5 | 9.1 | |
| Three or more visible cavities | | | | | |
| Yes | 48 | 12.5 | 8.8 | 13.3 | < 0.001* |
| No | 215 | 6 | 8.8 | 8.5 | |
| Soft tissue injuries | | | | | |
| Yes | 34 | 12 | 7.3 | 12.1 | 0.005* |
| No | 230 | 6 | 9.1 | 9.0 | |
| Use of prosthesis | | | | | |
| Yes | 55 | 8 | 9.272 | 10.35 | 0.318* |
| No | 209 | 7 | 8.908 | 9.11 | |
| Dental visit in the previous year | | | | | |
| Yes | 155 | 7 | 9.4 | 9.7 | 0.791* |
| No | 109 | 7 | 8.3 | 8.9 | |
| Source: recearch data * Mann Whitne | v II tost. ** Kmis | kal Wallis tas | + | | |

Source: research data. * Mann-Whitney U test: Kruskal-Wallis test

IV. DISCUSSION

Oral health is an important component of general health and quality of life. However, oral diseases still constitute an important public health problem in both highincome and low- and middle-income countries. Despite this, disease prevention and oral health promotion are largely neglected in the public health field [20].

Therefore, the present research, which seeks to measure the impact of oral health status on the quality of life of adults, assumes that oral health is an "integral and inseparable part of an individual's general health", that is, it is notably a significant component of people's general health and quality of life [3, 21].

The assessment of oral health-related quality of life (OHIP-14) found no significant differences between genders. A similar situation was observed in Greece [22] where the mean OHIP value was 2.0 (standard deviation \pm

2.7) for male gender and 2.5 (standard deviation \pm 2.8) for female gender – and in Germany [23].

The research findings reveal statistically significant differences between the quality of life and education of the participants.

The application of the OHIP to the adult population in England, Wales and Northern Ireland has revealed weaker marginal effects for all outcomes for occupational social class compared to education or income, i.e., educational and income-related inequalities were larger among young people and non-significant among 65+ year-olds [24].

In addition, Previous research [25] using the OHIP-14 with 1788 adults has identified that individuals' self-perception of their oral health was related to sociodemographic, socioeconomic, psychosocial, and behavioral variables, thus confirming that emphasis should be placed on social factors when addressing oral health problems.

Data from the 2010 SB Brasil reveal that adults from Northeastern Brazil had one of the highest rates of tooth loss in the country [10].

The present sample presented a relatively low socioeconomic status and a large number of low-educated participants. Such factors collaborate to and directly affect the oral health status as they are associated with knowledge about hygiene and care habits, and consequently highlight the need for dental actions aimed at health promotion and care and disease prevention, which is confirmed by research [26] carried out in Chile.

A large difference in quality of life was observed between white people and black people and *pardos* (mixed-race Brazilians). Participants with white skin color presented a better mean OHIP score (8.0) and statistical significance (p=0.036). Such finding suggests that their oral health-related quality of life is much better compared to that of black people, *pardos*, and/or other skin colors. This difference may be due to cultural reasons, factors related to discrimination and multidimensional aspects that may be associated with ethnic and racial disparities [27].

The epidemiological survey carried out in Brazil in 2010 [10] showed that Brazilian adults aged 35-44 years had a mean of 1.48 decayed teeth. In the same survey, only 0.9% of adults were caries-free.

Different from the aforementioned finding, it was observed that a great number of users of PHC centers (119; 45.07%) had no visible cavities, a finding that was statistically significant (p<0.001). This leads to think that public services may have provided more effective prevention programs and that people may be more concerned about their oral health.

In the present study, the interviewees who had three or more visible cavities (48; 18.18%) also presented data that suggested a lower quality of life compared to those with less than three cavities, with a statistically significant difference of p<0.001. This finding is supported by studies carried out in Makkah city, Saudi Arabia [28], where adults with higher caries experience presented lower quality of life.

The presence of gingivitis in the interviewees had an impact on their quality of life. The participants reported increased stress, irritability, discomfort, bad breath, decreased social interaction, and dissatisfaction with appearance, which had an effect on OHIP-14 scores. Likewise, research carried out in London [29] also demonstrated that the impact of periodontal disease on quality of life was mainly related to a significant association of periodontal problems with pain, nervousness, psychological distress, and functional, physical and psychological limitations of patients.

In this context, the lack of preventive and conservative oral health care actions targeted at these patients has a direct negative impact on their well-being [20].

The oral function, which encompasses a set of processes such as chewing, swallowing and phonation, is one of the points of quality of life. Thus, any type of injuries or harms to the oral cavity can impair and brings discomfort to the patient, as found in the results pointed out by the present study and confirmed by the study carried out in Quebec [21]. In addition to these problems, psychological and physical aspects may worsen the patient's condition. Therefore, the care of these people should be prioritized given the risks and severity of the disease. However, prevention and self-examination programs are necessary in order to raise awareness of the main actions one should take when faced with any type of injury, blister, patch or mouth sores.

The fact that the research was performed with people seeking care in primary care centers, the findings may not reflect the real dimension of the association between oral health condition and quality of life, and may constitute a limitation of the study. Although the data cannot be extrapolated to other populations, the findings showed that quality of life was influenced by the state of oral health, although many participants reported having a good quality of life.

However, tooth loss is still seen in a cultural way as a result of time and aging, that is, it is not considered a consequence of oral or stomatognathic diseases. There is still a need for improvement in the quality of primary health care services, as well as in the work process of health teams and professionals, in cultural standards, and in health education, in order to eliminate diseases such as caries and minimize the impact of oral health problems on quality of life.

V. CONCLUSION

The analysis of data allowed observing that the quality of life was influenced by oral health status, although many participants reported having a good quality of life. There is still a need for improvement in the quality of primary health care services, as well as in the work process of health teams and professionals, in cultural standards, and in health education, in order to eliminate diseases such as caries and minimize the impact of oral health problems on quality of life.

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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

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Abstract— The Prostate cancer is the second neoplasm that most affects men in Brazil (INCA, 2017). However, there is usually a neglect of man related to his health and resistance to screening by performing the digital rectal exam (Souza, Silva & Pinheiro, 2011). Given this scenario, the reality of the riverside is found, which needs further clarification about health services (Miranda, Corrêa, Nogueira, Palmeira & Rodrigues, 2017). Therefore, the present study aims to report the experience of nursing students in carrying out a health education action on the importance of the digital rectal exam in the prevention of prostate cancer. It is an experience report developed by undergraduate nursing students in a riverside community. Held on 11/15/2019, on Ilha das Onças in the municipality of Barcarena / PA, in a local church space, where there was an action in health to riverside dwellers, focusing on the prevention of prostate cancer. The report was based on the methodology of problematizing the "Arco de Maguerez". The action was received with great enthusiasm, the participants were very attentive and collaborative, expressed a lot of opinion related to the subject, demonstrated reluctance about the preventive exam, a fact that reinforces the relevance of addressing the subject. They also reported the great difficulty in accessing health services. Furthermore, it was found that the participants had little knowledge about the subject. This reality, which generated several doubts during the action. The activity points out the need for methods of prevention and the demystification of the digital rectal exam, in addition to showing that it is necessary to have information, respect for equity, the National Policy for Integral Attention to Men's Health and the Population Policy of the Field and Forest.

Keywords— Health Education, Men's Health, Prostate Cancer.

I. INTRODUCTION

Prostate cancer is the second neoplasm that most affects men in Brazil, because it is characterized, in most cases, as a silent disease, which consequently becomes neglected. Thus, dissemination can occur throughout the organism, causing death quickly (INCA, 2017).

According to the report of the National Cancer Institute (2019), the number of people affected by prostate cancer in the period from 2013 to 2019 reaches 144,155 thousand. However, of this total, about 7,266 individuals had no information about the treatment.

Through this reality, the National Policy for Attention to Men's Health was created, aiming to bring information and health services as a way of responding to the rates of health problems presented. This policy considers the specificities of the male population, and thus tries to reduce the low adherence of this public to primary care (Ministério da Saúde, 2008).

In this context, as a way of tracking the disease, digital rectal examination is an important tool in early diagnosis. During the exam, the responsible professional inserts the index finger into the rectal canal, which allows palpation in the organ, making it possible to evaluate possible changes in the size of the prostate (INCA, 2017).

It is inferred that the digital rectal examination is an important step in the identification of prostate cancer, because when there is an abnormality in the digital rectal and PSA (Prostate-Specific Antigens) exams, the patient is referred for a biopsy so that the diagnosis of the disease can be defined (Sarris *et al.*, 2018).

However, despite being a low-cost form of cancer screening, digital rectal examination is still avoided by some men because it causes discomfort, shame or even due to the lack of information about the technique used and the importance of the procedure (Souza, Silva & Pinheiro, 2011).

Furthermore, because it is a silent disease, men neglect to screen for prostate cancer (Freitas et al., 2015). In addition, it is important to note that riverside men, as well as men in urban centers, usually attend health services less compared to women. This fact makes diagnosis difficult in the early stages of the disease (Miranda, Corrêa, Nogueira, Palmeira & Rodrigues, 2017).

Health education in this context should be an educational act for the nursing professional, which should encourage self-care. This can occur through the instructions given to the individual, who acquires the necessary knowledge to take care of themselves, and may have autonomy over their health (Ramos, 2018).

It is necessary that the professional is also aware of the self-care of the person who suffers influences from the environment and culture, with regard to the learning that generates the patient's autonomy. And based on that, nursing is able to develop implementation actions ensuring the specific and particular needs of people (Bordalo, 2013).

Therefore, this study aims to report the experience of nursing students in carrying out a health education action about the importance of digital rectal examination in the prevention of prostate cancer.

II. METHOD

The present experience report deals with the implementation of Integrated Health Activities for Undergraduate Nursing students in the 4th semester of the School of Nursing Magalhães Barata - State University of Pará, which was developed by five students together with an advisor.

The activity developed had the greatest intention of carrying out the intervention to a reality, which refers to an experience in a riverside community in the municipality of Barcarena / PA. Thus, in order for the activity to take place, an Active Methodology based on the Problematization Method with the Arco de Maguerez was followed, which challenges students to solve problematic situations in the various social contexts.

Such methodology consists of a five-step process: Observation of Reality, the survey of Key Points, Theorization through bibliographic research, the planning of Solution Hypotheses and, finally, the Return to Reality for the application of a intervention action (Berbel, 2011).

Thus, in the first observation stage, one of the undergraduate students had the opportunity to visit Ilha das Onças, in the municipality of Barcarena / PA, where he could see that the riverside men obtained little knowledge about the prevention of prostate cancer due to lack of information. surrounding the area, in addition to realizing the great difficulty of local residents in accessing any health service.

In the second stage, the survey of key points occurred. The student together with the guiding teacher and four other classmates, met and shared the evidenced needs, defining the focus on men's health. Thus, nursing students sought studies and research on the subject, for theorizing and basing the action of returning to reality.

In the fourth stage, the formulation of the health education action was developed by the students of the nursing course in order to minimize the lack of clarification about the disease and the preventive exam. In this perspective, the choice of activities that fit the target audience was sought.

The application of the health action took place in November 2019, during the morning shift, in a local church

space. However, the activity only happened after the group of students made contact with the community leader of the locality where the activity would take place, after that contact she was willing to disclose and encourage the population of riverside men to appear on the day of the action. It was present in the application to reality, the nurse of the Territory coverage Unit, the teacher and advisor and the community leader of Ilha das Onças and the target population.

The target population was composed of men from the riverside community, who were aged between 35-55 years, and some of the family members of the target audience, such as their wives, were also present.

At the first moment of the action, the academics presented the theme that would be exposed, so that one of the students and the guiding professor explained about the "November blue" campaign. Subsequently, a dynamic of myths and truths about prostate cancer and digital rectal examination by means of "YES / NO" signs began, in order to identify the public's prior knowledge. After answering each question asked, the students observed the results on the plates, and from there they made an explanation to the listeners related to the questioning.

After that, one of the nursing students performed, with an anatomical and synthetic piece of the male genital apparatus, a simulation of how the digital rectal exam occurs, in addition to elucidating the information that the exam is fast and painless. After that, a folder made by the academics was delivered and explained.

At the end, a breakfast table was proposed to the residents present as a way of thanking them for their participation and welcoming the community towards the students.

III. RESULTS AND DISCUSSION

The action was received with enthusiasm and the participants were very attentive and collaborative, expressing too much their opinions related to the subject. In addition, it is important to highlight how much the public was reluctant about the preventive exam, a fact that reinforces the relevance of carrying out educational activities in health, especially in communities that lack information and services. In this context, it is essential to carry out educational interventions in health in the environment of the riverside man, since it enables the dissemination of knowledge and encourages self-care. Thus generating preventive actions for diseases, such as prostate cancer. However, it is also important to take into account prior knowledge about the community's theme (Santos *et al.*, 2015).

During the simulation of the preventive exam on the anatomical specimen, resistance related to the procedure was evident, in a good-humored way the residents reported understanding the importance of this prevention method. However, they stated that the digital rectal exam is something that generates a feeling of shame. This fact, which reinforces the low adherence on the part of the male public regarding the screening of the disease (Souza, Silva & Pinheiro, 2011).

In this context, the educational folder was developed in order to provide information to island residents on ways of preventing the disease and risk factors that can cause cancer, the main signs and symptoms of the pathology were highlighted in the material.

During the elaboration of the informative folder, the use of illustrative images and easy to understand language was prioritized, so that it was possible to visualize in a simple way how the digital rectal exam occurs, in addition to illustrating the difference of a healthy prostate for a prostate affected by cancer, thus aiming to reach the maximum public understanding of the subject.

Therefore, the production of a material showing the subject that will be addressed during an educational action, is something that contributes to the learning process. Thus, material written in a clear and objective way about prostate cancer is an important tool for absorbing the theme. What favors the decision making of the listener in relation to health care, in addition to enabling reflection on the subject in question (Moraes, Oliveira & Jesus, 2018).

IV. FINAL CONSIDERATIONS

Educational activities related to the prevention of prostate cancer are an important strategy in preventing the disease. In addition, it is extremely important to clarify the male and riverside population about the digital rectal exam, so that possible prejudices related to the procedure are demystified. Because, it is through continuous screening that the early identification of cancer becomes possible.

Educational action spaces are important scenarios for debate and exchange of information with the community on a theme. This is because this environment provides the listener with prominence in the learning process, a fact that makes the experience pleasant and relaxed. Thus, the present study contributed satisfactorily to the community. Thus, by clarifying doubts, the participants obtained information that they had not had before. This fact, which encourages behavioral change in the face of resistance in carrying out the disease screening. In addition, the experience was enriching for nursing students, as it was possible to contribute in a positive and enlightening way about the importance of the theme. In addition to encouraging, through the information provided during the game of questions and answers, the self-care of the target audience.

V. CONTRIBUTIONS TO NURSING

With the application to reality through educational action in health, it was possible to verify the importance of the nursing professional as a transforming agent in people's lives. With this, it is important to elucidate the advantages of using the problematization methodology for the learning stimulus, because there is a necessary focus on the critical reflection of the students on a given problem situation.

In addition, the search for hypotheses for solutions encourages the academic to develop the ability to solve problems, which is one of the basic instruments of nursing. Therefore, preparing future nurses from the minute observation, to the resolution of problems and, mainly, better and more appropriate intervention and transformation of lives.

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Conservation and Recovery of the water Eye of Alto da Santa Cruz in the Municipality of Saúde/ Ba/ Brazil

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Abstract— The present work had the intention to study on springs, having as main objective to understand how the actions of the Municipal Secretariat of Development, Agriculture and Environment and of the associations and groups of environmentalists of the municipality of Saúde/Bahia/Brazil contributed with the conservation and recovery the Alto da Santa Cruz water eye. Through this research it was possible to identify the methods that contribute to the recovery and conservation of springs, aiming to understand and highlight the actions of the Environment Secretariat and the groups of environmental researchers from Saúde – Bahia as relevant in the attempt to revitalize the water eye, however not being sufficient to recover it. It was also possible to notice that many actions, despite being in compliance with the legislation and with the studies that have already been done in the area, can not contribute to the environment in any way if there is no support from the population, the government and the higher inspection bodies.

Keywords— Spring recovery; Environmental degradation; Conservation.

I. INTRODUCTION

The existence of life on Planet Earth depends essentially on a liquid that, despite being abundant on Earth, is poorly distributed (does not reach the taps of the entire population) and is used irrationally by man, compromising its quality, its capacity for renewal and your availability.

In addition, in Brazil the distribution of water does not occur in an equal amount in the territory, so there is a shortage in some regions while in others, water is left over. In the North Region, for example, one of the smallest populations per m² is concentrated, however, the highest concentration of liquid fresh water in the country. In the Northeast and Southeast Regions, where most of the population resides, water is lacking and it is necessary to adopt protective measures of coexistence (OLIVEIRA; MOLICA, 2017, p.09).

In this sense, it is possible to inquire and reflect on who actually uses water. Has human consumption been prioritized as described by the law? It is known that there are still many people who do not have access to water, much less of good quality, in some cases this is not the result of contrasts of poor disposition in the country, which is mainly due to the distribution and irregularity of rainfall in the territory, but rather by lack of public policies that do not reach these populations, in addition, another factor that interferes is the pollution of superficial and underground rivers, the degradation of springs, among other aspects.

Oliveira and Molica (2017) corroborate stating that even attitudes considered small in the eyes of the population, such as the conservation of a water source is fundamental to guarantee the quality of water for human consumption.

Based on this, thinking of springs as a fundamental resource for water supply and at the same time as a target of environmental degradation, observing the significant number of springs that dry up for numerous reasons, especially due to the lack of conservation and disorderly use of groundwater, the present work proposed a research based on the following problem: To what extent, the actions of the Municipal Secretariat for Development, Agriculture and Environment and of environmental associations and groups in the municipality of Saúde – Bahia, contribute to the preservation, conservation and recovery of the Eye of Water of Alto da Santa Cruz of this municipality? Have these actions had the expected effect? Has there been a reversal of the environmental impacts in the springs and in the Eye of Water from Alto da Santa Cruz?

In the city of Saúde – Bahia, many reports are made by former residents of the neighborhood and even of the city, related to the Eye of Water focus of this research, which during the dry season supplied and alleviated the lack of water for a good part of the population.

In these reports, it is noticeable that the anthropic attitudes of degradation are the main causes that culminated in the extinction of the water flow of the small spring. It is known that many can be the causes, therefore, it was necessary to carry out this research, not to deepen this perspective, but to understand how it is possible to recover the source and protect it.

In this way, the research becomes of great relevance, o it is considered essential to raise the population's awareness in the context of the preservation of springs and that through groups or associations join the municipal public power, through the Municipal Development Secretariat, Agriculture and Environment and carry out actions that can assist in its recovery through efficient recovery methods.

The research also serves as an evaluation of the attitudes/actions already carried out by the municipal public power and by the associations in an attempt to preserve and recover the Eye of Water, checking if they could indeed have contributed to its revitalization, if it contributed emphatically, or it didn't help.

The general objective of the work was to understand how the actions of the Municipal Secretariat for Development, Agriculture and Environment and of environmental associations and groups in the municipality of Saúde – Bahia contributed to the conservation and recovery of the Alto da Santa Cruz. In relation to specific objectives, it was proposed: A. Characterize springs; B. Identify the methods of conservation and recovery of springs; C. Analyze attempts to preserve and recover the water eye in Saúde – Bahia by the Municipal Secretariat for Development, Agriculture and the Environment and by environmental preservation associations and groups.

Finally, this article is subdivided into topics, where in the first part of the work a reflection is made on the water cycle and the springs, then some methods of recovery and preservation of springs are presented, therefore the typology of the research is presented, through the materials and methods, and finally, the results obtained are analyzed, reflecting on the attempts to preserve and recover the Eye of Water in Saúde – Bahia. As closing, we have the final considerations and references used to support the research.

II. BRIEF LITERATURE REVIEW

2.1 WATER CYCLE AND SPRINGS

The water cycle or hydrological cycle, os its name suggests, refers to the ability that water has to change its physical state (liquid, solid or gaseous) during the path it travels until it returns to its previous state, forming thus a cycle that has no end (WWF – Brasil, 2007).

According to Castro and Lopes (2001), "simply put, the hydrological cycle is the path that water takes from evaporation in the sea, passing through the continent and back again to the sea" (Apud Secretariat of State for the Environment, 2009, p.05). In fact, the authors are very happy to make such a statement since the water leaves a certain state and as a cycle goes through the other stages and returns to its initial state.

The following figure shows the hydrological cycle in an illustrated way, see:



Fig.1: Scheme of hydrological cycle Source: ENVIRONMENT STATE SECRETARIAT, 2009.

Looking at the figure above, it is possible to visually perceive that through the sun's rays, the water leaves its liquid state and passes into the gaseous process through the evaporation and transpiration of the plants, then when it reaches the atmosphere, it condenses, passing from the gaseous state to the liquid, forming clouds and returns to the Earth's surface through precipitation (rain, snow or fog). When precipitating, before reaching rivers and oceans again, part of the water infiltrates the surface supplying the water table and the part that does not infiltrate drains superficially until it reaches the surface water bodies such as rivers and seas.

According to the State Secretariat for the Environment (2009, p. 4). "The spring is understood as the outcrop of the water table that will give rise to a source of accumulation water (dam), or watercourses (streams, streams and rivers)". Still looking at the image above, it appears that some springs arise from the contact of the water table with the soil, which in some cases may have water accumulation and in others run off superficially until reaching a receiving body (river). Another concept that exemplifies this situation very well, says that a spring:

> i. [...] deals with the outcropping, on the surface of the soil, of water from a water table (which, roughly speaking, can be compared to a granulated layer through which water flows, located between or over other layers, of solid rock) or even from an underground river. When this occurs, a source can be formed, where the water is dammed and accumulates, forming, for example, a lake. Or else, a watercourse can

be born (the liquid is not dammed and starts to flow in a stream, a stream or a river). (WWF – Brasil, 2007, p.20).

In addition, the spring can be of the slope type, when it originates in higher parts, as in hills or mountains, due to the contact of impermeable layers with the surface. They can also be known as diffuse springs, when they originate in lower areas, due to the outbreak of the water table. It is also noteworthy that the springs can have a continuous or seasonal flow, that is, they can appear all the time or dry out in certain periods. There are, therefore, as many other types of springs which it is not necessary to present in detail each one of them (SEMA, 2010, p.12).

2.2 METHODS OF PRESERVATION, CONSERVATION AND RECOVERY OF SOURCES

The permeability capacity of the soil is directly related to vegetation, this is a crucial factor to ensure that underground rivers are supplied, so it can be said that water and vegetation are directly related, whether in terms of humidity, precipitation, or even in guaranteeing soil permeability, both are inseparable (SEMA, 2009, p. 03).

The guarantee that a spring can have a seasonal or continuous flow necessarily depends on the infiltration capacity of the soil, when most of the water after a rainfall infiltrates, controlling runoff and decreasing erosion or silting processes (SEMA, 2010, p. 12).

However, the anthropic attitudes of degradation end up intensifying the seasonality of these springs, and in most cases, these in turn, do not reappear. It is a fact that many other agents also contribute significantly to this process, like animals, but not in the same quantity and intensity as humans.

Thus, it is necessary that methods of conservation and recovery of springs, be adopted, to guarantee the quality of the water, the recharge of rivers and springs and the guarantee of the life of the fauna and flora, in addition, the conservation of springs brings, above all social benefits such as supplying the population who need them, reducing water scarcity in some locations.

For these reasons, some authors claim that in order to conserve rivers, springs and, consequently, springs, one must start by preserving vegetation and riparian forests. This is confirmed in the statement by Maria, Milano and Seixas (2012, p. 11), when they say that "so that fresh water remains available for different uses (eg consumption and leisure), in addition to not polluting rivers, lakes and oceans, it is necessary to preserve the vegetation that protects the areas of water sources".

The "Ciliary Forest Notebooks: Preservation and recovery of water and life springs", which is a booklet organized by the State Secretariat for the Environment of the State of São Paulo published in 2009, brings in a brief but very detailed way, some suggestions of actions that can be taken by landowners where they have springs or even by the local population.

It is known that according to Federal Law 4,771/65, repealed by Law No. 12,651, of 2012, the springs are protected, being considered Permanent Preservation Areas (APP), where they must be conserved, especially the vegetation that surrounds them in an area of at least 50 meters. So the first thing to do is to conserve this APP area.

Other suggestions given by the aforementioned booklet are to surround the area of APP to prevent the approach of animals that can by trampling, compact the soil and decrease its permeability, the removal of animals also prevents water from being contaminated by feces and urine. Redistributing the roads that are located close to the springs, avoiding the construction of pits less than 30 meters from the APP, are, among others, some proposals that also contribute to the preservation of springs.

Professor Maria Aparecida Ribeiro de Almeida, in 2013, developed a proposal with the students of Dr. Osvaldo Cruz State College to recover a spring in the city of Campo Mourão – PR, according to her the proposal was as follows:

> ii. The method used in recovery consists of manually cleaning the surrounding springs by removing organic materials such as roots,

leaves, branches and mud. Then crack stone is placed (fill every spring) then the pipes are installed. The headboard is sealed with a mixture made with sieved soil, cement and water in the proportion of 3×1 . The stones are intended to filter the water. The pipes serve to allow the water to drain and will be arranged according to their function: a 50mm pipe to receive previous treatment with bleach is installed in the upper part of the spring, whose objective is that the farmer makes a disinfection using bleach every three months. A 50mm pipe with a reduction to $\frac{1}{2}$ inch will send water for consumption, another 50 mm pipe will be installed from 15 cm to 20 cm above the pipe that serves water to the residence and this will serve as an overflow (thief) and the pipe that will serve to exhaust the spring in the period of bimonthly disinfection must be 100 mm to speed up the flow process (ALMEIDA, 2013).

Despite the methodology adopted by the teacher and her students, before carrying out any source recovery method, one must take into account the type of source to be recovered and in the case of reforestation of the riparian forest, which consists of another method that can be adopted, choose native species from the place and distribute them properly on the ground.

The recovery through vegetation occurs in several ways and here we will mention only two analyzed by Mateus Robert Cardoso Winer in his Course Conclusion Work, the first is direct seeding that:

iii. It is a process of recovering the vegetation of a given area through the release of seeds in large numbers of native species with good germination potential, which can be manual, mechanized or both. In this process, pioneer species must be sown, in high diversity, or together with secondary species, depending on the resilience of the location (EMBRAPA, 2017 apud WINER, 2017, p.13).

The second recovery process analyzed by Winer (2017) which we quote here is the planting of seedlings, according to him:

iv. It is a practice adopted mainly in cases in which the agropastoral activity occupied the area where previously there was a forest formation, or else where the natural vegetation around the place to be recovered does not exist or is quite compromised [...]. The process in general has many positive aspects. Once stabilized, the seedlings will start to develop layers of litter and humus, which can attract seed dispersing animals and consequently accelerate the process of plant succession (RODRIGUES et al., 2009 apud WINER, 2017, p. 15).

The aforementioned methods aim at recovering the riparian forest from a spring, which in the same way as the eyelashes have the function of protecting the eyes, so is the riparian forest, it protects the spring from possible silting, ensures the infiltration of water, among other functions, are of fundamental importance to ensure that these natural resources are preserved and conserved, in addition, they are simple and possible measures to be applied either by landowners or by the interested community.

III. MATERIAL AND METHODS

The Municipality of Saúde (map 1) belongs to the State of Bahia, located in the microregion of Piedmont of Chapada Diamantina, where the object of study consists of the Eye of Water/spring located in beighborhood Alto da Santa Cruz which has stopped coming out continuously.



Map 01: Map of the Municipality of Saúde/BA/Brazil Source: IBGE Cities (2020)

The Municipality of Saúde – BA is located at geographic coordinates $10^{\circ}56'27''$ latitude S and $40^{\circ}25'04''$ longitude W, with a semitropical climate, altitude around 542m, with a total area of 499.722 km² and population around 11,845 inhabitants, with an estimated 12,913 inhabitants, for 2020. The economy of the municipality

today generates a GDP per capita 5,951.69 R\$ (IBGE, 2010).

Regarding the territory and environment, the Municipality of Saúde has 18.6% of households with adequate sanitation, 42% of urban households on public roads with afforestation and 8.1% of urban households on public roads with adequate urbanization (presence of manhole, sidewalk, paving and curb). When compared to the other municipalities in the State of Bahia, it is ranked 221 out of 417, 347 out of 417 and 152 out of 417, respectively. When compared to other cities in Brazil, its position is 3733 of 5570, 4434 of 5570 and 3002 of 5570, respectively (IBGE, 2010, p. 2).

Taking into account that this work aimed to describe and characterize the object of study (water eye/spring) and to analyze the various attempts of preservation, conservation and recovery of the spring and to understand which the main measures can be adopted for this purpose, consists of descriptive and qualitative research. According to Gil (2008, p.28) "research of this type has os its primary objective the description of the characteristics of a given population or phenomenon or the establishment of relationships between variables".

From the point of view of its nature, this is an applied research, having in mind that it aims to generate knowledge for practical applications directed to the solution of specific problems, having a qualitative approach. Furthermore, from the point of view of the objectives, it is an exploratory research, where it aims to provide greater familiarity with a problem, involving bibliographic survey, bringing the main concepts referring to the source and methods of recovering them, then an observation was made location and photographic record, identifying the object of study and describing the observed situation (GIL, 2008).

It is also characterized as a survey survey in the field since in the data collection a questionnaire was applied with the representatives of groups and movements of environmentalists, Friends of Nature Group (GAN), Grupo Live Water Eye respectively, as well as representatives from the Municipal Secretariat for Development, Agriculture and Environment and from them we identify whether and what actions have already been carried out to benefit the water eye.

Finally, a questionnaire was applied with the representatives mentioned above, and finally the analysis and discussion of the collected results was made. In the application of the questionnaires, inquiries were made to the representatives of each group or secretariat, to identify if they knew the water eye that is in the neighborhood of

Alto da Santa Cruz, in the municipality of Saúde and all said that they were aware of the spring. Then they were asked to describe the previous state of the spring and how it is currently, as will be seen in the results and discussions of the research findings.

IV. RESULTS AND DISCUSSIONS

From now on, the results found in the survey will be presented. As stated in the methodological part, questionnaires were applied to the target audience (representatives of each group or secretariat) in order to identify whether they knew Eye of Water, in the case of knowing, to make a comparison between its state previously, and today. In response to inquiries, the following findings were obtained:

GAN representative: "Before, the water eye was perennial, with good quality water, even families made money selling water, it had very good forest cover, the residents of Alto da Santa Cruz were supplied by it, it came to the train station. Currently, from the 1980s onwards, the spring began to suffer deforestation in its proximity, fires, exploration of stones and the removal of the land around the spring for use in gardens. In 2000, the spring began to disappear, returning at intermittent periods".

Representative of the Environment Secretariat: "Before, it was once a source that supplied the municipality of Saúde (human consumption), but over time it disappeared".

Representative of Grupo Live Water Eye: "Before the water eye came out of its source and passed through Alto da Cruz towards the station, today the cultural center, it was a stream where this same water also supplied the trains of railroad, had a fountain where several families survived and raised their children taking water and selling it to wealthy families in Saúde, for a long time it was the best water we had in the city, the kids had a party taking baths in its crystalline waters, more in 1977 the water eye shows the first signs of degradation, the fluids start to diminish and the water starts to become scarce, but the water eye has been undermining its water in time and time with limited flow, if it were two people to get water at the same time one had to wait for the water to sprout".

In figures 02 and 03, on the left, in 2016, the Eye of Water with a small outcrop of water can be seen, and in the photo on the right recorded three years later, in 2019, practically in the same period, between the September and October, we observed that the small spring is completely dry.



Fig.2: Eye of Water in 2016 Source: ALMEIDA (2016).



Fig.3: Eye of Water in 2019. Source: ALMEIDA (2019).

The images, although recent, actually illustrate the statements of the surveyed representatives. Then, a personal question was asked, so that they could say, in their opinion, what factors contributed to the water eye stop coming out and the responses were similar, signaling the environmental aggression, where they were mentioned: the disposal of garbage, fetus, and other situations, deforestation, the removal of black soil next to the spring (Figure 04), the neglect of public authorities, the planting of exotic trees that are aggressive to our region such as ficus (Ficus benjamina) and neem (Azadirachta indica), explosions for the removal of green quartz, in addition to the exploration of green marble, and the construction of roads that give access to the hill.

The following figure shows some of the situations described, it shows the area where Eye of Water is located, it also shows a part of the exposed and compacted soil in the vicinity of the source, see that there is still a significant forest upstream, and at the on the other hand, the place where the residents remove the black earth mentioned by the representatives surveyed here.



Fig.4: Eye of Water: current situation*1 - Eye of water; 2 - exposed soil; 3 - extraction of black soil.Source: ALMEIDA (2019).

According to the World Wide Fund for Nature (WWF – Brazil, 2007) the main problems affecting springs are:

v. soil salinization in irrigated cultivation areas, in the semiarid region, which in general is due to inadequate irrigation management; ii. lowering the level of groundwater in regions where there is overexploitation of groundwater; iii. pollution of water bodies due to its use as a sewer receiver, which is possibly the biggest environmental problem generated by the irrational use of water resources (in São Paulo, for example, 70% of water and domestic pollution, against 30% of industrial origin); iv. disorderly growth of cities and; v. deforestation of springs, banks of watercourses (WWW BRASIL, 207, p.33). Thus, it is observed that not only the problems mentioned above, but there are many situations that can affect the water quality and the perpetuity of the springs. The speech of this author reaffirms that in fact some of the statements described by the representatives of the groups and by the secretariat may indeed have contributed to the current situation of the source.

Then the survey participants were asked whether the location where Eye of Water is located is open and has free access for people and animals and unanimously stated that it was. In this case, the "Cadernos da Mata Ciliar" has already been cited, which says the following:

> vi. The area adjacent to the spring (APP) must be completely fenced in order to prevent access by animals, people, vehicles, etc. All measures must be taken to favor their isolation, such as prohibiting fishing and hunting, avoiding contamination of the ground or directly from the water by

unscrupulous individuals (SEMA, 2009, p. 12).

In this way, it is observed that Eye of Water is currently in a situation of vulnerability, exposed to free access of animals and people and as we saw earlier this can cause several damages to the water quality and to the soil. In addition, a small barrier was built in the vicinity of the source, as can be seen in figures 02 and 03, a ditch and a tank for storing the water that sprouted, the reports made by the representatives participating in this research were that this structure is concrete and that the material used in the small water barrier around the spring was basically sand and cement.

When asked if they knew any source recovery methods, the participants' responses were:

GAN representative: *"Isolate a large area around the source so that no one has access and reforest with trees in the region".*

Representative of the Environment Secretariat: "There is only one, the PRAD (Project for the Recovery of Degraded Areas). The process has three steps, the first is to isolate the area, according to what needs to be recovered on site, whether it needs a plant replacement, etc. and the third is the planting of species, then it is necessary to carry out periodic monitoring for three years ".

Representative of Grupo Live Water Eye: "Today there is only one way to recover the same, involving all communities, especially the residents of that community".

Asked if they had already planted seedlings at the site, all said yes, they also said they were native plants, among them: angico (Anadenanthera colubrina), ipe (Handroanthus), jatobá (Hymenaea courbaril), jenipapeiro (Genipa americana), ingazeiro (Inga), licuri (Syagrus coronata), brazilwood (Paubrasilia echinata), aroeira (Schinus terebinthifolius), bellies (Ceiba glaziovii), mango (Mangifera indica), among others. In this sense, it is more than clear to scientists, the indescribable value of maintaining native forests.

vii. Scientists have known for a long time that forests and forests play a relevant role in the existence and abundance of freshwater systems. The most accepted thesis says that forests, forests and preserved environments fulfill, among other functions, that of maintaining a constant supply of good quality water. (WWF – Brasil, 2007, p. 33).

With this, we can affirm that the attitude of reforestation, and with seedlings of the local vegetation, guarantees the supply of fresh water in the rivers and in the water table, in addition, it helps to maintain the relationship between water and vegetation, since the proper functioning of a it necessarily depends on the other and mutually.

Finally, the last questions, which had the objective of identifying the actions promoted by the groups and secretariat in an attempt to recover and conserve Eye of Water, aiming to identify if such actions were successful. For such inquiries, the following answers were obtained:

Representative of GAN: "Replanting of specimens of the original forest, lectures with the nearest residents, raising awareness of the danger of the removal of black soil around the source, Garbage collection". Was it successful? "In some, yes, like the planting of trees that remain in place and the failure is that the government did not provide support".

Representative of the Environment Secretariat: *"Planting trees, isolating the area and placing signs on the site". Was it successful? "In some, yes, in others not, such as the isolation of the area".*

Representative of the Live Water Eye Group: "I, plus a group of friends, decided to make a great joint effort known as Live Water Eye Group, in favor of cleaning the water eye, only when we were cleaning we noticed that water started to sprout among the garbage at that moment, the task force that would be just one day passed for a week in a row each time the cleaning came to an end, the water was increasing more and more, finally we spent a month doing the restoration of the big tank, after the little one, we made four fountains, two next to Maria Anita school and one next to Seu Luiz's house, and two in front of the water eye and a community laundry, we passed wires around the living water eye, all with help of the Health Society, where we created the Live Water Eye Group with CNPJ, with the title of public utilities Municipal and state utility, [...] several projects were made available. Those for the community, 18 classes of classes by EJA, 2 Licuri Cidadão projects where 40 more families benefited generating jobs and income, another 3 community gardens, another 28 families benefited from the Natal Feliz Project, where all the children received gifts, we had these projects for the group and we also took care of the water eye". Was it successful? "In some cases, like the removal of garbage, in others it does not achieve its expected result".

The actions described above take up everything that has already been diagnosed in this work on methods of preservation, conservation and recovery of springs. The groups and associations, as well as the Secretariat for the Environment (SEMA), have developed projects in line with what is expected for the recovery of these water sources, based on the APP Law and on studies already carried out on the recovery of springs. However, such attempts were not enough to guarantee the conservation of the Eye of Water, perhaps due to the lack of support and supervision from the higher bodies and also by the residents, who often for lack of knowledge, contribute negatively to the environment, and with the available natural resources.

V. FINAL CONSIDERATIONS

The present study had the purpose of proposing a study on springs, identifying methods of preservation, conservation and recovery of springs, through an analysis of the attempts to revitalize Eye of Water in the municipality of Saúde – Bahia.

Through research, it was possible to realize the fundamental role that an informed population has, in situations that may have some impact on the environment. We realized that many actions, despite being in compliance with the legislation and with the studies that have already been done in the area, can not contribute to the environment in any way if there is no support from the population, the government and the higher inspection bodies.

In short, we emphasize that the objectives of this work have been achieved and we hope that it will serve as a reference for the residents of the municipality of Saúde, so that through it they can have a different look at nature and all that it offers us and so they can change his posture based on a reflection of his attitudes of environmental degradation. May it also serve as a base for the Environment Secretariats of this and any other municipality, which are focused on working with the recovery of springs and Eye of Water. In addition, that can support numerous other researches, linked to the listed theme, even if there is no intention here to end the discussion and debate.

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Orthosis and Prosthesis Development for Large and Medium Animals using reverse Engineering and Additive Manufacturing Techniques

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Abstract— Nowadays, the search for innovative techniques for Veterinary Medicine has been constant. Problems such as laminitis, that causes hoof pain in large and medium-sized animals, foot fractures that occur by trampling or even hoof breaking, can impair the productive or functional development of the animals, even leading to their sacrifice. The aim of this research is to use reverse engineering and additive manufacturing technologies to contribute to the development of orthoses for these animals that need help to be rehabilitated back to their environment, with a more adequate comfort. As a result, it was possible to digitize the lower limb of a calf that had an open fracture using reverse flight time engineering technology with the Kinect One equipment and thus digitize the paw to create a fixation and immobilization orthosis for the member. The orthosis was produced by additive manufacturing technology to immobilize the lower limb of the fractured calf. Thus, it is concluded that reverse engineering and additive manufacturing technologies can greatly assist in the area of veterinary medicine.

Keywords— Fracture, additive manufacturing, orthoses, reverse engineering.

I. INTRODUCTION

Nowadays, the search for solutions to assist in the treatment of fracture, laminitis, broken hooves often caused by trampling of other animals confined in the same environment, injuries, among other pathologies, has been increasing. Dairy-producing animals such as cows, when presenting problems such as paw fractures or chronic hoof problems, impair productive development and are usually euthanized. Given the various events like these, in the area of Veterinary Medicine, the search for solutions to propose an improvement to the animal or allow a more comfortable living condition is a great achievement. Currently, two innovative technologies have stood out and demonstrated an evolution in this area. The first of these is Reverse Engineering, that allows you to digitize objects at full scale and digitally transform them into a virtual threedimensional biomodel without having to draw the model from scratch. The second technology is Additive Manufacturing, which allows you to transform the virtual

biomodel created by Reverse Engineering and transform it into a real biomodel, printed by a 3D printer.

The aim of this research was to develop an orthosis with immobilization function of the lower limb of a medium size animal to replace the locking pins that are not showing improvements or satisfactory results. This orthosis was created by Reverse Engineering Flight Time and Additive Manufacturing techniques by a 3D printer using the fused deposition modeling (FDM) technique.

REVERSE ENGENEERING

According to Raja, (2007); Sokovic and Kopac, (2006), Reverse Engineering is a technology that allows you to reduce product production cycles, so you don't have to draw an object using a computer-aided design program. According to Raja (2007), Reverse Engineering goes through 3 phases: point digitization; stitch processing and application. Reverse Engineering can be applied in several areas such as Medicine, Architecture, Engineering, Design, among others. Santos (2017), comments that in the area of

orthopedics, it is possible to create custom orthoses for each type of patient, so that the immobilizers fit the limbs more properly, avoiding problems such as discomfort and poor positioning in immobilization. The Reverse Engineering applied in medicine as anatomy study, prosthesis creation, implants, among others, has shown much benefit. For Vinesh and Kiran (2008), Noncontact Reverse Engineering is classified into two techniques, Reflective and Transmissive. An example of a reflective technique used is the Time Of Flight (TOF) scanning method. This technique has the principle of measuring the amount of time it takes a light pulse to travel to the object and make a return [Bellian et al., 2005; Dion; Bertone, 2004; Sekimoto et al., 2003].

ADDICTIVE MANUFACTURING

For Canciglieri et. Al (2015), Additive Manufacturing has its manufacturing processes based on liquid, solid and powder. According to Volpato (2017), nowadays there are more than 20 types of Additive Manufacturing systems that manufacture objects by adding layers. Objects are made of simple or complex freeform geometries, which in turn eliminate mold tools. According to Ahrens (2007), this technique allows the manufacture of molds, parts, objects using a virtual three-dimensional model, and can have its simple or complex geometries. One of the techniques that stands out for its easy access and cost effectiveness is fusion and deposition modeling. According to Volpato (2017), the principle of material extrusion technologies occurs through the process of depositing the material in the form of small diameter filament, which is obtained by the principle of extrusion in a calibrated nozzle. Basically the head is mounted on a system with controlled movements in the X and Y plane. This system usually operates on a construction platform made up of a mechanism that moves upwards towards the Z axis. At the end of every fusion and deposition layer, the process of building the next layer is repeated again until the object is ready, it means that it is built layer by layer until the part is constructed.

ORTHOSES

The purpose of the orthoses is to help and improve the conditions of patients who require support or have dysfunction of the body segments. They can be internal as: stents, valves, plates, etc.; or external as: glasses, plaster casts, splints; walking sticks. among others. According to Carvalho (2006), the orthoses can correct the posture and allow movements to a certain extent, being able to totally or partially immobilize the movements.

II. MATERIAL AND METHODS

For the development of this project all the computational processes developed were made in a Dell Brand Inspiron 15R 7520 Special Edition Notebook. To scan and capture the lower limb points of the animal we used the equipment Kinect One + Computer Adapter developed by the company Microsoft. The point capture process was made through Reverse Engineering technology using the Flight Time technique, as shown in Fig. 1.



Fig. 1 – Kinect One device and computer connection adapter.

According to Raja's methodology (2007), Reverse Engineering captures points, performs their processing and applies the meshes. For this methodology, the free version of the Kscan3D program was used, as shown in Fig. 2.



Fig. 2 –Kscan 3D program used to capture, process and apply points by Reverse Engineering technique.

For adjustments, three-dimensional design creation, cleaning of unwanted artifacts and modeling, the program used was *Meshmixer* version 3.5.474. This software was developed by the company *Autodesk* and is also a free program. Fig. 3 illustrates the program screen interface.



Fig. 3 – Autodesk Meshmixer program used for modeling.

The 3D ZONESTAR DIY 802QR2 printer was used to make the immobilizer. This printer has been assembled for the immobilizer making through a mounting kit that has two extrusion nozzles at XZ-axis and the heated working table at Y-axis, according to Fig. 4.



Fig. 4 – 3D Zonestar Diy 802QR2 printer with the technique of Deposition Fusion Modeling.

The printer comes with a free program called *Repetier-Host*. This program is responsible for slicing the threedimensional design developed by Reverse Engineering technology into layers and converting it to the 3D printer using the *gcode* language. Fig. 5 illustrates the interface of the *Repetier-Host* version 2.1.3 program.



Fig. 5 – Repetier-Host program used to slice three-dimensional objects for 3D printing.

For the printing of the orthosis we used on average 250 g of a 1.75 mm diameter filament in Metallic Blue color, 3DFila brand. The composition of the material is Poly (Glycol Ethylene Terephthalate) - PETG, as shown in Fig. 6.



Fig. 6 – PETG Filament Roll used for the manufacture of immobilizing orthoses.

As an initial procedure, the fractured calf's leg had the treatment, cleaning and care procedures before starting the stitches scan. For the following procedure, it was necessary to define an appropriate positioning for the Reverse Engineering technique to be started. After the care performed, the professionals stabilized the paw in the correct position for the beginning of the digitalization. Fig. 7 shows the position of the paw to be digitized.



Fig. 7 – Lower limb being prepared and positioned for digitization of points by Reverse Engineering technique.

As scanning began, the Kinect One device scanned the lower limb points through Reverse Engineering flight time and sent it to the Kscan 3D Program to process and triangulate each point thus forming a mesh as a surface and turning it into a three-dimensional biomodel, according to Fig. 8.



Fig. 8 – Creation of the three-dimensional biomodel through Reverse Engineering.

After digitization, the virtual biomodel was exported to the Meshmixer program, which allowed the modeling of the orthosis using the biomodel as a base reference. The program allowed the modeler to delete unwanted artifacts that were scanned along with the lower limb and also corrected defects or parts that were not captured. Fig. 9 illustrates the preparation of the orthosis volume and the division into two parts to allow the calf's foot to engage. An open hexagon design had also been developed to allow ventilation and give greater mechanical strength to the orthosis.



Fig. 9 – Modeling and adjustments in the virtual three-dimensional biomodel using the Meshmixer program.

Finally, with the orthosis modeling ready, the file was exported to the Repetier-Host program to perform the virtual biomodel slicing, thus producing, by the Additive Manufacturing technique, a physical biomodel and an orthosis to analyze and check possible scale failures and dimensions. Fig. 10 illustrates a biomodel with the fracture position markings and a small orthosis for fitting and position matching.



Fig. 10 - 3D printing of a Biomodel and part of the orthosis for conferences and analysis.

It is possible to analyze in Fig. 11 that the biomodel was the appropriate measurements and acceptable with the test orthosis. Both fit and allowed to check the orthosis in the animal to validate the orthosis and thus print the definitive for use.



Fig. 11 – Result of biomodel fitting and test orthosis for analysis.

After approval of all studies and analyzes between the Biomodel, the test orthosis and the animal's limb were made for orthosis for use on the calf's fractured paw. Fig. 12 shows the 3D printing of the ZONESTAR printer producing the immobilizer that was used on the animal.



Fig. 12 – 3D printing of an Orthosis by the technique of Additive Manufacturing.

III. RESULTS AND DISCUSSIONS

As a result, it was possible to digitize the fractured calf member and convert it to a virtual three-dimensional model for reference in creating the custom orthosis. The result obtained by the Additive Manufacturing technique was approved by the team because the immobilizer demonstrates sufficient mechanical resistance not to break and also by the correct fit of the orthosis with the fracture paw, as shown in Fig.13.



Fig. 13 – Analysis of the orthosis printed by the 3D printer with the fractured calf's foot.

After the orthosis test with the paw and the analysis of the dimensions of the socket, the animal underwent a last surgical procedure to remove the pins that were not having an immobilization effect. Finally, the immobilizer was used to fix the lower limb for not allow the movement of the bone that suffered the fracture in order to calcify in the correct position. Fig. 14 shows the animal in a normal posture walking through the grass.



Fig. 14 – Animal with immobilization orthosis walking through the grass.

The device has demonstrated satisfactory results due to the recovery of the animal and the form that it has presented in its movement, touching the paw more firmly in the soil and allowing its movement.

IV. CONCLUSIONS

Through Reverse Engineering technology, it was possible to digitize the lower limb by the reflective technique Flight Time to use as a virtual biomodel in orthosis modeling. After digitization, the designed orthosis was printed without problem by Additive Manufacturing technology. According to the results obtained by 3D printing, the pins implanted in the fractured limb of the animal that did not obtain satisfactory immobilization results for the bone to be regenerated were removed, so the orthosis applied to the calf's paw was able to immobilize the limb with a satisfactory result. The orthoses locked the fractured parts as well as allowed the animal to have its movement regularized and be able to walk again. This project opened the door for new research that may use Reverse Engineering and Additive Manufacturing to assist in the area of Veterinary Medicine that is still little explored. It is possible to create Prostheses for bovine and equine hooves with laminitis problem, jabutis hooves, bird nipples and many other applications.

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Entrepreneurial women in scientific and technological parks: The construction of self images

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PhD. in Processes and Cultural Manifestations

Abstract—The thesis values the role of women entrepreneurs in science and technology parks, in Brazil and Spain, for the development of innovation and entrepreneurship environments. The qualitative and interdisciplinary research discursively analyzes the self images constructed through scenography elaborated in the testimonies of women entrepreneurs in their socio-professional practices, based on cultural, identity and management aspects in the work activity.

Keywords—Culture, Identity, Scientific and technological parks, Self images, Women entrepreneurs.

I. INTRODUCTION

In most coutries in Europe and Asia, and in the United States, the interest in female entrepreneurship extends beyond the actions of government, attracting the eyes of many countries and multinational entities. There is a conviction that the economic power of nations depends on their future businessmen and their enterprises. In addition to the world forums, female entrepreneurship has been studied at various universities, as well as by governments and private institutions from various coutries.

In the meantime, this study proposes dialogues about entrepreneurship, female entrepreneurship, culture and identity, as well as recognizing ergological propositions¹ and the autonomy of the human being to cope with the theme of women entrepreneurs. The study was limited to discourse analysis, giving rise to the images of itself², built by the scenographies elaborated by the women entrepreneurs³, and present in socio-professional practices, in science and technology parks. It is noted that female entrepreneurship has been used as a parity mechanism for women's rights, as it evokes their participation, as historical subjects, in economic, social and environmental growth in their regions.

The dynamics of the contemporary world and the technological revolution - attached to the profound restructuring of capitalism - have long been in dialogue about the identity aspects of human beings in working spaces, especially entrepreneurial women. Identity is a source of meanings and involves culture, as well as encompassing each subject's view of himself and the other with which he relates through language. Discursive practices are here defined as practices of human action and language in action, relating to the way in which women entrepreneurs produce meaning and take positions in socioprofessional relationships. Moreover, to become aware of human interdiscursivity is to give birth to encounters of voices that form the network of discursive meanings and the conditions of their production, with which the enunciator elaborates, from enunciative scenographies, the dialogues with the Other.

In view of this, this study is relevant because it values the interdisciplinarity of the concepts demanded. It is believed to provide the researcher and, consequently the reader, multiple possibilities of connections between the

¹"Ergology is a multidisciplinary research method because human activity is too complex to understand and analyze from a single discipline, whatever it may be. All are necessary, although none is sufficient." (TRINQUET, 2010, p. 94).

 $^{2^{\}text{cu}}[...]$ – ethos is a discursive notion that is constructed through discourse, not an 'image' of the speaker outside his speech; - ethos is fundamentally an interactive process of influence over

and the other; - is a fundamentally hybrid (sociodiscursive) notion, a socially evaluated behavior that cannot be grasped outside of a precise communication situation, itself integrated into a particular socio-historical conjuncture." (MAINGUENEAU, 2008c, p. 17).

³In this study, the small part of the corpus that comprises women entrepreneurs, includes women partners who own companies

located in the Science and Technology Parks selected for this research. Thus, to avoid repetition of the terms "business owners, located in PCTs", only the expression "women entrepreneurs" is used during the writing of the thesis.

subjects that involve entrepreneurship, language and work, identity, discourses and cultural manifestations emanating from the scenographies and the images of themselves constructed by women entrepreneurs. In addition, the theme of this research contributes to the academy, which will have in its collection, a study on the entrepreneurial women, business owners, in scientific and technological parks, are propellers of socio-professional transformation, in the proposition of raising female representation in this locus, as well as highlighting, in and through discursive practices, the subjective and singular dimension of recognizing itself as protagonists working, and emphasizing the principles of equity in the construction of more sustainable societies ..

It is based, as a modal point of this research, the broadening of the understanding of how women, in the socio-professional context, become entrepreneurial and how they launch themselves as protagonists in this process. It is noteworthy here that women have advanced in the field of entrepreneurship and there is much to be researched about this progress. It is noteworthy that, in this study, the concept of work should be understood as an activity of citizen, democratic, development in all instances of the human being.

Based on the fundamentals of promoting female autonomy in the workplace, this study provides reflections that value the uniqueness of the human being. In addition, it is based on respect for the diversity and participation of women in the workplace, especially in Science and Technology Parks, that is, areas of concentration of people, companies, research centers and laboratories that promote and encourage entrepreneurship. These spaces suggest the sharing of ideas, allowing the formation of nuclei of social and economic transformation in various nations of the world. In addition, the Science and Technology Parks whose research has been conducted strengthen the innovation and entrepreneurship system with the strategy of involving universities, governments and industries. With a view to broadening these relationships for the involvement of civil society, culture and values in these strategies⁴ In terms of relationships, it is believed that the development of interdisciplinary research is pertinent in order to better understand these contexts where women entrepreneurs conduct their companies.

The autonomy of women, in this study, is understood as the conscious way in which people make decisions, based on their aspirations. It is assumed that more solidary societies, which value equity, may suggest the exercise of human rights in labor spaces, becoming priority requirements for the construction of more sustainable societies⁵.

Consequently, it is also highlighted in this research that discursive and language studies provide a relevant basis for discussions about culture, identity and the symbolic constructions that derive from it. Moreover, they enable a less instrumentalist interpretation of the world, that is, a view that suggests turning to the historical perspective of knowledge and the social relations that interact in socioprofessional contexts.

This doctoral research is associated with the Graduate Program in Processes and Cultural Manifestations at Feevale University, being part of the research line Language and Communication Processes. From this perspective, this study proposes broader discussions about the entrepreneurial woman, under the aspect of cultural and identity dynamics, entrepreneurship, language and work in a discursive approach. The entrepreneurial woman influences and is influenced by the culture, which interferes with the human relationship, which directly impacts the socio-professional practices and the construction of the images that the woman manifests in the investigated locus.

II. STATE OF ART

It is significant for any study to review academic output in the main national and international databases to place the research within the scope of the broad area of knowledge to which it belongs, in order to contextualize it. The review of academic production plays a fundamental role at this time, as it credits and recognizes the intellectual elaboration of other authors, privileging academic ethics, making room to show that the field of knowledge is already established, but may receive new research.

From this perspective, a mapping of academic productions was carried out with the idea of understanding the interests of researchers, having as its core research the expression "women entrepreneurs". First, a research was

⁴Quádruple Hélice. This concept was addressed in greater detail in the seventh chapter of this thesis.

⁵In this sense, the adherence of the term "sustainable societies" to research aligns with Freire's thinking: (1998, p. 44) "thinking critically about the practice of today or yesterday enables the improvement of the practice of tomorrow". This definition suggests rethinking less instrumentalist management models, external to the human being, that is, it evokes intrinsic perspectives of human identity and not of market values. Thus, the "balance between public and private responsibilities, between global and regional production, between material and cultural consumption, and between masculine and feminine qualities in society is suggested." (SCHUTEL, 2015, p. 206).

made of the CAPES archives ⁶, based on the database from 2015 to June 24, 2019, where 29 dissertation and thesis studies with the expression "women entrepreneurs" were identified. Studies focused on women entrepreneurs are relatively scarce, with only 27 dissertations recorded in the CAPES thesis and dissertation database in the chosen period. Studies suggest that the theme may be deepened, since only two theses recorded in the last five years has been found.

In an attempt to broaden the data search, we searched the base of the digital library of theses and dissertations, NDLTD⁷, using the same term for data search: "women in the English language, entrepreneurs" "women entrepreneurs", from the year 2015 to June 24, 2019. In this search for information were found 70 theses and dissertations. Note that the search with the expression "women entrepreneurs" presented, among the main languages of academic production, English and Portuguese. International thesis research is diversified involving perceptions about personality traits and credit granting. No theses and dissertations were found in the NDLTD database with proposals for interdisciplinary studies as the researcher conceives this research.

In order to investigate the academic production of articles on women entrepreneurs, searches were made in the database Web of Science, which allows the identification of journal articles in various areas of knowledge and as one of the oldest platforms for academic research. on the Internet. It was used for the search, because it is an international database, the expression "women entrepreneurs". The research was conducted between 2015 and July 1st, 2019. In the search, we found 465 articles.

19.57% of the articles were published in the United States; 11.82% of the articles were published in England; 9.03% were published in India; 6.23% of the articles were published in Spain. In Brazil, although it does not appear among the main countries of publication of articles with the expression "women entrepreneurs", 7 articles were found, representing 1.50% of the total articles published.

The analysis performed in the database Web of Science (2020a) reveal that 333 of the articles found are from the economics and business area, representing 71.61% of the

articles published in this period. In the area of female studies there are 33 articles, representing 7.09% of the mapped articles. We found 21 interdisciplinary works with the expression "women entrepreneurs". The interdisciplinary studies presented by the Web of Science have several approaches that demonstrate the researchers' interest in relation to women in business, family, the Internet, as well as to identify profiles of women entrepreneurs and the main barriers faced and issues of female empowerment.

Once the data on academic productions are presented, the relevance of this study is justified due to the need for further research on entrepreneurial women in PCTs, that is, in contexts that inspire cooperation and synergy between academia, society, the government, the environment and business. In spite of the number of articles published and the scale of theses presented, this research deserves to be highlighted by contrasting interdisciplinary dialogues.

Therefore, it is believed that meeting the images of themselves, images constructed by women entrepreneurs, allows considering that, in the analysis of the information selected in the corpus, there are significant discursive materialities to understand a little more about the subjectivity of the human being. in environments of entrepreneurship innovation.

Presenting the relevant historical aspects to contextualize the study of the entrepreneurial woman contributes to the promotion of discussions about their insertion in the universe of entrepreneurship, besides detailing the ideological and subjective questions staged in the intersection of the discursive thread. In this sense, seeking understanding about the entrepreneurial woman in Science and Technology Parks is to gather, in a broader way, the interdisciplinary concepts that discuss and problematize the economic and social issues for the construction of more sustainable and humane societies.

III. GUIDING QUESTIONS AND OBJECTIVE OF THE STUDY

Given this conjuncture, being an exploratory study, it was defined as a guiding research question: that entrepreneurial women, in socio-professional practices, discursively build the images of themselves, manifesting the search for a professional space in scientific and technological parks, revealing the motivations and clashes of work activity, in the exercise of female autonomy for the conception of more sustainable societies.

In addition, other complementary questions are also proposed:

⁽a) ⁶Capes means Higher Education Personnel Improvement Coordination in Brazil. The National Campaign for the Improvement of Higher Level Personnel (now CAPES) was created on July 11, 1951, by Decree no. 29,741, in order to "ensure that there are sufficient and qualified personnel to meet the needs of public and private". (CAPES, 2020a).

⁷Networked Digital Library of Theses and Dissertations. (NDLTD, 2020a)

- a) cultural aspects and identity representations are intertwined in the discursive practices of women entrepreneurs and are the result of symbolic constructions that permeate the social fabric in the work activity;
- women entrepreneurs, in addition to the search for autonomy and professional recognition, elect science and technology parks as environments of cooperation, knowledge construction and socioprofessional development, although there are value, individual and collective clashes in the entrepreneurial work activity;
- c) the enunciative-discursive construction of the selfimages produced by the entrepreneurs highlights the subjectivity of working, in which the woman recognizes herself as a body-self and validates the importance of her participation in generating the full development of scientific and technological parks, in building a more equitable and sustainable environments.

Thus, it is defined that the general objective of the research is to analyze the discursively constructed images of themselves, through scenographies elaborated by women entrepreneurs, in their socio-professional practices, from the cultural, identity and management aspects in the work activity.

In order to achieve the general objective, the following specific objectives were defined:

- a) to investigate the discursive practices of women entrepreneurs from the cultural and identity aspects manifested in the choices of personal references to undertake, as well as the challenges and opportunities of work as entrepreneurial activity;
- b) to understand, through language, what it is like to be an entrepreneurial woman, and why she elects a PCT to set up her company and perform her work;
- c) identify possible value clashes occurred in the management of the entrepreneurial woman in the dynamics of work activity;
- d) demonstrate how the entrepreneurial woman speaks discursively, in the construction of the images of herself, in her work, to generate the full development of the scientific and technological parks.

So, the following thesis is defended in this study: entrepreneurial women, business owners, in scientific and technological parks, are propellers of socio-professional transformation, in the proposition of raising female representation in this locus, as well as highlighting, in and through discursive practices, the subjective and singular dimension of working, recognizing itself as protagonists and emphasizing the principles of equity in the construction of more sustainable societies.

IV. METHODOLOGICAL TRACK

Given the selected theoretical framework, we proceed with the delimitation of the corpus of this study, such as the discursive language materialities of interviews with women entrepreneurs⁸ of four scientific and technological parks: PTA (Málaga, Autonomous Community of Andalucía/SP); TECHPARK (Novo Hamburgo, RS/ BR): TECNOSINOS (São Leopoldo, RS/BR): TECNOPUC (Porto Alegre, RS/BR). Thus, for the construction of the corpus, it was defined that the elaboration of the research object that counted with the speeches from ten women entrepreneurs in Science and Technology Parks.

The definition of labor territories⁹ In order to carry out this research, it is justified because they are environments that promote cooperation and innovation, with the objective of fostering the regional and global development of societies. From the point of view of its nature, it is an applied research and as to the technical procedures: bibliographic and documentary and with field research. From the point of view of objectives, it is considered an exploratory and descriptive research. As for the procedures, it is characterized, in the first methodological phase of the research, by a mapping of data on women entrepreneurs and on the Science and Technology Parks and, in the second methodological phase of the research, as a qualitative research with the ten women entrepreneurs participating.

The methodological apparatus that references the discourse analysis in this study is interpreted by means of a device created by the researcher, aiming to classify the data according to suggested theoretical categories¹⁰, through enunciative-discursive foundations (MAINGUENEAU, 2008a, 2008b, 2008c) from a socio-historical perspective.

⁹Cience and Technology Parks.

⁸The choice of the study object, that is, women entrepreneurs, business partners, was based on a methodological delimitation to account for the study objectives and to deepen the study outline in the PCTs.

¹⁰Methodological apparatus created by the researcher foresees three categories of analysis: A- Historical Cultural Dimension; B-Dimension Entrepreneurial Action; C- Discursive Enunciative Dimension. The interviews involving the selected Science and Technology Parks were conducted with five women entrepreneurs from Spain, and five women entrepreneurs from Brazil. The results were carried out in two blocks of analysis: the women's discursive materiality block in Spain and the women's discursive materiality block in Brazil.

The thesis is organized in nine chapters, where the first corresponds to the initial orientations to the reader about the researcher's trajectory and the construction of the thesis. In the second chapter, we present the general outlines of the research for the introductory conjuncture purpose.

In the third chapter, we seek to contextualize the cultural and identity issues of women as historical cultural agents. The dialogues show the reader the scenario in which women entrepreneurs reveal their socio-professional practices. Thus, a "background" is constructed that enables the recognition of clues that help in the reflection of the social and economic dimension of women entrepreneurs in the labor activity and the symbolic relations that emanate from these contexts, highlighting the dynamism of culture and how the identity of women in these loci is presented.

In this assertion, culture is engendered by ethos, as an image of itself, and by the interpretation of the human being in the world, which puts the individual in constant interaction with the transformations through which society is challenged. It is believed that it is useful to develop a descriptive apparatus about this context, signaling the main concepts, from which comes the speeches of women entrepreneurs. It is also noted that the history of women in the workplace encompasses positions of the need for equality of opportunity between men and women, whose identities are built by their relationship with each other, based on anthropological cultural contexts. The guiding authors of the theoretical axis are: Bourdieu (1994; 2010); Geertz (2008); Hall (2006); Scott (1995); Wagner (2010); Woodward (2009).

The fourth chapter presents the considerations about the concept of entrepreneurship and female entrepreneurship, promoting articulations between the ergological precepts of human subjectivity and female autonomy in the workplace. Among the main authors used to compose the dialogue on the subject, the following stand out: Ahl (2002); Bruin, Brusch and Welter (2006); Dolabela (2008); Filion (1999); Schwartz and Durrive (2016), UN Women (2016).

The fifth chapter highlights the central proposal of the theoretical basis of this study, called Enunciative-Discursive Analysis. It includes the constructs on scenography and ethos, as an image of themselves, necessary to account for quantitative research, that is, the discursive analysis of women in PCTs. The articulations are made through discourse analysis, with postulates of Maingueneau (1997, 2008a, 2008b, 2008c).

The methodology, used in this thesis, is presented in the sixth chapter, and is based on the architecture that leads to discursive study. The seventh chapter begins by presenting the environments of entrepreneurship and innovation, especially the Science and Technology Parks which are the working contexts where women entrepreneurs choose to establish their businesses. The proposal aims to express informative data about innovation environments and the Scientific and Technological Parks, supported by the Brazilian institute ANPROTEC (2018), the Spanish institute APTE (2019) and the international institute IASP (2019). In addition, the initial data from the data mapping carried out by the researcher regarding women entrepreneurs are evident.

The eight chapter is devoted to the analysis of discursive materiality from the discourses of women entrepreneurs who participated in the field research interviews. In the ninth chapter, we present the final considerations that summarize the results in relation to the guiding questions and the objectives conceived for the development of this thesis.

V. RESULTS

The results of the thesis point out that the study focused on women entrepreneurs in PCTs and related female entrepreneurship as a phenomenon that draws attention to the relevance of female leadership in business management, increasing the visibility of women in science and technology parks. Entrepreneurship was evoked as a global possibility for human autonomy, empowerment and professional recognition.

In addition, the research provided the opportunity to verify the cultural and identity issues, with ergological premises, limited to the discourse analysis of women entrepreneurs, by analyzing the self-images constructed in the discursive practices of women entrepreneurs, in three Brazilian PCTs, Techpark, Tecnosinos, Tecnopuc and a Spanish PCT, the PTA.

The guiding research question allowed validating that women entrepreneurs, in socio-professional practices, discursively construct the images of themselves, discursive ethos, manifesting the search for a professional space in the scientific and technological parks, revealing the motivations and clashes of work activity, In the exercise of female autonomy for the conception of more sustainable societies. The following specific questions were ratified: a) the cultural aspects and the identity representations are intertwined in the discursive practices of women entrepreneurs and are the result of the symbolic constructions that permeate the social fabric in the activity. of work; b) women entrepreneurs, in addition to the search for autonomy and professional recognition, elect science and technology parks as environments of cooperation,

knowledge construction and socio-professional development, although there are value, individual and collective clashes in the entrepreneurial work activity; c) the enunciative-discursive construction of the self-images produced by the entrepreneurs highlights the subjectivity of working, in which the woman recognizes herself as a body-self and validates the importance of her participation for the generation of the full development of scientific parks technologies in building a more equitable and sustainable environments.

Firstly, we established the presentation of the main academic productions, with the expression "women entrepreneurs", in three research bases, namely CAPES, NDLTD and Web of Science, which were presented in the general research delineations of this thesis. This data survey highlighted this study, as it did not find, in the researched bases, any research with an interdisciplinary character that brings together in the same study, the concepts discussed here, and thus has some novelty in the research.

Afterwards, we proceeded with a bibliographical study, presented in the third chapter, which made a contextualization about the cultural and identity issues. The theoretical dialogues showed the reader the contemporary scenario in which women entrepreneurs reveal their socioprofessional practices. Thus, a "background" was built that allowed the recognition of information that helped in the reflection of the social and economic dimension of women entrepreneurs in the labor activity and the symbolic relations that emanate from these contexts, thus highlighting the dynamism of the culture and how the identity of women in these loci of work activity is constituted.

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Next, we sought to present, in the fourth chapter, considerations about the concept of entrepreneurship and female entrepreneurship, promoting articulations between the ergological precepts of human subjectivity and female autonomy in the workplace. In this chapter, perspectives on entrepreneurship were embraced as a way of developing an idea, how to put it into practice, as well as understanding what this process of entrepreneurship is and the pillars of these dreams. In addition, the importance of having an ergological look regarding the work activity, place of construction of senses and development of the human being was evidenced. In addition, the relevance of the autonomy of the human being in labor activity and the aspects of female entrepreneurship were highlighted, as it increased the visibility of women in the labor locus, breaking with the resistances still present in the socioprofessional contexts. Among the main authors used to compose the dialogue on this theme, the following stand out: Ahl (2002); Bruin, Brusch and Welter (2006); Dolabela (2008); Filion (1999); Schwartz and Durrive (2016), UN Women (2016).

Soon after, the bibliographical research also discussed, in the fifth chapter, about the central proposal of the methodology of this study, called Enunciative-Discursive Analysis. It encompassed the constructs on scenography and ethos, as an image of themselves, necessary elements to account for qualitative research, that is, the discursive analysis of women in PCTs. The articulations were performed through the discourse analysis with postulates of Maingueneau (1997, 2008a, 2008b, 2008c). This theoretical framework was supported by propositions that involved the enunciative scenes, scenography and the construction of discursive ethes.

After the bibliographical approaches presented in the sixth chapter, it was necessary to create a methodological apparatus that was based on the architecture that led to the analysis of the self analyzes. The idea of the construction of the three conceived categories, A- Historical Cultural Dimension, B- Dimension of Entrepreneurial Action; C-Enunciative-Discursive Dimension was fundamental to perceive deeper glances on each aspect chosen to grasp the specific objectives of this thesis. It was also observed how much these categorical dimensions are intertwined, demonstrating that the images women construct of themselves originate from the interconnections of the three selected dimensions. The richness of information emanating from studies that venture into discursive discoveries and human subjectivity in the labor locus was highlighted.

Subsequently, the seventh chapter began by presenting the environments of entrepreneurship and innovation, especially the PCTs which are the working contexts where women entrepreneurs chose to establish their businesses. This data mapping provided clarifications on innovation environments and PCTs, supported by the Brazilian institute ANPROTEC (2018), the Spanish institute APTE (2019) and the international institute IASP (2019). In addition, we presented the elements of the data mapping of the first methodological phase of the study, conducted by the researcher, with information from the four PCTs involved in field research regarding women entrepreneurs. It was noticed that the general data on the number of companies whose partners are women is still small, showing a scenario still mostly male, with low female representation in the four investigated PCTs.

The eighth chapter, corresponding to the second methodological phase of the research, was devoted to the analysis of discursive materialities arising from interviews with women entrepreneurs who participated in the research in the four PCTs that involved two countries, Spain and Brazil.

From the established guiding questions, it was defined that the general objective of the research is to analyze the discursively constructed images of themselves, through scenographies elaborated by the women entrepreneurs, in their socio-professional practices, from the cultural, identity and management aspects in the activity of women. job.

It is considered that the general objective was achieved, as it brought glances on the images of women entrepreneurs built in the PCTs investigated. From the bibliographical studies already mentioned, from the methodological apparatus that allowed to understand in greater detail the cultural and identity aspects of the action of entrepreneurship. Thus, from the perspective of work as human development, from the ergological aspects of work activity, it was possible, through discursive analysis, to derive the images of themselves, the discursive ethos, built by women entrepreneurs. The data found in the first methodological phase of the research mapping were also relevant to understand the context of speech of women, since the construction of discursive meaning is also influenced by the environment in which these women interviewed act, besides showing the low representativeness of the entrepreneurial woman running her own business.

The first specific objective that aimed to investigate the discursive practices of women entrepreneurs, from the cultural and identity aspects manifested in the choices of personal references to undertake, as well as the challenges and opportunities of work as an entrepreneurial activity, was achieved, since the discourses analyzed made possible to get in touch with cultural values of each enterprising woman, in a search for the inheritance of the life that inhabits in each human being. It was identified in all loci

investigated that the entrepreneurial universe is still predominantly male. Thus, it is suggested that due to the low representativeness of women undertaking their own business in their own family environments and in a circle of friendships close to the interviewees, it was found that women, in the testimonies of some interviewees, recognized in men the inspiring example to undertake. It is also observed that some interviewees did not have examples of entrepreneurs in their families, which may suggest that women, even without a history of entrepreneurial life, enter entrepreneurship to perform work activities, according to their values and Identity choices.

The discursive materialities of the Spanish respondents indicated that the biggest challenges to undertake are maintaining business, because the country has high taxes for entrepreneurs in general. It was also highlighted that in the Brazilian bloc, according to discursive materialities, arising from interviews with Brazilian female entrepreneurs, it was a challenge to undertake the difficulty of managing the business as a whole, considering that entrepreneurship requires technical and management skills.

The second specific objective of the study prioritized, through language, what it is like to be an entrepreneurial woman, and why she elects a Science and Technology Park to set up her company and exercise her work. It was found that, in both blocks of analysis, derived from the language materialities of the interviewed entrepreneurial women, the opportunity to be connected to their beliefs and their values, seeking the creation, development and execution of their ideas, being leaders and performing Your dreams in entrepreneurship are perceived as positive points. It was noted that in what the Spanish block of discursive materialities, it was mentioned that the PCT would act as an identity reinforcement for small companies, besides identifying this locus as an environment of local development, international projection and networking, offering partnerships with universities. Thus, respondents from Spain confirmed that the country is perceived as a good place to undertake, noting that most of the interviewees are foreigners and have had professional experience in other countries. Regarding the Brazilian block of language materialities, it was identified that the Science and Technology Parks are perceived as environments for networking and where women perceive the valuation of their own management models. In addition, the Science and Technology Parks were remembered for the possibilities of connecting with universities, having good infrastructure and safety, attracting the vast majority of regional entrepreneurs to these environments.

The third specific objective of the research aimed to identify possible value clashes occurred in the management of entrepreneurial women in the dynamics of work activity. The interviewees of the Spanish discursive analysis block highlighted the existence of clashes related to the reconciliation of personal and working life, especially those who wish to be mothers. It was identified that there are barriers to the entrepreneurial women's professional and personal life, which may have suggested that many of the participants chose not to have children. They said that Spain's Science and Technology Park could provide better infrastructure conditions for children, such as providing more day care and care for entrepreneurial mothers. Interviewees from the Brazilian discursive analysis block reported that there are clashes to break the cultural barriers of a still masculine model of entrepreneurship. They also commented that it would be important for PCTs to devote more effort to making the environment of innovation and entrepreneurship more welcoming to women who want to simultaneously engage in motherhood.

Another relevant point that was mentioned in both interview blocks concerns the notoriety of the interviewed women's invested knowledge for the management of their business. It has been observed that women entrepreneurs seek unique ways of engaging in work activity, thus emphasizing the value of life inheritance and personal values for running their business. It was also found in the speeches of the interviewees from Spain images of themselves elaborated by the entrepreneurs who emphasize the importance of autonomy in the activity of entrepreneurship. The participants of the Brazilian bloc highlighted that entrepreneurship is related to human autonomy, revealing the need to often make an extra effort to boldly show the place of women in the socioprofessional environments in which they operate.

Thus, in both blocks of interviews analyzed, it was identified that female entrepreneurship is still viewed with some suspicion, revealing the existence of some barriers motivated by prejudice and socially constructed stereotypes. On the other hand, we highlight that the images themselves discursively constructed by the interviewees, from both blocks of analysis, revealed the strength of women to break these paradigms based on cultural stereotypes that limit women's work activity. It was noticed that the women interviewed have aptitude to lead cultural, individual and collective changes in the locus of work.

The fourth specific objective of this study aimed to demonstrate how the entrepreneurial woman discursively enunciates, in the construction of the images of herself, in her work to generate the full development of scientific and technological parks. It was observed that, both in the block of analysis of the discursive materialities of Spain and in the block of analysis of Brazil, the elaborated scenic framework showed an encompassing scene that refers to an organizational type discourse of entrepreneurial management and, similarly, a generic scene. with interviews with women entrepreneurs.

In the Spanish block, the scenography suggests changes and claims in the professional spaces, that is, in the search for greater representation of the entrepreneurial woman in the PCT, sharing with men the action of entrepreneurship. In view of this, the ethos said is of an empowered woman who, despite the difficulties of the work environment, revealed to have gained her autonomy in the work activity of work. Indeed, the ethos shown revealed that the entrepreneurial woman is autonomous, seeks freedom, making improvements for society and the country she has chosen to work in, knowing her contribution to the innovation and entrepreneurship ecosystem, as well as her collaboration towards a more environmentally friendly environment. egalitarian in the labor locus.

So, as a result, an image of the self was observed, that is, a discursive ethos of a woman entrepreneur who understands the woman as one who fights for her dreams and acts in an aggregating way, so that women, together with men, gain recognition and contribute to the development of an environment of innovation and entrepreneurship.

In the Brazilian block of discursive materialities, a scenography was built, where women sympathize with each other, participating in an imaginary community, incorporated by their own way of inserting themselves in the world, in search of professional space. The said ethos reveals a woman engaged in the feminine cause, seeking to build, in a harmonious way, more participative environments with greater diversity and cultural plurality. Thus, the ethos shown highlights an entrepreneurial woman aware of her value to the entrepreneurial ecosystem. Thus, there is a discursive ethos of entrepreneurial woman citizens who, through their inspire other women to follow in uniqueness, entrepreneurship, creating economic and social impact in the context in which they work, with the perspective of work related to the activity. that promotes human development.

VI. CONCLUSION

The construction of a scientific research leads to the possibility of important social changes in their operating contexts. The exercise of shedding light on the discourses emanating from social agents, especially women entrepreneurs, suggests the possibility of studying entrepreneurship as a socio-professional phenomenon, whose participation of each woman is indispensable for valuing the uniqueness of the human being in the activity of women. job.

Considerations about the insertion of women in working spaces guarantee the exercise of human rights and inspire the construction of more sustainable societies, economically and socially. Qualitative research initiatives on women entrepreneurs contribute to the understanding of the importance of social diversity and respect for human differences, as well as unveiling the parameters through which women entrepreneurs act and perceive their lives and social conditions.

The act of taking the word results in the elaboration of an image of oneself, of a discursive ethos. It is noticeable that in order to elaborate an image of herself, the entrepreneurial woman does not need to speak only of her personal characteristics or to show her self-portrait, but it is enough to take the word. Their language, their way of acting in the world, their beliefs, their values are able to make explicit the symbolic representation of their identity, their culture, and finally their person. The importance of speech itself reveals the construction of a scenic picture that manifests, not only by the enunciator, but by the nuances of his utterance, the practices he adopts and the construction of his image, his socio-professional discursive ethos.

The defined theme, which involved women entrepreneurs emerged from various concerns of the researcher, whose premise is to connect academia and the business market. This interdisciplinary study found a way to be a link between these two environments, certainly building ideas and reflections on women entrepreneurs in these historical contexts.

Thus, after several dialogues and intersections between the three categories conceived, in the methodological apparatus, where the images themselves, discursively elaborated by women entrepreneurs in work activity, were defended the thesis that entrepreneurial women, business owners, in scientific and technological parks, are propellers of socio-professional transformation, in the proposition of raising female representation in this locus, as well as highlighting, in and through discursive practices, the subjective and singular dimension of working, recognizing itself as protagonists and emphasizing the principles of equity in the construction of more sustainable societies.

This study gave entrepreneurial visibility and speech space, positively impacting the labor activity ecosystems in

which they work professionally. More than female entrepreneurship, entrepreneurship can be understood as a means of resignification, rather than the work itself, expanding its conceptual scope, as suggested in the three dimensions¹¹ of analysis in this thesis work. The vision of entrepreneurship gained strength when combined with ergological aspects as suggested in this research.

Although we are in 2019, it is understood that prejudice against female entrepreneurship still exists. Thus, entrepreneurial women found it difficult to be accepted in networkings, invisible in meetings and sales negotiations. Many clashes have been reported, highlighting the dramatic use of the body-itself. The cultures imbricated and analyzed here still show symbolic games of power, often implicit in environments of innovation and entrepreneurship, but these obstacles are overcome by women, although some of them experience these difficulties more intensely than others. What is important is that entrepreneurs become aware of their challenges and how to overcome them so that they can continue to be protagonists in their work activity.

It was noticed that one of the main contributions of this study is to look at women entrepreneurs in PCTs. The qualitative study was fundamental to explore the proposed objectives and validate the general and specific guiding questions of this study. In addition, culture and identity accompanied the discursive trails that lead to the images of themselves. It was evidenced, therefore, that it was fruitful to promote qualitative studies, based on discourse analysis to address research on women entrepreneurs. It was glimpsed to recognize women as transforming agents in working spaces. In addition, listening to what women have to say is, according to the researcher, the first step towards the realization of genuine changes in the socio-historical contexts of the world of work.

We acknowledged that, despite the efforts to seek to give greater visibility to women's issues in entrepreneurial labor locus. We noted that some aspects could be further, suggesting future studies. One of these aspects leads to research in other PCTs in order to investigate other contexts in innovation and entrepreneurship environments and learn more stories of women entrepreneurs. In addition, it is suggested the investigation of male entrepreneurs so that they can also express their ideas in relation to the theme under discussion. It was also found that women entrepreneurs are open to connections and cooperation, so it is suggested to investigate possible networks of cooperation in the entrepreneurial ecosystem,

¹¹Historical cultural dimension; Entrepreneurial action dimension; Discursive enunciative dimension.

supported by ergological and discursive principles.

It is also recommended, from this study, shared actions among the PCTs involved in order to promote joint activities that value the female presence within the PCTs, as well as to understand, in more detail, the needs of women entrepreneurs in these work environments. In view of the thesis proposal and UN 2030 agenda (AGENDA, 2018), which aims to achieve gender equality and empower all women and girls by 2030, PCTs could be at the forefront of actions that would help women entrepreneurs raising their representativeness in in female entrepreneurship with their own businesses.

It was also noted that one of the limitations of the study was the deadline for conducting interviews in Spain, since the researcher was in a doctoral internship and needed to conduct the interviews and understand the country's cultural context in a short time. It was also evidenced that some companies visited had no quiet place to conduct the conversations and, in some cases, noise hindered the transcription of the interviews.

Far from suggesting unpublished research, if this is possible, the results obtained may contribute to future studies on the theoretical aspects of the mobilized themes. This analysis was not intended to be exhaustive and conclusive, as it evoked approaches to entrepreneurial women and their participation in entrepreneurship. To seek understanding about women entrepreneurs in science and technology parks is to gather more broadly interdisciplinary concepts that discuss and problematize the economic and social issues of today. In a society whose entrepreneurial management often values the business economic aspects of how to generate profit or obtain financial results to the detriment of the human aspects, it becomes challenging to support the idea of the need for an ergological look at the human being and the activity. Work The entrepreneurial woman, in this aspect, ceases to be a resource and becomes an active human being producing knowledge in the work activity. In addition, it can also be said that female entrepreneurship enables women entrepreneurs to find a way to accelerate social change, as they have already demonstrated competence in managing companies in innovative and creative environments.

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Psychiatric Reform based on the Practices of Mental Health Professionals at CAPS Ad: Between the Nosocomial and Psychosocial Models

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Abstract— The object of this research is to verify the performance of the practices of the professionals of the *Psychosocial Care Center (CAPS-AD)*, in the light of Law 10.216 / 2001, of the *Psychiatric Reform, making* it possible to detect possible distortions, enabling the adequacy of the requirements of the psychosocial model established by mentioned Law. Firstly, we sought to understand how professionals have applied the *Psychiatric Reform Law. Second, as a secondary objective: the present research aims to detect possible* behaviors that reflect practices of the asylum model, with a view to psychiatric reform. To this end, it was verified, through an interview, the performance of mental health professionals during contact with users, the development of treatments applied and the types of interventions used; aiming to improve their service and consequently minimize or stabilize social stigma. As it is a qualitative research, it used Bardin's content analysis as a method. The data collection instruments were: non-directive interviews and notes taken in a field diary. The participants of the research sample work in three shifts, in a total of 15 professionals, namely: a) *Psychiatrist (1); b) Coordinator (1); c) Psychologists (04); d) Nursing technicians (03); e) General Physicians (02); f) Nurses (02), and; g) Social Assistants (02). The results obtained indicate that most professionals do not have specific training to work in the mental health area, except for the psychiatrist with specialization in mental health and chemical dependency.*

Keywords-Psychiatric Reform, Mental Health, Asylum and Psychosocial Model, CAPS ad.

I. INTRODUCTION

1.1. Brief journey about madness.

In Ancient Greece, the "madman" was considered a person with different powers. Madness was seen as a manifestation of the gods, being then recognized and valued socially. There was no need for its control or exclusion. (ALVES; et al, 2009, p.86). Madness was not always seen under the medical eye, but as a way of manifesting the human, going from the field of Mythology to Religion. Illness came to be understood as punishment and punishment and thus, the patient was then blamed for his illness.

According to Alves et al, (2009) madness was explained through religious thought, concepts of demonic possessions and witchcraft prevailed throughout society, so that the consequence was the treatment given to the "madman", this was done through work of magic and exorcism practices.

In the Middle Ages, according to Alves et al (2009), madness was seen as an expression of the forces of nature or something of the order of the non-human. It was exalted, in a mixture of terror and attraction. With the birth of Rationalism, madness ceases to belong to the context of the forces of nature or divine, assuming the side of unreason, the madman being the one who transgresses or ignores rational morality, yet in this context there is the association of madness with dangerousness.

It is, then, in the Modern Age, that several attempts to name and address madness occur, with the greatest challenge so far, that of treating madness. Even in the Modern Age, the notion of private property emerges, as a response to this proposal, everyone should produce, and anyone who did not produce should be "excluded". Linked to this, with Mercantilism, everyone who in some way could not contribute to the movement of production, trade and consumption, according to Jacobina (2000) "[...] started to be incarcerated; old people, abandoned children, cripples, beggars, people with venereal diseases, start to occupy real human deposits, those who rebelled, were locked in cages and chained "(p.94).

It was only at the end of the 18th century that the first medical specialty in psychiatry appeared. Its origin brought the hope of treatment to the population interned in European asylums and hospitals of that time. The psychiatrist who introduced the clinical view in this area was Philippe Pinel (1745-1827) (STOCKINGER, 2007).

According to Alves; et al, (2009) from this moment then madness is seen as a synonym for mental illness. Pinel orders the alienated to be chained, so madness seen as a disease should be treated medically. Pinel's initiatives pointed out two important issues: if, on the one hand, such initiatives create a field of therapeutic possibilities, on the other hand it defines a pathological and negative status with madness. Finally, Pinel's ideals end up reinforcing the separation of the insane, in order to study them and seek their cure. As a result of these initiatives, the asylum is seen as the best therapy, where seclusion and discipline are applied, with moral treatment as its objective.

As Goffman (1961) explains in Asylums, Prisons and Convents ... "This whole process of isolation and control, named by the author of 'Mortification of the Self', promotes a kind of deculturation, due to the distance from the routines and cultural transformations that occurred in the external world, generating dependence on the institution and fear of reintegrating into social life "(p.16).

We can assimilate that through the various efforts, and despite what seemed to be the "efficient solution" for the treatment of madness, medicine has not been able to give a satisfactory return to madness, the exclusion or imprisonment of these individuals who ran away from said normality, it had not been seen quite well by everyone.

According to Artoni (2004), even with all the ideas of naming madness as an organic disease and the possibilities of understanding it subjectively, none of these attempts since antiquity has managed to take the stigmas that society attributed them from mad people.

As Desviat (1999) clarifies. Criticisms of the "effectiveness" of the hospital model arose from the initial moment of its construction, but it was after World War II that professionals and society came to the conclusion that such a model should be rethought.

In Brazil, complaints of fraud in the service financing system started to emerge, which would be related to the abandonment, violence and mistreatment of psychiatric patients, initiating the Psychiatric Reform movements.

As a consequence, there was: "[...] the approval of the Reorientation Program for Social Security Psychiatric Assistance of the Ministry of Social Security and Assistance (MPAS), in 1982, the creation of a mental health policy engaged in fighting to the hospital-centered culture of the time "(ALVES et al., 2009, p.93).

Despite the Psychiatric Reform movement advocating a transformation in the way we look at mental illness, this was not enough for there to be an improvement in the service provided to this population, regarding the care of the mentally ill. From then on, conferences, meetings and even changes in legislation were made so that the mentally ill person had the right to be seen as a citizen and similarly, treated as such.

In 1987, the 1st National Conference on Mental Health and the 2nd Meeting of Mental Health Workers took place, with the theme: "For a Society without Asylums". Alves; et al, (2009, p.93). From these meetings and conferences, Social Reinsertion is then seen as the main objective of Psychiatric Reform. Organizations, associations, health authorities, mental health professionals, legislators and lawyers met at the Regional Conference for the Restructuring of Psychiatric Care within Local Health Systems.

It is at this historic moment that, aiming at the rupture of these asylum assistance models, the presentation of the Bill 3657/89, 1989, by Deputy Paulo Delgado, appears, aiming to regulate the rights of the mentally ill in relation to the treatment and effect the extinction, in a progressive, public and private asylums and their subsequent replacement by extra-hospital services.

The aforementioned project gave rise to Law no. 10,216, of April 6, 2001, which is in effect, proposing the gradual replacement of beds in psychiatric hospitals, as well as, of the old asylum institutions by Day Hospitals, Nucleus and Center Psychosocial Care and Therapeutic Residences, Community centers in addition to other mental health care devices. A favorable environment is thus created so that those who suffer psychically can have the necessary support to re-enroll themselves in the world as a social actor.

Based on these general ideas, we can say that it is only possible to consider that two models of action in the field of mental health are alternative if they are contradictory. And two models will be contradictory if the essence of their practices leads in opposite directions as to their basic parameters. (AMARANTE, 2012, p.144.)

It is in accordance with these ideals that the construction of a substitute network for the psychiatric hospital and the traditional hospital-centered model began, starting with the creation of extra-hospital mental health care services.

In this context, services such as the Psychosocial Care Centers - CAPS, the Psychosocial Care Center for child care - CAPSi and the Psychosocial Care Center for Alcohol and other Drugs - are created for prevention and treatment actions (CAPSad) (ALVES et al, 2009, p.94).

1.2. General Objectives

This research aimed to detect possible behaviors that reflect practices of the asylum model, with a view to psychiatric reform. To this end, it will be verified, through an interview, the performance of mental health professionals during contact with users, the developments of treatments applied and the types of interventions used; aiming at improving their service, and consequently, minimizing or stabilizing social stigma. This project intends, in the light of the Psychiatric Reform, to verify how the practices of mental health professionals at CAPS AD in Porto Velho take place, whether or not they are in accordance with the Reform.

1.3. Specific objectives

a) Understand how professionals have exercised the applicability of the Psychiatric Reform Law in their practices.

b) To know how the methods, resources, parameters, techniques or management that these mental health professionals have used in the exercise of these practices take place.

II. METHODOLOGY

2.1. Research methods

This project presents a qualitative approach. Qualitative research is characterized by investigating situations in the human universe, such as meanings, ideas, behaviors and others. In the face of such adversity, it was decided to carry out the content analysis of this study, the stages of the technique proposed by Bardin, since it is the most cited work in qualitative studies. According to Bardin (2009, p.121) "These steps are organized into three chronological poles: 1) pre-analysis, 2) exploration of the material and 3) treatment of results, inference and interpretation".

The first phase, pre-analysis, is developed to systematize the initial ideas put forward by the theoretical framework and establish indicators for the interpretation of the information collected. This moment includes the general reading of the material surveyed, especially the interviews, which are already transcribed, for a better analysis of the theme.

The second phase is the exploration of the material; it consists in the construction of the research wording, considering the excerpts of the statements in units of records, the classification and aggregation of information in thematic categories (BARDIN, 2009). In this phase, the responses of the interviews, and of all the collected material, are cut into record units and added to the research text, as well as document texts, or field diary notes.

The third and final phase is the treatment of the results obtained and interpretation; "Gross results are treated in a meaningful and valid manner" (BARDIN, 2009, p.127). Also according to BARDIN (2009), which allows the establishment of results tables, figures and models, which condense and highlight the information provided by the analysis.

2.2. Subjects

The participants in this research were the mental health professionals who work at CAPS AD; in the initial forecast, 18 professionals who work in the three different service periods at the CAPS, however (three) were unable to participate; one for being on sick leave, another for having been returned to SEMUSA to work in another institution, and the third, refused to participate in this research. We then carried out the research with the 15 collaborating professionals, dealing with: a) Psychiatrist (1); b) Coordinator (1); c) Psychologists (04); d) Nursing technicians (03); e) General Physicians (02); f) Nurses (02), and; g) Social Assistants (02). A copy of the Informed Consent Form (Appendix 01) was delivered to all research participants, which was signed.

2.3. Inclusion criteria:

a) Be a professional in the mental health network.

b) That in their practices they provide assistance to users of Caps Ad.

c) Professionals who signed their express informed consent to participate in the research in accordance with the applicable legislation.

2.4. Exclusion criteria:

a) Professionals who do not work in the Mental Health network.

b) Professionals who do not serve the public of the Caps Ad network.

c) Professionals who did not want to participate and did not sign their express informed consent to participate in the research in accordance with the applicable legislation.

2.5. Instruments and procedures for data collection

The present research was carried out through recorded nondirective interviews, with the interviewee's consent, and notes described in a field diary. Having done this, a study of the data obtained was carried out, and of the information collected in order to carry out a comparative study with the theoretical framework raised. As Chizzoti (2010, p.92) clarifies, "[...] the non-directive interview is a way of collecting information based on the interviewee's free speech".

Care measures were taken in case of any discomfort at the time of the interview. The researcher, being a student in the last year of psychology, is prepared to reduce any emotional damage that any question asked during the interview would cause to the collaborating interviewee, and if there is any discomfort, the professional would have psychological support for emotional support.

The interviews were conducted individually with each professional, according to the availability of this and the

researcher. The place where the interviews were conducted was CAPS AD itself. The interview was conducted as follows: the researcher asked the question and the collaborating professional had the necessary time to verbalize their ideas and answers about it. To guarantee the reliability of the data collected, the interviews were recorded and later transcribed.

2.6. Research Location

This research was carried out at the Psychosocial Care Center for Alcohol and other Drugs, located at Av. Guaporé, n° 3929; Neighborhood: Agenor de Carvalho in Porto Velho, Rondônia.

2.7. Data analysis and discussion

We emphasize that for a better understanding of the collected data, we will perform the analysis after the transcriptions. Content analysis is presented under several categories, thus enabling many styles of analysis, however, the category we will use is called "thematic analysis".

As Bardin (2009, p. 96) explains to us "By focusing more on the topic of investigation, we can extract the meanings associated with the topic, in the mind of the person interviewed". The thematic data analysis technique is known as text inference in which latent content is sought for the subject's said and unspoken content. Likewise, according to Bardin (2009), the thematic analysis method is one that, from the material transcribed, read and reread, will allow the researcher to observe the major themes that stand out from the content, which are evident in the discourse.

According to Lima and Pacheco (2006, p.120) "The interpretation of the results of the content analysis is necessarily subordinate, in the first place, to the search for answers to the research questions that have been asked".

2.8. Performance time and function of each professional interviewed.

The mental health professional must think beyond the simple duty to "cure and treat" the person with a mental disorder; in his performance, it is expected that the subject as a person will be prioritized and valued, instead of looking only at the symptoms and diagnoses placed on him, understanding that this user of the mental health service needs to be seen under three prisms; being the physical, psychic and social aspects.

The service time in the mental health area and, specifically in the CAPS-AD, of each of the professionals who participated in this research: The participants in this research have an average of 03 (three) to 09 (nine) years of experience in the CAPS- AD, and still two professionals present, in addition to their time at the institution, another five and four years working in mental health at other institutions.

These were the collaborating professionals of this research and their respective activities: psychiatrist, service coordinator, nursing technicians, general practitioner, nurses, social workers and psychologists. Only one professional at the institution has a specialization in mental health and chemical dependency, another is still studying in the same area. The others have specialization in psychiatry, psychoanalytic clinic, organizational psychology and cognitive behavioral therapy. Data obtained from the interviewees themselves.

Table 1 - Justifications of those who did not participate in the research

| Employee Role | Amount | Reason |
|-----------------------|--------|------------------------------------|
| Nurse | 03 | He refusedtoparticipate. |
| Psychiatrist | 02 | Medical Leave. |
| NursingTechnicia n | 04 | Returned to the Health Department. |

In view of the data presented above, we agree with Boarini's ideals: "Mental Health professionals, faced with the difficulties of entering or without maintaining in the labor

market, have increasingly sought to work in public services without having, however sufficient preparation and commitment to your proposals and purposes "(BOARINI, 2011, p.167).

In the table below, the justifications of the 03 (three) employees who did not participate in this research; according to the initial forecast for it.

III. A MODEL OF PRACTICES OF MENTAL HEALTH PROFESSIONALS AT CAPS AD.

It is thinking about these practices and these diverse functions that mental health professionals at CAPS-AD were offered a look at themselves and the other, through their practices, in order to verify the application of the Psychiatric Reform Law, by the various professionals of this institution, seeking to understand how they practice in the mental health area, with the bonus of the possibility of reviewing their practices, and who knows, possible errors or insufficiencies resulting from professional practice.

An example of this form of action in the light of psychiatric reform, and the importance of the work of the multidisciplinary team, so that there are case studies and possible advances in the treatment of the CAPS AD user, appears in the speech of one of the psychiatrists interviewed;

| Table 2 | Performance | ofprofessionals |
|---------|-------------------|--------------------|
| 10000 | 1 01 101 100 1000 | 0,10,00,000,00,000 |

| Employee Role | Time experience | Testimonial |
|------------------|---------------------------------|--|
| Psychiatrist 1 | 03 years in Mental Health | I develop clinical activities, as a psychiatrist, so I try to listen to the patient and explain the importance of him carrying out all the treatment not only with me, but with all the professionals, and when I see that it was not with colleagues, I pull my ear even, you know I can't do the treatment alone, and I explain that it is for their good and their family too, I always reinforce the importance of the family in the treatment, they really spend most of their time with the patient, so they have to know how to deal, I always call them together and explain some things, I raise doubts from the family for them to give this strength to them, you know, I also do activities outside the institution, such as lectures and dissemination of CAPS work, I am part of the multidisciplinary team and Traveling CAPS. |

It is in order to replace the professional asylum of professionals in the new substitutive devices, that the proposal of the multidisciplinary and interdisciplinary team emerged. "The work of the team should include a permanent rethinking of its daily practice and of the relationships established between the team itself, with users and with the community" (FRANÇA 2005, p.156).

Regarding the professional being attentive to his way of acting and concerned with the patient's well-being, it can be seen clearly in another testimony:

| Employee Role | Time experience | Testimonial |
|----------------------------|---------------------------------|--|
| Coordinationo f CAPS-AD | 06 years in Mental Health | I started in the administrative, I did my administrative work and whenever I could I listened, supported or welcomed some patients that I saw and felt that I needed special attention. Then I became technical manager and director of CAPS AD, and in these 6 years, I try to receive each patient with attention, perform a good listening, look in the eyes of the patients, so that he sees that I am listening to him and giving importance to what he is speaking, but I don't see it in the majority of my team, some don't even listen to patients who will say to look them in the eye, the CAPS AD public, demand specific care and extra attention and I try to stop what I'm doing and listen a little them. |

Table 3 - On the attention of professionals

According to this way of acting, we sought to promote a bond with CAPS users, and as a consequence, avoid disconnecting them from their community "by introducing an extra-hospital care model that could gradually break with the hospital-centered practice, whose task we understand that it is the responsibility of all mental health institutions, substitutes and committed to psychiatric reform" (FRANÇA 2005, p.148).

This view was clear that the patient is not a single professional, but that he "belongs" to the entire team, as seen in another statement:

| Employee Role | Time experience | Testimonial |
|------------------------|--------------------------------|---|
| General Physician 1 | 01 year in Mental Health | It is part of a whole, you know, we are a team here, I always like to emphasize to the patient, he likes to arrive at the office and he thinks that the medicine is the solution to all problems, and the medicine is just a part of the whole construction of the work, what will consecrate the treatment is the set, not only the work of the doctor, but also the work of the psychologist, Social Worker, patient participation in the groups is the whole set, I tell them, they think that getting here and renewing the prescription solves all the participates in all the team's practices. |

We perceive this concern in becoming a team to provide the best service to the CAPS AD user, through the testimony of another professional of the institution:

| Table 4b - The professional | as a member of the | multidisciplinary team |
|-----------------------------|--------------------|------------------------|
|-----------------------------|--------------------|------------------------|

| Employee Role | Time experience | Testimonial |
|---------------------|---------------------------------|--|
| Social Worker 01 | 04 years in Mental Health | We don't work alone. We are a multidisciplinary team. We do case studies, there is interdisciplinarity in our team. You seek to do the best for the patient within the scope of the legislation. |

Still on this theme of the importance of acting as a team, not seeing the patient as the mentally ill without recognizing him with his subjectivity, plurality and as a reflection of that, the team showed at times, dedication and special attention to the entire history of the CAPS - AD user, as well as their social and emotional background. More and more professionals have recognized the need to dialogue with the rest of the team, so that they can see the user as a subject in its entirety and there is no fragmented planning of the therapeutic plan, which was clarified in the speech of the following professional:

| Table 4c - The professional | as a member of the | multidisciplinary team |
|-----------------------------|--------------------|------------------------|
|-----------------------------|--------------------|------------------------|

| Employee Role | Time experience | Testimonial |
|---------------|---------------------------------|--|
| Nurse 01 | 07 years in Mental Health | My practice occurs with the multidisciplinary team, there are several professionals all in full communication, to be better directing the treatment and monitoring of the patient, this is done with all professionals and with the various services offered by CAPS, on my part I stay at part of the screening, reception and initial interview. As it is a very small team, it facilitates contact, we always exchange pertinent information and we have a lot of openness and confidence to give suggestions for various situations, even with doctors who are generally closed, those here at least are super calm and open to study and discuss cases. |

Another professional also in the nursing area stressed the importance of the work of the multidisciplinary and interdisciplinary team.

| Employee Role | Time experience | Testimonial |
|---------------|---|---|
| Nurse 02 | 04 years and 07 months in Mental Health <i>at</i> <i>CAPS AD</i>) | " I am never alone, I am always working with a psychologist or social worker. I supervise the technicians so that they perform better care for the patient and adjusted to the CAPS model, I participate in multidisciplinary meetings, I also make home and institutional visits, trying to provide the best care for the patients here, you know ". |

The team showed a unique discourse about acceptance, understanding and the importance of carrying out a joint work, where each professional has its fundamental role and everyone exchanges ideas and plans, so that all together, assemble the best therapy for each CAPS user AD.

As França explains (2005, p.156):

It also proposes, in view of the growing expansion of knowledge and the complex nature of the mental illness object, the intervention of the interdisciplinary team as a privileged work tool, as it offers a place for knowledge to be tested, limited, criticized and expanded, producing new knowledge and new crisis intervention practices, giving new meaning to the knowledge already established and providing a new production of meanings.

3.1. Real practices of professionals in the face of a psychotic break.

It is in the face of impasses, some uncertainties and countless challenges that the various mental health professionals at CAPS AD, try to walk at a slow (micro) pace towards Psychiatric Reform.

According to Boarini (2011, p. 87):

Certainly the high rate of medical consultations, with a degree of resoluteness of the care provided practically null, even when the complaints refer to organic problems, but the clinical examination is negative, generates impasses and challenges that are sometimes not adequately addressed.

These are exactly questions similar to these challenges, impasses and uncertainties about what would be the best conduct in the face of a psychotic outbreak, for example, which we will see in the statements of some of the interviewees of this research.

| Employee Role | Time experience | Testimonial | | | |
|----------------|---|---|--|--|--|
| Psychiatrist 1 | 03 years in Mental Health at CAPS AD | I make a welcome, I try, right, the verbal restraint directs to the bed (bed), I activate the SAMU. If it gets worse, we use mechanical restraint, because we do not have the necessary instruments, we use these resources. Sometimes chemical containment is necessary, but soon SAMU arrives and provides emergency care. There is always this interface between the team and CAPS AD. | | | |

Table 5a - Defining professional conduct

It was noticed in the speech of some of the interviewees, aspects of uncertainty, fear and lack of clarity as to how to deal with this adverse situation, but so expected in an institution that deals with mental health;

| Employee Role | Time experience | Testimonial |
|---------------------------|--|---|
| Social Worker 02 | 06 years in Mental Health at CAPS AD | In the face of the psychotic break, I don't have much to do, right? I call Samu, and I am already taking him to the nursing room, to try to talk and try to understand him. I ask someone on the team to call the family and try to explain to her what is happening. |
| Coordinationof CAPS-AD | 06 years in Mental Health | I try to perform first aid, as far as possible and what I know how to do, I call the doctor who is in our unit to perform the necessary procedure for the moment, after the doctor is treating the patient and applying the medication for contain, only if medication is necessary, you know, I warn the multiprofessional team, so that if this patient is stabilized and stays in the unit, he will go through the team to see better referrals. |

 Table 5b - Defining professional conduct

In several speeches we can witness the predominance of attention more focused on the biological aspects of the patient, represented by most professionals when resorting to medication, containment and SAMU care, demonstrating very limited views, and which generate these impasses in the day-to-day care of the patient. institution, precisely because they exclude subjective content as part of the person's illness. "It is possible to suppose that both the user and the professional experience frustrations: the first for not having their suffering diminished and their complaints answered and the second for realizing that they are not coping with the situation, although they often place the responsibility for the cure on the first one". (BOARINI, 2011, p.88).

These other professionals also presented in their speeches a speech of attempts and uncertainties:

| Employee Role | Time experience | Testimonial | | |
|--------------------------|--|---|--|--|
| General Physician 02 | 02 years in Mental Health at CAPS AD | Here we usually refer to UPA, depending on the outbreak we contain it and take the medication that we have here, although I don't know if there are these medications. When we have it, we do "Diazepam" and "Haldol" and Fenergam when we have it and call SAMU, and contain the patient, tie him up, let me talk soon, there is a beautiful name, right. | | |
| NursingTechnic ian 01 | 01 year in Mental Health at CAPS AD | First I'm going to call SAMU and Fireman; trying to contain it looks like ho it, if a doctor has a prescription, we administer the usual haldol - fenergam. don't have it, try to calm him down until the SAMU help comes, Fireman, the itself, if you are not aggressive, simply try to listen carefully and try to talk c with him. Never debate or contradict the individual, I believe that he moves this phase to aggression. | | |

Table 5c - Defining professional conduct

The referral can even be done, but not with the characteristics of this perspective discussed above. It is important to note that all the professionals interviewed said that at these times they prefer that these users be attended by psychologists and or psychiatrists, with the justification that they have "more ways" to deal with these cases, according to the literature.

According to Guedes, Nogueira and Camargo Jr. (2008 apud Boarini, 2011, p.89): the most indicated therapeutic action in the literature is the referral of these patients to psychiatrists and psychologists, which is confirmed in the following statements:

| Employee Role | Time experience | Testimonial | | |
|---------------------------|--|--|--|--|
| Coordinationof CAPS Ad | 06 years in Mental Health at CAPS AD | I try to perform first aid, as far as possible and what I know how to do, I call a psychologist and the doctor who is in our unit to perform the necessary procedure for the moment, after the doctor is treating the patient and making the application of medication to contain, only if medication is needed, I warn the multiprofessional team, so that if this patient is stabilized and stays in the unit he will go through the team to see better referrals. | | |
| Nurse 01 | 07 years in Mental Health at CAPS AD | Look, I try to make a reception and in this reception try to listen, for many thing, stabilized, to try to understand the patient to establish a bond, right now I try to assess the level of consciousness depending on the situation I already refer him psychologist or if it is a more acute case direct to the doctor and the unit doct take appropriate action. | | |

 Table 5d - Defining professional conduct

Also according to Guedes, Nogueira and Camargo Jr. (2008 apud BOARINI, 2011), the most appropriate therapy is the referral of these patients to psychiatrists and

psychologists, aspects already mentioned above, was clearly evidenced in the speeches of nursing professionals in of this interviewee;

Table 5e - Defining professional conduct

| Employee Role | Time experience | Testimonial | | | |
|---------------|--|---|--|--|--|
| Nurse 02 | 04 years and 07 months in Mental Health <i>at CAPS</i> <i>AD</i>) | Ah, first I try to stay calm, you know, I think we have to be calm and try to calm the patient down, then I see if there is a doctor in the sector, if not, we will call SAMU, because here we don't have any medicines, if the doctor has it there and asks for such medication there, people do it, but if not, just trigger SAMU and try to calm him as much as possible, put him in the observation room, I only do the medication with the doctor's prescription. It triggers the family too and because we can't contain him, right, the most we can do is also refer him to the psychologist to talk and try to calm the patient down, I see that the psychologist has another way to talk to these patients in outbreaks, even you interns know how to do it better than us. We try to do that makeup until SAMU arrives and send it to JPII, | | | |

Faced with a psychotic outbreak, 05 (five) professionals presented more humane behaviors and aimed at the whole,

paying attention both to biological issues and to subjective content.

| Employee Role | Time experience | Testimonial | |
|-------------------------|--|---|--|
| NursingTechnician 02 | 10 years in Mental Health at CAPS AD | I try to calm the person in the best possible way, guiding them, asking them to calm down, it is if they become aggressive, I will try to contain them, I immobilize, right? looks depending on the person I take by both arms, (at that moment I was asked if this professional has already received a course, training or instruction for this type of restraint) it was not in practice. Here at CAPS this is not the case, but if you have to contain it, you know, so as not to attack anyone, not to hit, not to hit anything, to become aggressive. And if you need to call for medical help, nursing, enter medication. We advise calling Samu and taking him to João Paulo II (Hospital), if you don't have a | |

Table 5f - Defining professional conduct

| | | doctor here, right, even if the person freaks out here, I've seen it, I've worked in all CAPS, (Madeira Mamoré, Três Marias and here, I just didn't work at Infantil). | | | |
|-------------------------|--|--|--|--|--|
| General Physician 01 | 01 yearat CAPS AD | My form of assistance is to try to understand what is causing that patient to behave in that way, to try to seek the focus of the problem, and from that focus, outline the therapy, which I realize a lot, I work in an emergency; some patient arrives in an outbreak, the team is very anxious to speak, ah, make a haldol-fenergan, make a haldol. Once a young woman arrived who had attempted suicide at home, and does the haldol, does the haldol, because she is hysterical, I said no calm people, it is not like that let me talk to her, I got there I was talking to her, I talked to one and she calmed down and I didn't have to take the medication, so not the medication that I don't need to get rid of a problem, I need to understand what the patient's problem is, to be able to solve it and show him that together we will be able to solve. | | | |
| Psychologist 01 | 06 years in mental health at CAPS AD | In my work environment it is always listening to the patient's therapy, welcoming the patient, making rapport trying to make a possible therapeutic connection. Trying to understand what he is feeling, because he is like that, and then we proceed with referrals, there are cases, for example, of people at imminent risk of suicide, or putting other people's lives at risk as well, this type of outbreak. we call SAMU, for patient removal, for emergency care, because the network here in Porto Velho is João Paulo II. My practice always in the face of the outbreak is always trying to understand and listen to the patient. Ex: A patient in the old CAPS building, which had a swimming pool, and an outdoor area, he was jumping into the pool saying he was going to kill himself and he tore his clothes and the guard said he was going to hit him, then I asked to be excused and said wait a minute let me try to talk to him and I did it, I introduced myself said looking into his eyes who I was, who was trying to have altered thinking, or you may be hallucinating or that kind of behavior. A patient never attacked me because I always had a respectful attitude towards the patient, introducing myself, listening to him ask what's going on, and the doctor instructed me to do his removal for SAMU, and then I explained everything to him it would happen that he would go to the hospital, to get out of this 1 frame, I will call his family, everything I did I made him aware of everything I was going to do. If you are rude, and have no patience, you will not reach these patients. | | | |
| Psychologist 02 | 03 years in mental health at CAPS AD | According to the Protocol on mental health in an outbreak: If there is an aggressive outbreak that leads to aggression, there is no way to intervene, right, so I don't know how the girls have acted on this issue, but look, I think it's very difficult to see, if this type of aggressive outbreak, usually the family that noticed it and brought it here, we can't often have an intervention didn't see it, even because of the protocol even in mental health, it wouldn't even be seen here at CAPS AD. I don't know what I've been doing here. In an outbreak the indication is that we make contact with a doctor I see the possibility of medication and whether or not there is a need to intervene, and if it is the case, together already think there about the referral so that he stabilizes and returns to the service CAPS, stabilization is usually via JPII, via the State, right, being sent to JPII, JPII, if there is a need, refer him to the psychiatry of HB, when he stabilizes and when he is discharged, HB, send here to CAPS AD, back to work, of course it's when these are serious and severe disorders, which is the demands CAPS, but when he is really in an outbreak we always have this contact and this protocol. It is very important at all times to call the family, especially when you have an outbreak, we always ask a social worker to call or get in touch with the family, they are very important at this moment, we call, tell us to come here, the patient is like this, the family you are responsible. which is the CAPS demand, but when it is really in an outbreak we always have this contact | | | |

| | | and this protocol. It is very important at all times to call the family, especially when you have an outbreak, we always ask a social worker to call or get in touch with the family, they are very important at this moment, we call, tell us to come here, the patient is like this, the family you are responsible. which is the CAPS demand, but when it is really in an outbreak we always have this contact and this protocol. It is very important at all times to call the family, especially when you have an outbreak, we always ask a social worker to call or get in touch with the family, they are very important at this moment, we call, tell us to come here, the patient is like this, the family you are responsible. |
|-----------------|--|---|
| Psychologist 03 | 09 years in mental health at CAPS AD | sometimes he is in a psychotic crisis with production, hallucinations, delusions, but he manages to keep his life there. It is necessary to have an intervention, but sometimes in the most severe cases in patients more resistant to medication it is more complicated. |

In view of these reports, we can see how much we still need to walk, fight and actually validate the rights and duties of people in psychological distress, these already advocated in the Psychiatric Reform Law.

Lawmakers, eager to meet the demand for Mental Health in the population, organized Law No. 10,216 / 2001, which aims to protect and guarantee the rights and duties of people with mental disorders, which reorganizes the mental health care model.

According to this law, all patients who suffer from some type of mental disorder are entitled to the best treatment in the health system, appropriate to their needs, as well as to be treated with humanity and respect, and in the exclusive interest of promoting their health, aiming to achieve their rehabilitation through insertion in the family, work and community.

Article 3 of Law 10.216 / 2001 states that it is the responsibility of the State to "develop mental health policy, assist and promote health actions for people with mental disorders, with the due participation of society and the family, the which will be provided in a mental health facility, thus understood the institutions or units that offer health care to people with mental disorders" (2001, s / p.).

Articles 4 and 6 of this Law provide that hospitalization will only occur when the other extra-hospital resources are insufficient for treatment, requiring a medical report that contains the description of the reasons for this hospitalization.

In addition, these users should be protected against any form of abuse and exploitation, with guaranteed confidentiality of the information provided regarding their clinical condition, and with the right to medical assistance, at any time, to clarify the need or not for a possible involuntary hospitalization. Patients must have free access to the available means of communication and should receive the greatest amount of information regarding their clinical condition and treatment.

It is also worth mentioning that all the rights mentioned above, as well as the others that are in force, throughout the text of Law 10.216/2001, must be fulfilled by the institution that manages and or organizes mental health care, so that patients can fully exercise them, under penalty of holding those who disrespect them responsible. That is why it is necessary to have prior knowledge of the legislation, both on the part of the professionals, as well as by the institution and by all who work in it, whether they deal directly with the service user or not.

3.2. The knowledge of Law 10.216 / 2001 (Law of Psychiatric Reform) by the professionals interviewed.

Having an understanding of the role and the real role of CAPS AD in the context of the reform is one of the first steps so that these professionals can measure the importance of their performance for the application of the law 10.2016 / 2001. However, the fact that a professional is inserted in the CAPS device, does not give us the guarantee that he knows the minimum of Psychiatric Reform and its law.

We were able to realize that for most of the interviewees, there is a lack of knowledge about the Law, in view of the interviewees' statements, it is possible to understand that more than half do not have satisfactory knowledge about the Psychiatric Reform Law, see:

| Employee Role | Time experience | Testimonial | | | | | |
|--------------------------|--|---|--|--|--|--|--|
| Psychiatrist 01 | 3 years in Mental Health at CAPS AD | I don't know much, but there are controversies: Eliminate the hospice and eliminate the beds, but there is a pharmacological evolution. | | | | | |
| CAPS AD Coordinator | 6 years in the mental health network | Look, I don't know the whole law, but I know about the new protocols for mental health in fact the law only exists on paper, there is no appreciation for the work we do wit patients to improve their quality of life. | | | | | |
| Social Worker 02 | 06 years in mental health, 05 in CAPS AD | Jeez, wow! Well, what I know about the law is that it came to improve mental hear those who were once considered "crazy", are now seen with more respect and digr by their own family and society. She confirmed that it is not just restraint, but that can work with them on the social aspects and assistance that can help them and the families, and all this did not have before, I mean before the psychiatric reform law. | | | | | |
| NursingTechnic ian 01 | 01 yearat CAPS AD | No, I don't know, do you have a new law? I would even like to know. | | | | | |
| NursingTechnic ian 02 | 10yearsinmentalhealth,04 in CAPS AD | The new law? No not yet. I heard people saying, where was it, boy? I heard it, but I think it was there at the hospital, but I can't remember what that law is. So far I haven't heard about the Psychiatric Reform law, not that I remember. | | | | | |
| NursingTechnic ian 03 | 05 yearsat CAPS AD | I don't know, but I can go on the right, right? Psychiatric reform if I am not mistaken, about it, the way of leading the patient with mental illness was different, and after this reform it brought an improvement to mental health care. Before the reform, the service was less humanized than today. | | | | | |
| General Physician 01 | 01 yearat CAPS AD | I know and what I remember was when I was in college that I saw everything, it was that in the past psychiatric patients were inmates in psychiatric hospitals. And the current understanding is that we do one more job to integrate these patients into society, than to reclose the patient. | | | | | |
| General Physician 02 | 02 yearsat CAPS AD | It was a big reform, really big, that the assistance mode was hospitalization, they interned everything and the treatment was very inhumane and now it is more humane. | | | | | |
| Nurse 02 | 04 years and 7 months at CAPS AD | <i>I know more or less, I know it was deinstitutionalized the institutions, right? whice not to have patients institutionalized and CAPS was made for that, right.</i> | | | | | |

Table 6a - About the Psychiatric Reform Law

In this paragraph, a counterpoint was established through the speeches of the professionals who presented some knowledge about the Law, so only 04 (four) professionals from the 15 (fifteen) interviewees, brought answers that contemplated some aspects foreseen in the Reform Law. The excerpts of the interviews below demonstrate the professionals who were able to talk more about the Psychiatric Reform Law with more richness and clarity of details in their statements;

| Employee Role | Time experience | Testimonial | |
|------------------|-----------------------|---|--|
| Social Worker 01 | 04 yearsat CAPS AD | Yes, I know her, the psychiatric reform, removed that hospital-centered issue, the psychiatric reform brought the deinstitutionalization of these patients, it also brought the services closer to the patients, also decreasing hospitalizations, and the families did not know how to work with this patient, it is an advance! | |

Table 6b - About the Psychiatric Reform Law

| Nurse 01 | 07 yearsat CAPS AD | Well, I know that the whole work should not be aimed at the hospital level, but at reinserting the patient to the activities he performed before having the psychiatric problem of not all the treatment not being aimed at the hospital level. | |
|-----------------|-----------------------|--|--|
| Psychologist 01 | 06 yearsat CAPS AD | Yes, right. It came to benefit psychiatric patients, until the 1980s, hospices were deposits of people and were also neglected by families, slept in unhealthy places, were people who suffered abuse, suffered violence, went hungry, the treatment was totally inhumane, and this violated human rights a lot even before the psychiatric reform, she came to put the patient back in his family environment and within the community, just as we left hospital care for psychosocial care. | |
| Psychologist 02 | 03 yearsat CAPS AD | So, I see that the fight is still there today, with a lot to do with Law 11 or 12 thousand and something from Paulo Delgado, and in fact we are still fighting for it to be put into practice, that in fact the CAPS were an advance in the Psychiatric Reform, taking patients out of asylums so that they could be hospitalized only in really necessary situations, in psychiatric hospitals. | |

And it happened that only 01 (one) professional demonstrated the understanding of Law 10.2016 / 2001, in a satisfactory way, as in the following statement:

| Table | 6c - About | the | Psychiatric | Reform | Law |
|--------|-------------|-----|-------------|--------|-----|
| I unic | 00 - 110000 | inc | 1 Sychianic | Rejonn | Luw |

| Employee Role | Time experience | Testimonial |
|--------------------|-----------------------|--|
| Psychologist 03 | 09 yearsat CAPS AD | I know and study Paulo Delgado's law and also the new ones in relation to RAPS, Psychosocial Care Networks, it is in the question of the rights of patients with mental disorders, the availability of the patient to be welcomed in the environment that is not a hospital, to remain close to community, close to the family, to have the most welcoming service possible, to take a little and exclude, especially here at CAPS, this issue of marginalization, the way common sense sees chemical dependency, to really see subjects as subjects of rights, who is entitled to health treatment and whatever it is, if it is a mental disorder he has the right to have this access to health treatment, if it were an amputation, a cardiac patient, regardless of that. |

The lack of knowledge of the law may be related to the lack of information, but it was also evident in the speech of the majority the lack of interest and concern in the knowledge of the law.

3.3. The application of the Psychiatric Reform Law by other team professionals

Next, we will see the reports described in a field diary, regarding professional activities in the researched institution, which are reflected and analyzed in the light of law 10.216/01.

At the time of one of the visits, for active search, we witnessed not only stigmatizing words, but also, the breach of confidentiality by the professionals, about patient information, which should not be mentioned at that moment, considering that they would not be those who would receive the home visit; what goes in the opposite direction to what is in force in the Law on Psychiatric Reform, in its sole paragraph and item IV: to guarantee the confidentiality of the information provided.

While waiting for a therapeutic group, a professional from the reception brought the following comment (the name is fictitious):

> "Maria, get ready, your group is going to rock today, the patient problem has arrived! (Laughter), good luck. "

When referring to the user as a "problem patient", this professional acts contrary to the law of the Reformation, in his sole paragraph and item II: where he describes that the person with mental disorder must be treated with humanity and respect [...]

Another aspect recorded in the field diary:

"Right in the first weeks of the internship, which caused me disgust and discomfort, it was the speed of the assistance of a professional, showing extremely hospital practices, where each CAPS AD user, who entered his office, did not exceed 5 to 7 minutes of "service". When this attitude was questioned to another professional at the institution, the answer was:

"This one just renews prescription, baby, he doesn't even look at the patient's face".

In a period that preceded the realization of the group, a CAPS AD professional was found, eating a snack and keeping in a bag to put 02 (two) other snacks in his bag, which would be offered after the group's thermos, so we asked :

- Hi, aren't these snacks for the group?

This professional replied:

(Laughter) - First I know, for God's sake, then they, they care about that (snacks and fruit).

To which he obtained the following comment:

Do not do this, it is not certain, many of the users only have this meal that they make here.

In this survey, of the 15 collaborators in this survey, there are only 03 (three) professionals who have their practices really in the light of the Psychiatric Reform Law, and among the three, I highlight 01 (one) case that marked in a special way, given the empathy , ethics, love and respect dedicated to the user who was attended by this professional in our presence.

When invited by a professional, in his attendance, to perform the reception and initial interview in mental health, we could see how he treated the CAPS AD user with respect and great attention when listening to him, even though he presented high agitation and anxiety, possibly because he had been abstaining for 20 days at the time, without interrupting him, because he was worried about the time or delay. At that moment, we witnessed a really welcoming approach. We realized that that user was received, treated and attended to with humanity.

In accordance with the provisions of Law 10.216 / 2001, in its sole paragraph, item II: To be treated with humanity and respect and in the exclusive interest of benefiting your health, with a view to achieving your recovery through insertion in the family, at work and in the community.

Table 7 - Representation of the subjects' opinion regarding the application of the law by the other team professionals:

| Quantitative of professionals | What they said |
|----------------------------------|---|
| 04 (four) | There is application of the Psychiatric Reform Law. |
| 10 (ten) | Some exercise the application, others do not. |
| 01 (one) | They do not exercise the application of the Law. |

At this point, we will address the perception of each employee interviewed about the application of the law 10.216/01, by the other members of his team, whether they see in their co-workers, a performance with the presence of the law enforcement, or not. Following are excerpts from the interviews, where each of the four employees expresses their opinions regarding the applicability of Law 10.2016/2001, by the other members of their team:

| Employee Role | Time experience | Testimonial |
|-------------------------|-----------------------|---|
| Psychiatrist | 03 yearsat CAPS AD | Yes, I see that there is, the patient is inserted in therapeutic actions, a multidisciplinary team and interdisciplinarity occurs. |
| General Physician 02 | 02 yearsat CAPS AD | Yes, there is an application that could be better if it had more resources, but with the little we have we do, we are applying it, the class here at Caps Ad is too good in front of others, you know, we have a home visit here that requires, we have night service, we have the Itinerant CAPS, we go to the interior, in those places that do not have access and we attend once a month. |
| Social Worker 01 | 04 yearsat CAPS AD | Yes, there is, we don't work alone. We are a multidisciplinary team. We do case studies, there is interdisciplinarity in our team. You seek to do the best for the patient within the scope of the legislation. |
| Nurse 01 | 07 yearsat CAPS AD | I see here in our team there is an application of the law of psychiatric reform to a reduction in the old model, the practices have been those that have improved the social, emotional and family aspects of patients. Our discussions are a lot to reduce even this old model and start applying the newer standard. My performance I see is in accordance with the law and with what every service does. |

Table 8a - On the application of the Psychiatric ReformLaw

In this second moment, excerpts from the interviews were listed, where each of the ten employees expresses their opinions regarding the applicability of Law 10.2016 /

2001, by the other members of their team, evidencing in the statements below the fulfillment of this by only a few professionals team's;

| Table 8h | - On the | application | of the | Psychiatric | Reform | Law |
|----------|----------|-------------|---------------|--------------------|---------|-----|
| 10010 00 | On inc | application | <i>oj inc</i> | 1 sychunic | Rejoint | Luw |

| Employee Role | experience | Testimonial |
|--------------------------|--|--|
| CAPS AD Coordination | 06 years | I see that they are not all, but most professionals do not work for love, little is done based on the law, it is a superficial performance, it is not a welcome with love and commitment to that patient, they do not have that satisfaction in attending and helping the patient, go through mechanical practice. There is no service as it should be, and that understanding that it is not only the patient who gets sick, but the whole family is sick and needs to be heard, worked and helped. |
| Social Worker 02 | 05 yearsat CAPS AD | I realize that psychiatrists and general practitioners tend to enforce patients' rights more, trying to involve them in all the services they should have access to in CAPS AD, the other professionals do not. |
| Technical 01 | 01 yearat CAPS AD | As far as possible, yes, some, right, even because of the guidance they have, yes, it should all be right, but we know how it is. |
| General Physician 01 | 01 yearat CAPS AD | The whole team here? I think some do, some don't, so we try to work this together right, the best way to make that patient fit to live in society. |
| Nurse 02 | 04 years and 7 months at CAPS AD | There are countless professionals, right, here at CAPS, there are doctors who really go to the medication side, but it is not the psychiatrists, oddly enough, I see this a lot, think that medicalization is everything. There are others who know they have to wean, they have to take everything off and they look well at the reinsertion side and work more with the patient, I see that it's cool, it's cool, but it ends up not happening. I see that this reinsertion is to be desired and it ends up not happening because they stay here and there and end up falling back, you know, so I see that some do not apply and this delays the patient's treatment. |
| NursingTechn ician 03 | 05 yearsat CAPS AD | I will be sincere here at CAPS, even because there are 3 shifts, there are professionals who do it and others do not, and most of the time they fall into the practice of knowledge, as well as doctors, some will not say that they are all, but some act in law others do not, because they think they know more than everyone, so I think that in this part we leave something to be desired because I understand that the multidisciplinary team is a set, not an individual job. Not all act according to the law, for example; the ethical issue, it doesn't happen I'm not talking about a case study that needs to be mentioned to the patient, but something outside that context and that always happens. I believe that my practice is in accordance with psychiatric reform. |
| Psychologist 01 | 06 yearsat CAPS AD | I see that there is not everyone, but the biggest problem is that most have no specialization, most of them who come to mental health do not have specific training to work with mental health. It comes as generalists, be it psychologists, nurses, clinicians and there must be law enforcement by the multiprofessional team, but it does not always occur by everyone on the team because the patient is not just a professional on the team, I see that there is an application in their majority by the team. |
| Psychologist 02 | 03 yearsat CAPS AD | They try to walk in what we understand about Psychiatric Reform yes, I don't see that they are all professionals, but in general, even our doctors I see that they try each other, right, despite the very different, totally separate view, but they try. |
| Psychologist 03 | 09 yearsat CAPS AD). | The professionals who work on my team, I say on my shift, I think they all have this job very clear, sometimes they don't necessarily have this reading about the law, they don't |

| | | know it in depth, but it translates into their way of working, the other psychologist colleague, social worker, nurse, the doctors here we are able to discuss the cases and work hard on this perspective of the Reformation of trying to include. |
|--------------------|-----------------------|--|
| Psychologist 04 | 05 yearsat CAPS AD | Look at knowledge, I see that most of them have, you know, but I don't know how to apply it, because I don't know if everyone has the same understanding, you know, but I believe so, because at least with those I talk about it not so much a doctor, as the other psychologists, but I realize that for some there is application. |

And finally, the answer of a professional who said he did not see the application of the law by the other professionals of the CAPS AD team;

| Table 8c - | On the | application | of the | Psychiatric | Reform | Law |
|------------|--------|-------------|--------|-------------|--------|-----|
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| Employee Role | Time experience | Testimonial |
|--------------------------|-----------------------|--|
| NursingTechn ician 02 | 04 yearsat CAPS AD | I don't see it, because they don't treat patients as they should, right, according to the law, we know, we see, but most are very good professionals, but if they don't comply with the law, it doesn't help the patient, but there is always one or the other that saves, you know. |

We can say that, in general, there is no application of the Psychiatric Reform law by most CAPS AD mental health professionals, some for lack of knowledge of the law, others for having their practices already plastered and based on hospital-centered and asylum models.

3.4. The methods used to reduce the stigmas suffered by users

In a search to verify how attempts are made to reduce the stigmas suffered by people in psychological distress through the work of CAPS AD professionals, we asked these "what methods are used to reduce stigma by users?".

A single professional presented his way of reducing stigmas and labels as follows:

| Table 9a | -On | reducing | stigmas |
|----------|-----|----------|---------|
|----------|-----|----------|---------|

| Employee Role | Time experience | Testimonial |
|-------------------------|----------------------|---|
| General Physician 01 | 01 yearat CAPS AD | But what I try to do for the patient is that he is not obliged to expose that part of his privacy, right, but here in our team we don't have this prejudice, I believe that this prejudice is more of society itself. We try to face the patient as he is with every set of situations that may have led him to even use drugs. |

Two professionals describe their ways of reducing stigmas as follows: Raise the user's esteem, working on their qualities and always reinforcing their potentials:

| Table 9b - | On | reducing | stigmas |
|------------|----|----------|---------|
|------------|----|----------|---------|

| Employee Role | Time experience | Testimonial |
|------------------|----------------------|---|
| Technical 01 | 01 yearat CAPS AD | I always use words of encouragement, I always give words of encouragement; man you will be fine, raise your head, you will overcome yourself, and for the more adults I say it's never too late to change, throw stones who don't have a glass roof, everyone can make mistakes and everyone sins and so on, this is my way of helping and I try to get it out of their heads, I try to pass on to them that people will not care about it, only if he gives more importance to what others say, I try to raise their self-esteem, sometimes these patients |
| | | never heard a good word, a compliment or a nice opinion that will help them, I tell them that they have to fight to get rid of this problem. |
|---------------------|------------------------|---|
| Social Worker 01 | 04 yearsat CAPS AD) | In our case, the first thing we try to do is make him aware, that he needs, to recover his self-esteem, we work on raising the patient's self-esteem, so that he does not label himself or allow himself to be stigmatized. |

Three professionals reported that their methods used to reduce the stigmas suffered by users, is self-care so as not to stigmatize, personal care, paying attention to how they look and especially how they treat the CAPS AD user, as they recognize that the the user feels when he is stigmatized.

| Employee Role | Time experience | Testimonial |
|--------------------------|-----------------------|---|
| NursingTechn ician 02 | 04 yearsat CAPS AD | If policing with emphasis on the appropriate terms, (it was asked if the professional has already acted like this) yes, I already recognize it, but I try not to do more. |
| Technical 03 | 05 yearsat CAPS AD | I know very well how to separate things in my appointments, I believe that the professional has to be vigilant in his words and the way he attends, even a look can make a patient feel bad, I always try to use the patient's name. |
| Social Worker 02 | 05 yearsat CAPS AD | The very care not to stigmatize, personal care knows, even if you don't do it, speak up, don't look with prejudice, you still have to watch yourself, because sometimes colleagues do it and it ends up taking you and them if you don't have that care you end up talking too. I believe that the concern with guaranteeing the right drives us to think of the other as a citizen in a non-stigmatizing way, that way I see the citizen, before seeing "the beggar", a homeless person, I try to look at the patient's history and see you as a person. |

When asked if they have already witnessed attitudes, speeches, looks, stigmatizing actions in general, by the professionals of the team itself, 05 (five) professionals

from the 15 interviewees reported that yes, as seen in the statements below:

| Employee Role | Time experience | Testimonial |
|--------------------------|-----------------------|--|
| NursingTechn ician 02 | 04 yearsat CAPS AD | I've seen it happen a few times, but look, I treat it differently, because hey, the person is in the area, knowing that, talking among us, you know, we don't even understand a little. |
| NursingTechn ician 03 | 05 yearsat CAPS AD | I have witnessed these behaviors here many times over the years and I will be very sincere, I prefer to omit myself, so as not to have problems in the work environment. Because the way you approach this person is even an offense, so I prefer to omit myself in some things. |
| CAPS AD Coordination | 06 years CAPS AD | I always have a meeting to talk to the employees to review some attitudes that some have, but it works for everyone, you know, I speak to reinforce the attitude of looking at the patient while he speaks, I try to talk to the patient himself and make him aware that he must not give attention to these things and try to focus on his treatment, I try to solve all his demands in relation to CAPS AD). |
| General Physician 02 | 02 years CAPS AD | Ah, we always see or hear, right. Yes, I have seen it several times, but I have never seen it in front of the patient. |
| Nurse 01 | 07 yearsat CAPS AD | Yes, I have seen it, but I offer a lot of information to end these stigmas and labels. For me, one way to reduce the stigma suffered is to offer information to everyone. |

Table 9d - On reducing stigmas

Still 02 (two) professionals mentioned that these stigmatizing attitudes occur frequently, as we will see in the answers below:

Table 9e– On reducing stigmas

| Employee Role | Time experience | Testimonial |
|-------------------------|---------------------|---|
| General Physician 02 | 02 years CAPS AD | Yes, I have seen it several times but I have never seen it in front of the patient. So I explain to the co-worker how the treatment works and then I will laugh at him and take him out for having acted like that, you know. Some people for lack of knowledge they end up putting labels and stigmas, but others do not. |
| Nurse 01 | 07 years CAPS AD | Here it is very common for us to hear employees treating patients in a pejorative way, to speak certain terms that we do not use and should not, so sometimes they do it due to lack of knowledge, right, but others are not really mean, I think this is sad. |

Still in the interview of this collaborator, she brought in her speech an example that she says is commonplace in the researched institution, and her way of acting in front of the team's stigmatizing statements;

| Employee Role | Time experience | Testimonial |
|------------------|---------------------|---|
| Nurse 01 | 07 years CAPS AD | Yesterday I was eating in the kitchen, then I heard them say: ah! He is crazy, I think the patient was giving a lot of work due to the way they spoke, at these times my posture is more to inform and say no, it is not like that and explain, and not letting them continue talking that way, guiding the person not to speak this way, I do it, sometimes they keep doing it and it only increases but I am doing my part of informing, because I believe that the lack of knowledge leads society, the family and the CAPS user to the process stigmatization, how to call by the pejorative name I try to reinforce the positive side of their life situation guide and talk about the patient the way to be called by name recognize that he is a citizen and that he needs treatment like any other citizen. |

Table 9f- On reducing stigmas

Relating the statements mentioned above, with the field diary, we confirm these attitudes in one of the home visits made by the team. Stigmatizing speeches and attitudes can be perceived by 03 (three) professionals, and the following sentence is mentioned on the way to the visit to a patient on the street:

| Employee Role | Time experience | Testimonial |
|---------------------|--------------------|--|
| 03 professionals | Diverse | " This one is worse than farrowing, it is one child after another, when it wins this one, it already sucks on another one, you will see" |

Still on this visit, arriving at the place where the CAPS AD user was found, 02 (two) professionals expressed disgust at the odor presented by the user, who realized that she approached a 4th professional and hugged him sideways, as she she felt welcomed and not stigmatized.

In this question about the methods to reduce stigmas, 09 (nine) professionals reported that their methods and forms used to reduce the stigmas suffered by users; they take

place through the information provided, these referring to the treatment, user profile and the CAPS AD functioning itself, information that aims to demystify some preconceptions and clarify countless doubts. These nine professionals emphasized that the first step is to inform and raise awareness among the patient; and the second is to take this information to the user's family, as they report that the more information the family receives and the more they are aware of the user's reality, the less they will suffer stigmas, labels and prejudices.

Some doubts arise after this verification, where 09 (nine) professionals say that the job of reducing the user's stigma is with the user and the family. Is this the only way to reduce the stigmas suffered by users? Can the ideal and described identity of CAPS AD users be able to walk hand in hand? Has the performance of the various professionals of the researched institution really managed to reduce the stigma suffered? Still on this issue, we had the proper perception: professionals who work the stigmas in isolation aiming only at the focus on the user and the family, professionals who are unaware of the services provided by the institution for the reason of not being performed at CAPS AD. A point common to all,

The rehabilitation process aims to minimize the negative effects, as well as, the stigmas and prejudices suffered.

As Pitta (2016 p.134) explains, still as goals of rehabilitation, among others:

• Prevent or reduce disabilities, loss of social skills;

- Restore potential skills in playing social roles;
- Strengthen latent skills and potential dignities;
- Facilitate social and psychological adaptation to the effects of social damage on the individual's life;
- Minimize deterioration;
- Enable optimal levels of self-determination, execution of personal and independent responsibilities, improve the person's sense of wellbeing.

IV. FINDINGS ON THE UNDERSTANDING OF CAPS AD PROFESSIONALS ABOUT PSYCHIC SUFFERING.

The statements described below clearly and objectively demonstrate the professionals' understanding of mental illness.

This single collaborator described his understanding of mental illness, as caused by genetic and psychological factors.

| Employee Role | Time experience | Testimonial |
|-------------------------|----------------------|--|
| General Physician 01 | 01 yearat CAPS AD | So I face how the patient has a genetic predisposition to develop that disease, the whole society in fact I think he needs psychological and psychiatric monitoring because I think we need it, we go through environmental and family situations that are triggers, which they would be by example; the abuse he suffered at the age of two, a husband who kept his wife in private prison and in an unhealthy relationship, somehow the person had an emotional dependence and somehow ended up allowing this to happen, sometimes the person gets so involved in that situation that she really freaks, we are constantly suffering various situations that can leave us a trauma or some situation of mental confusion. |

Two professionals understand that mental illness occurs due to two unique factors, the psychological and the social:

| Employee Role | Time experience | Testimonial |
|----------------------------|-----------------------|---|
| Coordinationo f CAPS AD | 06 years | As a mental disorder, as a pain that is there because of something, such as sadness, depression, anger, and all this leads to mental disorder, there are other steps and one of them is the world of drugs. |
| Nurse 01 | 07 yearsat CAPS AD | Look, I understand mental illness as something that deviates from the standard of normality, and we cannot talk about illness, right, because for me it is actually an assessment of the pattern of behavior, right, so when the person runs away from what, a mental problem, right. It is not like a physical disease that can evaluate a failure in the functioning of the body, I think it is more a failure in the functioning of how society, the |

Table 10b - The professional's understanding of psychological suffering

| | population thinks that it is normal, so much so that what is considered normal for some |
|--|--|
| | people in some places, in others, it is considered abnormal, and then we cannot define it |
| | very well. Escape from the pattern established by that population, region at last. He is in |
| | fact an atypical patient, he is different from everything we have seen because it is difficult |
| | to deal with mental illness, we still do not understand 100% or 10% of mental illness so it |
| | is difficult to treat him. |
| | |

Three professionals understand that mental illness occurs due to purely genetic factors, hereditary inheritance, complications during pregnancy or childbirth, among other factors.

| Employee Role | Time experience | Testimonial | | |
|--------------------------|--|--|--|--|
| General Physician 02 | 02 yearsat CAPS AD | In relation to mental illness, we are light years behind, discovering what causes the disease, we only have treatment, we only treat as I would say a long shot. We know very well that pneumonia is caused by a bacterium that is installed in the lung and we know the symptoms, we know how to isolate the bacteria, but in mental illness not what caused it, lack of potassium or what. | | |
| NursingTechn ician 02 | 04 yearsat CAPS AD | I see that the person is born with a problem in genetics, knows with some disorder and due to not treating or the family not paying attention to it early in pregnancy or when the child is born. | | |
| NursingTechn ician 03 | NursingTechn cian 0305 yearsat CAPS ADHere at CAPS, I see it from the side of the genetic disposition even by the disorder and alcohol, by the chemical substance, crack and so on, and and that there is some type of disorder and that most of the time they are chro requires continuous treatment and can happen to anyone in society, with me, with | | | |

Table 10c - The professional's understanding of psychological suffering

Four professionals understand that mental illness occurs due to purely psychological factors, such as emotional trauma and unresolved personal conflicts.

 Table 10d - The professional's understanding of psychological suffering

| Employee Role | Time experience | Testimonial |
|---------------------|-----------------------|---|
| Social Worker 01 | 04 yearsat CAPS AD | I see it as a very strong psychological shock, as an evil of the century, I think that all of us due to the current dynamics that we live, from stress, from the demands that are imposed on us, we are subject to certain moments of becoming patients at a mental health unit, as CAPS. |
| Social Worker 02 | 05 yearsat CAPS AD | I understand mental illness as something totally psychological, as one of the saddest evils that exists, because sometimes the person who suffers cannot say what he feels and how he feels, and we will not understand, because I really believe, who only understands who goes through or experienced it, and it is very sad not to be understood (cried), I see these people in a prison, where they are not heard and sometimes are not seen. It is as if these people were in a box, a dark square, all black at all, that you cannot see anything and it imprisons the person in a way that sometimes they have no shape and no idea how to get out of there, I understand like that and I find it very sad, because we know almost nothing about mental illness and everything we know is still very small near the universe of the human mind. |

| Nurse 02 | 04 years and 7 months at CAPS AD | It is complex, you see, a lot of the person's emotional goes, sometimes we are so well and suddenly we start to feel sad, and sometimes we don't notice, and end up getting sick even at work, with stress, I think mental illness is very complex it is not easy to deal with, especially in relation to the person's mind, but I really like this area, I identified myself a lot, you know, and I try to do my best. |
|--------------------------|--|---|
| NursingTechn ician 01 | 01 yearat CAPS AD | I see that there are people with a weak mind and a lot of work, a lot of stress and marital problems, a lot of debts, problems in the family, or a loss of a relative, I believe that all of this is what makes the person sick with the mind. |

Five professionals understand mental illness as a bio psychosocial factor, having in their speeches the justifications for the combination of the three factors: biological, psychological and social as a cause of human illness:

| Employee Role | Time experience | Testimonial | | | |
|--------------------|--------------------|---|--|--|--|
| Psychiatrist 01 | 03 at CAPS AD | I understand it from the bio-psycho-social point of view, with the mental and emotional aspects and the social point of view that covers the economic, being employed or not, family conflicts and others. | | | |
| Psychologist 01 | 06 at CAPS AD | I do understand that the psychic disorder has a bio-psycho-social, biological, genetic, environmental, social basis, psychological factors of the patient's personality structure that favor the appearance of these mental disorders. | | | |
| Psychologist 02 | 03 at CAPS AD | I understand that it is a biopsychosocial process, it has a whole and in our case it has and most of the time it comes as a comorbidity associated with the drug issue. Sometimes mental illness comes before, then comes the use of drugs, we have this particularity, right here at CAPS AD, in relation to mental illness. It is not the same to talk about the other CAPS, we have an association, sometimes there is the illness, there is already a biological inheritance, and then the drug comes together and brings this mental illness of the user, who already has this issue of several conflicts social systems installed and then the junction of it all ends up making this patient sick, I see this a lot. | | | |
| Psychologist 03 | 09 at CAPS AD | Complex saw, for being formed by several factors, it is a very biopsychosocial process, my view on mental illness is a psychodynamic look, it is a look that comes from psychoanalysis, thinking about this personality structure, how this patient was formed, from these bases these environmental experiences that this patient had, so I think about mental health structured in this way. The person has a personality structure and she got sick and it got more exacerbated and there was, for example, the psychotic crisis, panic attacks, anxiety crises triggered by the use of the drug, this bias of drug addiction, drug addiction, all of that, I I see it as a consequence of a personality structure. | | | |
| Psychologist 04 | 05 at CAPS AD | I consider the disease to be more serious, I see it as a series of factors that make that person get sick, in fact for me I understand it as the result of our three bases; bio-psycho- social, I believe that it is very difficult to deal with questions of the mind, and suddenly you tell this to other people and know that they do not believe, or even that they believe, do not understand and do not know how to help you, or you yourself without any guidance before, start to hear voices and give you orders telling you, where you are going or coming from, and you have to fight against it without even knowing where it came from. I consider the most difficult of the diseases that we know, and the one that causes the most suffering for the person the most that is possible to be treated. | | | |

Table 10e - The professional's understanding of psychological suffering

The employees present a vision of what the mental disorder would be, based on the idea of mental "disease", sometimes for biological, sometimes psychological, or social issues.

V. KNOWLEDGE OF CAPS AD PROFESSIONALS ABOUT NATIONAL CONFERENCES ON MENTAL HEALTH

The only professional who participated in national conferences is also the only one who has satisfactory knowledge on the subject:

| Employee Role | Time experience | Testimonial |
|--------------------|--------------------|---|
| Psychologist 03 | 09 at CAPS AD | I have already participated, I was at a conference in Rio de Janeiro in 2011, it takes place every 2 years, since then I have not been able to attend national conferences since then, but I try to follow the published articles regardless of my availability to be over there. I read a lot of what they produce there, I think it's important, it is the professionals bringing their practices, what they have done and what has worked, how some things have worked, what I like most to see are these reports of the professionals from different areas work and improve their performance in the challenges of working with mental health, that we can learn a little and put into our practice. |

| Table 11a - Proj | fessional's kno | wledge of 1 | national mental | health con | ferences |
|------------------|-----------------|-------------|-----------------|------------|----------|

Five out of fifteen employees have no knowledge of national mental health conferences:

| Table 11b - Professional's knowledge of national mental heal | th conferences |
|--|----------------|
|--|----------------|

| Employee Role | Time experience | Testimonial |
|-------------------------|-----------------------|--|
| CAPS Coordination | 06 yearsat CAPS AD | I did not participate in any national conference and I confess that I know nothing about them, I only participated in seminars, courses in mental health, suicidal ideation, people in street situations, and emergency care for psychiatric patients. |
| NursingTechn ician | 01 yearat CAPS AD | No lady, I never participated and never heard about her here either. |
| General Physician 01 | 01 yearat CAPS AD | I have no knowledge. I also did not participate in any conference, I believe that there must be every year in some state in the country. |
| Nurse 01 | 07 yearsat CAPS AD | I have never participated in any, I know they exist but I have never heard anything so profound. |
| Psychologist 04 | 05 yearsat CAPS AD | I didn't participate in any and I don't know anything about them. |

Nine professionals have a superficial knowledge of national mental health conferences, they also did not participate in any of them:

| Table 11c - Professional | knowledge about | national mental | health conferences |
|--------------------------|-----------------|-----------------|--------------------|
| iddle iie iidjessiondi | monicage abom | nanonai menuai | neurin conjerences |

| Employee Role | Time experience | Testimonial |
|--------------------|-----------------------|--|
| Psychiatrist 01 | 03 yearsat CAPS AD | I did not participate in national conferences, only from 01 state, which I was the organizer of and brought some colleagues and other professionals to discuss mental health, public health and seek new opinions about mental health and be open to talking about issues of great importance in this context, but I have already participated in several mental health workshops, mini courses and mini conferences to set up mental health action plans. |

| Social Worker 02 | 03 yearsat CAPS AD | I have never participated, I have already participated in two mental health courses, the knowledge I acquired there that talked about mental health conferences is that there are several cycles of lectures and rounds of conversations, to discuss mental health in Brazil, how is the change going? and adaptation of CAPS, NAPS and Therapeutic Communities. What I also see is that even the little we know, we must put into practice, these conferences serve to empower the team, but no one on the team ever goes, because if only one could go, they could pass on the knowledge to the others, but not even this happens, if there was a team, it would be better to assist the patient, and it would improve the functioning of the network and the patient would be better assisted. |
|--------------------------|--|---|
| NursingTechn ician 02 | 04 yearsat CAPS AD | I have already participated in several here in the city: I saw the psychiatric approach as to how to treat the patient, there are several specialists, doctors spoke about the new techniques of the new medications he is taking. |
| General Physician 02 | 02 yearsat CAPS AD | I didn't participate in any. They always try to improve the treatment of the psychiatric patient so that they can treat the psychiatric patient well. |
| Social Worker 01 | 04 yearsat CAPS AD | I didn't participate in any national, but I already participated in the last one that happened in the state. And I've heard of the national ones, yes, the last one in 2010. It regulates and regulates everything we've already said and followed up to here. |
| Nurse 02 | 04 years and 7 months at CAPS AD | I didn't participate in any. Has knowledge of harm reduction (alcohol and drugs). Smoking Seminar, Emergency Seminars for Psychiatric Patients and Coping with Alcohol and Drugs. |
| NursingTechn ician 03 | 05 yearsat CAPS AD | I never participated, but as far as I know it is the conferences that take place anywhere in Brazil where professionals working in mental health will discuss or address some topic for the betterment of mental health patients, that's about right, looking for solutions, means for the patient. |
| Psychologist 01 | 01 yearat CAPS AD | I did not participate in any, but I have already read about the mental health conferences and from them emerged the anti-asylum movement, the laws and the very reports of experiences of mental health professionals. |
| Psychologist 02 | 03 yearsat CAPS AD | I did not participate in any, I do not know much about the subject, but I have read and participated in several courses and seminars in mental health. |

It is up to the professionals who deal with mental disorders on a daily basis, the function of seeking to study, analyze and understand this universe, which is so complex that it is psychological suffering, but this is not what we identified in this researched institution.

VI. FINAL CONSIDERATIONS

The main objective of the research was to understand how the Psychiatric Reform Law is being experienced through the practices of mental health professionals at CAPS AD in the city of Porto Velho. For this reason, through a field diary and interviews, we seek to get to know the institution, all the professionals who make up the team and its users, for a better view of this complex context, so that in fact the themes represented in this research are assimilated in more depth and the practices of mental health professionals are more efficient in terms of the Psychiatric Reform model. Checking the performance of professionals in this area of mental health, whether it is in accordance with the Psychiatric Reform Law in force, whether the services and resources used have been sufficient to comply with the said Law in relation to its users. We seek to know the performance and resources used by these professionals to reduce the stigmas suffered or faced by CAPS AD users.

Regarding knowledge about the Psychiatric Reform Law, the vast majority of professionals interviewed do not have a satisfactory knowledge of the law. Thus, these professionals do not seem to be concerned with knowing the Law and applying it in their practices.

Most CAPS AD professionals work at the institution for an average of 5 to 9 years, but even before that time, they brought in their speeches that they did not have a specific training to work in mental health, with the exception of the psychiatrist, who reported in your interview has a specialization in mental health and drug addiction. It was

found that the fact that they have no training does not cause dissatisfaction with their performance.

Given the facts, the importance of a course, training or qualification is emphasized for these professionals, aiming at a modification that will surpass the current and predominant model in most professional activities of this institution, aiming at a resumption of ethical conduct, in the models of listening and looking at the CAPS AD user, who are externalized in the daily interpersonal relationships that occurred in each service.

A point that deserves attention is when most of them, when describing their activities and functions in mental health, demonstrated to work in a team, leaving aside the individualized performance that reflects the hospital model restricted to medical records, patients and users. However, all of them presented in their speeches the importance given to the multidisciplinary work that the Psychiatric Reform proposes.

When asked about their understanding of mental illness, the interviewed employees, in their answers, delineated the possible causes of these diseases, biological, psychological and social factors.

In view of all the literature used as the basis for the theoretical framework and various materials, with regard to the Psychiatric Reform law, which was collected via granted interviews, descriptions in a field diary and the experiences during the period we were at the institution, we realize that many times the changes in the mental health area have been restricted to assistance changes, although mental health is an area that cannot and should not be limited only to the treatment of mental "problems", such as biological disease, this is not what we see in the practice of institution. So that this restriction does not occur, it may be necessary to rethink the mental health field in a different way than the current one.

Probably, given the need to point out that it was possible to overcome the asylum model, some changes made in the name of the Psychiatric Reform Law ended up being reduced to a mere reformulation of care services, that is, these changes were restricted to changing addresses, because asylum practices still permeate and supplant psychosocial practices in the institution.

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A Research to Innovation and Implementation in Supply Chain Management

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Abstract— The interest to find an inexorably beneficial and convincing technique for supervising structures, while keeping up the trustworthiness of research and gathering works out. It has driven pharmaceutical firms, and various performers of the restored pharmaceutical item and store network arrange, This paper attempt to recognize what occurs along the inventory network (SC) when item and procedure advancement rehearses is executed. The examination analyzes the SC approach and scope of SC capacities and connections. This examination will think about the usage of procedure and item development rehearses as logical elements, whose impact on the configuration and execution will be explored too. This paper gave little consideration to the procedure advancement measurement in SC writing. This give investigations control new scientist on better administration of development execution along the store network the board.

Keywords— Plans of action, Value Networks, inventory network Innovation, production network usage, Pharmaceutical Industry, Contract Manufacturing Organizations.

I. INTRODUCTION

At present, supply chains should bargain a normal quick dissemination of technological advancement. The ongoing innovative dissemination may change the condition of the inventory network and its setups.

Advancement is tended to vague. In any case further consideration is yet expected to inspect the difficulties that range the entire store network when firms actualize development rehearses. That is to research the whole inventory network configuration. The connections among the production network individuals. There are a lot of activities that advances a viable administration of provider association, satisfying client needs, development of merchandise and data sharing all through the stock system of an industry. Key SCM and coordination's rehearses are identified with the overseeing client needs, viable conveyance of products, joining, and sharing data over the store network. The previous writing reports that most organizations do not change the configuration of their stock chains when they begin to actualize advancement rehearse. A superior connection of the effect of development usage, from a comprehensive point of view is required. Therefore it will be conceivable to moderate any dangers that may spread alongside the store network. Additionally such a comprehensive point of view will provide an increasingly sensible investigation of the unmistakable effect of advancement execution. That may prompt better administration of development along the various periods of the inventory network.

The procedure of advancement is developing as an intriguing exploration way because of the expanded disseminations of digitalization and a normal flood in process advancement. There are uncountable number of insightful distributions on the transaction between the different parts of advancement and the inventory network subjects. The exploration addresses that the item measurement. Up until now, the procedure advancement technique and its suggestions for the store network have been under research.

The connection between development execution and inventory network configuration can be better deciphered by grasping the thoughts of possibility hypothesis. That recommend the characteristics of an organizations inside and outer relevant conditions should be considered in its structure, in order to improve its exhibition. This exploration will considers the usage of item and procedure advancement rehearses as logical elements, who's away on the configuration and execution will be examined too. The research examines what occurs along the store network when a firm chooses to actualize advancement through exploring the interaction between development practices' usage and inventory network configuration. (Examining the angles identified with activities, provider determination, supply and dissemination arrange plan, transportation mode, office globalization/restriction, sourcing choices, and cooperation and data sharing).

II. LITERATURE REVIEW

Definitions of innovations

Innovation is a "complex and multi-dimensional marvel" and its writing includes different research workforce and definitions to a great extent dependent. Technological involves growing new items and new types of authoritative structure, opening up new markets, making new creation capacities and finding new wellsprings of crude material. Innovation contends that innovation is the primary capacity of business enterprise regardless of whether by utilizing new assets or creating existing information assets to make what he depicts as riches at the modern or global levels. Characterizes development as the exercises and changes performed to deliver new or improved items or procedures inside a firm to improve its activities. The idea of advancement connected with touching off development and making new markets. The considering advancement is explored in various investigations the advancement typology created in further order can be performed relying upon the range or impact of development exercises. Traditional development method identified with the application setting and process advancement depend on the curiosity of the development radical versus gradual, specialized versus authoritative. Development may likewise be considered as standard. progressive or as continuing, specialty, transformative and problematic. The tale conversation uncovers that the development field of study is multifaceted and includes numerous measurements. This examination is thinking about the usage period of the development procedure. Our advantage is the effect of advancement practices' usage inside the limits of the inventory network district.

Innovation polices in developing countries

Determined settled organization advancement arrangements have clear targets and a coordinating institutional set-up have demonstrated a key element for accomplishment in creating organization. A brought together organization or administering body can offer the joint effort and initiative required for powerful sending of development supporting strategies. Diverse key advancement strategies across various administrator and the minor formation of a "development execution". Highperforming advancement offices or chambers have announced legitimately to or been led by top-level government authorities. For example, the head of office.

A solid coordination of scholarly development arrangements with execution approach targets is likewise attractive, as it can cultivate gainful imagination, for example, perceived brands and solid physical or elusive resources.

Supply chain outline

Production network the executives have a lot of approaches used to proficiently incorporate providers, makers, Stockrooms and stores. So stock is delivered and dispersed at the correct amounts to the correct areas, and at the opportune time, so as to limit framework wide expenses while fulfilling administration level prerequisites. In the store network town, configaration are overwhelmingly conceptualized as far as auxiliary components, for example, the size of organizations, where these hubs are found geologically, how crude material is conveyance and how the last item arrives at the last clients.

This definition requires some insights. Initially, the inventory network that the board considers each office affects costs and takes on a job to tailor the item to customer needs from supplier and assembler offices through warehouses and dispersal centers for resellers and stores. Without a doubt, in some surveys in the store network, it is important to represent suppliers and customers, since they influence the execution of the inventory network.

Second, the goal of the managers' inventory network is to be competent and practical across the entire framework: the absolute framework overhead, from transportation and transportation to raw material inventories, from work in progress to the completion of the goods. , must be limited. Consequently, the emphasis is not only on limiting transport costs or reducing inventories, as it could rather adopt a framework strategy for the production network of managers.

Finally, since the executive production network revolves around a precise reconciliation of suppliers, producers, distribution centers and stores. It incorporates the exercises of the association on numerous levels, from the key level to the strategic level to the level operational.

The core plan for a network of stores accurately and effectively addresses item administration fund and data

progressions from source to end customer, with the ultimate goal of making value understood and increasing consumer loyalty. Then the design is emphasized with the incorporation of the tasks and the system of a solitary company with those of the other individuals in the inventory network.

Contextualization of supply chain management

Possibility hypothesis recommends that for firms to accomplish more prominent execution, they should build up a fit between their structures and their interior and outside conditions. To stretch out this idea to the production network level an exhaustive examination of the conceivable logical components that speak to inner and outside store network conditions is required. Production network possibility contemplates explore the job of logical variables and their effect on execution. Apply an unexpected asset based view in concentrating how associations create inventory network versatility and vigor, thinking about geological scattering, deals multifaceted nature, separation and conveyance unpredictability as the primary relevant components. The significant job of logical factors in production network coordination contemplates, considering store network multifaceted nature a relevant factor. Possibility hypothesis causes to notice the fit between inventory network structures and their surroundings.

III. METHODOLOGY

Research Scope and Limitations

Considering the above hypothetical contention, this investigation will concentrate on the connection between innovation practices' execution and production network configaration. In particular, the thought is that the development stages are arranged inside the nonexclusive store network periods of plan, source, make, convey and return.

For this exploration, item and procedure advancement rehearses execution is considered as far as logical elements, inspected in more noteworthy detail in the following segment.

Supply chain configuration (structure):

- 1. Localization/globalization
- 2. Provider choice and supply arrange plan
- 3. Actions the board instruments and creation rehearses
- 4. Carrying mode and conveyance arrange structure

- 5. Supply chain policy (strategy):
- 6. Group technique
- 7. Assessment-production
- 8. Innovation exercises' implementation (environment):
- 9. Connected to items: declaring new items (for example new item improvement), item extend reestablishment, item transforming and item overhaul
- 10. Related to advancement: ceaseless improvement follows, process re-building, improvement ventures for existing procedures, and expanding creation line skills. These laid out components coordinated the exploration group in recognizing the case choice criteria and the information assortment process, just as in characterizing the examination confinements and tending to the concentration in the information investigation stage.

Research design

A contextual analysis philosophy is viewed as reasonable for this examination. A contextual investigation system helps to find and portray genuine marvels, as it is a perfect procedure for replying 'how' and 'why' questions and considering the related factor.

This exploration follows a contextual analysis approach as the most suitable research system to give a top to bottom explanation of the connection between development practices' usage and inventory network configuration settings and choices a theme not thoroughly examined so far, utilizing case-based research presents a possibility to broaden the writing and participate in principle age. In addition, the contextual analysis philosophy permits the exploration group access to the real chiefs behind the current inventory network configuration up to a more profound comprehension of the inspirations hidden a significant number of the configuration settings, which test a quantitative methodology been actualized. This exploration may be found on a simultaneously preformed contextual analysis in china and Bangladesh.

Case selection

Given the system reliance of supply chains, we need to consider firms with various inventory network configuration settings, with worldwide stock, creation and conveyance systems. In light of these criteria, and considering geological closeness to the exploration group, the scientist distinguishes two corporate gatherings including ten auxiliaries with central command in China and Bangladesh, having diverse administration styles and business standards.

Data collection and analysis

Information was gathered through immediate, online meetings (unstructured and semi-organized) with key store network administrators from the two corporate gatherings. Each meeting was directed totally in English. The scientist characterized dependent on their profound contribution in the store network area for all items in corporate gatherings and their broad expert involvement with production network the executives. This exploration focused on the whole production network along these lines, the essential paradigm for recognizing respondents concentrated on distinguishing key sources who was administer the full scope of capacities and connections in the inventory network. Consequently, each key source partakes in the arranging and execution of development rehearses at the gathering level and all data about the store network of the diverse item connections ought to be imparted to this key witness. Considering the two key witnesses was perceived in bunches A and B. In corporate gathering B, the exploration group was lead an underlying meeting to clarify the reasons for the examination with the gathering's Director General for R&D, whose reason for existing was set up key innovative work activities for the gathering. In view of this gathering, the key witness was recognized as the VP of the inventory network the executives gathering. The key witness for bunch A was distinguished after email correspondences with their supervisory crew as answerable for the gathering's store network arranging and CRM. To affirm a total dataset, the analyst was ask openfinished inquiries about advancement, usage, item and procedure qualities, execution markers, and store network arrangement modifications (for instance, Number of organizations in the production network, size and physical area, and provider and structure of the seller arrange). A precharacterized starter poll was sent to respondents preceding

the main meeting, enhanced by more inquiries explored during consequent meeting cycles. Altogether, the meetings was roughly 11 hours of each meeting was recorded 45-75 minutes.

The agent was making four field visits to the Group A and B offices during which field perceptions was archived in the examination notes. Email and phone correspondence was utilized for some explanation, mostly at a later stage to approve the examination. All contextual analysis practice was accessible upon demand. The essential information was joined by rich optional information from inside organization archives. It was useful to confirm the information recovered from the meetings.

IV. FINDINGS AND CASE DESCRIPTION

Companies under Study

The researcher have broken down the instance of four Bangladeshi firms, situated in the pharmaceutical area around Dhaka and dynamic at various phases of the pharmaceutical inventory network. The researcher directed semi-organized meetings for the most part identified with the idea of their total their future purposes and how this collection would have the option to deliberately revive their plans of action and their zone while confronting the undeniably worldwide rivalry. The researcher went through top to bottom in attempting to prompt how they accept their new serious model, their system, could step from an operational level to grasp progressively key objectives, while pooling assets and sharing basic tasks. To triangulate our outcomes, we at that point gathered quantitative information got from auxiliary hotspots for these four organizations then focused on a top to bottom investigation of the bits of knowledge that came out from our meetings and along these lines from our subjective strategy. Moreover, we supplemented the discoveries created from the meetings with the four firms by leading three master interviews.



Fig.1: Basic Model of Pharmaceutical SCM

When the information was gathered, we coded the meetings and sorted ideas that allude to a similar wonder at that point. In a requesting approach of our coding procedure, the researcher utilized the system assembling an information plan that involved first request ideas on one hand. Which are "at the degree of the source terms and codes" and on the other second request ideas that are "at an increasingly conceptual level". At last, building up a grounded hypothesis model. The researcher at that point progressed by taking an example of different organizations (that are not yet part of the system) inside the pharmaceutical area, which are all delegate of various phases of the inventory network. To give a total review of the business, we encased all the related exercises, from the creation of crude materials for the synthetic and pharmaceutical industry to the medication disclosure and research administrations from the dissemination and deal to firms that give counseling administrations identified with mechanical development. The researcher included both SME and enormous firms in the example so as to give a heterogeneity of points of view identified with the issues examined. Therefore, the researcher had the option to feature both the differentials in their plans of action towards their way to deal with emergencies and their readiness to take a functioning part in a system as a response to the emergency that they encountered as a major aspect of the area. For these organizations, the researcher directed semi-institutionalized meetings organized with open-finished inquiries in regards to their plans of action, the future mechanical directions of the particular phase of the

production network, and their points of view about the inclusion inside a system that could rejuvenate their region and that could give a motivation to the business all in all. Concerning different meetings, the researcher coded them by utilizing the system again and afterward we pooled these experiences with the ones increased through the meetings with the four firms inside the system to reveal more brilliant insight into our grounded hypothesis. Discoveries of the meetings permitted the researcher to follow what follows: the four Bangladeshi firms situated in the pharmaceutical locale around have chosen to build up a system dependent on the "Business arrange contracts" perceived banding together on explicit key objectives and shared exercises with full legitimate impact. The objective of this particular sort of agreement was to increment inventive limit and seriousness available for the organizations that choose to accomplice. It turned into a key component to help the development of key systems, giving a premise to the formalization of relations, rights, obligations and administration of the system. The presence of an agreement likewise distinguished the system as a group yet characterized subject, with impacts on the dealing force and notoriety of the accomplices, taking into account the recuperation of seriousness.

The four organizations considered incorporate a Square Pharmaceuticals ltd, Beximco Pharmaceuticals ltd, Globe Pharma and Beacon Pharma. Conceived because of going into a system contract between these organizations so as to cultivate the seriousness of firms in the business and to encourage the monetary and innovative improvement, the system 'Beximco Pharmaceuticals ltd' plans to sufficiently react to the advancement that the market was encountered. That was need to share assets, substantial and immaterial, to assemble the information and legacy of the key resources for establish an association ready to meet the developing needs of the interest, the immersion of the inventory, just as the breaks that the emergency has opened up, by noting the difficulties that the market presents with one voice. The system, through the foundation of profoundly synergistic activities planned for expanding the seriousness of the taking an interest firms, which likewise produces a positive effect on different organizations in the region, targets making the whole region of the division of Dhaka, previous lead of greatness in the field, the Prime Contract Manufacturing Excellence focus in Bangladesh.

As indicated by Square Pharmaceuticals ltd, changed the territory in the Prime Contract manufacturing excellence focus in Bangladesh was permit firms to make extra an incentive for the district of Dhaka, moving the concentration from the customary client provider relationship to an open arrangement of associations, a bunch that may adapt adequately to the difficulties that the market postures to the business. Teaming up with the plan to create items and administrations other than those as of now in power, so as to offer greatness in quality principles, was an objective of indispensable significance for organizations who need to guarantee an elevated level of intensity.

Notwithstanding a national scene that needs strong interests in particular information, the system Beximco Pharmaceuticals ltd, through the joint effort understanding, was became the proprietor of a mutual skill. All things considered, it was a primary player in inventive procedures and in the production of extra upper hand. Inside the business, Beximco Pharmaceuticals ltd. recognized today as a group however characterized substance, was a crucial player in an economy where information was a key driver of development.

The system model permits firms to grasp open markets other than the national market, depending on accomplices that was not part of the Bangladeshi setting, yet was a piece of the more extensive worldwide setting; the system Beximco Pharmaceuticals ltd permits its organizations to confront the global market in the pharmaceutical business, holding onto openings and defeating difficulties together. Its goals are: (a) sharing of obtainment procedures and formation of a stage to purchase certain item classes (b) upgrade, sharing, transformation of the current establishment legacy (c) streamlining of coordination (d) decreasing natural effect and waste administration (e) streamlining of vitality (f) advancement of skill and ability of the accomplices and the production (g) dispatch of modern research ventures (h) improvement of undertakings that target characterizing process developments (I) bolster change on account of apparatuses of progress the executives.

As perceptible the system Pharma Beximco, in its lifecycle, is relied upon to experience three phases of advancement (specifically guarded, far reaching and hostile). Until this point in time, the system is arranged to be in a protective stage. it is in reality primarily centered around making stages that empower the sharing of coordination, buying and waste administration, so as to support the productivity of procedures and the advancement not just of the pharmaceutical firms that are now part of the system, however of the considerable number of ones situated in the Center of Bangladesh. Right now, the system to incorporate different on-screen characters, whose coordinates effort is streamline forms once concede access to a pool of shared assets that address the issues of guaranteeing an appropriate finishing of all exercises anticipated by the chain, would permit firms to climb the lifecycle of the system and go to its next stage. Such firms are subsequently ready to make this change with critical assets, which empower them to understand their desires and formative objectives. That is the reason it is critical to consider fortifying the guarded situation by opening up to join different accomplices, for example, those associated with the waste removal business to free assets and force security to manage the subsequent stage, that of development. In the broad stage different understandings become possibly the most important factor, this season of advancement: which is when CRO accomplices and ventures that are occupied with biotech would permit firms inside the system react to the more extensive and increasingly articulate information that the market requires so as to permit, using new innovations and the full sending of abilities from various pieces of the system, the improvement of progressively viable treatments. These treatments are expected to totally address the issues of patients, and to give that lift to the development framework that, right now specific, should be continually upgraded. By then, the hostile stage gets feasible for the system. This is the phase where organizations come out of the corporate limits to move to developing markets and to draw in the consideration of outside speculators, destroying rivalry and

proceeding to seek after the exclusive requirements of greatness that have so far permitted the system to make and support upper hand. Right now, assembling will subsequently speak to an incredible open door particularly in developing markets, with Asian nations to comprise the primary concentration for huge pharmaceutical organizations who wish to concentrate their creation on redistributing.



Fig.2: Group a products supply chain footprint

Supply chain configuration

Regardless of the unique attributes of their procedures and items, here and there the two gatherings show comparable store network design settings. The setup settings of the considered stock chains in the two gatherings. The two gatherings have providers, creation units, deals branches and distribution centers for the most part amassed in Asia, however with a solid nearness in Bangladesh and China. Their joint effort exercises contrast as the gatherings store network approaches. Present the strides of the gatherings supply chains, including supply, creation, conveyance, focal warehousing and deals. Gathering a spotlights on Pharmaceuticals material stockpile and new item advancement and execution. Its deals follow B2C procedures, which are overseen by inspecting provider execution at regular intervals and haggling until understandings are reached. Gathering B centers around limited inventory from Asia and different conveyance places; its business methodology is for the most part B2C.

Significance of research

How advancement execution will impact their procedures and introduction. Procedure and item advancement practices' execution will be a significant effect on tasks because of a convergence of persistent improvement ventures and new item advancement exercises in the creation zone. A comparative effect may be found on inventory network system and dynamic. In addition, it will empowers and improves joint effort and data sharing between store network individuals. There are no critical proof that advancement usage influences office limitation or globalization choices, which will essentially base on quality confirmation and costeffectiveness contemplations. The fruitful system and item advancement practice execution organizations initially will be upgrade inside coordination and their cross-utilitarian business group models. At the production network level coordinate effort and data sharing will be key components for the effective execution of advancement. Organizations will be show a consciousness of the requirement for better joint effort, yet no strong plans will be create to upgrade inventory network coordinated effort. The papers will discover accord with the previous contention that provider choice inner coordination, joint effort and data sharing practices ought to be adjusted so as to accomplish better and more noteworthy intensity.

Inventory network individuals need to anticipate the additional estimation of such coordinated effort and how it will improve their presentation before they start working together in development ventures. Subsequently, to amplify the unmistakable effect of advancement execution the business motivating forces of all the production network individuals ought to be adjusted and the store network ought to be in a condition of fit. On the off chance that the production network will in misalignment (rebel) of executing development will be concentrated intra-authoritatively. It may over the long haul misuse the commitments of upstream and downstream individuals. Better financial execution and more noteworthy responsiveness along the store network will accordingly be difficult to keep up.

Dyadic connections comprise a key region for additional improvement, as they challenge inventory network reconfiguration before actualizing advancement rehearses. Vital understandings assume a significant job in overseeing crude material providers, extraordinarily fortifying the dyadic connections. Another significant factor impacting dyadic relationship is provider criticality, which originates from the center innovative ability of certain providers.

On the hypothetical headway, this examination will profit by researching the size of the relevant components not just their inclination. For instance, item advancements are as often as possible presented bringing about the test of overseeing high uncertainty of item request. The impact of item advancement execution proliferates along the store network to make difficulties in stock administration because of incessant item futility. The impact of relevant elements is thusly critical in light of their inclination. Because of their recurrence of occurrence and the extent and scope of their consequences for supply chains on the loose.

The point of this exploration practice development and execute on SCM works concentrating on the assembling segment in Bangladesh and looking at china. The outcomes suggests that inward activities deferment key advancement practice just as connection has critical and positive with firm and specialist. Advancement and store network the board relationship data quality and data sharing were found to have a huge relationship with firms.

V. CONCLUSION

The Significance of this research comes from the shortage of inter penalizing exploration. In spite of the theoretical and practical need for pertinent inter penalizing investigations, supply chain and innovation management the two significant streams of research with little correspondence. Ongoing research offer advantageous bits of knowledge into the arrangement between role of innovation and production network design. Nevertheless, to combine the dimension of both product and process innovation. Most of the perceptual scholarly publications availability while ignoring the level of process innovation centered on its impact on several activities of new product development and supply chain. The research will be contributes in examining the inventory network from an all-encompassing point of view rather than the functional approach currently pursued.

The examinations help researchers and new researchers better understanding the real impact of investment implementation across the chain. The innovation will be presuming that fruitful execution of advancement rehearses that guarantees streamline esteem creation alongside the whole production network. An adjustment mentality and plan of reasonable development technique that will be convey here to all the production network individuals. The innovation practice to be a long-haul process and transformative development, occur after various preliminaries and having a cross-practical and between authoritative natures. The examination result will be advantage bits of knowledge to production network and advancement professionals for their dynamic while actualizing development. It suggest them to use on coordinated effort to beat the potential inadequacies of store network rebel. This will help improve the advancement the executives and will help accomplish and continue an improved inventory network execution. The authors acknowledge the potential limitations of this study. Why they are not easy to disassemble, mainly because of their inner similarity. Research focus their efforts at the data analysis stage by conducting multiple coding rounds to ensure good quality of their research. Considering the case base research are not allow statistical generalizations, the corporate groups and the tested product families will not be considers as representatives of their country or industrial sector. The cases present the chances to build up a learning stage to propel our knowledge on the events studies. The researcher have endeavor/ensure to guarantee contextual investigation legitimacy and information examination unwavering quality, as exhibit prior in the methodology section. Although a case base trail is not limited to specific methods, the authors argue that current data and findings are a satisfactory quality for scientific research. In the future, the research would be benefit by thoroughly integrating the configuration settings as for extra relevant components relating to authoritative structures or to industry segment accuracies. The research of this exploration will be utilizing as a system for execution development in the broke down commercial gatherings. Thus, collaborating agreements and partnership between members of the supply chain emerge as an interesting topic for future research.

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Valuation of a Green Belt in the Cerrado Biome

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Abstract — The complex relationship between economy and the environment results in the aggravation of environmental problems while categorizing the urgency of thinking about connections between economy and nature. Nowadays it is a challenge to master techniques of valuation of natural resources to curb their predatory exploitation, enabling sustainable paths for development. In this context, the objective research is to carry out the valuation of an area called the green belt of a fuel storage terminal located in Cerrado biome. For this valuation, was used the replacement cost method associated to the values of the environmental regulation services. The main results were that the total cost of replacement of the area and respective value of annual and total environmental services, in which it can be check that the environmental services exceeded the investment made. It was also possible to verify the local forest densification and the list of flora and fauna species that include individuals protected by current legislation. It was concluded, therefore, on the applicability of the proposed method as well as on the study importance as an initiative for the Cerrado's environmental resources valuation.

Keywords — environmental compensation; environmental valuation; valuation of the Cerrado.

I. INTRODUCTION

Occupying approximately 24% of the national territory, Cerrado is the second largest Brazilian biome in extension with about 204 million hectares. Most of it is in the Brazilian Central Plateau comprehending high altitude regions in the central portion of the country. This feature guarantees a fundamental role of the biome in the distribution of water resources throughout the country, constituting the origin of great Brazilian hydrographic regions and the South American continent (Lima & Silva, 2018).

Besides being the cradle of the waters, Cerrado is one of the world's hotspots and its conditions guarantee the richest Savannas' flora of the world with a high level of endemism. The richness of birds, fish, reptiles, amphibians and insect species is equally large, although the richness of mammals is relatively small (Klink & Machado, 2005).

Environmental resources, the source of human life over the time, are used by man for his subsistence according to his evolutionary state. Predatory exploitation of these resources, including in Cerrado, has been the cause of flora and fauna extinction, water, soil and air pollution. This motivates the formulation of environmental preservation, conservation, management and control measures. According to Maia (2002), at most part, environmental resources are considered public, freely accessible and without a defined price in the market, so people consider themselves the right to use it in an abusive, unconscious and uncontrolled way.

In this context, the economic valuation of environmental resources theme is the proposal to value the environmental asset, collaborating with the sustainable use of these resources. Delfes *et al.* (2016) recognizes the need, through an economic valuation study, to diagnose how much the population (directly and indirectly) values the referent environmental asset, enabling a better use regarding the sustainability of the region.

Menuzzi & Silva (2015) highlight the complexity of the relationship between economy, environmental and its complexity results in the aggravation of environmental problems, while categorizing the urgency in the revision of many economic concepts, seeking a new way of thinking about the connections between economy and environment nature. Pasqualeto & Silva (2014) also point out that techniques of economic valuation of environmental resources have been questioned by economists due to the demand for more elaborate techniques that avoid incorrect analysis. This reinforces the demand for cautious exercise of such valuation, which is possible considering this paper.

The economic valuation of environmental resources demonstrates great importance in the face of environmental licensing processes and environmental management of various projects, as well as the assessment of damages under legal proceedings. It occurs as a result of environmental compensation procedures, damage assessment for the application of infractions and fines, project feasibility analysis, among other processes, an assertive calculation base must be provided to not underestimate the value of environmental resources involved an enterprise context.

That said, this research aimed to perform the valuation of a green area called green belt of a fuel storage terminal located in Cerrado biome through replacement cost method associated with the valuation of regulatory services by Constanza *et al.* (1997).

II. MATERIAL AND METHODS

The research was conducted between September/2018 and June/2019 when the economic valuation of a green area called the green belt of a fuel storage terminal, located in the city of Senador Canedo, in the state of Goiás, Brasil, was carried out.

2.1. Enterprise Characterization

The project characterization was based on the description of the fuel storage terminal, that is the operational nature of the company studied, including its green belt. Such characterization also involved environmental, economic, social and legal aspects, that represent an essential data for environmental valuation. The aspects were obtained from technical in site visits, from environmental studies provided by the company and from the available literature.

Finally, this characterization was complemented by an evolution survey of the area through the georeferenced system Google Earth, which had records from 2002 to 2019.

2.2. Valuation method definition

From a previous analysis of references that relate various environmental valuation methods and considering the objective of the valuation, the possible hypotheses, the data availability and the knowledge of the ecological dynamics of the valued object, the replacement cost method was defined (MCR) as the one that most applies to the green belt valuation of the fuel storage terminal.

The replacement cost considers the estimated benefits generated from the replacement or repair environmental resource after it has been damaged, for example in the case of reforestation in a deforested area. The estimates use market prices as base to replace or repair the damaged good or service, assuming that the environmental resource can be properly substituted, knowing, however, that not all the complex properties of environmental service will be replaced by a simple resource substitution (MAIA *et al.*, 2004).

It is also possible to question the possibility of adopting the avoided cost method for the case since the forest fragment studied has the function of minimizing the risk of fire. However, such a conception would underestimate the other possible values of the environmental service that the resource offered, it is to enterprise or to the population that benefits from the environmental services in question.

MCR was also associated with the valuation of regulatory services performed for world biomes by Constanza *et al.* (1997). The method of Constanza *et al.* (1997), from an international research, relates world biomes to approximate values of ecosystem services in an area such as gas regulation, water regulation, erosion control, soil formation, waste treatment, pollination, biological control, production food, recreation, among others. With this, it is possible to obtain a monetary value from this area. This association was also performed by Romacheli & Spinola (2011) in the economic valuation for the typical Cerrado physiognomy, thus allowing an update of the value previously raised eight years ago.

2.3. Modeling, data listing, calculations and critical analysis

Once knowing the valuation objective, the assumptions made, the availability of data and the ecological dynamics of the evaluated object, it is possible to adopt a method for environmental valuation (MOTTA, 2011).

For the green belt economic valuation of a fuel storage terminal located in the Cerrado biome, was used the replacement cost method associated with the valuation of regulatory services by Constanza *et al.* (1997).

To calculate the replacement cost, the replacement actions applicable to the study area were listed and pointed out by Vicente (2008), Romacheli & Spinola (2011) and Moreira *et al.* (2019) which were: soil collection; physicochemical analysis of soils; mechanized mowing or plowing; ant controlling; harrowing, subsoiling or furrowing; location and opening of the pits; fertilizer distribution, limestone and soil correction; chemical crowning in the pits; distribution of seedlings and plantings; tutoring; controlling of leaf-cutting ants; manual or mechanized mowing; chemical crowning of seedlings; replanting. For pest and competitor vegetation control actions after planting, a five-year horizon was considered.

Once the actions were related, a survey of values and budgets practiced in 2019 by Moreira *et al.* (2019) was made in companies located in the capital (Goiânia) in the region of the enterprise since the fuel storage terminal did not easily have the implementation values of the project that took place over 20 years ago. So the budgeted values were then averaged.

Finally, the value in reais per hectare (R\$/ha) of the green belt was obtained, as well as the value of environmental services provided, and the return time of the replacement investment made. From then on, a critical analysis of the material and methods used for such research was performed, as well as the value obtained. With such value, it was possible to know the importance of associating the preservation and environmental conservation of green areas with risk areas, industrial, commercial and relevant economic areas. In addition to collaborating with professionals who demand knowledge for the economic valuation of green areas with risk areas, industrial, commercial and relevant economic areas and sensitize entrepreneurs, public agencies and the general community for the preservation and environmental conservation from the valuation of preserved areas associated with economic activities.

III. RESULTS AND DISCUSSION

3.1. Green Belt Characterization: A Fragment of the Cerrado Biome in Evolution

Senador Canedo's fuel storage terminal has a total area of 798,215 m² (79.82 ha), of which 4,490 m² (0.459 ha) of built area, and a nominal fuel storage capacity such as diesel, gasoline and gas liquefied petroleum gas of 138,346 m³. The terminal is located at GO-536 Highway No. 01, Central Brazil Industrial District, Senador Canedo-GO, at latitude 16°42'25" South and longitude 49°06'34" West. The highway delimits the terminal to the east. To the north, the terminal is bounded by GO-019 State Highway. To the south and west the boundaries are rural properties.

Senador Canedo's terminal is one of the poliduct's units. Noteworthy for its high level of automation, the pipeline operates since 1996, maintaining the title of the longest pipeline in Brazil, with 964 km of trunk line, plus approximately 45 km of extensions, crossing 40 municipalities of three States (São Paulo, Minas Gerais and Goiás), as well as the Federal District.

When the company arrived in Senador Canedo, the region was characterized as a rural area and land use was intended for grazing. The terminal was installed and surrounded by a green belt, planted by the company. According to Transpetro (2006) the green belt has 545,900 m² (54.59 ha), discounting the orchard, the passage of the poliduct and access and transit areas, there is an area of 523,300 m² (52.33 ha). The implementation of this native forest was accompanied by a project whose supervision counted on trained and qualified professionals. For this reason, the area has a high diversity of species of native Cerrado flora, some of them even protected, as determined by the Secretariat of State of Goiás for Environment and Sustainable Development (SEMAD) through Memorandum nº. 34 (SEMAD, 2012), which is the case of Aroeira (Myracrodruon urundeuva), Ipê (Tabebuia sp.), Gonçalo Alves (Astronium fraxinifolium), Pequi (Caryocar brasiliensi) and Baru (Dipteryx alata). Due to the urban expansion of the municipality of Senador Canedo, the area is no longer rural and is today called the Central Brazil Industrial District.

In the management of the green belt by the company is considered the subdivision of the area in 3 parts, with different levels of conservation. Fig. 1 shows such areas. The area 1, with 107,000 m² (10.70 ha) in green color, represents an area that has been primarily recovered and received a new planting campaign in 2008, thus consisting of the most densely populated area. The area 2, with 206,600 m² (20.66 ha) in red, has a smaller density and area 3, with 209,700 m² (20.97) in pink, did not include revegetation, because it is an area of expansion of the terminal.



Fig. 1: Sub-areas of Senador Canedo's terminal green belt.

The area 1 includes an ecological trail called "Mico-Estrela Trail" implemented between 2008 and 2009 which aims to encourage conservation, protection, landscape beauty and the defense of scientific sources of the Cerrado through environmental awareness and the rational use of natural resources in Senator Canedo. The project also enables the strengthening of relationships with the local community, such as residents, teachers and students of the Senador Canedo municipal network, and employees of the unit, reaffirming the company's commitment to social and environmental responsibility (MAGALHÃES *et al.*, 2009).

According to dimensions of the green belt arranged by Magalhães *et al.* (2009) was considered as focus of this work the area of 31.336 ha (313,360 m²), which comprises the areas 1 and 2 of the belt, which underwent recovery and contains significant samples of local biodiversity.

A list of flora and fauna species identified in the area was prepared by Transpetro (2006) and (2018) and maintained during the performance of this work based on monitoring and technical visits in the area. Such listings are used by Appendices A and B.

On the west side of the terminal is the Laginha stream, which has riparian forest and floodplain areas along its banks. In this stream the non-contamination rainwater effluents of the terminal are disposed.

Since the implementation of the green belt in 1996, there has been a thickening of vegetation, as can be seen in Figures 2, 3, 4 e 5, the result of a survey conducted with the Google Earth system, which had images since 2002.



Fig. 2: Green belt registration in 2019 (Google Earth, 2019, adaptad by authors)



Fig. 3: Green belt registration in 2015 (Google Earth, 2019, adapted by authors).



Fig. 4: Green belt registration in 2009 (Google Earth, 2019, adapted by authors).



Fig. 5: Green belt registration in 2002 (Google Earth, 2019, adapted by authors).

3.2. Economic Value and Critical Analysis Calculation

To obtain the updated replacement cost, considering the recovery actions applicable to the area of the green belt studied in the light of that carried out by Vicente (2008), Romacheli & Spinola (2011) and Moreira *et al.* (2019), a survey of values and budgets was practiced in 2019 by Moreira *et al.* (2019) and companies located in Goiânia-GO. The budgeted values were then averaged and presented in Table 1. These budgets were necessary, becouse the company did not have the project implementation values that occurred more than 20 years ago. For actions to plague control and competing vegetation after planting, a five-year horizon was considered.

| Table. | 1: Average | value | of budgets | in | 2019 for | actions to |
|--------|------------|--------|-------------|----|----------|------------|
| | 1 | ecover | r the green | be | elt. | |

| Operations | R\$/ha | |
|---|---------------|--|
| Previous activities and interventions | | |
| Soil sample | R\$ 58.00 | |
| Physical-chemical analysis of soils | R\$ 150.00 | |
| Subtotal | R\$ 208.00 | |
| Land clearance, pest control and competing | | |
| vegetation | | |
| Mechanized mowing or plowing | R\$ 3,200.00 | |
| Ant control | R\$ 658.00 | |
| Subtotal | R\$ 3,858.00 | |
| Soil preparation | | |
| Railing, subsoiling or furrowing | R\$ 2,452.00 | |
| Pit leasing and opening | R\$ 4,356.00 | |
| Soil correction | R\$ 1,946.16 | |
| Chemical crowning in the pits | R\$ 1,410.48 | |
| Subtotal | R\$ 10,163.14 | |
| Planting activities | | |
| Distribution of seedlings and plantings | R\$ 4,604.72 | |
| Tutoring | R\$ 4,749.14 | |
| Subtotal | R\$ 9,353.86 | |
| Pest control and competing vegetation after | | |
| planting | | |
| Combat leaf-cutting ants | R\$ 1,477.00 | |
| Manual or mechanized mowing | R\$ 3,200.00 | |
| Chemical crowning of seedlings | R\$ 1,533.40 | |

| Subtotal | R\$ 6,210.40 |
|----------|---------------|
| R | eplant |
| Replant | R\$ 2,010.04 |
| Subtotal | R\$ 2,010.04 |
| Total | R\$ 31,803.44 |

Given these values, there is an average total cost of R\$ 31,803.44 to recovery/restoration of one hectare of Cerrado in the city of Senador Canedo. In the budget, the values consider costs of materials, tools, inputs and services. It is noteworthy that the use of chemical mowing was not considered, since ecologically harmonic principles were taken as basis.

Next to the recovered area, the main environmental services are listed: erosion and flood control, availability of cerrado fruits and herbal medicines for sustainable exploration, preservation of flora, fauna and their local habitat, temperature regulation, control of gas emissions greenhouse effect (CO2), increased recharge and water availability in the hydrographic basin (the Paranaíba River basin and the Meia Ponte River sub-basin), an environment conducive to environmental education activities, among other preservation and conservation researches of Cerrado, protection of the operational area against fire, among others.

Constanza *et al.* (1997) present, among the studied biomes, the Savanna. Romacheli & Spinola (2011) state that Savanna can be considered a biome similar to Cerrado, since in general, they have ecological and physiognomic relationships with other savannas in tropical America and on continents such as Africa and Australia and that is why they were used the values of regulatory services listed in Table 2 in their economic valuation of a typical Cerrado fragment.

Updating the total value of regulation services by Constanza *et al.* (1997) in relation to the accumulated American inflation between 1994 and the date of this survey, March/2019, has a value of US\$ 232.00 ha/year corrected to US\$ 404.50 ha/year. Considering the dollar value on April 28, 2019 of R\$ 3.92, we have the updated value in reais to R\$ 1,585.64 ha/year. Adding then, all the values calculated in this research (replacement cost of Table 1 and adjustment service of Table 2), it is understood that the estimated value of the studied area is R\$ 33,389.08 per hectare. Table. 2: Regulation services provided by the Cerrado biome based on the values of Constanza et al. calculated in 1994 (1997).

| Regulation services | Estimated benefit value (US\$/ha/year) |
|---------------------|---|
| Gas regulation | 7 |
| Water regulation | 3 |
| Erosion control | 29 |
| Soil formation | 1 |
| Waste treatment | 87 |
| Pollination | 25 |
| Biological control | 23 |
| Food production | 67 |
| Recreation | 2 |
| Total | 232 |

Therefore, it is estimated, in view of the proposed method, that the area already recovered 23 years ago (31,336 ha) provided an annual amount of R\$ 49,725.67 for environmental services, making a total of R\$ 1,143,690.42 for this period environmental costs for a total replacement cost in 2019 of R\$ 997,355.88, a cost that would be reverted to environmental benefits in a 20-year payback time, in addition to adding value to fixed assets, which, according to the company, is estimated at R\$ 250,000.000.00. Consider that the project was implemented in 1996. Replacement values may vary according to the specificities of the area and region, so it is worth considering the possibility of updating it for each case.

It is important to consider that, in addition to areas 1 and 2 comprising the 31,336 ha studied, the company also has area 3 (20.97 ha), considered as an expansion area, which is kept clean with fire breaks, thus allowing a advance of native vegetation planted in the last 23 years, as can be seen in the sequence of Figures 2 to 5. So, it is possible to consider an increase in environmental services of R\$ 33,250.87 per year, without a robust specific replacement cost investment in this area. This allows us to consider the relevance of plantations in these areas, extrapolating the environmental services provided by the studied area next to the region bordering it.

Constanza *et al.* (1997) shows limitations in his method that, since it is a valuation of 16 world biomes, such values may be underestimated and under the guidance of the authors, the particularities of each case must be deepened. It is observed that the recreation services, for the specific case of the fuel storage terminal studied, could be revised since the area was incorporated with an ecological trail, according to Magalhães et al. (2009), such a project even allows the fulfillment of specific condition of environmental license of the polyduct that supplies the terminal. Another environmental regulation service value proposed by Constanza et al. (1997) and liable to increase would be water regulation. This is because, according to Bastos and Ferreira (2010), the drainage network in the area of Cerrado biome domain is mostly perennial, guaranteeing the supply of water to several regions of Brazil, including the main hydrographic basins being: Platina, Amazon, São Francisco and Araguaia-Tocantins, which justifies the popular saying that "Cerrado is the cradle of Brazilian waters".

However, it is worthwhile remember that the valuation of environmental services by the MCR tends to underestimate the environmental services provided by nature, since there is a whole complex of ecosystemic services that demands time to the recovery until it approaches of the original conditions. But it is worth highlighting the company's initiative to recover an area where it had not degraded, since when the area was acquired it was composed of pasture and today it is made up of a Cerrado's fragment.

The results of this research, in addition to demonstrate the environmental gains from the regulation services provided and calculated by the Cerrado biome, provide the company with a basis for environmental compensation evidence from licensing agencies, guaranteeing credits and benefits, among others, in support of its environmental licensing processes. Such results and methods also allow guiding environmental and professional in the segment in out calculations of compensation and carrying environmental valuation, in addition to guiding the compensation practices recognition carried out by projects located in Cerrado biome. And, finally, to enable society and the academic community to recognize such practices and the possible gains with the conservation and preservation of urban forest fragments.

IV. CONCLUSION

The work carried out made it possible to know the environmental services provided by the green belt of the fuel storage terminal located in Senador Canedo - GO, using the economic replacement cost valuation method associated with the regulation services valuation method. An estimated value was obtained from the studied area of R\$ 33,389.08 per hectare. It was possible to estimate that

the area already recovered 23 years ago (31,336 ha) provided an annual amount of R\$ 49,725.67 in environmental services, making a total of R\$ 1,143,690.42 in environmental services for a replacement cost total of R\$ 997,355.88 in 2019, this cost reverted to environmental benefits in a return time of 20 years, that is, in environmental services the investment cost has already been exceeded. Replacement values may vary according to the specificities of the area and region, so it is valid to consider the possibility of updating it for each case.

It is also recommended to carry out studies that allow the creation of specific indexes, as done by Constanza *et al.* (1997), for Cerrado biome and that consider its wealth and diverse formations and that in sequence can consider particularities of the environmental regulation services of each region and of the biome.

It was also possible to know the forest density of the studied area in the period between 2002 to 2019, making a horizon of 17 years. In view of this density monitoring, it was possible to obtain a list of 146 fauna specimens and another 28 fauna specimens that include individuals protected by current legislation, in addition to concluding by the expansion of environmental services to the areas adjacent to the recovered area, which in turn were kept surrounded and with firebreak, so they are potential areas for recovery and conservation.

As a result, it is possible to consider the essential role of companies in adopting measures for compensation, recovery and environmental preservation, adding value to their enterprises through the provision of environmental services in their preserved and/or conserved areas. The results and methods presented here and proposed respectively, allow to guide environmental and professional in the segment to carrying out calculations of compensation and environmental valuation, in addition to guiding the recognition of compensation practices carried out by enterprises located in Cerrado biome. And, finally, to enable society and the academic community to recognize such practices and the possible gains with the conservation and preservation of urban forest fragments.

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Appendix

Appendix A - List of Registered Flora Species

| | Specie |
|----|--|
| 1 | Acosmium brachystachyum (Benth.) Yakovl. |
| 2 | Acosmium dasycarpum (Vogel) Yakovlev. |
| 3 | Albizia niopoides (Bent.) Burkart var. niopoides |
| 4 | Albizia polycephala (Benth.) Kilip ex Record |
| 5 | Anacardium occidentale |
| 6 | Anacardium othonianum Rizzini |
| 7 | Anadenanthera falcata (Benth.) Speg. |
| 8 | Andira humilis Mart. Ex Benth. |
| 9 | Anemopaegma arvense (Vell.) Stellfeld ex de |
| | Souza |
| 10 | Annona coriacea Mart. |
| 11 | Annona crassiflora Mart. |
| 12 | Annona sp1. |
| 13 | Annona sp2. |
| 14 | Annona sp3. |
| 15 | Apeiba tibourbou Aubl. |
| 16 | Apis mellifera scutellata |
| 17 | Arrabidae brachypoda Burg. |
| 18 | Aspidosperma macrocarpon Mart. |
| 19 | Aspidosperma polyneuron M. Arg. |
| 20 | Aspidosperma sp. |
| 21 | Aspidosperma tomentosum |
| 22 | Aspidosperma tomentosum Mart. |
| 23 | Asteraceae1 |

| 24 | Astronium fraxinifolium Schott. |
|----|--|
| 25 | Banisteriopsis sp1. |
| 26 | Banisteriopsis sp2. |
| 27 | Bauhinia sp1. |
| 28 | Bauhinia sp2. |
| 29 | Bauhinia sp3. |
| 30 | Brosimum gaudichaudii Tréc. |
| 31 | Buchenavia tomentosa Eichler |
| 32 | Byrsonima coccolobifolia Kunth. |
| 33 | Byrsonima crassa Nied. |
| 34 | Byrsonima sp. |
| 35 | Caesalpinia echinata Lam. |
| 36 | Callisthene mino (Spreng) Mart. |
| 37 | Campomanesia pubescens (DC.) O. Berg. |
| 38 | Caryocar brasiliense Camb. |
| 39 | Casearia sylvestris Swartz |
| 40 | Cecropia pachystachia Tréc. |
| 41 | Cedrela fissilis Vell. |
| 42 | Chorisia speciosa A. StHill |
| 43 | <i>Clitoria</i> sp. |
| 44 | Cochlospermum regium (Mart. ex Schrank.) Pilger |
| 45 | Connarus suberosus Planch. |
| 46 | Copaifera langsdorffi Desf. |
| 47 | Crotalaria sp. |
| 48 | Croton glandulosus L. Muell Arg. |
| 49 | Croton urucurana Baill. |
| 50 | Curatella americana L. |
| 51 | Cybistax antisyphilitica (Mart.) Mart |
| 52 | Davilla elliptica A. St. Hil. |
| 53 | Dilodendron bipinnatum Radlk |
| 54 | Dimorphandra mollis Benth. |
| 55 | Diospyros burchellii DC. |
| 56 | Diospyros burchellii Hiern. |
| 57 | Diospyros sp. |
| 58 | Diplusodon sp. |
| 59 | Dipteryx alata Vog. |
| 60 | Enterolobium ellipticum Benth. |
| | |

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| 61 | Eriotheca gracilipes (K. Schum.) A. Robyns |
|----|---|
| 62 | <i>Eriotheca pubescens</i> (Mart. & Zucc.) Schott & Endl. |
| 63 | Erythroxylum deciduum A. St. Hil. |
| 64 | Erythroxylum suberosum A. St. Hil. |
| 65 | Erythroxylum sp1 |
| 66 | Erythroxylum sp2 |
| 67 | Eugenia calycina Camb. |
| 68 | Eugenia dysenterica Mart. ex DC. |
| 69 | Eugenia sp. |
| 70 | Genipa americana L. |
| 71 | Guapira noxia (Netto) Lundell |
| 72 | Guazuma ulmifolia Lamb. |
| 73 | Hancornia speciosa Gomez |
| 74 | Himatanthus obovatus R. E. Woodson |
| 75 | Hymenaea courbaril L. |
| 76 | <i>Hymenaea courbaril var. stilbocarpa</i> (Hayne) Y.T.L. |
| 77 | Hymenaea stigonocarpa Mart. ex Hayne |
| 78 | Inga alba (Sw.) Willd. |
| 79 | Jacaranda brasiliana (Lam.) Pers. |
| 80 | Jacaranda mimosifolia |
| 81 | Kielmeyera coriacea (Spreng.) Mart. |
| 82 | Leguminosae – caesalpiniodeae |
| 83 | Leguminosae 2 |
| 84 | Leguminosae 3 |
| 85 | Leucaena leucocephala (Lam.) de Wit |
| 86 | Luehea grandiflora Mart. & Zucc. |
| 87 | Machaerium acutifolium |
| 88 | Machaerium hirtum (Vell.) Stellfeld. |
| 89 | Machaerium opacum Vogel |
| 90 | Memora nodosa (Silva Manso) Miers |
| 91 | Miconia sp. |
| 92 | Mimosa debilis Humb. & Bonpl. Ex Willd. |
| 93 | Moraceae sp1. |
| 94 | Moraceae sp2. |
| 95 | Myracrodruon urundeuva |
| 96 | Myracrodruon urundeuva (Engler) Fr. Allem. |
| 97 | Myrcia linearifolia Cambess. |

| 98 | Myrciaria cauliflora |
|-----|---|
| 99 | Myrcine guianensis (Aubl.) Kuntze |
| 100 | Neea theifera Oerst. |
| 101 | Ouratea hexasperma (A.Sthill) Baill. |
| 102 | Oxalis densifolia Turcz. |
| 103 | Palicourea sp. |
| 104 | Parkia pendula (Willd.) Benth. ex Walp. |
| 105 | Peixotoa sp. |
| 106 | <i>Peltaea</i> sp. |
| 107 | Phytolacca sp. |
| 108 | Piptadenia gonoacantha (Mart.) J.F. Macbr. |
| 109 | Piptocarpha rotundifolia (Less.) Baker |
| 110 | Platipodium elegans Vogel |
| 111 | Plenckia populnea Reissek |
| 112 | Pouteria ramiflora (Mart.) Radlk |
| 113 | Pouteria torta (Mart.) Radlk |
| 114 | Pseudobombax tomentosum (Mart. & Zucc.) A. |
| | Robyns |
| 115 | Psidium guajava L. |
| 116 | Psidium sp1. |
| 117 | Psidium sp1. |
| 118 | Qualea grandiflora Mart. |
| 119 | Qualea parviflora Mart. |
| 120 | Roupala montana Aubl. |
| 121 | Rourea induta Planch. |
| 122 | Sabicea brasiliensis Wernhm |
| 123 | Salacia crassifolia (Mart.) Peyr. |
| 124 | Salacia elliptica |
| 125 | Salacia sp. |
| 126 | Salvertia convallariaeodora |
| 127 | Serjania sp. |
| 128 | Smilax goyazana A. DC. |
| 129 | Solanum lycocarpum St. Hil. |
| 130 | Sterculia chicha A. St. – Hil. Ex Turpin |
| 131 | Strychnos pseudoquina A. St. Hil. |
| 132 | Stryphnodendron adstringens (Mart.) Coville |
| 133 | Stylosanthes guianensis Sw. |
| 134 | Styrax ferrugineus Nees & Mart. |
| | 1 |

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| 135 | Syagrus romanzoffiana (Cham.) Glassman |
|-----|--|
| 136 | Tabebuia aurea (Manso) Benth. & Hook |
| 137 | Tabebuia caraiba (Mart.) Bur. |
| 138 | Tabebuia chrysotricha (Mart. ex A.DC) Standl |
| 139 | Tillandsia sp. |
| 140 | Tocoyena formosa (Cham. & Schltdl.) K. Schum |
| 141 | Vernonia sp1. |
| 142 | Vernonia sp2. |
| 143 | Vochysia haenkeana Mart. |
| 144 | Vochysia tucanorum Mart. |
| 145 | Xylopia aromatica (Lam.) Mart. |
| 146 | Zeyheria digitalis (Vell.) Hoehne |

Appendix B – List of Registered Fauna Species

Table. 4: List of Registered Fauna Species

| | Specie |
|----|---------------------------|
| 1 | Ara ararauna |
| 2 | Amphisbaena alba |
| 3 | Aratinga Leucophthalma |
| 4 | Atta sp. |
| 5 | Boa constrictor |
| 6 | Bothrops jararaca |
| 7 | Buteo magnirostris |
| 8 | Callithrix penicillata |
| 9 | Camponatus sp. |
| 10 | Chironius bicarinatus |
| 11 | Coedou sp. |
| 12 | Coragyps atratus |
| 13 | Crotalus durissus |
| 14 | Crotophaga ani |
| 15 | Erythrolamprus aesculapii |
| 16 | Euphractus sexcinctus |
| 17 | Gnorimopsar chopi |
| 18 | Guira guira |
| 19 | Myrmecophaga tridactyla |
| 20 | Lycalopex vetulus |
| 21 | Ozotoceros bezoarticus |
| 22 | Pitangus sulphuratus |

| 23 | Polybia occidentalis |
|----|----------------------|
| 24 | Polybia sericea |
| 25 | Sicalis flaveola |
| 26 | Synoeca syanea |
| 27 | Theristicus caudatus |
| 28 | Trigona spinipes |
| 29 | Turdus fumigatus |

Deformation Contour Analysis in Elastic Plastic Fatigue Fissure using Local and Global Integral Approach

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Abstract— This paper present mathematical modelof local and global integral for elastic plastic damage mechanism of displacement discontinuity. The discrete nature of stress intensity factor approach where there is large scale yielding is inadmissible; hence, continuous energy path contour analysis becomes crucial. The simple energetic path can easily be evaluated computationally and the most prevalent method. However, fails to account for dynamic effect, kinetic energy and thermal effect, body force and effect of surface traction. The research is focused on deformation contour analysis of elastic-plastic void growth. In this paper, local andglobal representation of deformation field near a crack tip due to loading was examined using Divergence theorem and energy balanced method. The local integral is equivalent to energy release rate for nonlinear elastic materialunder quasi-static condition. The global J- Integral captured thermal effect, body force non zero surface traction and effect of plasticity. The integral permits more accurate analysis possible for all deformation fields including very close proximity of crack tip and all categories of material.TheFatigue crack growth analysis was developed to support economic fail safe and damage tolerance philosophies, and the execution, effectuation of damage tolerance control procedures for the workings of structural systems.

Keywords— Fissure, local integral, global integral, contour and deformation.

I. INTRODUCTION

Plane strain deformation field surrounding the tip of a crack is of immense significance in damage mechanism of solid component in structural design and analysis. It deals the studies of the behaviour of stress and strain field in the neighbourhood of fissure tip. The product of stress and strain exhibits a singularity which is inversely proportional to the magnitude of crack from the tip and near the tip where there is numerous invisible deformation fields or contours. This represents energy line integral with the characteristics of path that does not depend on all the contours encircling fissure tip. In Rice (1968) this line integral has same value for all paths around the tip of a crack in two dimensional deformation field of linear and non-linear elastic material. The correct choice of this contour is crucial; the result gives approximate estimate of the degree of strain concentration near the tip of a crack in a notch crack problem. Irwin (2004) posited that the principle of continuous deformation path is related to path independence if a path c_2 was obtained from c_1 by

continuously moving c_1 with ends fixed until it coincide with c_2 . This revealed that here are two of the indefinite numerous intermediate paths for which the integral always retain its value. Besides, there is a continuous deformation path of an integral keeping the ends fixed since deformation path always consist of only points at which the function is analytic, hence the integral retain same value.

Contour integral has great contribution in fracture mechanics; it characterizes the parameter used for nonlinear materials by idealizing the elastic plastic deformation as nonlinear elastic. According to Boulenouar et al (2013) the use of crack propagation laws based on stress intensity factors is quite good in scientific and engineering application of mechanics of fracture. The stress intensity factor sufficiently defines the stress field close to the crack tip and provides fundamental information on how the crack is going to advance. Furthermore, Rice (1967) applied deformation plasticity to analyze crack in a nonlinear material; therefore, in nonlinear energy released rate, J integral could be used

and represented as a path independent line integral.Riceand Rosengren (1968) also showed that J integral uniquely characterize crack tip stress and strain in nonlinear materials. So,the J integral could be viewed as both an energy parameter and a stress intensity parameter. It is again seen as path independence contour integral for the analysis of crack problems. The contour integral could be evaluated along a contour surrounding the crack tip where numerical accuracy is better. In path independence, it is possible to compute J at remote contour provided an appropriate correction term that is an area integral is applied. Furthermore, for J integral to

remain path independent, the stress strain must vary as $\frac{1}{r}$

near crack tip. This energy release rate measuresthe energy available for an increment of crack extension also known as crack driving force or crack extension force. It has the potential ability to evaluate the integrity of structural component: it has become common to evaluate the integrity of structures using path independent J- integral interpreted as the intensity of the elastic - plastic deformation and the stress field surrounding a crack tip. However, the integral loses the property of path independence and can no longer be interpreted as the energy released rate under some conditions. It is not evident that if the elastic plastic stress or strain fields near a crack tip is characterizable in terms of Jintegral. In addition, Oyesanya (2007) found that the integral cannot characterize the crack tip stress strain analysis of structures under thermal loading outside HRR dominance. In small size dependent fracture analysis characterized by strain gradient elasticity the convenient strain gradient J- integral is incapable of accounting for the deformation energy distribution from the strain gradient. It underestimates the critical load and over estimates the critical deflection then higher order J- integral was necessary for analysis of fracture behaviour of structures with none negotiable strain gradient Lam e'tal (2004).

Due to complexities in investigating crack tip stress and strain of displacement amplitude loading condition, the discrete nature of stress intensity factor approach becomes inadmissible where there is large scale yielding. The need for continuous energy path contour becomes crucial. However, the simple energetic path fails to account for dynamic effect, kinetic energy, thermal effect and body force. It loses its physical significance as a crack driving force when deformation is not reversible. Therefore, in this paper, a global representation of deformation field near a crack tip due to loading was examined using globalized energy balance approach. It is a general representation of J integral which includes the existence of a fracture process region and the effect of plastic deformation, body force, thermal strain and inertial effect of material.Crack tip singularities are investigated using energy line integral that exhibits path independence for all contours near the tip of the crack in a two dimensional deformation field of a linear elastic material. Besides, the global J- Integral is used to extract the magnitude of crack tip stress intensity factor in fatigue crack problem and the characteristics of the J-integral under mode-1 loading. The integral permits accurate analysis possible for all deformation fields including very close proximity of crack tip. This arbitrary continuous and differentiable contour represent the magnitude of energy available for crevice propagation, that is, the value of this integral equates the energy released rate of linear and nonlinear elastic plastic body which contains void.

II. LOCAL ENERGETIC PATH CONTOUR INTEGRAL

Plastic zone size plays crucial role in actual crack propagation, hence elastic fracture dynamics that can be used notably among is J-integral. It is a parameter that deals with energy while stress intensity factor is a local parameter that deals with displacement and stress field in the vicinity of a crack. The approaches may be different but the goal is the same to characterize a crack. The magnitude of plastic zone affects that actual fatigue crack progression. Therefore, elastic plastic fracture dynamic model for crack growth becomes crucial. This gives rise to energy flux integral that denotes path independent energy line integral that quantifies the strength of the singular stress and strain field in the vicinity of a crack tip (a measure of energy available for an increment of crack extension, the energy released rate). It is also known as crack extension force or crack driving force. The magnitude of this J-contour integral can be calculated from a path independent contour integral in the neighbourhood of the flaw tip.

However, taking into view an arbitrary contour *c*that encloses a crack tip whereby the path is in anticlockwise direction to evaluating J along the contour, the value of this integral called contour integral. This is equal to the energy released rate in a nonlinear elastic material that contains a crack.In Jin and Sun (2004), and Daniel (2003) potential energy of a crack body is denoted by

$$J = \frac{d\pi}{dA}$$

where \mathcal{T} is the potential energy of body. The potential energy equals strain energy minus work done. The force induced by external agencies is given as

$$\pi = u - F$$

where u = the strain energy stored in the body and

F = work done by external forces.

$$G = J = -\frac{d\pi}{dA}$$

where G is the rate of change in potential energy with the crack,

A = crack area,

u = strain energy stored in the body and

F = work done by external forces.

$$\pi(l) = \iint_{A_0} w dx dy - \int_{c_i} T_i u_i dc \tag{1}$$

 π = potential energy of cracked solid,

W =strain energy density

 T_i = traction on the boundary segment

$${}^{C_{t}}G = \frac{d\pi}{dl} = -\frac{d}{dl} \iint_{A_{0}} w dx dy + \frac{d}{dl} \int T_{i} u_{i} dc$$

$$G = -\frac{d}{dl} \left(\iint_{A} w dx dy + \iint_{A_{h}} w dx dy \right) + \int_{c_{i}} T_{i} \frac{du_{i}}{dl} dc$$

$$(2)$$

$$G = -\iint_{A} \frac{dw}{dl} dx dy + \int T_{i} \frac{du_{i}}{dl} dc - \frac{d}{dl} \iint_{A_{h}} w dx dy$$
(4)
$$G = -\iint_{A} \frac{dw}{dl} dx dy + \iint_{A} \frac{dw}{dx} dx dy + \int_{c_{0}} T_{i} \frac{\partial u_{i}}{\partial l} dc - \int T_{i} \frac{\partial u_{i}}{\partial x} - \frac{d}{dl} \iint_{A_{0}} w dx dy$$
(5)

$$\int_{c_0} T_i \frac{\partial u_i}{\partial l} dc = \iint_{A_h} \frac{\partial w}{\partial l} dA$$
(6)

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$$dA = rdrd\theta$$
$$A_h = A_0 - A$$

Substituting equation (6) into equation (5) hence integration along the contour c_0 is reduced to c

 $T_i = \sigma_{ij} n_j = 0$ on the part of the contour c_0

$$G = \iint_{A} \frac{\partial w}{\partial x} dx dy - \int_{C} T_{i} \frac{\partial u_{i}}{\partial x} dc + \iint_{A_{h}} \frac{\partial w}{\partial l} dx dy - \frac{d}{dl} \iint_{A_{h}} w dx dy$$
(7)

Using the Divergence Theorem and considering the first term of equation (7) gives below

$$\iint \frac{\partial w}{\partial x} dx dy = \int_{c} w dy + \int_{c_h} w dy \tag{8}$$

Substitute equation (8) into equation (7)

$$G = \int_{c} w dy + \int_{c_{h}} w dy - \int_{c} T_{i} \frac{\partial u_{i}}{\partial x} dc + \iint_{A_{h}} \frac{\partial w}{\partial l} dx dy - \frac{d}{dl} \iint_{A_{h}} w dx dy$$
(9)

$$w = B(l)\widetilde{w}(X-l,Y) = B(l)\widetilde{w}(x,y)$$
⁽¹⁰⁾

$$\int_{A_h} w dy = \int_{-h}^{h} B(l) \widetilde{w}(-h, y) dy + \int_{-h}^{-h} B(l) \widetilde{w}(h, y) dy$$
(11)

$$\iint_{A_{h}} \frac{\partial w}{\partial l} dx dy = \iint_{A_{h}} B'(l) \widetilde{w}(x, y) dx dy$$
(12)

Considering the last term in equation (5)

$$\frac{d}{dl} \iint_{A_{h}} w dx dy$$

$$x = X - l$$

$$w = B(l)\widetilde{w}(x - l, Y) = B(l)\widetilde{w}(x, y)$$

$$\frac{d}{dl} \iint_{A_{h}} w dx dy = \lim_{\Delta l \to 0} \frac{1}{\Delta l} \left[\iint_{A_{h}} (B(l + \Delta l)\widetilde{w}(x - \Delta l, y) - B(l)w(x, y)) dx dy \right] \quad (13)$$

Consider the dummy variable below,

$$x^{*} = x - \Delta l$$

$$\iint_{A_{h}} \widetilde{w}(x - \Delta l, y) dx dy = \int_{-h}^{h} \left(\int_{-h - \Delta l}^{h - \Delta l} w(x^{*}, y) dx^{*} \right) dy$$
(14)

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$$\iint_{A_h} \widetilde{w}(x - \Delta l, y) dx dy = \int_{-h}^{h} \left(\int_{-h - \Delta l}^{h - \Delta l} w(x^*, y) dx^* + \int_{-h}^{h} w(x^*, y) dx^* + \int_{-h}^{h - \Delta l} \widetilde{w}(x^*, y) dx^* \right) dy$$
(15)

$$\iint_{A_{h}} \widetilde{w}(x - \Delta l, y) dx dy = \iint \widetilde{w}(x, y) dx dy + \int_{-h}^{h} \left(\int_{-h - \Delta l}^{h - \Delta l} \widetilde{w}(x, y) dx - \int_{h - \Delta l}^{h} \widetilde{w}(x, y) dx \right) dy$$
(16)

$$\Delta l \rightarrow 0$$

$$\iint_{A_h} \widetilde{w}(x - \Delta l, y) dx dy = \iint_{A_h} \widetilde{w}(x, y) dx dy + \int_{-h}^{h} (w(-h, y) \Delta l + \widetilde{w}(h, y) \Delta l) dy$$
(17)

As $\Delta l \rightarrow 0$ then,

$$B(l + \Delta l) = B(l) + B'(l)\Delta l$$
⁽¹⁸⁾

Putting equation (13) and equation (18) into equation (13) gives

$$\frac{d}{dl} \iint_{A_h} W dx dy = B'(l) \iint_{A_h} \widetilde{w}(x, y) dx dy + B(l) \int_{-h}^{h} (w'(-h, y) - w'(h, y)) dy$$
⁽¹⁹⁾

Substituting equation (11), equation (12) and equation (19) into equation (9)

$$G = \int_{c} w dy - \int_{c} T_{i} \frac{\partial u_{i}}{\partial x} ds = J$$
⁽²⁰⁾

This is the energetic path independent contour integral near crack.J = 0 for any close contour given that C_1 and C_2 are two arbitrary contours around the crack tip connected by segment along crack face C_3 and C_4 , then a closed contour is formed. The total J along the contour is equal to the sum of contribution from each segment:

$$J = \int_{C_1} + \int_{C_2} + \int_{C_3} + \int_{C_4} = 0$$

$$C_3 = C_4 = 0 \quad and \quad C_1 = -C_2$$

Therefore, any anticlockwise path that surrounds a crack will have same value of integral which is path independent. The integral is zero over a closed path, Kanninen and Popelar (1985)

III. GLOBAL ENERGETIC PATH CONTOUR INTEGRAL

Anderson (2014), Moran and Shih (1987) investigated on the general J – integral where the simplified energy integral is modified. However, global representation of J- integral account for dynamic effect, time dependent material behavour including the inertial effect.

$$J = \frac{F}{v}$$

F = energy flux

$$J = \lim_{c=0} \int_{c} (w+T) dy - \sigma_{ij} n_j \frac{\partial u_i}{\partial x} ds$$

W =stress work

$$w = \int_{0}^{z_{ij}} \sigma_{ij} d\varepsilon_{ij}$$
$$T = \frac{1}{2} \rho \frac{\partial u_i}{\partial t} \frac{\partial u_i}{\partial t}$$

T = kinetic energy density

$$\partial (\sigma_{ij} u_i) = \rho \frac{\partial^2 u_{ij}}{\partial t^2} + \sigma_{ij} \frac{\partial u_i}{\partial x_j}$$

$$=T+\dot{w}$$

$$\int_{\partial v} \sigma_{ij} u_{ij} m_j ds = \frac{d}{dt} \int_{v} (W+T) dv - \int_{\partial v} (w+T) v_j m_j ds$$

$$v = volume$$

 m_i = outward normal to surface ∂v and

 $v_i =$ instantaneous velocity of ∂v

In a case of two dimensional flawed solid materials where the partial separation is along x- axis and the origin at crack tip. Define a contour to fixed in space containing advancing crack and bounded by the area A while the crack tip is enclosed by a small contour c fixed in size and move with the crack. Therefore, the energy balance law is given as:

$$\int \sigma_{ij} u_i m_j dc = \frac{d}{dt} \iint_A (w+T) dA - \iint_C \left[(w+T) v \partial_{ij} + \sigma_{ij} u_{ij} \right] m_j dc$$
(23)

 $\int_{c_0} \sigma_{ij} u_i m_j dc =$ the rate at which energy is input into the body

 $\frac{d}{dt}\int (w+T)dA$ = the rate of increase in energy of the body

The last term is the rate at which energy is lost from body due to flux through c

$$n_{j} = -m_{j} \text{ on } C$$

$$\therefore F(c) = \int_{c} \left[(w+T)v\delta_{ij} + \sigma_{ij}u_{i} \right] n_{j}dc$$

The flux does not depend on shape of c: therefore, flux to crack tip is given as $F = \lim_{c \to 0} \int_{c} [(w+T)v \delta_{ij} + \sigma_{ij}u_i]n_j dc$

(24)

As time increases by dt, fissure extends by dl = Vdt and energy expended

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(21)

(22)

is fdt therefore, energy release rate is given as

$$J = \frac{F}{v}$$
(25)

substituting equation (24) into equation (25) give rise to a global expression for J-integral

$$\therefore u_i = -v \frac{\partial u_i}{\partial x} + \frac{\partial u_i}{\partial t}$$
(26)

Hence, in steady state situation, the second term in equation (26) vanishes and the displacement at fixed distance from propagating crack tip remains constant, but close to crack tip displacement changes rapidly with positions (at a fixed time). The first term is dominative in all cases in equation (26)

$$J = \lim_{c \to 0} \int_{c} \left[(w+T) \delta_{ij} - \sigma_{ij} \frac{\partial u_{i}}{\partial x} \right] n_{j} dc$$

$$= \lim_{c \to 0} \int_{c} \left[(w+T) dy - \sigma_{ij} n_{j} \frac{\partial u_{i}}{\partial x} \right] n_{j} dc$$
 (27)

The above equation applies to all categories of material response: elastic, plastic, visco-plastic viscoelastic behavior. It was derived from globalize energy balance.

Equivalent Domain Global Energy Integral

Reza (2014) and Nguyen (2014) also supported the generalized integral

$$J = \lim_{c \to 0} \int_{c} \left[(w+T) \delta_{ij} - \sigma_{ij} \frac{\partial u_{i}}{\partial x} \right] n_{j} dc$$

$$T = \frac{1}{2} \rho \frac{\partial u_{i}}{\partial t} \frac{\partial u_{i}}{\partial t} \qquad J = \int_{c^{*}} \left(\sigma_{ij} \frac{\partial u_{i}}{\partial x_{j}} - w \delta_{ij} \right) q m_{i} dc - \int_{c^{+}+c^{-}} \sigma_{2j} \frac{\partial u_{i}}{\partial x_{1}} q dc$$

$$\sigma_{ij} = \varepsilon_{ij}^{total} = \varepsilon_{ij}^{e} + \varepsilon_{ij}^{p} + \alpha \Theta \delta_{ij} \qquad J = \int_{A^{*}} \frac{\partial}{\partial x_{i}} \left(\left(\sigma_{ij} \frac{\partial u_{i}}{\partial x_{1}} - w \delta_{ij} \right) q \right) dA - \int_{c^{+}+c^{-}} \sigma_{2j} \frac{\partial u_{i}}{\partial x_{1}} q dc$$
(28)
$$J = \int_{A^{*}} \left(\sigma_{ij} \frac{\partial u_{i}}{\partial x_{1}} - w \delta_{ij} \right) \frac{\partial q}{\partial x_{i}} + \left(\sigma_{ij} \frac{\partial \varepsilon_{ij}^{p}}{\partial x_{1}} + \frac{\partial \varepsilon_{ij}^{p}}{\partial x_{1}} + \alpha \sigma_{ii} \frac{\partial \Theta}{\partial x_{1}} - F_{i} \frac{\partial u_{i}}{\partial x_{1}} \right) q dA - \int_{c^{+}+c^{-}} \frac{\partial u_{i}}{\partial x_{1}} q dc$$
(29)

$$q = \frac{1}{\Delta l} \frac{\partial x_1}{\partial x_i}$$

 Θ = thermal effect,

 $F_i = \text{bodyforce}$

p = plasticity effect

The above general representation of J- integralapplies to all categories of material response: elastic, plastic, visco-plastic viscoelastic behavior. The global integral permits accurate analysis possible for all deformation fields including very close proximity of crack tip.

IV. CONCLUSION

Elastic plastic fracture dynamics that can be used in material design and evaluating the integrity of structurenotably among which is J- integral, a parameter that deals with energy released rate while stress intensity factor is a local parameter that deals with displacement and stress field in the vicinity of a fissure. The integral quantifies the magnitude of plastic zone effect that affect actual fatigue crack progression. Therefore, elastic plastic damage dynamics model for crack progression becomes necessary. This gives rise to energy flux integral that denotes path independent energy line integral and the strength of the singular stress and strain field near the crack tip that is a measure of energy available for an increment of crack extension or the energy release rate. It is also referred as crack driving and extension force. This is computed from path independent integral in the neighbourhood of flaw tip which has the potential of the release of energy from the system per unit area extension of crack growth. J integral is useful in numerical calculation of stress intensity factors. The global energy line integral account for dynamic effect, time dependent material behavior including the inertial effect. It is applied to all categories of material response: elastic plastic, visco-plastic material for a better evaluation. The global integral permits accurate analysis possible for all deformation fields including very close proximity of crack tip. Fatigue crack growth analysis are developed to support economic fail safe and damage tolerance philosophies and the execution, effectuation of damage tolerance control procedures for the workings of structural systems.

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Identification of Employees through Radio Frequency Control using Arduino and RFID

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Abstract— RFID technology allows objects to be identified automatically, through radio frequency, transmitting their data to receivers located remotely, the automated identification technology that has a high adaptability for multiple and different applications, being for small monitoring to advanced remote monitoring, and can be applied in several professional areas, from the health area, educational areas that extends to the engineering area. In today's society, RFID technology is increasingly present in our daily lives, although its presence is imperceptible and unknown to most of its users. In the present dissertation the mentioned technology, characteristics, applications are presented, with the final objective of creating a device to identify employees and with data from their specific episodes. In this sense, a previous study of the technology and its main areas of application was carried out, having been fundamental the study of the already existing applications of RFID applied in the area of civil construction and in other sectors focused on the part of security work.

Keywords— RFID. Identification. Technology. Security Work.

I. INTRODUCTION

The need for information dissemination was responsible for advancing the development of communication in the course of human evolution. People have always had the urge to express themselves through communication, and initially, there was no technology for transmitting information remotely and in real time, they were through letters, carrier pigeons, ships and others.

Nowadays, with the technology on the rise to innovate in a competitive market, companies are looking for new technologies that facilitate the organizational process, people identification, work safety and communication with greater speed in the execution of processes.

Large companies find it difficult to monitor the flow of products in and out of their inventories, and employees in the company to make this control more effective, rotary and partial inventories are made, as well as manual points or digital points for daily control of employees. But even the inventories are not one hundred percent effective, nor are the automatic points entirely correct (INFOVAREJO, 2019).

Thus, the use of technology is a strong ally, which in recent times has been widely explored for facilitating the

professional's life, making the control of objects in a company more coherent (WOLDAYNSKY, 2010).

In the retail market, new technologies are being considered to replace the current standard of the bar code, for bringing specific information about each object individually, having an effective and real-time control (SOUZA, 2010).

Soon, the PPE (Personal Protective Equipment) is of paramount importance because it prevents accidents at work and thus also helps the Human Resources - HR sector (SAUDEEVIDA, 2017).

In order to aim for improvements in stock control and monitoring of safety equipment, companies are already using innovative means to manage the storage of products and the daily movement of people who work on site. One of the technologies that are currently used is RFID (Radio Frequency Identification) technology.

Thus, we implanted RFID cards on employee badges and with the help of a prototyping platform (Arduino) we monitored them. The equipment proposed here has as its main objective to control the flow of employees by means of radio frequency identification (RFID), using the Arduino software and hardware application. Thus, the prototype will show the PPE's that each employee will have in their possession, helping the Health and Safety sector in relation to PPE's, in addition to the HR sector in controlling employees.

The data collected through the RFID reader are analyzed using a spreadsheet, making it easier to monitor the electronic point at the entry and exit of the employee, mitigating their forgetfulness in "hitting the point", also helping in the control of PPE's that each employee will have in their possession. Thus we analyze the operation of RFID technology in real time, through the employees who arrive at the correct time at the workplace and make their due departures at the corresponding time.

II. METHODOLOGY

The research is applied, qualitative, descriptive and experimental, using indirect approach procedures through field tests.

This study was carried out at Instituto Presidente Antônio Carlos, located in the municipality of Porto Nacional - TO (ITPAC - Porto), located at a latitude of 10 $^{\circ}$ 41'42 " south and a longitude of 48 $^{\circ}$ 23'01 ' 'Oeste, Zona 22, about 60 km from the state capital, Palmas, as shown in Fig. 1 and Fig 2.



Fig. 1: Location of the municipality of Porto Nacional.



Fig. 2: Location of the Itpac- Porto Nacional FL

Five (5) RFID cards were inserted at random in the badges of building maintenance employees at the Presidente Antônio Carlos Institution - ITPAC / PORTO.

As this is an indirect approach, employees are not identified, but differentiated by numbers, from employee 1 to employee 5. Two tools will be combined, RFID cards and Arduino, in order to monitor the arrival and departure of the employee and his PPE's.

The prototype was developed to help mainly in the management of the employees' point and thus also to manage the use of their PPE's, which are facing major difficulties in the management and management of the use of safety equipment. This small unidentified flaw can lead to product losses and waste due to inadequate control, which also affects the HR sector, creating difficulties for this sector with regard to the arrival and departure of employees with clarity.

In order to subtract losses and assist technicians, radio frequency management known as RFID will be adopted, an efficient technology that is innovating the world, as it provides speed and security in the exchange of information between the reader device and its cards, providing technician management or the person in charge of the sector.

The use of an information system to manage, control the exit and entry, which was done with the Arduino software can be found on the Arduino IDE website, in conjunction with an RFID technology system to perform data collection from people, making the whole process more efficient and agile.

The equipment consists of making the network cable, thus taking the information collected by the reader. The instant the tag enters the reader's range, that is, in its magnetic field it will be energized, thus transmitting information. The Arduino tool, appropriates the data collected by the reader, the data that the employee is present and carrying the PPE's and transmits to the ethernet shild, which will inform itself with the network connected to it, looking for an address and ID, which is in the database.

Thus, this database will contain all the cards (RFID) registered by the researcher, and each card registered on the badge will pass to the Arduino monitor if the employee is present, showing free access. Monitoring the employee.

- o Read the RFID tag with the prototype;
- o Add the tag id number on the Arduino device;
- o Incorporate the tag id number into the database;

If the prototype card reader identifies a tag that is not cataloged on the device or in the database, it will inform that that RFID card was not registered on the equipment, sending the message "access denied", thus making the professional responsible, take the measures to catalog the employee in his spreadsheet, through a computer.

The cards that will be used are of the passive type, that is, this model does not contain a battery, and so its energy is fomented by the reader in question, so when the radio waves from the reader find the tag, they create an electromagnetic field from which they take energy of the reader, sending information to its own memory which has a lower cost (SANTINI, 2008).

The switching of data between the card and the reader is done through an electromagnetic field capture, which will have a range of 6 meters, when the label (card) comes into contact with the field in question, it stimulates the label and sends an analog signal to the reader, converting the signal to digital, so that you can read the data on the card.

Each RFID card has its own numbering where none is equal to another, thus corresponding to the type of equipment that is in place, its quantity and its monitoring.

The prototype will be installed in the area with the highest flow of employees entering and leaving, that is, close to the ITPAC guardhouse. The RFID reader, which is of low frequency, was installed close to the connection port, so that it can energize the RFID cards and read them, at a maximum distance of 6 meters.

For the operation of the same to be used a source, so as to have the power of the Arduino, together with the cabling and the pin which will be coupled on top of the Arduino for communication via network cable.

Arduino is an open-source platform for electronic prototyping (interactive process of creating software models that is part of the analysis of the life cycle of systems development in general) that is, open source, based on flexibility, being your hardware and software easy to handle. The product is intended for designers, hobbyists and anyone who wants to create something in an interactive environment (ARDUINO, 2012).

In this way, the safety equipment that is properly labeled and registered, showing the employee's name, safety equipment, and thus data collection is made, where the Arduino assigns the number read and does a search for the data on the server ARDUINO IDE.

The pinning was done as follows: SDA pin connected to Arduino port 10 - SCK pin connected to Arduino port 13 - MOSI pin connected to Arduino port 11 - MISO pin connected to Arduino port 12 - NC pin - Not connected -GND pin connected to Arduino GND pin - RST pin connected to Arduino port 9 - Pin 3.3 - connected to Arduino 3.3 V pin

If the employee leaves the company, in other words, when the card is disconnected, it will be collected and thus destroyed, as the card cannot be reused, the card data is unique, doing the same with the PPE.

From the assembly of our prototype, as shown in Fig 4, we used a 16×2 LCD Display, model HD44780. We replaced only pins 12 of Arduino Uno with pin 6, and 11 with 7, since they are already being used by the RFID reader. The potentiometer is used to control the LCD contrast, and a 10 K resistor was used in the circuit. To program the prototype, the Arduino IDE program was used, using the C ++ language, which is shown in Fig 5, (FILIPEFLOP, 2014).



Fig. 4: Mounting Rfid Reader with Arduino.

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72 conteudo.concat(String(mfrc522.uid.uidByte[i], HEX)); rfid 73 } 1 #include <SPI.h> 74 2 #include <MFRC522.h> 75 Serial.println(); 3 finclude <LiquidCrystal.h> 76 77 Serial.print("Mensagem : "); 5 #define SS PIN 10 78 6 #define RST_PIN 9 79 conteudo.toUpperCase(); 80 8 MFRC522 mfrc522(SS_PIN, RST_PIN); 81 if (conteudo.substring(1) == "A0 FF 19 2A") //UID 1 - Chaveiro 10 LiquidCrystal lcd(6, 7, 5, 4, 3, 2); 82 83 { 12 char st[20]; 84 Serial.println("Ola Gafanhoto !"); 13 85 14 void setup() 86 Serial.println(); 15 (87 16 88 lcd.clear(); 17 Serial.begin(9600); 89 18 SPI.begin(); 90 lcd.setCursor(0,0); 19 mfrc522.PCD_Init(); 91 20 92 lcd.print("Ola cartao !"); 21 Serial.println("Aproxime o seu cartao do leitor..."); 93 22 94 lcd.setCursor(0,1); 23 Serial.println(); 24 95 25 //Define o número de colunas e linhas do LCD: 96 lcd.print("Acesso liberado!"); 26 97 27 lcd.begin(16, 2); 98 delay(3000); 28 99 29 mensageminicial(); 100 mensageminicial(); 30 31 } 102 } 32 103 33 void loop() 104 if (conteudo.substring(1) == "E9 74 76 c2") //UID 2 - Cartao 34 105 35 (37 // Look for new cards 106 { 107 Serial.println("Ola chaveiro !"); 38 39 if (! mfrc522.PICC IsNewCardPresent()) 108 40 109 Serial.println(); 41 { 110 42 return: 111 lcd.clear(); 43 } 112 44 113 lcd.setCursor(0,0); 45 // Select one of the cards 114 46 115 lcd.print ("Ola Chaveiro !"); 47 if (! mfrc522.FICC ReadCardSerial()) 116 48 117 lcd.setCursor(0,1); 49 { 118 50 119 lcd.print ("Acesso Negado !"); 51 return: 120 52 53 } 121 delay(3000); 122 54 55 //Mostra UID na serial 123 mensageminicial(); 56 124 } 57 Serial.print("UID da tag :"); 125 58 126 } 59 String conteudo= ""; 127 void mensageminicial() 60 128 61 byte letra; 129 (62 130 63 for (byte i = 0; i < mfrc522.uid.size; i++) 131 lcd.clear(); 64 132 lcd.setCursor(0,0); 65 [66 Serial.print(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " ");</pre> 133 lcd.print (" Aproxime o seu"); 134 lcd.setCursor(0,1); 67 68 Serial.print (mfrc522.uid.uidByte[i], HEX); 135 lcd.print ("cartao do leitor"); 69 136 } 70 conteudo.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " "));</pre> Fig. 5: Arduino programming with Rfid reader. 71

III. RESULTS AND DISCUSSIONS

Therefore, with the programming done and the prototype working, we implanted it so that it could capture the electromagnetic waves of the employees' badges and identify their presence and their respective PPE's, the employee who is not registered or with problems at the point will be denied access according to Fig 6, the employee who is normalized and no pending will have access released as shown in Fig 7.



Fig. 6: Prototype accusing denial.



Fig. 7: Prototype accusing release.

After the installation and the prototype as shown in Fig. 8 and the implantation of the cards on the badges, we

monitored the entry and exit of the badges, thus verifying the veracity of the equipment functioning.



Fig. 8: Arduino e cartão.

With the data collected we can make a more accurate survey, thus bringing more practicality and fewer errors regarding the employees' days worked.

So the data is collected by network cable and placed in an Excel spreadsheet showing the employees who are using the badge and use the PPE, the table shown in Fig 9, the spreadsheet was assembled in an easy way using as five columns and six lines with the first line being the employee subdivisions, the type of epi used and whether he is allowed or denied access, making a change in color, if denied red if released green.

| Funcionario | EPI (BOTINA) | EPI (OCULOS) | LIBERADO | NEGADO |
|-------------|--------------|--------------|----------|--------|
| C1 | ОК | ОК | | |
| C2 | ОК | ОК | | |
| C3 | ОК | ОК | | |
| C4 | OK | ОК | | |
| C5 | ОК | ОК | | |

Fig. 9: Employee relationship using Badge and PPE.

According to Deys (2018) who implemented an Inventory Management System using Rfid Technology, using materials compatible with our work, we realized that it is a tool that brings benefits to the company helping in making future decisions.

IV. CONCLUSION

In view of the problem found, the management and control of employees' points was adopted through radio frequency identification, using RFID technology, a management model that can be implemented, from small to large companies. A tool a little more expensive than the method used today, but in the end it becomes very effective. Having as main objective the speed of the results.

With the data collected we can make a more accurate survey, thus bringing more practicality and fewer errors regarding the employees' days worked. Therefore, the implantation of the device makes the process of electronic entry and exit point greatly accelerated, as well as assists in the verification of the use of PPE by the employee, assisting the HR and workplace safety sector. The challenge of using robotics software was faced, which we managed to obtain good results, which was proposed, which is to identify employees through RFID.

The present work proposes future research, so I leave as a contribution the material and the prototyping model, develop a real-time monitoring prototype using a mobile application, thus bringing together RFID, Arduino and the app, in order to accelerate the model even more already proposed with numerous improvements.

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Physical-Chemical Characterization of Fermented Coconut Water (*Cocos nucifera L*)

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Abstract— This study was carried out with the objective aimed to characterize the physical and chemical composition of coconut water produced by 1 yeast strain selected from 3 strains isolated from farms that produces sugar cane spirit in the region of origin in the city of Salinas, MG. Physical and chemical analyzes were made, determining total acidity and alcohol content, acetic acid, higher alcohols, acetaldehyde, furfural, ethyl lactate, methanol and ethyl acetate. Due to the lack of studies on the fermented coconut water and being a new product, the test results were compared with the parameters found in the literature of wine and other fermented fruits, noting that the results are similar. The LBCM 678 strain showed the best performance among the others strains being selected for the final fermentation and to chemically characterize the fermented coconut water. The results were: Acetaldehyde 0.23 ± 0.015 mg/100mL, Ethyl acetate- 5.02 ± 0.068 mg/100 mL, methanol 0.37 ± 0.01 mg/100mL, higher alcohols- 4.64 ± 0.046 mg/100mL, furfural and ethyl lactate were not detected in the detection limits of the equipment, volatile acidity, -4.3 ± 0.2 mg/100mL and ethanol content- 9.83 ± 0.25 °GL.

Keywords— selected yeasts; alcoholic fermentation; physicochemical analysis.

Caracterização Físico-Química de Fermentado de Água-De-Coco (*Cocos nucifera L*)

Resumo Este estudo foi realizado com o objetivo caracterizar a a composição físico-química do fermentado de água de coco produzido por 1 cepa de levedura selecionada dentre 3 cepas (LBCM 671, 676 e 678) isoladas de fazendas produtoras de cachaça na região da indicação de procedência da aguardente de cana do tipo cachaça de Salinas. Foram feitas análises físico-químicas, determinando acidez total e teor alcoólico, ácido acético, álcoois superiores, acetaldeído, furfural, lactato de etila, metanol e acetato de etila como parâmetros para seleção da melhor cepa. Devido à escassez de estudos sobre o fermentado de água de coco e por ser um produto novo, os resultados das análises foram comparados com os parâmetros encontrados na literatura sobre vinho e outros fermentados de mostos de frutas, notando que os resultados encontrados são similares. A cepa LBCM 678 foi a que apresentou melhor desempenho fermentativo dentre as demais sendo selecionada para a fermentação final e para se caracterizar quimicamente o fermentado de água de coco. Os resultados encontrados foram: acetaldeído- $0,23\pm0,015$ mg/100mL, acetato e etila- $5,02\pm0,068$ mg/100mL, metanol- $0,37\pm0,01$ mg/100mL, alcoois superiores- $4,64\pm0,046$ mg/100mL, furfural e lactato de etila não foram detectados nos limites de detecção do equipamento, acidez volátil- $4,3\pm0,2$ mg/100mL e teor alcoolico- $9,83\pm0,25$ GL.

Palavras-Chave— leveduras selecionadas; fermentação alcoólica; análises físico-químicas.

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I. INTRODUCTION

Coconut (Cocos nucifera) is a member of the family *Arecaceae* (palm family) and the only species of the genus Cocos. It is an agricultural and livelihood crop for many people in Southeast Asia, the Pacific region, Africa and some countries in Latin America. Often named 'tree of life' because of its versatility, coconut is a vital multipurpose crop grown throughout the tropical regions of the world. Coconut palms can grow in fragile environments and poor quality soil, where few alternative crops would thrive. Nearly one third of the world's population depend on coconut as their source of food and their economy (C. ODURO-YEBOAH et al., 2020).

In Brazil, coconut cultivation develops mainly along the coast, being found in areas from the state of *Pará to Espírito Santo* (FONTENELE, 2005). Current statistics show that Brazil has more than 280 thousand hectares implanted with the crop, practically in almost all the Units of the Federation (1.8 billion fruits) (IBGE, 2019).

The industrial use of the coconut fruit occurs through the processing of solid or albumen dried (copra) or fresh endosperm, the latter most used in Brazil, being used in the manufacture of products such as coconut milk and grated coconut , employed in the food industry of sweets, cakes, chocolates, chocolates, etc., or used "in natura" in domestic cooking. A more recent and rapidly expanding type of processing is the extraction and bottling of coconut water (liquid endosperm) through the application of processing and conservation technologies (PRADES, et al., 2012).

As it easily deteriorates once exposed to the air, most of the coconut water is consumed in its natural form in the areas where it is produced. Coconut water is commercially processed using ultra high temperature technology. However, it loses its delicate fresh flavor and some of its nutrients during heating (KAILAKU et al., 2017), so would be desirable a non-thermal process to protect the fresh flavor and nutrient content of coconut water (GAUTAM et al., 2017).

In general, coconut water is sold within the fruit itself, where it is sterile. Coconut water is the liquid from the endosperm found inside the coconut cavity that begins to form around 2 months after the natural opening of the inflorescence (LIMA, 2013). According to research, coconut water corresponds to 25% of the weight of the fruit, and its basic composition is 95.5% water, 4% carbohydrates, 0.1% fat, 0.02% calcium, 0.01% phosphorus, 0.5% iron, in addition to amino acids, vitamin C, B vitamins and minerals (KAILAKU et al., 2017). According to the Brazilian Legislation, in its Decree 6,871 of June 4, 2009, which regulates Law No. 8,918, of July 14, 1994, which provides for standardization, classification, registration, inspection, production and inspection of drinks, (article 49) Fermented with coconut water is the beverage with alcoholic content of four to fourteen percent by volume, at twenty degrees Celsius, obtained from the must of fermented coconut water (BRASIL, 2009).

The yeasts used in the manufacture of alcoholic beverages are generally strains of Saccharomyces cerevisiae. In spontaneous fermentations, a large number of species may be involved, with predominance of Saccharomyces cerevisiae. The fermentation process carried out with selected yeast strains has the advantages of favoring the faster start of the process, avoiding contamination risks presented by fermentation, faster and more uniform fermentation rates, greater yield and quality of the resulting product and eliminating variations in the bouquet of the drink (BARBOSA, 2013).

The chemical, physical-chemical and organoleptic characteristics of fermented beverages depend on several factors involved, especially in the fermentation process due to the metabolites produced by yeasts (GRANATO et al., 2014). The importance of metabolites, higher alcohols and esters mainly produced by yeasts during fermentation is reported by Souza et al., (2012) and Vidal et al., (2013). Most of the published works have focused on the use of selected *Saccharomyces cerevisiae* to produce fermented drinks (GONÇALVES, 2015).

Until now, there is few studies in which alternative forms of conservation or trans-formation are proposed. Consumers demand foods that, in addition to satisfying the taste, are healthy or contribute to their health, this demand can be covered by the so-called functional foods, hence the interest in the development of products through fermentation since these foods and Its component shave many possible health benefits (MELINI et al., 2019). Fermented foods can be produced with simple economic ingredients and techniques, and can contribute significantly to the human diet, especially in rural home sand communities in villages around the world.

This study was carried out with the objective aimed to characterize was to promote the fermentation of coconut water using 3 different strains of yeasts selected from 18 strains isolated from farms producing cachaça in the region of the indication of origin of cachaça cane spirit for the production of coconut water fermented and obtain the chemical characterization of the fermented coconut water produced using HPLC, GC-FID, GC-MS.

II. MATERIAL AND METHODS

Fermentations were carried out using the LBCM 671, 676 and 678 strains selected in a previous study (BARBOSA, 2013) belonging to the collection of the Microbiology Laboratory of the Federal Institute of Northern Minas Gerais-*Campus* Salinas.

Green coconuts were used, which were washed with neutral detergent and sanitized with chlorinated solution (100 mgL⁻¹/15min/pH 6.8) (ROSA and ABREU, 2000). After sanitation, the coconuts were rinsed with good quality drinking water, containing an active chlorine concentration of around 0.5 mgL⁻¹. The water was extracted, the Brix degree was measured and the amount of glucose to be added was calculated so that the must reached the total soluble solids concentration of 16° Brix measured with the aid of an Atago PAL 1 digital refractometer.

The strains of S. cerevisiae previously kept in YPD+20% glycerol at -80°C were reactivated and cultured in YPD medium (1% yeast extract, 2% peptone, and 2% glucose). The inoculants were obtained according to Duarte et al., (2010). After reactivation in 1mL of YPD, the inoculums were transferred to increasing volumes up to 1 L. From this point, every 24 h, the cells obtained were removed from the flask in sterile water and stored at 4°C; a small amount (10%) was left in the flask and fed back with sterile YPD broth. This process was repeated for 3 days until sufficient cells were obtained for the inoculum. Viability and population counts of yeasts were determined using Neubauer Chamber by staining with methylene blue and microscopic analysis. The inoculum composed of 4.92x10⁸ cells/mL of strain 671, 1.40x10⁸ cells/mL of strain 676 and 2.4x108 cells/mL of strain 678 were used to ferment batches of 1 L of coconut water at 16 ° Brix. autoclaved (121°C, 20 min). The pH of the wort was measured at 25 ° C, using a pot of the brand Digimed, model DM-20, obtaining the value of 5.5. To avoid cell stress of yeast strains, fermentation was carried out using the fed batch method. The fermentation process was started using 0.4 L of sterile coconut water for each inoculum. After that, the Brix degree was monitored every 1 h and, when the must reached 3°Brix, 0.15 L of sterilized coconut water was added. This procedure was repeated 4 times until the volume of the vats was completed to 1 L. This point was considered as the initial fermentation time (T0). During the fermentation process, 3 consecutive triplicate fermentations were carried out for each strain and the vats were kept in a shaker incubator at 28°C until the Brix degree value stabilized in the interval between 0.0-0.5, which was defined as the standard to determine the end of fermentation after approximately 24 h (T24). The useful

The parameters described below were analyzed in the fermented coconut water in order to chemically characterize the produced drink. For the determination of the alcoholic degree of the fermented (% v/v), at 20°C and the acidity in mg/100 mL, an electronic distiller (Super DDE by Gibertini) was used. The alcoholic degree was determined based on the alcohol separation of the sample, by distillation, and its subsequent measurement on the electronic densimeter (ANTON PAAR brand model DMA 35A). And acidity by titrometry, with 0.01 mol/L sodium hydroxide solution, according to the standards of ABNT (1997), Brazil 2005. All samples were analyzed in duplicate. Ethanol and acetic acid were determined in the fermented by HPLC. Before HPLC and GC-FID analyzes, the samples were filtered through a milipore filter with an opening of 0.22 µm. The main major volatile compounds were analyzed by GC-FID according to Duarte et al. (2011). The determination of acetaldehyde, ethyl acetate, methanol, furfural and higher alcohols were performed by gas chromatography, Agilent gas chromatograph, with flame ionization detector, using a 60 m, 0.25 capillary polyethylene glycol (Supelco) column mm internal diameter and 0.25 µm film thickness. The chromatographic conditions were as follows: injector temperature equal to 225°C, detector temperature equal to 280°C; flow of carrier gas (helium) 30 mL/min .; flow of gases in the detector, hydrogen 30 mL/min. and synthetic air 300 mL/min. and split rate equal to 30. The temperature programming of the column oven, during the chromatographic analysis, was initially at 50 ° C for 6 minutes and then was raised to 100°C, at a ramp of 15° C/min., up to 190°C (standards) and 250°C (samples) for 2 min., at a ramp of 20°C/min. The injected volume was 2.0 µL of the distillate. The injections were performed in triplicate (SOUZA, 2010). То perform the chromatographic analyzes it was necessary to perform a standard curve, using the patterns of the investigated substances, in different concentrations. The following standards (Merck) were used: isoamyl acetate (HPLC grade), isoamyl alcohol (PA grade), ethanol (PA grade), ethyl acetate (PA grade), methanol (PA grade), 1-propanol (PA grade)), acetaldehyde (grade PA), isobutanol (grade PA) and furfural (grade PA). Such standards were prepared in 40% v/v alcoholic solution (HPLC-Fisher Scientific grade ethyl alcohol and deionized distilled water. Using the peak areas of these standards associated with the peak areas of the internal standard used (n-pentanol-2.5%), an index was obtained associated with the standard concentration used, based on these two parameters

(standard concentration x standard substance area/internal standard area ratio), the linear regression equation of the graph was obtained and the quantity of each compound of each sample was determined.

III. RESULTS AND DISCUSSION

For all strains tested, the same fermentation conditions were adopted. The 3 strains studied showed the same behavior for the consumption of soluble solids, per hour, because the higher the consumption, the better the performance of the yeast.

The strains showed a high consumption of soluble solids, thus showing a high fermentative performance. The strains were subjected to 10 days of conducting the experiment, where the strains had 10 fermentative cycles.



Fig.1 - Evaluation of the consumption of soluble solids. Average consumption of soluble solids

The alcoholic levels and the concentration of acetic acid obtained for the fermented are shown in Figure 2. These criteria are directly linked to the production yield. The strains showed excellent performance, but did not differ. The alcoholic levels of the samples showed average values between 8.10 and 9.20% v/v, which can increase in systems with greater efficiency and fermentation control (BARBOSA, 2013). Yeast ethanol production is usually in the range of 5% to 10% v/v (LIMA, 2013), whose variation in concentration was observed in the present study as well as in other works found in literature. Barbosa (2013) carried out 15 fermentations of sugarcane juice, using selected yeasts and found values of alcohol content ranging between 7.25 and 8.9% v/v. The averages of ethanol production at the end of fermentation showed significant differences (p<0.05) only for the LBCM 678 strain in relation to the LBCM 671 and 676 strains, which did not differ between them.

Liang et al. (2020) studied three different varieties of Hong Qu wine fermentation starters, and found significant differences in alcohol content. Some organic acids excreted in the fermentation medium are derived from intermediate pathways, such as acetic, malic and succinic (TAVARES, 2009). Acetic acid, which is the organic acid predominantly excreted in the growth medium, is produced by oxidation of acetaldehyde, with removal of hydrogen, in the reaction opposite to the normal reduction of acetaldehyde to ethanol (JANZANTTI, 2004).

Acetic acid is quantitatively predominant and its concentration varies from 60% to 95% of the total acidity. The excess of acidity promotes an undesired and slightly "aggressive" flavor in sugarcane spirit, depreciating the quality of the DRINK (PINHEIRO, 2010). The proportions of acids in alcoholic beverages are largely determined by the yeast lineage and fermentation conditions and, to a lesser extent, by the substrate used (MISHINA, GOMES, MORAIS, 2016). *S. cerevisae* in the presence of oxygen can convert up to 30% of the wort sugar into acetic acid (RAMOS, 2015).

Regarding the total acidity of the fermented, the 3 strains studied did not differ statistically from each other,

thus showing the same behavior in the fermentation process. As can be seen in Figure 2. According to data in the literature, there is a positive correlation between the wine's increasing acidity and the concentration of bacteria in the must, just as there is a negative correlation of these with alcoholic yield.



Fig.2 - Evaluation of the alcoholic content and acidity of the fermented. Average alcohol content of the fermentate expressed in % (v/v) and total acidity of the wine expressed in g of acetic acid/100mL of the fermented.

Acetaldehyde is a compound that reduces the quality of beverages and, when ingested, interferes with the central nervous system, so it is important to quantify it, and its concentration should be kept to a minimum. Aldehydes are common in the initial fermentation process, tending to disappear at the end. The cause of the excess of aldehydes in the drinks can be an indication of spontaneous oxidation (ROSCA et al., 2016).

Volatile esters are responsible for the fruity aroma of fermented drinks and consequently constitute a vital group of desirable aromatic compounds in beers and wines (VIEIRA, 2016).

 Table 1- Volatile compounds (mg/100 mL of anhydrous alcohol) in fermented products obtained by the 3 different yeast strains produced on a laboratory scale (1 liter).

| Strain | Acetaldehyde | Ethyl Acetate | Methanol | Superior Alcohols | Furfural | Ethyl Lactate |
|---------------|--------------|------------------|----------|----------------------|----------|------------------|
| 671(mg/100mL) | 2,2 | 4,10 | nd | 29,6 | nd | nd |
| 676(mg/100mL) | 1,8 | 3,80 | nd | 32,75 | nd | nd |
| 678(mg/100mL) | 1,2 | 4,60 | nd | 37,38 | nd | nd |

nd - not detected within the device's detection limit

Higher alcohols and esters are compounds present in fermented drinks that are incorporated into the flavor and aroma of the drink. These compounds are present in small amounts, but enough to offer characteristics specific to the fermented drink (SILVA, 2016).

The reduction in the acid content is relevant due to its effect on the acidity of the drink. According to Cisilotto

(2017), acidity can significantly and negatively influence the sensory quality of fermented drinks.

Most esters are made up of ethyl esters, formed during fermentation and distilled along with ethanol. These reactions occur because ethanol can react with acids derived from pyruvic acid, such as lactic and acetic acid, as well as short chain organic acids (butyric, capric, caprylic, capric and lauric) (MISHINA, GOMES, MORAIS, 2016). Several factors interfere in the synthesis of esters, such as the yeast strain, the composition of the medium, aeration (inhibits the formation of esters) and temperature. The main ester of cachaça is ethyl acetate, which in small concentrations incorporates a fruit aroma into the drink, which is desirable and pleasant. In excessive amounts, however, it gives an undesirable and sickening aroma (RIBEIRO, 2016).

Regarding the esters, an average content of the reference compound (ethyl acetate) of 4.4 mg.100mL⁻¹ was found (SOUZA et al., 2012).

As for total upper alcohols, the concentration range ranged from 27.16 to 37.38 mg.100mL⁻¹.

Regarding methanol levels (mg100 mL⁻¹), they were not detected within the detection limit of the device.

Aromatic compounds play an important role in the aroma and flavor of alcoholic beverages derived from fermentations performed by yeasts, thus contributing to the acceptance or not of the product by the consumer market (SOUZA, 2010). Thus, the 3 strains selected for the production of fermented coconut water, lines 671, 676 and 678, were evaluated for possible differences in the production of n-propanol, isobutyl alcohol and isoamyl alcohol, as well as the production of acetate esters. ethyl, isoamyl acetate, ethyl hexanoate, ethyl octanoate and ethyl decanoate. As can be seen, the 3 strains had the same formation profile.

Volatile esters are responsible for the fruity aroma of fermented drinks and consequently constitute a vital group of desirable aromatic compounds in beers and wines. The ethyl acetate analyzed showed a difference in the fermentative kinetics of strain 678.

In the laboratory scale fermentation study, of the lines analyzed LBCM: 671, 676, 678, the line LBCM 678 showed better fermentative performance and physicalchemical parameters according to the discussion above and with the analyzes made and presented in Figure 3.



Fig.3 - Evaluation of fermentative parameters

Thus, the LBCM 678 strain was used to chemically characterize the fermented coconut water. Samples from a triplicate fermentation were analyzed. The results are shown in Table 2.

Table 2 - Volatile compounds (mg/100 mL anhydrous alcohol) in the fermentation obtained by strain LBCM 678.

| Strain | Acetaldehyde (mg/ 100mL) | Ethyl Acetate (mg/ 100mL) | Methanol (mg/ 100mL) | Higher alcohols (mg/ 100 mL) | Furfural (mg/ 100mL) | Ethyl Lactate (mg/ 100mL) | Acidity g acetic (acetic/ 100mL) ferm. | Alcohol content (%v/v) |
|-------------|-----------------------------|------------------------------------|----------------------------|---------------------------------------|----------------------------|------------------------------------|--|------------------------------|
| LBCM 678 | 0,23±0,01 | 5,0±0,06 | 0,37±0,01 | 4,64±0,04 | nd | nd | 4,3±0,2 | 9,80±0,25 |

nd - not detected within the device's detection limit

The analysis of volatile components (acetaldehyde, ethyl acetate), methanol, ethanol, higher alcohols (1-propanol, isobutanol, amyl and isoamyl) and total acidity are parameters to check if the product's characteristics are within the limits established by legislation Brazilian.

According to the physical-chemical analyzes it was observed that compounds that depreciate the quality of the fermentate such as acetaldehyde, furfural, methanol and ethyl lactate were well below the limits established by Brazilian legislation. While the compounds that show the quality, such as ethyl acetate and higher alcohols, showed high values in comparison with other fermented fruits, however within the limits of the current legislation (BRASIL, 2005).

As for the content of ethyl alcohol (9.80°GL), expressed in% of ethanol in volume at 20 $^{\circ}$ C, it appears that the fermented produced is within the limits established by the Brazilian legislation on drinks, that is, Article 72 of the Section 2 of Decree No. 2,314, of September 4, 1997 and for Brazil (2005).

The high production of total acidity gives the product an unpleasant vinegar taste. The total acidity of the wine must be in the range of 3.3 to 7.8 g/L (TORRES NETO et al., 2006). It was found that the fermented had a concentration of 4.30 g/L. This value is similar to that reported by Duarte et al., (2011), endorsing the greater capacity of acetic acid production by pure S. cerevisiae. The reduction in the acetic acid content is relevant due to its effect on the acidity of the drink.

In the beverage industry, it is important to know the concentrations of acetaldehyde, as it has a central role in the manifestation of alcohol intoxication. Brazilian law allows the following maximum values of total aldehydes in distilled beverages, expressed in acetaldehyde/100 mL of anhydrous ethanol: brandy 30.0 mg/100 mL, cognac 40.0 mg/100 mL, rasp 80.0 mg/100 mL, simple grape distillate 40.0 g/100 mL, pisco 200.0 mg/100 mL (BRASIL, 2005).

Generally, the cachaça produced by selected yeasts showed higher concentrations of desirable volatile compounds. The main volatile compounds were identified by GC-FID (Table 2).

Concentrations between 50 to 80 mg/L contribute to the product's aroma (RIBEIRO, 2014). Ethyl acetate was found in the fermented coconut water at a concentration of 50.00 mg/L, which provides a positive impact on the quality of the drink (SOUZA et al., 2012). This result is in line with those reported by Erten and Tanguler (2010), which shows the ability of yeasts to improve the production of ethyl acetate. The high concentration of ethyl acetate found in fermentates produced by inoculation of selected yeasts, probably occurs because of its β -glycosidase activity (GAENSLY, 2016).

The presence of higher alcohols is associated with "alcoholic aroma" and its production by different strains of S. cerevisiae was reported by Araújo (2018). These higher alcohols are fundamental to the taste and aroma of the drink.

The maximum concentration established by Brazilian legislation for higher alcohols is 4500 mg/L of anhydrous alcohol (LEITE et al., 2013). Table 2 shows that the maximum was 46.40 mg/L. Thus, the product did not exceed the maximum allowed limit for the sum of the higher alcohols in the fermented product.

Acetaldehyde represents about 90% of the total concentration of wine aldehydes and wine distillates and is a product of the oxidation of ethanol (CORRÊA, 2015). It can be seen that the fermented coconut water has a concentration of 2.30 ± 0.01 mg/L of acetaldehyde. White wines or similar products, such as the fermented coconut water, which have a concentration above 700 mg/L of anhydrous alcohol indicate that the fermented wine was subjected to aeration (aerated or oxidized) or to high doses of sulfitation of the must before alcoholic fermentation. The results show that the fermented coconut water has a concentration much lower than 700 mg/L of acetaldehyde, since it has not undergone any treatment such as aeration and sulfitation of the must.

Among the analyzed constituents, methanol is emphasized as one of the most important, as its production is undesirable and if it occurs, it should not exceed the limit of 35 mg/100 mL of the drink or 500 mg of methanol/100 mL of anhydrous alcohol (OLIVEIRA, 2016). As can be seen in Table 2, the methanol value was lower than the maximum allowed, which demonstrates that the removal of pectin from the must was quite efficient, because in the alcoholic fermentation process, methanol is formed by the degradation of pectin, a polysaccharide present in coconut water (ALVES, 2017).

Furanic aldehydes, furfural (F) and 5hydroxymethyl-furfural (HMF) are compounds formed during non-enzymatic browning reactions in food. The toxicity of these furan compounds in humans is not well known, with the exception of furfural, for which the IDLH ("Imediately Dangerous to Life or Health Air Concentration") value, which is 100.00 ppm, is already established. The literature suggests that prolonged or repetitive contact with furfural may cause dermatitis, irritation of the mucosa and respiratory tract, in addition to affecting the central nervous system. Both (F) and (HMF) can be considered indicators of food and beverage degradation, when found in large concentrations (WEBER, 2017). Furfural was not detected within the device's detection limit in coconut water fermentation.

The physical-chemical analyzes showed that the fermented coconut water has qualities comparable to other fermented fruits, such as cashew, orange, and wines produced from grapes.

IV. CONCLUSIONS

The S. Cerevisiae LBCM 678 strain positively influenced the final quality of the fermented coconut water producing: higher levels of desirable compounds, such as esters and higher alcohols, lower volatile acidity, higher concentration of ethanol and lower concentration of acetaldehyde and methanol.

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Medical devices for self-help management: the case of stroke rehabilitation

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Abstract— Introduction: Self-help devices (SHD) have been used as an alternative to conventional treatment for post stroke rehabilitation. This review aims to look for evidence that a stroke survivor may have increased muscle strength with the use of SHD. Methods: This article was conducted according to PRISMA, a statistical tool (state of the art by systematic review) and previously registered in PROSPERO (international prospective registry of systematic reviews) under number CRD42018091424. Studies addressing the use of SHD and its effect on muscle strength in stroke patients were included. The studies were read, selected and their metadata extracted. A Downs & Black scale was used to assess methodological quality. Results: 41 publications were analyzed, of which only three met the proposed inclusion criteria. Two articles showed positive results in strength gain using SHD. One study presented a decrease in the mean reaching forces when compared to the intervention groups (subacute and chronic with assistance to grip) and controls but SHD assisted in performing the activity. Conclusion: Studies using SHD suggest muscle strength improvement in stroke patients.

Keywords— Stroke, self-help devices, strength, systematic review, assistive technology, assistive devices.

I. INTRODUCTION

Stroke is the second main death cause, leading to 11.8% death causes on the planet, and the third leading disability sake in the world[1]. In addition, it generates a high social burden and generates high costs for health systems[2]. This disease is characterized by a cerebrovascular malfunction, ischemic or hemorrhagic, that can result in deficiency of balance and gait, aphasia, dysphagia, intestinal and voiding dysfunction, depression, altered cognition and generalized muscular weakness[3].

The muscle weakness after stroke is a result of affected area neural hypofunction, followed by reducing muscle activity, tissue histochemical changes, and spasticity[4,5]. If it persists, it may progress to function loss and immobility[6]. Recent studies have highlighted the rehabilitation role in improving strength and complications after stroke [7–9]. During rehabilitation some tools can be used to increase treatment such as self-help devices (SHD).

SHD can be defined as any item, piece of equipment, software program or system that is used to increase, maintain or improve the functionality of people with any type of disability[10]. They are part of a growing area of study with multiple applications that promotes greater acceptance by the patient and transforms current health care delivery models [11,12]. Studies suggest the efficacy of SHD in improving upper limb motor function, gait and aphasia, after stroke episode[8,13,14]. Their association with conventional therapy has been the object of study by researchers[15]. However, the effect of SHD on strength in patients with stroke was not elucidated. Provision of home-care, instant feedback and patient entertainment are SHD characteristics that give greater incentive and decrease patient frustration[11,16]. In addition, Bendixen et al (2009) demonstrated that the use of SHD can reduce treatment costs by up to 46% when compared to conventional treatment[17]. The objective is to review studies that

evaluate muscle strength in patients who had had a stroke and underwent SHD.

II. METHODS

This systematic review was performed according to the items established by the PRISMA (Preferred Reporting Items for systematic Reviews) guide[18] of the main items that a systematic review should contain. Previously, a review protocol was drawn up, which included the research strategy, methods and eligibility criteria (inclusion and exclusion). The StArt tool (State of the Art through Systematic Review v.2.3.4.2), developed by the team of the Software Engineering Research Laboratory of UFSCar, was used to conduct the systematic review, and the analysis and selection of the studies were performed by the program. This tool has been used in other reviews[19–21].

Search strategy and eligibility criteria

The descriptors of the MeSH (Medical Subject Headings) were used: "Self-help devices" (which includes the terms Assistive Technology and Assistive Devices), "Stroke" and "Strength". The Boolean operator used was AND and OR and searches were performed from January to March 2018. The electronic databases consulted were: PubMed, Clinical trials, IEEE, Scopus and Web of Science, searching studies that addressed the use of ShD in individuals who had stroke. An unlimited search was performed using the terms: stroke* OR strenght* OR Self-help devices* OR Assistive Technology OR Assistive Devices

Only studies in the English language, which included Self-help devices were included in this review. There was no restriction of design and study period. The PICO strategy (Population, Intervention, Control and Outcomes) was used. The inclusion and exclusion criteria for assessing the eligibility of the studies are described in Table I.

| Table I Criteria for eligibility (inclusion and exclusion) of |
|---|
| articles for systematic review |

| Criteriacateg ory | Inclusion | Exclusion |
|----------------------|--|--|
| Population | Men and women, adults and the el- derly, after is- chemic or hemor- rhagic stroke. | Men and women, adults and the el- derly, with other diseases associated with stroke. |
| Intervention | Use of assistive technology as a therapeutic pro- posal. | Association of con- ventional therapy (therapeutic exer- |

| | | cises, mechano- therapy, etc.) to as- sistive technology, throughout the in- |
|----------|---|---|
| | | tervention period. |
| Variable | Studies that evalu- ated muscle strength. | - |

The reviewers (P.A.F.M. and N.A.M.V.) independently conducted database searches as well as analyzed the title and summary of articles collected and identified, from the eligibility criteria, the potential studies for this review. The results were compared and, in the event of any disagreement, a consensus was reached. If agreement was reached, they would proceed to the next step, which included reading the full text of the selected articles to certify that they met the eligibility criteria. This step was also performed by the two reviewers separately and, subsequently, consensus was achieved. The studies that did not meet the proposed criteria were excluded with justification. All disagreements were evaluated by a third reviewer (J.C.T.R.).

This study was previously International Prospective Register of Systematic Reviews and Metaanalyzes (PROSPERO) under the number CRD42018091424.

Evaluation of methodological quality and data extraction

The evaluation was performed by two independent authors (P.A.F.M and E.D.S.S.), and a third author (J.C.T.R.) to resolve any disagreement. The articles included in this review had their methodological quality assessed by the Downs & Black instrument[22]. This tool evaluates the delineation of articles from five sub scales: reporting quality, internal validity (bias and confounding), external validity and the ability to detect significant effect of the study (power). This study used the version of 27 yes or no questions, the first 26 being scored a point (1) for yes and zero point (0) for no, except for the fifth question of maximum score two points (2) and the last question item that is scored from zero to five (5) points according to the significant effect of the study. The selected studies had their data extracted: general characteristics (Author, Year and Country), Population, Intervention, Evaluation method, information about SHD used and Results. The metadata were extracted by two independent investigators (P.A.F.M.).

III. RESULTS

The literature review identified 41 abstracts and after the withdrawal of the duplicate studies, the application of the inclusion and exclusion criteria during the reading of the titles, abstract and later the full text participated in this

review 3 studies, two before and after design type and a clinical trial design type in the English language. Figure 1 shows the study flow diagram (PRISMA):



Fig.1: Study flow diagram (PRISMA)

The studies evaluated had low scores for external validity, power and confounding, and median score for bias. All studies had high scores for reporting quality. The evaluation results of the methodological quality of the included studies are shown in table II:

| Author, Year and Country | Population | Intervention | Self-help Devicesemployed | Evaluation method | Results |
|---------------------------------|---|---|---|---------------------------|-----------------------|
| Lambercy, 2011, Singapore | n = 15 (7 men) Age (mean in years ± standard error of the mean) = 55.5 ± 14.6 Chronicity (mean in days ± standard error of the mean) = 597.5 ± 294.1 Patients lost = 2 (cause: fall and ADHD/depression) | Robot-assisted fingers gripping/extension and pronation/supination exercises in 18 one- hour sessions for 6 weeks associated with conventional therapy (Occupational Therapy) from 6 to 12 weeks. | Haptic Knobis a robotic orthosis with two degrees of freedom for grip training. | Jamar grip dynamometer | Improved hand grip |

Table II Methodological quality evaluation of the reviewed studies

| Thielbar, 2016, USA | n = 23 Age (mean in years \pm standard error of the mean) = VAEDA (61 \pm 12); sem VAEDA (56 \pm 10) Chronicity (mean in months \pm standard error of the mean) = VAEDA (95 \pm 114); without VAEDA (46 \pm 47) Patients lost = 1 (cause: no related) | Task oriented protocol with or without the VAEDA in 18 one-hour sessions for 6 weeks. | VAEDA is a glove driven by voice and electromyography, which performs finger extension and imposes resistance to finger flexion. | Jamar grip dynamometer | Improved hand grip |
|------------------------------|---|---|--|---------------------------|----------------------------------|
| Ziherl, 2010, Slovenia | n = Sub acute (23); Chronic (10) Age (mean in years \pm standard error of the mean) = Sub acute (51,0 \pm 13,3); Chronic (45,6 \pm 13,0) Patientslost = 0 | Robot-assisted take- and-place exercise with the same assistance for 6 minutes of workout per workout session. | Virtual reality game for all groups and the Haptic Master robot with a rotational degree of freedom and two degrees of translational freedom. | Final effector sensor | no improvement in handgrip |

Characteristics such as year of publication, country of origin and sample are summarized in table III and the results of the articles in Figure 2:

| | Reporting (11) | External Validity (3) | Bias (7) | Confounding (6) | Power (5) | Total (32) |
|----------|-------------------|-----------------------------|-------------|--------------------|--------------|---------------|
| Lambercy | 8 | 0 | 5 | 1 | 0 | 14 |
| Thielbar | 8 | 0 | 4 | 3 | 0 | 15 |
| Ziherl | 8 | 0 | 3 | 1 | 0 | 12 |

Table III Data extracted from articles selected for review.

Two studies included [23,24] presented positive effects for muscle strength , one study showed an increase in muscle strength for palmar grip at the end of treatment (Week 6) and both showed an increase in the follow-up period (Week 10 and 12) when compared to the previous intervention period (Week 0). However, there was no statistically significant difference between the periods, p = 0.637[24] and p =0.307 [23] for grip strength. With reevaluation in the posttreatment follow-up period, there was a decrease in the mean strength compared to the final period of therapy, also without significant statistical differences.

The third study[25] presented a decrease in the mean reaching forces to be arrested when compared to the intervention groups (subacute and chronic with assistance to grip) and controls (control, subacute and chronic without assistance to grip), and the group had negative mean values, which means SHD assists in performing the activity. The study presented a significant difference between the groups without assistance to grip (subacute, chronic and control), with p = 0.004 for subacute and p = 0.003 for chronic.



Fig.2 Studies results included to review. A) Analysis of palmar grip strength (%) from results obtained in the Lambercy (2011) study. The force is presented in relative value between the impaired and unimpaired hand. It presents value of p = 0.307 between the periods. B) Analysis of palmar grip strength (N) from the results obtained in the Thielbar (2016) study. It presents a value of p = 0.637 between the periods. C) Analysis of the mean grip strength \pm SEM (N) from results obtained in the Ziherl (2010) study. It presents a value of p = 0.004 (*) between the subacute group without assistance and control, p = 0.003 (#) between the chronic group without assistance and control.

IV. DISCUSSION

This study is the first review to evaluate the effect of SHD on muscle strength in stroke survivors. Two revised studies presented a positive effect on improving muscle strength [23,24]. A third study had negative mean grip strength values, although SHD assisted in performing the activity [25]. The results suggest an increase in muscle strength in surviving stroke patients undergoing SHD. Importantly, the study in which there was no increase in muscle strength assumed that the SHD used accommodated the subjects and let the assistants do the movement without making any effort [25]. Regarding the positive effects studies, they present results that demonstrated increased muscle strength in the ten and twelve-week follow-up period compared to the pretreatment period (week 0), but with no statistically significant difference.

Hand grip strength is indicated as an important variable for cardiovascular disease monitoring. Increasing this variable has been associated with low risk of mortality in cardiovascular disease [26]. Manifestation of palmar grip weakness is a good predictor of functional deficit after stroke [27]. In the revised studies, strength was assessed using dynamometers or sensors widely used in the literature [26,28,29], but there are other ways to assess stroke strength, such as the Wolf test [30] and Stroke. Impact Scale [31]

SHD and the association of conventional motor function rehabilitation have been shown to improve palmar grip strength and beneficial impact on cortical neuronal plasticity [32]. This plasticity is regulated by the expression of proteins such as brain-derived neurotrophic factor (BDNF), calcium-calmodulin-dependent kinase II (CaMKII), glial fibrillar acid protein (GFAP), scaffolding proteins, and postsynaptic membrane receptors that cause adaptation. changes in synapse number, morphology and transmission power [33]. This reveals that increased strength may be explained by factors extrinsic to the muscle. In addition to reaffirming the beneficial effect of SHD in improving the strength of stroke patients.

During the extraction phase, one study was excluded due to the lack of strength as a variable of evaluation. Another excluded work was a case study that combined SHD with conventional therapy throughout the treatment period. In this case study, the subject presented hypertension and endstage renal disease, predisposing to an inflammatory pattern, and a bias that interfered with the structure and production of muscle strength [5,34].

In this study, the Downs & Black scale was used because it presents a wide range of study types to which it can be applied, such as nonrandomized clinical trials, cohort studies, and case studies. There is a great divergence in the literature regarding the assessment of power on the Downs & Black scale. Some researchers suggest the evaluation by the presence of the effect size calculation, α (type I error) and β (type II error), which makes a quantitative evaluation in a qualitative evaluation of the presence of a statistical calculation, underestimating the power proposed by Downs. & Black [35].

In evaluating the quality of the studies, good external validity, confusion and control of mean bias were not presented according to the Downs & Black questionnaire. The lack of control over these variables implies the low reproducibility of these studies, so as not to obtain statistically significant differences and heterogeneity of results. Studies of the randomized clinical trial with strength assessment by blinding evaluators and better methodological quality are needed to evaluate the effect of SHD on muscle strength in stroke patients.

V. LIMITATIONS AND CLINICAL RELEVANCE

We note that some studies may not have been identified for screening because they do not include other databases. Another limitation was the heterogeneity of the studies, which made comparison difficult.

Knowledge of studies evaluating the clinical efficacy of SHD use aimed at increasing post-stroke muscle strength gains has pointed to a new perspective for improving functionality, increasing independence, and contributing to improved post-stroke quality of life stroke.

VI. IMPLICATIONS FOR HEALTH MANAGEMENT PRACTICE

The use of assistive devices assists in the management of post stroke rehabilitation, and this reflects in the functional improvement of the patient as it provides autonomy and independence. In this context, it's applicability includes assessment, patient and caregiver education, treatment and follow-up. The use of these devices in the treatment of post stroke patients is intended to improve functionality as a whole, including not only improved structure and function. Therefore, help-devices contribute to the management of health services and increase the quality of life of patients with stroke.

VII. CONCLUSION

The use of SHD in the stroke can contribute to the increase of muscular strength. However, there is a need for randomized clinical trials with well-defined methodological design to certify the therapeutic effect of SHD on muscle strength in patients with stroke.

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CONFLICTING INTERESTS

The Author(s) declare(s) that there is no conflict of interest.

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Determination of Efficient Height Combination of Twin Tower under Seismic Loading

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Abstract— Now a days multistoried building design and the architectural vision has wants a new innovation. A number of competitors enclosed by them used to create the structure with their individual option and also the requirement of market and the multistoried building perform as tremendously critical work in pioneering and fresh fields. It should enlighten the complexity of manufacture area all along with the architectural and structural point of view. By combined and miscellaneous floor arrangement on similar ground wants the consistency on the structural approach. This types of structure are Twin tower structure used in this modern world. In this examine, the parameter of evaluation of result such as displacement and storey drift are obtained in requisites of the twin tower multistoried structure located in earthquake Zone-III, earthquake effects are performing on the construction under 11 different height combination and analyze with the assistant of design software.

Keywords— Twins Tower, Efficient Height, Lateral Loading, Response spectrum analysis, Seismic Effects.

I. INTRODUCTION

With the help of multistory structure guide the structural engineer to analyze and design as per harmful earthquake effects. Current days, Twin towers are very much in demand due to its good architectural and structural design, individual plan along with additional space with similar base support. For that, we should know the well-organized point parameters when these types of structures are in the get in touch with of earthquake loads.

II. OBJECTIVE

This study analyses the different parameters like base shear, shear force, bending moment displacements in longitudinal and transverse direction. After this, storey drift is calculated in both X as well as Z direction. The most efficient twins' tower height combination will be analyzed after all parameters. There is total 11 height combination of twin tower multistoried building at medium soil condition under seismic forces for earthquake zone III exist.

III. STRUCTURE MODELING

The twins tower modeling done in design software. The twin tower building detail of the multi storey construction are shown in Table 1 and Table 2 and shown graphically with the help of graphs. Top view and front view of various Shapes of G+12 building shown by the help of figures. Various height combination used in this paper up to 12 floor twin with 11 different height combination. After than efficient height combination for each parameter along with its remarks has drawn below each parameters.

| Building configuration | G+12 |
|----------------------------|--------------|
| No. of bays in X direction | 9 |
| No. of bays in Z direction | 9 |
| Height of building | 51.580m |
| Dimensions of building | 45M X 45M |
| Size of beam | 750mmX650mm |
| Size of column | 550mmX450mm |
| Concrete and Steel Grade | M 30 & FE415 |

Table. 1: Details of building

Table. 2: Detail of loading

| Earthquake parameters | Zone III with RF 4 & |
|-----------------------|--|
| | 5% damping ratio |
| Period in X & Z | 0.692 & 0.692 for both |
| direction | direction |
| Dead load for floor | 2KN/m ² & 0.5 KN/m ² |

| and | |
|-------------------------|--|
| waterproofing | |
| Live load for floor and | 3.8KN/M^2 & 1.2u KN/M ² |
| roof | |

IV. RESULT AND DISCUSSION

These result is observed by the following cases-

| Table 3: Maximi | ım Displaceme | nt in X d | irection in | Zone III |
|------------------------|----------------------|-----------|-------------|-----------|
| 1 000 00 01 1110000000 | and D app rece cance | | | 20110 111 |

| | Maximum Displacement |
|----------------|----------------------|
| HEIGHT CASE | (mm) |
| | For X Direction |
| Α | 131.980 |
| В | 122.788 |
| С | 130.483 |
| D | 137.960 |
| Е | 144.911 |
| F | 151.011 |
| G | 155.951 |
| Н | 159.481 |
| Ι | 161.450 |
| J | 161.825 |
| K | 160.701 |



Fig. 1: Maximum Displacement shown in X direction Zone III

| Table 4: Maximum | Displacement | shown in Z | direction in |
|------------------|--------------|------------|--------------|
| | Zone III | | |

| HEIGHT CASE | Maximum Displacement (mm) |
|----------------|------------------------------|
| | For Z Direction |
| Α | 168.458 |
| B | 178.957 |
| С | 191.855 |
| D | 204.35 |
| E | 215.912 |
| F | 226.077 |
| G | 234.347 |
| Н | 240.337 |
| Ι | 243.814 |
| J | 244.738 |
| K | 243.263 |



Fig. 2: Maximum Displacement shown in Z direction in Zone III

| Table 5: Base Shear show | 1 in X an | nd Z direction | in zone l | III |
|--------------------------|-----------|----------------|-----------|-----|
|--------------------------|-----------|----------------|-----------|-----|

| HEIGHT CASE | Base Shear (KN) | | |
|-------------|--------------------|-------------|--|
| | X direction | Z direction | |
| Α | 18079.26 | 14962.41 | |
| В | 16797.29 | 13996.19 | |
| С | 15203.78 | 13193.95 | |
| D | 15102.46 | 14176.83 | |
| Ε | 16083.18 | 14067.64 | |

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| F | 18463.25 | 14410.82 |
|---|----------|----------|
| G | 23552.23 | 15221.03 |
| Н | 10012.44 | 14707.36 |
| Ι | 9804.96 | 14383.24 |
| J | 30472.28 | 8112.48 |
| K | 26285.39 | 8015.43 |



Fig. 3: Base Shear shown in X direction in zone III



Fig. 4: Base Shear shown in Z direction in zone III

Table 6: Maximum Axial Forces shown in Column at
ground level in zone III

| HEIGHT | Column Axial Force |
|--------|--------------------|
| CASE | (KN) |
| А | 8502.388 |
| В | 8698.226 |
| С | 8938.696 |
| D | 9171.270 |

| E | 9387.021 |
|---|----------|
| F | 9576.525 |
| G | 9730.927 |
| Н | 9843.141 |
| Ι | 9908.945 |
| J | 9927.641 |
| K | 9902.112 |



Fig. 5: Maximum Axial Forces shown in Column at ground level in zone III

| Table 7: Maximum Shear I | Forces | shown | in | Columns | in |
|--------------------------|--------|-------|----|---------|----|
| ZON | ıe III | | | | |

| HEICHT CASE | Column Shear Force (KN) | | | |
|-------------|-------------------------|---------------|--|--|
| HEIGHT CASE | Shear along Y | Shear along Z | | |
| Α | 294.635 | 374.260 | | |
| В | 306.869 | 397.620 | | |
| С | 321.973 | 426.315 | | |
| D | 336.671 | 454.078 | | |
| E | 350.341 | 479.839 | | |
| F | 362.323 | 502.463 | | |
| G | 371.990 | 520.886 | | |
| Н | 378.839 | 534.253 | | |
| Ι | 382.566 | 542.051 | | |
| J | 383.115 | 544.191 | | |
| K | 380.689 | 541.011 | | |



Fig. 6: Maximum Shear Forces shown in Columns in zone III

 Table 8: Maximum Bending Moment shown in Columns in zone III

| HEIGHT CASE | Column Bending Moment (KNm) | | | |
|-------------|-----------------------------|----------------|--|--|
| | Moment along Y | Moment along Z | | |
| Α | 737.827 | 668.461 | | |
| В | 783.494 | 695.994 | | |
| С | 839.973 | 729.958 | | |
| D | 898.882 | 762.978 | | |
| E | 944.257 | 793.672 | | |
| F | 988.496 | 820.573 | | |
| G | 1024.505 | 842.288 | | |
| Н | 1056.606 | 857.702 | | |
| Ι | 1065.789 | 866.142 | | |
| J | 1069.873 | 867.488 | | |
| K | 1063.524 | 862.186 | | |



Fig. 7: Maximum Bending Moment shown in Columns in zone III

| Table 9: M | aximum | Shear | Forces | shown | in | beams | parallel |
|------------|--------|---------|----------|---------|----|-------|----------|
| | to 2 | X direa | ction in | zone II | Ι | | |

| | Beam Shear Force |
|-------------|---------------------------|
| HEIGHT CASE | (parallel to X direction) |
| | (KN) |
| Α | 158.162 |
| В | 162.153 |
| С | 167.055 |
| D | 171.798 |
| E | 176.199 |
| F | 180.066 |
| G | 183.232 |
| Н | 185.529 |
| Ι | 189.871 |
| J | 187.242 |
| K | 186.701 |



Fig. 8: Maximum Shear Force shown in Beam for X in zone III

Table 10: Maximum Shear Forces shown in beams parallelto Z direction in zone III

| | Beam Shear Force | | |
|-------------|--------------------------------|--|--|
| HEIGHT CASE | (parallel to Z direction) (KN) | | |
| Α | 2.681 | | |
| В | 3.124 | | |
| С | 3.271 | | |
| D | 3.590 | | |
| E | 3.738 | | |

| F | 4.064 |
|---|-------|
| G | 4.552 |
| Н | 4.879 |
| I | 4.237 |
| J | 3.998 |
| K | 3.881 |



Fig. 9: Maximum Shear Force shown in Beam for Z direction in zone III

| Table 11: | Maximum | Bending | Moment | shown | in beams |
|-----------|-------------|------------|-----------|--------|----------|
| | parallel to | o X direct | ion in zo | ne III | |

| HEICHT CASE | Beam Bending Moment |
|-------------|---------------------------|
| HEIGHT CASE | (along X direction) (KNm) |
| Α | 6.701 |
| В | 7.810 |
| С | 8.336 |
| D | 8.975 |
| E | 9.347 |
| F | 10.161 |
| G | 11.381 |
| Н | 12.199 |
| Ι | 10.673 |
| J | 9.995 |
| К | 9.838 |



Fig. 10: Maximum Bending Moment shown in beams parallel to X direction in zone III

 Table 12: Maximum Bending Moment shown in beams
 parallel to Z direction in zone III

| HEIGHT | Beam Bending Moment |
|--------|---------------------------|
| CASE | (along Z direction) (KNm) |
| Α | 253.577 |
| В | 264.028 |
| С | 276.940 |
| D | 289.433 |
| Е | 301.023 |
| F | 311.203 |
| G | 319.493 |
| Н | 325.510 |
| Ι | 329.024 |
| J | 329.994 |
| K | 328.574 |



Fig. 12: Maximum Bending Moment shown in beams parallel to Z direction in zone III

| Table 1. | 3: Maximum | Torsional | Moment | shown a | in beams |
|----------|---------------|-----------|-----------|---------|----------|
| | parallel to X | and Z dir | ection in | zone II | I |

| | Beam | Beam | |
|--------|------------------------|------------------------|--|
| HEIGHT | Torsional Moment | Torsional Moment | |
| CASE | (along X direction) | (along Z direction) | |
| | (KNm) | (KNm) | |
| Α | 29.201 | 28.670 | |
| В | 29.266 | 28.428 | |
| С | 29.291 | 28.869 | |
| D | 30.821 | 28.880 | |
| Ε | 32.392 | 28.499 | |
| F | 33.772 | 29.262 | |
| G | 34.895 | 30.961 | |
| Н | 35.711 | 32.736 | |
| Ι | 36.184 | 31.091 | |
| J | 36.762 | 35.148 | |
| K | 36.119 | 34.342 | |



Fig. 13: Maximum Torsional Moment in beams parallel to X and Z direction in zone III

V. CONCLUSION

The design of twin towers height combination of building subjected to seismic effects the analytical results obtained from 11 combination of twins tower multistoried structure. As seen in results the minimum displacement in X direction height case B and Z direction height case B, minimum base shear in height case I and K in respectively X and Z direction, minimum axial force in height case B, minimum column shear force in height case B in both direction, minimum column bending moment height case B in both direction, beam shear force height case B is optimum as well result same for torsional force. That means height case B is very efficient cases for twins tower in height case.

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Comparison of Sanitary Sewage Treatment Systems: Nereda in Relation to the Stabilization Pond Treatment System in the Legal Amazon

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Abstract—The difficulty that great nations often suffer in relation to the lack of efficient basic sanitation for their entire population has, over the years, become a concern of global proportions. Although the rate of service with sewage collection corresponds to a high percentage of active water connections in suitable areas in Porto Nacional in the state of Tocantins, (City and therefore, state belonging to the legal Amazon) when we look at the total scenario of the Amazon Legal, only a small percentage of people living in these areas are served with sewage collection and treatment. Knowing then that the percentage of a given population served with collection and an effective sewage treatment system is directly related to the quality of life and health of its population, this work set out to present the innovative Dutch sewage treatment system that emerged on the NEREDA patent, compared to the conventional sewage treatment system used in the city of Porto Nacional - TO. Finally, the objective of this study was to present this Dutch technology based on public domain data presented by Brazilian bodies and entities, as well as other studies already carried out and the data of the company that owns the patent. Although still little known in the world, this technology presented great potential both qualitatively and economically because it presented a greater amount of treated sewage per second with quality equal to or greater than other methods, in addition to low implementation value due to the possibility of use most of the existing treatment plants.

Keywords—Sanitation, Sewage treatment, Conventional WWTP, Nereda, WWTP.

I. INTRODUCTION

With the exponential growth of the global population, one of the major concerns that arises and is directly related to the health and wellbeing of this same population is basic sanitation. Brazil, for example, has long been experiencing problems involving this subject. The report of the United Nations (UN) registered by UNESCO [1] that deals with the global development of water, more than 2 million people around the world are not served by any form of sewage collection and treatment. Data from the Brazilian Institute of Geography and Statistics (IBGE) [2] report that a large number of epidemics and endemics that plague Brazilians are closely linked to the precariousness of the country's sewage collection and treatment system, which serves only about 60,2% of the population and can manage only about 46% of it.

ABCON and SINDCON (Brazilian Association of Private Service Concessionaires and National Union of Concessionaires) [3] bring data in one of their latest published surveys that show that Brazil, when compared to other countries, is in 106th place in terms of access to basic sanitation, even having a lower performance than their neighbors in South America. The same survey points out that about 14% of children and adolescents in the country do not even have the right to treated water guaranteed, of these, 7,5% even have water at home, but not processed or filtered, which confirms the great need that Brazil still has for heavy investments in this area. A brief comparison comparing Brazil to other countries in terms of access to treated water and the sewage collection and treatment system is illustrated in Table 1.

| Country | Access to treated water | Access to Sewerage Services | |
|-------------|----------------------------|-----------------------------------|--|
| Netherlands | 100% | 100% | |
| BRAZIL | 83,00% | 60,20% | |
| JORDAN | 96,90% | 98,60% | |

| IRAQ | 88,60% | 86,50% |
|-----------------|--------|--------|
| MOROCCO | 85,40% | 76,70% |
| SOUTH AFRICA | 93,20% | 66,40% |
| CHINA | 95,50% | 76,50% |
| BOLIVIA | 90,00% | 50,30% |
| CHILE | 99,00% | 99,10% |
| MEXICO | 96,10% | 85,20% |
| PERU | 86,70% | 76,20% |

Source: Adapted from ABCON and SINDCON, (2019).

Data from the Sanitation Company de Porto Nacional -TO [4] confirm that in the municipality of Porto Nacional approximately R\$44,587,595.45 have already been invested between the years 1999 to 2018, of which 38% were invested in the system production and water supply, 57% in the sewage collection and treatment system and 4% in other investments that were necessary.

The city has a sewage system that consists of a treatment unit that is in the urban perimeter of the city, approximately 12km from the water treatment plant. Data from the Municipality of Porto Nacional - TO [5] reveal that the city has rugged characteristics, which is why the local sanitation company opted for dividing the area of the city in several sub-basins, totaling today 14 sewage pumping stations that facilitate transportation of collected sewage to the treatment plant.

City Hall data [5] also reveals that the entire operational area of the sewage treatment plant currently stands at approximately 188,900 m², and of this, the total operating structure occupies approximately 40,000m² and has the capacity to treat 68 liters of effluents. per second.

When we talk about sanitary sewage, the Sanitation Atlas carried out by IBGE [6] points out that in cities or even states that have a low sewage collection rate, the treatment does not even exist, it only comes into existence, in most cases, when cities have at least 100,000 inhabitants.

With this information in mind, this study aimed to present a comparative analysis of the sewage treatment system developed in the Netherlands in recent years that was registered under the NEREDA patent, with the conventional sewage treatment system used in the legal Amazon, more specifically the one used in the city of Porto Nacional.

The main purpose of this comparison is related to the search for knowledge about this new system that is

beginning to be implemented in Brazil and in other countries in order to identify possible advantages in relation to the current conventional systems of Brazilian sewage treatment, more specifically in city of Porto Nacional - TO, city belonging to the legal Amazon.

II. METHODOLOGY

Porto Nacional is a municipality located in the State of Tocantins, northern region of Brazil and is located 64km from the capital Palmas. The city has an area of 4,449.917km². Figure 1 better illustrates the location of the city in relation to the state and country.



Fig. 1: Location of the municipality of Porto Nacional. Source: Adapted from the Porto Nacional City Hall, (2018).

Porto Nacional according to the last IBGE census [7] carried out in 2019, has an estimated population of 53,010 people living in its regions and is the 4th largest city in the State, therefore, one can imagine that it is a city that produces a lot of sewage and that, as it is a city surrounded by many hydrographic basins, the need for adequate sewage collection and treatment is of fundamental importance so that these sources are not contaminated.

The facilities of the city's Gross Sewage Treatment Station are located at the end of Avenida Tocantins, just after the city's agricultural exhibition park, as shown in Figure 3 below.



Fig. 2: Location of the STPof the Porto Nacional – TO. Source: Adapted from Google Earth - CNES Airbus Satellite - Zone 23 DATUM WGS 84, (2019).

The main information that was the target of the comparison proposed by this study was the efficiency values related to the volume of effluent treatment per second in both forms of treatment in relation to the volume of the treatment plant facilities themselves.

In order to carry out this work, we carried out an on-site visit to the facilities of the sewage treatment plant in Porto Nacional - TO get to know you and thus check if the facilities matched the data provided by the city hall and the sanitation company.

With the data in hand, the effectiveness of the current sewage treatment in Porto Nacional - TO was verified in relation to the percentage of the population served.

The data regarding energy expenditure, type of biomass used, BOD reduction and sedimentation time obtained from the Nereda system were compared to the data from the sewage treatment system in Porto Nacional - TO and a table was constructed with the summary of the comparative analysis, the results obtained are described below.

III. RESULTS AND DISCUSSIONS

3.1 Porto Nacional

The sewage treatment system of Porto Nacional - TO, consists of a preliminary treatment that consists of the use of a mechanized curved grid, mechanized sander, mechanized helical screw and a parshall flow meter with W = 1 throat. Subsequently, after preliminary treatment, a pumping station within the WWTPs operational area launches the effluent into an anaerobic up flow reactor which, after treatment, proceeds to a post treatment in series stabilization ponds of the optional and maturation types. A burner for the gases from the treatment process connected to the treatment system exists in the vicinity of the Reactor. After the entire treatment process, the treated

effluent is then discharged into the Luiz Eduardo Magalhães hydroelectric lake. The treatment station area can be better verified in Figure 4.



Fig. 3: Location of the STP of the Porto Nacional – TO. Source: Adapted from Google Earth - CNES Airbus Satellite - Zone 23 DATUM WGS 84, (2020).

According to city hall data, through the municipal water and sewage plan [5], in Porto Nacional, the rate of service with sewage collection corresponds to 91% of active water connections in suitable areas, with 100% of the collected sewage being fully treated. The so-called apt areas are defined as those areas of population agglomeration that have a density equal to or greater than 16 inhabitants per hectare, meeting this requirement, the sector has the technical feasibility of service for the local sanitation company.

3.2 Nereda

Information from the Nereda Community [10] reveals that currently, 16 countries around the world have Nereda plants in operation, including Brazil, which currently has 11 of these plants in operation, 1 in Tocantins (In Araguaína starting operations in 2019, with a treatment capacity of 60 liters of effluents per second, working with a peak flow of up to $2,196m^3/h$), 1 in Goiás, 3 in São Paulo, 2 in Rio de Janeiro and 4 in Pernambuco.

Royal HaskoningDHV (RHDHV) information [11] reports that Nereda technology for wastewater treatment uses only aerobic granular biomass as a resource that is used inside tanks where the entire treatment process occurs (shown in Figures 5 and 6), pointing out that this technology is extremely economical because in addition to requiring only about two fifths of the area of conventional reactor installations followed by a pond, the process consumes about 50% less electricity in its Processes (reactors followed by pond consuming on average

0.60kWh/m³ of treated effluent and the Nereda system consuming an average of 0.28kWh/m³).

In this technology, biomass develops as a granular sludge with rapid stabilization, these granules have an enormous capacity for sedimentation, which means that there is no need for a slow phase (decantation of the USB reactor and slowness of the optional ponds and maturation of the system sewage treatment plant in Porto Nacional -TO) and separated for decantation as is commonly the case with conventional methods, therefore, in this process, all phases of treatment can occur simultaneously in a single tank that receives granular biomass which in turn controls the biochemical oxygen demand and causes all the suspended matter in the tank to settle, leaving only the treated effluent, which is then pumped out of the tank, which may or may not need some other treatment phase depending on the laws in force. each city or state.



Fig. 4: Pure biomass granules. Source: (RHDHV, 2018).



Fig. 5: Comparison of the structure of flakes and granules. Source: (RHDHV, 2018).

The sanitation company of Porto Nacional - TO [4], which also has concessions throughout the country, is one of the pioneers in the use of Nereda technology in Brazil. The same points out on its website that this technology considered as revolutionary, uses instead of flake structures as in the conventional process, a structure in granules, which have an extremely higher sedimentation speed and do not need to add any chemicals, while in the sewage treatment plant of Porto Nacional - TO, the structure of the formed sludge is more flocculated and after its treatment in the anaerobic upstream reactor, a continuous flow flotation process with physical chemical treatment is necessary for the complete effluent treatment.

The same sanitation company continues to reinforce that the choice for this type of bacteria has many advantages, because in addition to removing all organic matter in a much more timely manner, this process also manages to remove excess phosphorus and nitrogen from wastewater (It manages to achieve a reduction in BOD in the order of 85 to 90% while the sewage treatment plant in Porto Nacional - TO was designed to have a BOD reduction in the order of 85%), that is, the entire primary process, secondary and tertiary boils down to a single system that works at a speed far exceeding all of these combined. Giancarlo Ronconi, Chief Technology Officer of the company concludes by saying on the website that the gain in space savings, electricity consumed in the process (about 50% less when compared to other conventional systems), chemical products (The Nereda system does not use products chemicals) and maintenance equipment are some of the main advantages of the Nereda treatment system.

In order to have an idea of the proportions of space savings in the project, Figures 7 and 8 below make a comparative plan sketch of the space occupied by the old conventional system used in the WWTP Deodoro located in Rio de Janeiro - RJ (Reactor followed by lagoons) and the current Nereda system implemented, both for operation with a constant flow rate of 750 liters per second.



Fig. 6: UASB + Stabilization Ponds - Total Reactor Volume = 41.000 m3. Source: National Meeting of Waters (2018).



Fig. 7: Nereda - Total Reactor Volume =21.500m3. Source: National Meeting of Waters (2018).

Figure 9 below shows the sedimentation speed that this new method presents when observed over a period of 30 minutes. According to the sanitation company of Porto Nacional - TO [4], the city's sewage treatment plant can present its treatment results within 8 to 10 hours.



Fig. 8: Sedimentation process in 30 minutes. Source: (RHDHV, 2018).

The Nereda Community [10] brings information that says that because its technology is very flexible, plants with both activated sludge and anaerobic up flow reactors can easily be converted to use Nereda technology. It is also stated that when this happens, both the biological and hydraulic capacity of the plants are significantly increased, this is since the treatment speed will be increased. With the technology, a plant with a volume of 1000m³ will easily be able to carry out all the treatment of effluents at a speed of approximately 35 liters per second while to obtain this same volume with a conventional technology associating UASB reactors + stabilization ponds, at least a plant of approximately 2000m³ would be needed. Table 2 illustrates a brief result of the comparative analysis between Nereda technology and the reactor treatment system followed by lagoons in Porto Nacional - TO.

Table. 2: Comparison of raw sewage treatment systems.

| Reactor followed by Lagoons | | WWTP Nereda | |
|----------------------------------|-------------------------------|----------------------------------|-------------------------------|
| Average energy consumption | 0,60 (kWh/m ³) | Average energy consumption | 0,28 (kWh/m ³) |
| Type of Biomass used | Flake | Type of Biomass used | Granule |
| BOD reduction | Up to 85% | BOD reduction | Up to 90% |
| Sedimentatio n Time | 8 to 10 hours | Sedimentatio n Time | 30 minutes |

Source: Prepared by the Author.

The average energy consumption is a point to be analyzed due to the great need that we usually have to save this resource so that the operating costs do not become too high. The type of biomass present in the treatment systems here defines the speed of sedimentation of suspended matter and consequently the speed of treatment. The BOD reduction levels are analyzed to make sure that the treated effluent has the minimum characteristics of reducing the biochemical oxygen demand necessary for the treated effluent to be released into a receiving body. The sedimentation time was analyzed because this factor is crucial for saving time in the treatment process of both systems.

The information provided by the Nereda Community [10] reports that there is also the possibility of using Nereda technologies in conjunction with conventional technologies just to speed up their process by reducing the time for systems that take 6 to 10 hours to complete the process. treatment of a certain amount of sewage for 3 to 5 hours, which brings to this use in hybrid extension the additional advantage of increasing the quality and speed resulting in improved sedimentation characteristics, greater capacity and greater biological removal of nutrients from the activated sludge. reach 90% removal of these due to interference from granular sludge from Nereda technology.

In terms of reducing Biochemical Oxygen Demand, the Nereda system also shows great efficiency, as can be seen in Table 2 below. *Table. 3: Efficiency of some of the main sewage treatment systems.*

| Sanitary sewage treatment system | Efficiency in BOD Removal (%) |
|---|-------------------------------|
| Septic tanks | 35 - 60 |
| Upstream Flow Anaerobic Reactors (UASB) | 55 - 75 |
| Conventional Activated Sludge | 75 - 95 |
| Activated Sludge with Extended Aeration | 93 - 98 |
| Nereda | 80 - 90 |

Source: Adapted from the Ministry of the Environment (2018).

IV. CONCLUSION

As the main objective of this study was to compare one of the most used sewage systems in the legal Amazon (Reactor followed by series stabilization ponds), more specifically in Porto Nacional - TO with the Nereda wastewater treatment system, the main results obtained in quali-quantitative and economic terms follow.

The Nereda system in fact allows for fast and efficient treatments in compact and uncomplicated projects. The system uses a much smaller amount of mechanical equipment than in conventional processes. All these facts are capable of significantly reducing the direct costs of implementing a plant of this model or even in relation to the possible extension of capacity that may become necessary in existing conventional plants (CAPEX). Operation and maintenance costs (OPEX) are also much lower due to the reduction of the mechanical equipment, chemical-free operation and the relatively high energy efficiency that the process promises.

The costs of implementing the Nereda system in relation to installations of conventional systems composed of reactors followed by lagoons or activated sludge systems can lead to savings ranging from 20 to 30%.

Bearing in mind the fact that the Nereda system by the present reports demonstrates results in construction costs lower than those of conventional technology, for example in relation to the volume of the tanks being up to four times smaller and having a lesser need for equipment, its great ease of use. if converting or even joint use with conventional methods, we can infer that the use of this new method, despite the precise investment savings are obviously specific to each location and vary according to the project, the country, the climate of each location, and the characteristics of local effluents, which makes it difficult to provide a generalized response, requiring further studies to do so, however, focusing on the places where the studies prove their economy and effectiveness, this system will indeed be of great relevance. We therefore encourage the sanitation companies to seek more information and make the necessary studies of the needs that the cities where they operate have a system that can work with a greater amount of effluent per second, the effectiveness of the treatment of the type of effluent with which handle beyond the values for implantation or hybridization of the system in order to obtain the possible advantages of this new system so that the population can benefit from a more efficient system, including, in Porto Nacional - TO the local sanitation company can obtain lower costs using in a future expansion the current technology for hybridization with the Nereda system, so that it can also serve a larger percentage of the population, being more easily able to reach 100% of the population.

Other works can also be carried out in order to better ascertain the effectiveness of Nereda technologies in conjunction with conventional Brazilian technologies.

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Loss of smell and COVID-19: Anatomical and physiological considerations

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Abstract— There are numerous conflicting discussions about the outbreak of the new coronavirus (COVID-19). This letter to the editor presents some anatomical and physiological considerations regarding one of the symptoms reported by patients: the loss or reduction of smell, based on recent descriptions and studies, and aims to stimulate knowledge and debate on this topic.

Keywords— Coronavirus covid-19, covid-19, loss smell, olfactory nerve, covid-19 pandemic.

In December 2019 it was observed the emergence of a new disease in Wuan (China) that is related to the development of pneumonia and in more severe cases it can lead to death. Since then, the international scientific community has been mobilizing to describe this pathology in terms of how it is contagious, how to prevent it and what are the possible treatments (GUO et al., 2020). All of this aroused more interest as of January 30, 2020, a date that the World Health Organization (WHO) officially declared the epidemic COVID-19 as a public health emergency of international interest. Following the increase in the number of cases and the spread to several continents, on 11 March 2020, WHO declared the Covid-19 pandemic (JIANG et al., 2020).

At that time, due to the transmission between people, there was an increase in the rate of spread of the virus and half of the affected countries recorded the first cases of Covid-19 in the ten days prior to that date. In the past two weeks, according to WHO, the number of cases outside China has increased 13 times and the number of affected countries has tripled. There were already more than 118,000 cases worldwide and 4,291 deaths (WU et al., 2020). 3,917,366 cases of COVID-19 and 274,361 deaths were confirmed worldwide until May 10, 2020. The ways of protection are the same as those used to prevent common respiratory diseases, such as seeking medical attention in case of fever, cough and difficulty breathing; describe travel history and contact with others in recent days; wash hands frequently with soap and water or 70% V / V alcohol-based hand sanitizers; cover the mouth when sneezing or coughing and always with elbow flexed. (LIVINGSTON; BUCHER; REKITO, 2020).

SARS-CoV-2 (virus that causes COVID-19 disease), can be transmitted from one sick person to another or by close contact through an aerosol caused by sneezing, interpersonal touches such as handshaking, saliva, aerosol caused by coughing, phlegm or touching contaminated objects or surfaces (door handles, handrails, cell phones and others) (GUO et al., 2020; LAI et al., 2020).

Early diagnosis is one of the ways to prevent dissemination. Germany, through early detection with an increase in the number of COVID-19 tests to 500,000 per week, helped to keep the number of deaths relatively low (LESCURE et al., 2020). This fact can be explained by the

performance of many laboratory diagnoses, such as molecular biology exams (real-time RT-PCR) used to diagnose COVID-19, Influenza or the presence of Respiratory Syncytial Virus (RSV), and the immunological (rapid test), which detects the presence of antibodies or not (HELMY et al., 2020; LESCURE et al., 2020).

One of the first reported symptoms is the reduction or loss of smell. Smell is a type of special sensitivity captured by nerve endings of the olfactory nerve, the first cranial nerve pair, which originates in numerous small nerve bundles located in the upper third of the nasal cavity and upper third of the nasal septum (olfactory type mucosa) (DOTY et al., 2004; BUCHAIM; ISSA, 2018). The primary neurons (neuron I) are the olfactory cells themselves, bipolar neurons located in the olfactory mucosa of the nasal cavity, whose small peripheral extensions end in dilations called olfactory vesicles. The central prolongations, which are of the unmyelinated type, form filaments consisting of a cluster of olfactory bundles, which together constitute the olfactory nerve (MACHADO; HAERTEL, 2013).

Primary olfactory neurons are stimulated by odorants, that is, chemicals from the air that are transformed into action potentials (JOHN H. MARTIN, 2013). After this stimulus is received, the special visceral afferent fibers that make up the olfactory nerve pass through several foramens called cribriforms that form the cribriform lamina of the ethmoid bone (BUCHAIM; ISSA, 2018). In this way they gain access to the anterior cavity of the skull where they synapse with the secondary neuron (neuron II), which are called mitral cells, whose branched dendrites synapse with the also branched central extensions of neuron I, constituting their shape called the glomerulus olfactory (WILLIAMS et al., 1995).

At this synapse site, an enlargement of the olfactory nerve called the olfactory bulb is formed. The projections of these secondary neurons (mitral cells) are myelinated axons that pass through the olfactory tract, gaining the lateral and medial olfactory streaks directly to the primitive allocortex on the anterior face of the cerebral hemispheres. The conscious olfactory nerve impulses end in the uncús (primary cortical projection area), corresponding to the piriform cortex. From there, it projects into the thalamus, which then goes on to the straight and olfactory gyres (orbitofrontal). Smells that can be associated with emotions such as aversion or pleasure are projected into the limbic system (WILLIAMS et al., 1995; JOHN H. MARTIN, 2013; MACHADO; HAERTEL, 2013; BUCHAIM; ISSA, 2018). Olfactory sensitivity has some peculiarities, such as: having only two neurons from reception to cortical projection; the primary neuron is not located in a ganglion, but in the upper third of the nasal cavity; be homolateral for projection; nerve impulses go directly to the cortex without first passing through the thalamus; projection towards the alocortex instead of the isocortex, as occurs in other ways (MACHADO; HAERTEL, 2013).

The anatomical description can help to understand the path of the SARS-CoV-2 virus and the development of anosmia, a technical term used for the loss or absence of smell, also present in craniocerebral trauma with ethmoid fracture. Could this be the way of the virus to neuronal destruction in the Central Nervous System? It is estimated that 30% of those people infected with the new coronavirus have neurological manifestations such as loss of taste and smell, mental confusion, stroke and muscle pain unrelated to any muscle injury (MAO et al., 2020; RAMOS et al., 2020; SHEEHY, 2020).

The advancement of clinical and experimental research may answer even more questions such as: how often is this symptom? What is the recovery time for smell? With the partial loss of smell should the person be in social isolation? What is the action of retrovirals such as Valacyclovir, an antiviral medication used to treat infections caused by the herpes simplex virus and the varicella-zoster virus, such as herpes zoster and genital herpes (CHEEMA et al., 2020)? Physical therapies by photobiomodulation are effective in nerve repair and could accelerate recovery (BUCHAIM et al., 2015, 2016, 2017; DE OLIVEIRA ROSSO et al., 2017; ROSSO et al., 2017, 2018)?

COVID-19 is perhaps the biggest confrontation of world science in the last 100 years since the Spanish flu. At this moment, many questions are still unanswered or there are prospects for an answer soon. We hope that this challenge will be overcome, mainly with the discovery of vaccines (many are already in laboratory tests or are already being tested in humans). May science win!.

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Satisfaction with Quality of Life in older Adults with Type 2 Diabetes

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Abstract— Purpose: To assess satisfaction with quality of life in older adults with DM2.

Methods: This is a cross-sectional study of older adults with DM2 receiving specialized care through Brazil's National Health System. We used a questionnaire to assess health status and collect sociodemographic data and the SF-36 to asses QoL. Data were analyzed using the R statistis software and significance level of 5%.

Results: Participants were 248 older adults aged 65-94 years (mean age: 73.2 ± 6.4 years). There was a predominance of: individuals aged 70-79 years (118, 47.6%), women (140, 56.5%), married individuals (142, 57.3%), individuals with up to seven years of study (161, 64.9%), retirees (232, 93.5%), individuals with monthly income of up to two minimum wages (176, 71.0%), diagnosis duration of 1-10 years (129; 52%); foot wound (25; 10.1%); and amputation (15; 6.0%). The variables that remained related to each domain in the regression model were: physical functioning – age (p=0.007), education (p=0.015), income (p=0.005); pain – gender (p=0.031), income (p=0.027); vitality – age (p=0.007), race (p=0.011), gender (p=0.011), education (p=0.018); social role functioning – age (p=0.005), education (p=0.043), income (p=0.005); emotional role functioning – income (p=0.004); mental health – gender (p=0.003), income (p=0.025).

Conclusion: Older adults with diabetes were less satisfied with QoL, thus demonstrating that the impact of diabetes cannot be measured solely by using clinical parameters such as glycemic control and the presence of comorbities.

Keywords— Older adults; Diabetes Mellitus; Quality of life; Chronic Diseases.

Key Messages

- Older adults with diabetes are less satisfied with QoL.
- The impact of diabetes cannot be measured solely by using clinical parameters.
- The SF-36 allows a better view of diabetic older adults' health status and QoL.

I. INTRODUCTION

Population aging is a major global issue as the number of older adults, i.e., people aged 60 and over, is expected to increase from 841 million people in 2013 to more than 2 billion people by 2050, with 80% of this

population living in less developed countries [1,2] such as Brazil, which is expected to rank sixth in the number of older adults worldwide by 2025 [3].

The growth of the older population includes a shift in disease profile in which infectious diseases have been replaced by chronic diseases such as diabetes mellitus (DM), with potential loss of quality of life [2,4].

According to the American Diabetes Association, diabetes can be classified into four general categories: type 1 diabetes (DM1), type 2 diabetes (DM2), specific types of diabetes, and gestational diabetes. However, DM2 accounts for 90% of diabetes cases in the population [5, 6].

A DM epidemic is underway. Globally, half a billion people are estimated to have diabetes, with 80% of them living in low-and middle-income countries. Therefore, it is a public health problem that may impair functional capacity, autonomy and quality of life [7].

However, few robust clinical studies have specifically assessed quality of life (QoL) impairment in older adults with diabetes (ADA, 2017; IDF, 2017). In adition, it is important to note that QoL impairment is expressed in different aspects, such as physical health, functional capacity, pain, emotional instability, and depression [8].

QoL is defined as an individual's perception of their position in life in the context of the culture and value system in which they live and in relation to their goals, expectations, standards and concerns [9].

Health-Related Quality of Life (HRQoL) is the assessement of QoL in disease or treatement situations. It is an individual's multidimensional and subjective perception of their health status – or perceived health status [10]. In this regard, the World Health Organization has suggested incorporating the assessment of physical, psychological, social, emotional and functional facets when assessing HRQoL as it is a multidimensional concept [9]. Given that, the objective of the present research was to assess satisfaction with quality of life in older adults with type 2 diabetes mellitus.

II. METHODS

This is a descriptive and analytical cross-sectional study of older adults (aged 65 and over) with type 2 diabetes mellitus receiving specialized care through Brazil's National Health System, also known as the Unified Health System (*Sistema Único de Saúde – SUS*) in the city of Fortaleza, Ceará, Northeastern Brazil. The study was carried out at the Integrated Diabetes and Hypertension Care Center (*Centro Integrado de Diabetes e Hipertensão – CIDH*), which is a reference center of the specialized care network of SUS in the state of Ceará.

Patients with DM were diagnosed during regular consultations at CIDH according to the ADA criteria: polyuria, polydipsia and weight loss plus casual plasma glucose $\geq 200 \text{ mg/dL}$; fasting plasma glucose $\geq 126 \text{ mg/dL}$ (7 mmol/L) and plasma glucose $\geq 200 \text{ mg/dL} 2$ hours after a 75g glucose drink [5].

The sample size was estimated using a finite population formula that considered the number of older adults in the city of Fortaleza (n=242,430) according to the last DATASUS Report [11]. We considered a minimum sample size to estimate the population proportion with a maximum expected proportion of 20%, a significance level of 5% and a maximum permissible error of 5%.

The medical records were systematically selected out of 1978 records of older adults with at least a one-year diagnosis of DM2. We selected one in every eight records following the original numbering. Inclusion criteria were: people aged 65 years and over diagnosed with DM2 for at least one year. People under 65 years of age and people with type 1 diabetes or without diabetes were excluded from the study.

The selected older adults were invited to participate in the research and data were collected during their visit to CIDH for routine consultation. Data were collected using a questionnaire addressing sociodemographic variables (age, gender, education, economic status) and health status (self-reported diseases, medication use, treatment duration) and the SF-36 (QoL).

Several types of generic questionnaires are used to assess QoL from a health perspective. In our study, we used the 36-item Medical Outcomes Study (SF-36 Short-Form Health Survey) as it was designed for use in clinical practice and research.

The SF-36 is a valid and reliable instrument to assess QoL in patients with DM2 [12, 13]. Although the SF-36 is designed for self-administration, the researcher is allowed to ask questions to the repondents. This was important in our research as some older adults were not able to self-administer the questionnaire.

In Brazil, the SF-36 was translated and validated and the questionnaire was sensitive to detect changes in QoL [14]. The SF-36 assesses physical and cognitive aspects and produces an index measure of health status that incorporates several dimensions. It has been widely used for the assessment of patients with chronic diseases. The questionnaire contains 11 questions and 36 items distributed into the following eight domains [15,16]:

1. Physical Functioning (PF): ten items that assess the performance of activities of daily living (ADL), such as self-care, dressing, bathing and climbing stairs.

2. Physical Role Limitation (PRL): two items that assess the impact of physical health on the performance of ADL and/or work activities.

3. Pain: two items that assess the level of pain and its impact on the performance of ADL and/or work activities.

4. General Health Perceptions (GHP): five items that assess the subjective perception of general health status.

5. Vitality: four items that assess the subjective perception of health status.

6. Social Role Functioning (SRF): two items that assess the impact of physical health status on social activities.

7. Emotional Role Functioning (ERF): three items that assess the impact of emotions on the performance of ADL and/or work activities.

8. Mental health (MH): five items, a mood and well-being scale, and a question to compare respondents' current health status to their health status one year ago.

The SF-36 assesses both negative (desease) and positive aspects (well-being). Each domain is scored on a 0-100 range, with 0 corresponding to the worst health status and 100 indicating the best health status [14].

The data were colleted from March to June 2017 by the main researcher (nurse), a dental student, two medical students and a geriatrician, who were previously trained in a pilot study.

Data were analyzed using the R statistis software version 3.4.2 [17]. Qualitative variables are described as absolute and relative frequencies and quantitative variables are described as mean, medium, quartiles and standard deviation values. The Shapiro-Wilk test was used to test the normality of the quantitative variables. The p-value obtained was less than 0.001, thus rejecting the null hypothesis that the data are normally distributed.

Given the non-normal distribution of the data, we used the Mann-Whitney and Kruskal-Wallis tests to check for associations between variables. Variables with a descriptive value of less than 0.20 in the bivariate analysis were included in the multiple analysis. Given the characteristics of the dependent variables analyzed in our study, we opted no to use a linear regression model. Instead, we used a beta regression model as described by [18] Ferrari e Cribari-Neto (2004), which is appropriate for categorical outcomes (proportions). All the inferential analyses were performed adopting a significance level of 5%.

The scores of the QoL domains range 0-100, and the lower the score the worse the QoL. However, it should

be noted that in the regression model the dependent variables were measured using a proportion scale.

This research was approved by the Research Ethics Committee under Approval No. 1.666.717. The patients were informed about the objectives of the study and anonymity was guaranteed. All the participants gave their written informed consent.

III. RESULTS

Descriptive analysis of sociodemographic and health variables.

Participants were 248 older adults with DM2 whose age ranged 65-94 years, with a mean age of 73.2 ± 6.4 years. There was a predominance of individuals aged 70-79 years (118; 47.6%), women (140; 56.5%), married individuals (142; 57.3%), mixed-race Brazilians (128; 51.6%), individuals with seven years of study (161; 64.9%), retirees (232; 93.5%), and individuals who received up to two minimum wages (176; 71.0%), as shown in Table 1.

Table 1. Sociodemographic characteristics of diabetic older adults. Fortaleza, Ceará, 2017.

| Variables | n | % |
|--------------------|-----|------|
| Age group | | |
| 65-69 years | 92 | 37.1 |
| 70-79 years | 118 | 47.6 |
| 80 years and older | 38 | 15.3 |
| Gender | | |
| Men | 108 | 43.5 |
| Women | 140 | 56.5 |
| Marital status | | |
| Single | 13 | 5.2 |
| Married | 142 | 57.3 |
| Divorced | 16 | 6.5 |
| Widowed | 72 | 29.0 |
| Race | | |
| White | 112 | 45.2 |
| Black | 8 | 3.2 |
| Pardo | 128 | 51.6 |
| Education | | |
| None | 35 | 14.1 |
| Up to 7 years | 161 | 64.9 |
| 8-12 years | 35 | 14.1 |

| Variables | n | % |
|--------------------|-----|------|
| More than 12 years | 17 | 6.9 |
| Retired | | |
| Yes | 232 | 93.5 |
| No | 16 | 6.5 |
| Income | | |
| Less than 1 MW | 16 | 6.5 |
| Up to 2 MW | 176 | 71.0 |
| 2-5 MW | 36 | 14.5 |
| More than 5 MW | 10 | 4.0 |

Source: own construction (2017).

Table 2 depicts the health variables. Most participants reported a diagnosis duration of one to ten years (129; 52%), insulin therapy (133; 53.6%), and use of of three medications/day (217; 87.5%). Use of hypoglycemic agents and diet (115; 46.4%), foot wound (25; 10.1%) and amputation (15; 6.0%) were also predominant.

Descriptive analysis of the quality of life domains.

Table 3 shows the descriptive analysis of the eight domains of the SF-36. Social Role Functioning exhibited the best mean score (82.9 ± 24.6), followed by General Health Perceptions (77.6 ± 13.9), Mental Health (68.6 ± 23.9) and Emotional Role Functioning (28.2 ± 34.3).

| Table 2. Diabetic older adults' | health problems. Fortaleza, |
|---------------------------------|-----------------------------|
| Ceará. 2 | 2017. |

| X7 | | 0/ |
|----------------------------------|-----|------|
| variables | n | %0 |
| Duration of type 2 diabetes | | |
| 1-10 years | 129 | 52.0 |
| 11-20 years | 78 | 31.5 |
| More than 20 years | 41 | 16.5 |
| Foot wound (current) | | |
| Yes | 25 | 10.1 |
| No | 223 | 89.9 |
| Amputation | | |
| Yes | 15 | 6.0 |
| No | 233 | 94.0 |
| Insulin | | |
| Yes | 133 | 53.6 |
| No | 115 | 46.4 |
| Number of medications used | | |
| Up to 3 | 31 | 12.5 |
| More than 3 | 217 | 87.5 |
| Source: Own construction (2017). | | |

Table 3. Descriptive statistics of SF-36 domains among diabetic older adults. Fortaleza, Ceará, 2017.

| Domains | Mean | Standard Deviation | 1 st quartile | Median | 3 rd quartile |
|----------------------------|------|--------------------|--------------------------|--------|--------------------------|
| Physical functioning | 45.4 | 35.2 | 10 | 45 | 80 |
| Physical role limitation | 29.1 | 35.1 | 0 | 12.5 | 50 |
| Pain | 57.2 | 33.7 | 21 | 61 | 100 |
| General health perceptions | 77.6 | 13.9 | 67 | 77 | 92 |
| Vitality | 56.6 | 23.8 | 40 | 55 | 75 |
| Social role functioning | 82.9 | 24.6 | 50 | 100 | 100 |
| Emotional role functioning | 28.2 | 34.3 | 0 | 0 | 66.7 |
| Mental health | 68.6 | 23.9 | 52 | 76 | 88 |

Source: Own construction (2017).

Bivariate analysis of mean scores of quality of life (SF-36) domains according to sociodemographic variables.

Table 4 shows the means and standard deviations of the QoL scores in each domain of the SF-36 in relation

to the sociodemographic variables. PF (p<0.001), Vitality (p=0.029) and SRF (p<0.001) scores differed across age groups. Patiens aged 80 years and older scored lowest in PF (26.7±32.9) and SRF (68.8±24.1) while those aged 65

to 69 years exhibited better QoL ($PF=51\pm33.5$ and $SRF=87.4\pm23.3$). As for vitality, the lowest scores were

found in the population aged 70 to 79 years (52.7 ± 23.9).

 Table 4. Bivariate analysis of SF-36 domains according to the sociodemographic characteristics of the diabetic older adults.

 Fortaleza, Ceará, 2017.

| Variables | Domains | | | | | | | |
|--------------------|----------------------|--------------------|----------------------|--------------------|--------------------|----------------------|--------------------|--------------------|
| variables _ | PF | PRL | PAIN | GHP | Vitality | Social | Emotional | Mental health |
| Age group | | | | | | | | |
| 65-69 years | 51.0±33.5 | 33.7±38.8 | 57.9±34.9 | 77.2±14.2 | 61.8±22.1 | 87.4±23.3 | 33.7±37.8 | 69.1±22.4 |
| 70-79 years | 47.1±35.6 | 28.6±31.9 | 59.4±31.9 | 78.9±13.4 | 52.7±23.9 | 84.0±24.2 | 26.0±30.2 | 68.0±25.4 |
| 80 years and older | 26.7±32.9 | 19.7±34.0 | 48.6±35.7 | 74.3±14.8 | 55.9±25.3 | 68.8±24.1 | 21.9±36.6 | 69.5±23.0 |
| p value | < 0.0012 | 0.088 ² | 0.275 ² | 0.302 ² | 0.029 ² | <0.001 ² | 0.139 ² | 0.988 ² |
| Marital status | | | | | | | | |
| Single | 42.7±33.8 | 34.6±46.3 | 65.8 ± 28.4 | 83.5±11.1 | 59.2±21.0 | 89.4±20.3 | 33.3±45.1 | 74.8±20.5 |
| Married | 48.7±36.1 | 30.6±36.0 | 58.1±33.3 | 78.2±13.4 | 57.7±24.5 | 84.0±24.3 | 30.5±35.2 | 71.5±24.2 |
| Divorced | 45.0±36.4 | 34.4±41.7 | 53.8±37.3 | 77.0±13.8 | 58.8±21.3 | 86.7±21.1 | 33.3±40.4 | 65.0±23.8 |
| Widowed | 39.5±33.4 | 25.3±29.8 | 55.1±34.2 | 75.0±15.3 | 53.4±24.1 | 79.3±25.7 | 23.1±29.4 | 62.3±23.2 |
| p value | 0.382 ² | 0.865 ² | 0.705 ² | 0.164 ² | 0.604² | 0.379 ² | 0.618 ² | 0.012 ² |
| Race | | | | | | | | |
| White | 40.0±33.2 | 27.2±32.6 | 56.4±33.4 | 77.6±13.6 | 52.8±21.6 | 81.4±24.1 | 26.2±32.1 | 68.8±23.3 |
| Black | 53.1±28.0 | 37.5±42.3 | 62.4±28.3 | 83.8±12.1 | 54.4±23.5 | 93.8±17.7 | 41.7±42.7 | 71.5±24.9 |
| Pardo | 49.6±36.9 | 30.3±36.8 | 57.5±34.5 | 77.1±14.4 | 60.1±25.2 | 83.6±25.3 | 29.2±35.7 | 68.3±24.5 |
| p value | 0.070^{2} | 0.746 ² | 0.924² | 0.496 ² | 0.033 ² | 0.2712 | 0.5472 | 0.918 ² |
| Sex | | | | | | | | |
| Men | 50.7±37.0 | 33.1±35.8 | 63.5±31.8 | 76.7±13.9 | 61.8 ± 20.6 | 85.4±23.9 | 31.8±35.1 | 75.0±20.8 |
| Women | 41.3±33.4 | 26.1±34.3 | 52.3±34.4 | 78.2±14.0 | 52.6±25.3 | 81.0±25.0 | 25.5±33.6 | 63.7±25.0 |
| p value | 0.0561 | 0.071^{1} | 0.0131 | 0.4331 | 0.006^{1} | 0.1421 | 0.1191 | < 0.0011 |
| Education | | | | | | | | |
| None | 32.1±35.1 | 13.6±28.7 | 49.1±34.7 | 76.6±16.3 | 55.9 ± 22.5 | 72.9±25.3 | 12.4±28.1 | 68.7±22.8 |
| Up to 7 years | 43.7±34.8 | 30.1±34.7 | 56.1±33.2 | 77.1±13.6 | 54.7±23.9 | 81.3±25.8 | 29.0±34.0 | 67.6±24.3 |
| 8-12 years | 51.7±30.2 | 32.9±38.2 | 63.0±35.1 | 78.7±14.6 | 59.7±23.4 | 93.9±15.6 | 33.3±37.1 | 69.0±23.2 |
| More than 12 years | 75.6±32.5 | 44.1±35.9 | 72.1±29.6 | 81.2±10.6 | 69.7±22.5 | 96.3±10.6 | 43.1±34.9 | 77.2±23.1 |
| p value | < 0.001 ² | 0.006 ² | 0.077 ² | 0.676 ² | 0.088 ² | < 0.001 ² | 0.003 ² | 0.344 ² |
| Retired | | | | | | | | |
| Yes | 44.5±35.2 | 28.7 ± 34.8 | 56.4±33.6 | 77.3±14.1 | 56.1±23.7 | 83.4±24.1 | 27.4±33.7 | 68.6±23.6 |
| No | 58.1±33.6 | 35.9±39.8 | 67.9±34.9 | 81.1±11.7 | 64.4±23.7 | 75.8±31.1 | 39.6±42.6 | 69.3±27.7 |
| p value | 0.1491 | 0.4731 | 0.2361 | 0.404^{1} | 0.2261 | 0.3361 | 0.2641 | 0.7011 |
| Income | | | | | | | | |
| Less than 1 MW | 36.6±37.2 | 15.6±22.1 | 48.9±38.3 | 75.1±14.7 | 49.7±27.0 | 63.3±28.7 | $10.4{\pm}26.4$ | 55.0±28.2 |
| Up to 2 MW | 41.9±34.2 | 26.8±34.5 | 53.2±32.9 | 77.2±14.1 | 54.5±23.3 | 83.2±24.3 | 26.3±33.5 | 67.7±23.9 |
| 2-5 MW | 69.0±28.4 | 46.5±37.4 | 78.8±27.2 | 80.8±12.1 | 69.4±17.8 | 91.3±18.9 | 44.5±35.6 | 77.4±17.1 |
| More than 5 MW | 45.5±40.6 | 40.0±41.2 | 61.1±28.1 | 78.9±16.0 | 55.5±33.4 | 90.0±16.5 | 40.0±41.0 | 74.8±30.3 |
| p value | < 0.0012 | 0.006 ² | < 0.001 ² | 0.470 ² | 0.004² | 0.0032 | 0.002 ² | 0.0132 |

Note: ¹ Mann-Whitney U test; ² Kruskal-Wallis test

Source: Own construction (2017).

Single older adults presented better mean scores in all the domains, except in PF. However, only the MH scores differed significantly from those obtained in the other domains (p=0.012). Vitality scores differed significantly (p=0.033) across races, with mixed-race Brazilians presenting the best scores. In the other domains, White individuals exhibited the worst QoL scores.

Women presented worse scores for Pain (p=0.013), Vitality (p=0.006) and MH (p<0.001). Older adults with more than 12 years of study presented better QoL scores in all the domains compared with their uneducated peers, with statistically significant differences in the PF (p<0.001), PRL (p=0.006), SRF (p<0.001) and ERF (p=0.003) domains. Also, non-retirees presented better mean scores in all the domains, except in SRF. However, the differences were not statistically significant. In addition, individuals who received less than one minimum wage presented the worst scores in PF (p<0.001), PRL (p=0.006), Pain (p<0.001), Vitality

(p=0.004), SRF (p=0.003), ERF (p=0.002) and MH (p=0.013).

Bivariate analysis of mean scores in the domains of quality of life (SF-36) according to health problems

Table 5 compares QoL scores in each domain according to health conditions. Older adults with foot wound had worse QoL scores in all the domains, with significant differences in the PF (p=0.014), PRL (p=0.037) and SRF (p=0.010) domains. Likewise, older adults without amputation presented worse scores compared to amputees, with a significant difference in the MH domain (p=0.004). Insulin users exhibited better scores, with a significant difference in the Vitality domain (p=0.041). Additionally, older adults who used up to three medications/day presented better scores, but with no significant differences.

Table 5. Bivariate analysis of SF-36 domains according to diabetic older adults' health problems. Fortaleza, Ceará, 2017.

| Variables | Domains | | | | | | | |
|---------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|-------------|---------------|
| variables <u> </u> | PF | PRL | Pain | GHP | Vitality | Social | Emotional | Mental Health |
| Diabetes duration | | | | | | | | |
| 1-10 years | 49.5±35.9 | 30.6±35.9 | 59.1±34.4 | 77.9±13.9 | 58.4±22.5 | 83.1±25.0 | 30.0±35.3 | 69.1±22.5 |
| 11-20 years | 44.4±35.3 | 31.1±36.5 | 55.8±33.7 | 76.1±14.4 | 56.8±25.2 | 80.9±25.5 | 29.1±35.4 | 69.7±23.3 |
| More than 20 years | 34.5±31.2 | 20.7±28.5 | 53.7±32.0 | 79.3±13.3 | 50.4±24.2 | 86.0±21.5 | 21.1±28.6 | 65.2±28.9 |
| p value | 0.082 ² | 0.359 ² | 0.539 ² | 0.503 ² | 0.224 ² | 0.605 ² | 0.443² | 0.883² |
| Foot wound (atual) | | | | | | | | |
| Yes | 30.2±35.5 | 17.0±31.2 | 45.3±37.5 | 77.5±15.5 | 51.8±25.8 | 70.0±29.5 | 17.3±30.6 | 60.8±24.8 |
| No | 47.1±34.9 | 30.5±35.3 | 58.5±33.1 | 77.6±13.8 | 57.1±23.5 | 84.4±23.6 | 29.4±34.6 | 69.5±23.7 |
| p value | 0.0141 | 0.0371 | 0.0651 | 0.985^{1} | 0.2601 | 0.0101 | 0.065^{1} | 0.072^{1} |
| Amputation | | | | | | | | |
| Yes | 36.0±32.1 | 36.7±32.6 | 61.9±33.6 | 82.3±12.7 | 63.0±16.9 | 88.3±18.0 | 31.1±34.4 | 84.0±15.6 |
| No | 46.0±35.4 | 28.6±35.2 | 56.9±33.8 | 77.2 ± 14.0 | 56.2±24.1 | 82.6±24.9 | 28.0±34.4 | 67.6±24.0 |
| p value | 0.3241 | 0.202^{1} | 0.6961 | 0.1861 | 0.3271 | 0.4811 | 0.677^{1} | 0.004^{1} |
| Insulin | | | | | | | | |
| Yes | 43.7±34.6 | 28.4±34.8 | 54.9 ± 34.5 | $76.8{\pm}14.0$ | 53.8±23.5 | 82.6±25.3 | 27.3±33.8 | 68.5±24.4 |
| No | 47.4±36.1 | 30.0±35.5 | 59.7±32.8 | 78.4±13.8 | 59.8±23.7 | 83.3±23.9 | 29.3±35.1 | 68.8±23.3 |
| p value | 0.4761 | 0.704^{1} | 0.2411 | 0.3231 | 0.0411 | 0.916 ¹ | 0.687^{1} | 0.970^{1} |
| Number of medicatio | ns used | | | | | | | |
| Up to 3 | 39.8±34.5 | 25.0±32.9 | 56.7±39.9 | 80.4±13.7 | 58.2±23.6 | 76.6±27.7 | 25.8±34.1 | 66.2±23.5 |
| More than 3 | 46.2±35.4 | 29.7±35.4 | 57.2±32.8 | 77.2 ± 14.0 | 56.4±23.8 | 83.8±24.0 | 28.6±34.4 | 69.0±24.0 |
| p value | 0.3781 | 0.4981 | 0.916 ¹ | 0.1371 | 0.6301 | 0.1431 | 0.6831 | 0.4511 |

Note: ¹ Mann-Whitney U test; ² Kruskal-Wallis test.

Source: Own creation (2017).

Table 6 shows the results of the Regression Analysis of the mean scores obtained in the quality of life domains (SF-36) in relation to sociodemographic variables and health conditions. Age ≥ 80 years (p=0.007), more than 12 years of study (p=0.015) and income of 2-5 minimum wages (p=0.006) remained associated with worse

scores in the PF domain in the regression model. In addition, income of 2-5 minimum wages (p=0.005) remained associated with worse scores in the PRL domain while female gender (p=0.031) and income of 2-5 minimum wages (p=0.027) remained associated with worse scores in the Pain domain.

Table 6. Variables that remained in the regression model.

| Variables | Domains | | | | | | | |
|-----------------------|---------|-------|-------|-----|----------|--------|-----------|---------------|
| v al lables | PF | PRL | Pain | GHP | Vitality | Social | Emotional | Mental Health |
| Age group | | | | | | | | |
| 65-69 years | - | - | - | - | - | - | - | - |
| 70-79 years | 0.925 | - | - | - | 0.007 | 0.567 | - | - |
| 80 years and older | 0.007 | - | - | - | 0.567 | 0.005 | - | - |
| Race | | | | | | | | |
| White | - | - | - | - | - | - | - | - |
| Black | - | - | - | - | 0.806 | - | - | - |
| Pardo | - | - | - | - | 0.011 | - | - | - |
| Gender | | | | | | | | |
| Men | - | - | - | - | - | - | - | - |
| Women | - | - | 0.031 | - | 0.011 | - | - | 0.003 |
| Education | | | | | | | | |
| None | - | - | - | - | - | - | - | - |
| Up to 7 years | 0.513 | - | - | - | 0.927 | 0.367 | - | - |
| 8-12 years | 0.275 | - | - | - | 0.253 | 0.043 | - | - |
| More than 12 years | 0.015 | - | - | - | 0.018 | 0.144 | - | - |
| Retired | | | | | | | | |
| Yes | - | - | - | - | - | - | - | - |
| No | 0.037 | - | - | - | - | - | - | - |
| Income | | | | | | | | |
| Less than 1 MW | - | - | - | - | - | - | - | - |
| Up to 2 MW | 0.379 | 0.231 | 0.991 | - | - | 0.005 | 0.12 | 0.025 |
| 2-5 MW | 0.006 | 0.005 | 0.027 | - | - | 0.009 | 0.004 | 0.004 |
| More than 5 MW | 0.677 | 0.144 | 0.892 | - | - | 0.248 | 0.067 | 0.072 |
| Duration of type 2 di | abetes | | | | | | | |
| 1-10 years | - | - | - | - | - | - | - | - |
| 11-20 years | 0.263 | - | - | - | - | - | - | - |
| More than 20 years | 0.011 | - | - | - | - | - | - | - |

Source: Own construction (2017).

Age 70-70 years (p=0.007), mixed-race Brazilians (p=0.011) and female gender (p=0.011) remained associated with worse scores in the Vitality domain. Also, it should also be noted that more than 12 years of study (p=0.018) entered into the model while income and insulin use were removed from the regression model.

Age ≥ 80 years (p=0.005), 8-12 years of study (p=0.043) and income of up to 2 minimum wages (p=0.005) and of 2-5 minimum wages (p=0.009) remained associated with worse scores in the SRF domain in the regression model. In addition, only income of 2-5 minimum wages (p=0.004) remained associated with worse scores in the ERF domain in the regression model.

In the MH domain, only gender (p = 0.003) and income (p = 0.025) remained in the model. Marital status and amputation were no longer significant.

IV. DISCUSSION

The impact of DM2 on the quality of life (QoL) of older adults is not deeply discussed in the literature. Therefore, this study stands out for analyzing the impact of this chronic disease on the quality of life of this population group.

Using the SF-36 questionnaire to analyze the domains of QoL in older adults with DM2 enabled the participants to take a look at their own health status, which, may assist them in decision-making behaviors [19].

The age of the participants ranged 65 to 94 years and there was a predominance of individuals aged 70 to 79 years (47.6%). This finding depicts the classification of the older population into two age subgroups: individuals aged 65 to 84 years, who are considered the "young old", and individuals aged 85 years and older, who are called the "very old" [20].

The predominance of the "young old", represented by the study participants' mean age of 73.2 years, is in line with research using demographic data [21]. On the other hand, researchers reported an important percentage of older adults over 80 years of age (about 12%) [22], which is also in line with the findings of the present study (15.3%). These people need careful monitoring given the increased risk of health problems in this age group.

The predominance of women (56.5%) demonstrates their health care attendence behavior. Also, because women tend to live longer than men, older women outnumber older men almost everywhere [2]. The predominance of married and widowed older adults is

supported by researchers who reported a predominance of married and widowed older adults in their research [23].

There was a higher percentage of self-declared Black older adults in our study. Studies have reported higher prevalence rates of DM in Black adults [24,25]. However, there are divergences in the contextualization of the use of race and ethnicity in research [26].

Althroug the development of DM2 does not depend on the level of education [27], in our study the association between DM2 and education of up to seven years of study persisted in the regression analysis of the mean scores in different domains of quality of life (SF-36). These findings are corroborated by a standardized cohort study of eight Western European countries that demonstrated inequalities with an inverse relationship between level of education and risk of DM2 [28].

Education can improve knowledge on and attitudes towards DM [29]. In addition, education can also improve adherence to the treatment plan because patients with low literacy may have difficulty understanding instructions and are hence at increased risk of health problems [30,31]. Retirement, which was reported by 93.5% of the participants, is a social institution that ensures permanent income. However, older adults may face a decrease in income as only 4% of the participants in our study received more than five minimum wages. Low income can have an impact on older adults' QoL as they may experience difficulty paying their own bills and become expensive to their descendants, thus leading them to experience feelings of low self-esteem [32].

In our study, more than half of the participants (52%) exhibited a diabetes duration of one to ten years. It should be noted that diabetes duration is a risk factor for complications such as diabetic neuropathy and nephropathy [33]. Of all the older adults analyzed in our study, 10.1% exhibited foot wounds and 6.0% were amputees. Diabetic foot is a consequence of infection, ulceration and/or destruction of deep tissues associated with neurological abnormalities and is a common cause of disability. Patients with diabetic foot ulceration are found to be more socially deprived and hence have poorer QoL [34].

The older adults analyzed in our study used insulin and oral hypoglycemic agents and followed a diet plan. In addition, 87.5% of them used more than three medications/day. Patient adherance to treatment is a major problem in clinical pratice and a challenge for health professionals [35,36]. It is emphasized that the treatment of DM2 should take into consideration the patient's age, cognition, cultural factors, support systems, eating patterns, physical activity, social context, blood glucose levels and drug interactions, adverse reactions and contraindications [5].

The statistical analyses of the mean scores in the SF-36 performed in our study revealed better scores in Social Role Functioning (SRF), General Health Perceptions (GHP) and Mental Health (MH). Assessing the domains of QoL allows the identification of the most and/or least affected areas of the health of a given population [37].

In our study, older adults aged 80 years and older exhibited the worst QoL score compared to younger individuals. The perception of QoL varies according to age, with older individuals exhibiting less satisfactory QoL scores [38]. In addition, advanced age seems to be associated with lower scores in the physical, psychological and social domains of QoL [39].

Another important finding in our study was that single older adults exhibited better QoL scores, which is in line with the findings reported by other researchers [40]. However, worse QoL scores among widowed older adults have also been reported. It is believed that widowhood interferes with the management of DM2 because the loss of a beloved companion can cause health alterations and is associated with increased vulnerability to depressive symptoms, which is a risk factor for porrer QoL [41].

Ethinicity is another factor that may influence QoL. In our study, nonwhite older adults exhibited better QoL scores compared to their White peers, particularly with regard to vitality. Studies have identified a predominance of frailty among White older adults compared to Black older adults [42,43]. However, researchers continue to seek biological, psychological, and contextual explanations for such differences [44,45,46].

Gender also seems to influence the perception of QoL. In the present study, men exhibited better scores in all the domains of QoL compared to women. This was also true in a study of Koreans and Americans, in which older women presented lower QoL scores compared to men [48]. This finding may be explained by the fact that women have negative aging perceptions while men have more positive feelings and enjoy life better [47].

Negative perceptions of QoL are associated with low levels of education in diabetic older adults [49,16,28], which is in line with the findings of the present study, in which uneducated older adults exhibited worse QoL scores. Literacy was found to predict self-monitoring and self-care behaviors in diabetic older patients, which may improve QoL. QoL perceptions also differed between retirees and non-retirees in our study. Retirees presented worse QoL scores. This findings is supported by researchers who also found poorer QoL and higher rates of depression among retirees [19]. Income decreases markedly after retirement, which can influence QoL [51]. In our study, older adults who received less than one minimum wage had worse QoL scores compared to those who received two to five minimum wages.

Diabetes duration had a strong influence on QoL in our study as older adults with a diabetes duration of more than 20 years exhibited worse QoL scores. Diabetes duration and glycemic control are important factors related to the development and severity of diabetic retinopathy, neuropathy, nephropathy [7].

It should be noted that older adults with foot lesions presented worse QoL scores compared to those without foot lesions, mainly with regard to PF, PRL and SRF. Physical, social and emotional aspects of QoL were also the most affected in another study [52]. Similary, nonamputees also exhibited worse QoL scores compared to amputees, particularly with regard to MH. This finding may be explained by the factors related to this condition, such as pain and emotional aspects, including suffering.

With regard to the therapy used to control DM2, the older adults who used insulin presented better QoL scores compared to those who did not use inlusin. Likewise, the particpants who used up to three medications/day had better QoL scores compared to those who used more than three medications/day. Glycemic control is the main goal of treatment. Glycemc control with insulin therapy reduces the risk of microvascular complications and may prevent macrovascular complications [53,54,55].

Insulin therapy can be initiated in the early stages of DM2 treatment when only lifestyle changes (diet and exercise) combined with oal hypoglycemic agents are insufficient to achieve glycemic control [5].

The permanence of the variabes age, gender, ethnicity, education, income, retirement and diabetes duration in the logistic regression model allowed a better understanding of the relationship between the domains of QoL and these variabes. This finding favours the planning of heath promotion actions to prepare older aduts with DM2 for healthier choices in their daily life with a view to improving their quality of life.

V. LIMITATIONS OF THE STUDY

Although we used a random sampling method, the research population consisted of older adults from one single city. Therefore, the findings of our study cannot be extrapolated. However, it should be noted that the city where the study took place is the fifth largest Brazilian city. Additionally, the CIDH is a reference center for the study of DM2; therefore, its results may also be found in other places and may serve as a basis for the measurement of older adults' quality of life. Finally, the difficulties in accurately defining the duration of DM2 due to the asymptomatic period prior to diagnosis should also be noted.

The findings of our study may assist in the planning of interventions targeted at older adults with DM2. The SF-36 results showed that older adults with diabetes are less satisfied with their QoL, thus demonstrating that the impact of diabetes cannot be measured only by using clinical parameters, such as glycemic control and presence of comorbidities.

Furthermore, knowing the QoL of older adults with DM2 is key to planning and implementing evidence-based interventions and public health policies. Therefore, further research should be carried out because studies carried out to assess QoL in diabetic older adults are still incipient.

VI. CONCLUSION

The findings showed that older adults with diabetes were less satisfied with QoL, which was influenced by age, gender, education, race, income, diagnosis duration, foot wound and use of medication. The findings demonstrated that the impact of diabetes cannot be measured solely by using clinical parameters such as glycemic control and the presence of comorbities.

The SF-36 provided a better view of older adults' health status and QoL domains, which may assist in the planning of health promotion programs to prepare older adults with DM2 for healthier choices in their daily life and hence improve their quality of life.

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Startups, entrepreneurship, or employability condition?

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Abstract—This theoretical article aims to analyze startups as a way of coping with entrepreneurs in the context of unemployment and precarious work. It presents a contextualization of labor relations, which results from the global macroeconomic crisis, which deteriorated the process of global economic growth in the period between 2011 and 2016, its implications for the Brazilian market, and the repercussions on the employment situation in the country until 2019. About the understanding of the development requirements of startup entrepreneurs, the concepts of entrepreneurship, innovation, disruptive innovation, as well as startup and business incubators will be addressed from a historical-conceptual perspective. The incubators, besides offering the physical space, aims to develop entrepreneurs by promoting an entrepreneurial culture from the academic environment. The question that emerges from this analysis indicates that entrepreneurship has presented itself as an alternative route and by necessity, to subjects in conditions of unemployment and discouragement in the face of labor market difficulties.

Keywords—Entrepreneurship; Incubators; Startups; job.

I. BETWEEN DISCOURSE AND PRACTICES: AMBIVALENCES AND CONTRADICTIONS

The current context of postmodernity is forged by neoliberalism, marked by technological supremacy – and neoliberalism is defined here as a model that encourages individual entrepreneurship in contrast to collective action, which, according to Rodrik (2017), guarantees the market priority in the conduct of government policies.

The understanding of the employment and health situation today requires a reflection on this socioeconomic model and itsvicissitudes. On the one hand, there is an *Agenda 2030*, established by the United Nations, where global guidelines for the guarantee of socioeconomic development were presented, and broad access to health and social justice for all countries of the globe called *17 Sustainable Development Goals(SDG* s).On the other hand, the statistical data presented in the *World Employment Social Outlook 2019* (ILO, 2019) show the signs of a lasting socio-economic crisis, a decrease in the conditions of decent work and social

justice, and the widening of the differences between the richest countries on one side and the poor and developing countries on the other – indicating a fissure of the neoliberal model. The employment crisis has been aggravated by technological advances, which do not fail to bring benefits while eliminating jobs and providing "uberization" or unsecured work. Decent work that would be a condition proper to improving the quality of life and health passes off the socio-political walls.

II. THE PROMISE AND REALITY (OF THE LACK) OF EMPLOYMENT

The 17 objectives set out in the *SDGs* were considered by the International Labor Organization as a plan for structural, economic and social transformations around the world that were quite ambitious, as they would address the concerns of closer proximity to civil society and human rights groups aimed at establishing conditions for governance, economic growth, women's rights, environmental degradation, decent work and inequalities within and between societies. The future that

was envisioned from there would reflect the ideas in which all countries, regardless of their level of development, could reach: people, through human development; the planet, through environmental sustainability; prosperity, through inclusive economic growth and transformation; and partnership through a network of international cooperation.

From this understanding, inclusive and fully functioning labor markets could offer decent work and support social justice, understanding that paid work is the main source of income for most of the world's population action, reaffirming the principles *of equality, democracy, sustainability and* proposed *social cohesion*.

However, in the current scenario, the global statistical framework calls for urgent investments in neglected areas of the economy in developed and developing countries, thanks to the persistence of significant deficits in decent work and, sometimes, the total desolation in the face of the impossibility of work. In this sense, a contradiction is explicit with the directions outlined by itself ONU in 2015 when it proposes an agenda centered on the human being.

The generalization of the decent work deficit finds its indications in various representations, including the workforce employed globally, where 3.3 billion people experienced, in 2018, some lack of material well-being, economic security, equal opportunities, or space for development.Being in a job does not always guarantee a decent life. Another indication of the deficit is the unattractive jobs, tending to informality that pays with low wages and does not guarantee access to social protection and labor rights. In this sense, the numerical disproportionality between 1.1 billion self-employed workers in subsistence activities and only 360 million people regularly employed. Regarding gender differences, the participation rate of the female workforce is still 27% lower than that of the male workforce. This work context tends to worsen as 174 million people are expected to be unemployed by the end of 2020 due to the expansion of the workforce.

In Latin America and the Caribbean, according to the International Labor Organization (2018), the average unemployment rate increased for the third consecutive year from 7,9% in 2016 to 8,4% at the end of 2017 (rate equivalent to the existence of about 26,4 million unemployed in the region in absolute numbers). While youth unemployment reached 19,6% in 2018, which means that for every five young people looking for a job, one failed. The informality rate in the same year reached 53,8% for the region, which represented, in absolute numbers, 140 million people in occupations associated with precarious conditions, lack of rights, and social unprotecteon. There is also a trend towards the transfer of the working population from the formal salaried sector to self-employment, which rose by 28,6% between 2013 and 2018. Unemployment (20%) and informality (60%) of young people up to 25 years of age bring discouragement and frustration, which added to the 164 million migrant workers are a source of concern in the socio-political aspect for the region. The lack and economic dynamism in recent years in the region directly affected 26 million unemployed people in the 2019 lights out.

The economic growth rates of 0,9% (carried out in 2018) and 2% (scheduled for 2020) are insufficient to lift the populations out of poverty with the required speed, as they do not indicate the resolution of the problems of informality, volume, and qualities of employment.Similarly, these rates are insufficient to meet and finance the demands of the middle classes in terms of quality services and jobs. The desired growth to achieve positive results in this context should reach economic growth rates of 5 to 6% (OIT, 2019).

The new technologies, the growing informality of new forms of contracting and production, the economic impacts of political instability in the globalization process, represent the criticality of the current moment not only for Latin America and the Caribbean but for other countries in the world.

In Brazil, the National Continuous Household Sample Survey corroborates global trends, indicating that the number of self-employed (24,0 million people) and the underutilized population (27.6 million people) were records of the historical series started in 2012. The number of unemployed people in Brazil jumped from 6,699 million in 2014 to 12,575 million in 2019, representing a percentage growth of 87,7% in just 5 years. While the population of employed people, in the same period, grew only 4,9% (IBGE, 2019).

The health and mental health conditions of the workforce gain greater space in a context of precariousness and reduction of work opportunities, making it necessary to elucidate the data and indicative of the area.

> III. PRECARIOUSNESS IN WORK RELATIONSHIPS AND ITS IMPACT ON

MENTAL HEALTH

In the 2017 *Mental Health Atlas*, less than half of the world's population received all essential health services, and that in 2010 almost 100 million people were driven into extreme poverty because they had to pay for health services. The mental health situation in the world presents an even more critical picture of the disparity in its approach between the rich and the richest and the least favored countries.Despite progress in some countries regarding the policies of planning and implementation ofactions, there is a lack of investments and health workers able to deal with mental health. In low-income countries, the number of mental health workers is less than 2 per 100 000 people, and who recommends as ideal number 1 worker for every 10 people with mental illnesses.

Studies by WHO and OPAS indicated that depression would be, in 2020, the greatest reason for leaving work in the world. It is estimated that currently,322 million people in the world suffer from depression, 18% more than ten years ago, this number represents 4,4% of the world's population. Although there are known effective treatments for depression, less than half of those affected (in many countries, less than 10%) receive such treatments. In addition to the inaccurate assessment of healthprofessionals about the disease, the main difficulties and obstacles about the treatment of depression include the lack of resources, and the social stigma associated with mental disorders and itself. In addition to depression, 264 million people suffer from anxiety disorders worldwide, an average of 3,6% of the population. The number represents a high of 15% compared to 2005. The impact on the world economy is approximately \$1 trillion a year for the treatment of mental illness. Investments in prevention and treatment are still very low, especially given that the estimates reported in the Mental Health Atlas 2017 indicate that for every US\$ 1 invested, considering the treatment of common mental illnesses such as depression and anxiety, the rate of return is US\$ 4 in the improvement of health and work capacity. Although a larger number of countries report having national plans for suicide prevention strategies, it is estimated that around 800 000 people die by suicide each year, which is the second leading cause of death among people aged between 15 and 29.

The pressures in the world of work, which had been addressed since the 1980s due to psychosocial risks, have gained ground in the contemporary world, following the evolution of neo-capitalism. In 1984, the WHO Occupational Health Committee defined psychosocial factors at work as "interactions between work environment, work content, organizational conditions, capacities, needs, culture, extra work, considerations that can, through perceptions and experiences, influence health, work performance, and job satisfaction" (ILO, 1986, p. 3). Stress at work has advanced as competitive pressures between organizations, and internally through departmental structures have become present around the world, the effects of advances in globalization and neoliberalism.

The precariousness of work involved in the rhythm of organizational changes, restructuring, and outsourcing, in activities regulated by contract, or even without any social guarantee, have serious consequences for mental health and well-being. In the same way that the reduction of opportunities, the fear of losing jobs, the decreased financial stability, the increase in competition, high expectationsregarding performance, all are contributing to an increasingly stressful work environment. In this sense, stress at work becomes a physical and emotional response of the worker's organism to the demands of the work environment, where demands are taken in imbalance to the resources and abilities specific to the subjects, which leads them to suffer and consequently to illness.

In *Workplace Stress, the collective challenge*(ILO, 2016) showed the relationshipbetween stress and work in both developed and developing countries. However, the changes resulting from globalization and technological advances, especially with instant communication tools, have imposed on workers a pace, pressure, and a level of competition, which has made the separation of work and private life a superhuman challenge. Work-related stress has expanded occupational health and safety demands beyond occupational medicine and psychology and social well-being. For the OIT, work would play a central role both by driving workers to psychosocial risks and to ensure measures to protect workers' health and well-being. Once again, a gap between a policy of intentions advocated by a set of countries is identified:

If occupational health is threatened, there is no basis for productive employment and socioeconomic development. The burden of mental illness is highly relevant to the world of work. It has an important impact on people's well-being, reducing employment prospects and wages, with a deleterious effect on income and families, on business productivity, and causing high direct and indirect costs to the economy (OIT, 2016, p. 2).

In Brazil, according to DIESE, cases of sick leave

from work increased by 25%, between 2005 and 2015, reaching 181.608 people. Depression affects about 5,8% of the population, which makes the country the champion of cases in Latin America. The data from the INSS indicate that in 2018 there was the granting of just over 11.000 medical leave for mental disorders, indicating the evolution of 12% compared to 2017. Complementing this scenario, the Agency Nacional of Supplementary Health (ANS, 2019) indicated that between 2011 and 2018 there was an increase of 63% in the number of psychiatric attending, 146% in sessions with psychologists, 438% in hospitalizations in a day hospital for mental health and 130% in psychiatric hospitalizations.

The question of how these statistics present themselves in the face of the challenges of *startups* is a central issue for this article.For a better understanding of the contours of the theme related to these nascent businesses, it is necessary to explore the aspects related to entrepreneurship and the new configurations present in the world of work in the postmodern context.

IV. UNDERTAKE AND INNOVATE WHY AND FOR WHAT?

In "Theory of Economic Development" (Schumpeter, 1912/1982) being an entrepreneur meant breaking with the circular flow of the economy by performing different combinations in the means of production, innovating to ensure profitability and longevity of organizations. Thus, economic development would only occur through the entrepreneur, which is the promoter of change while consolidating a new organizational structure. Landowners and capitalists, as well as their managers in general, would not fit entrepreneurship since they have an already pre-established form of work organization. Entrepreneurs would be at risk of innovation being successful or not.For this author, there would be a limitation of the economic sciences as to the understanding of the entrepreneur's vision and what moves his behavior to break with the established economic cycle. The action of entrepreneurs would deserve an in-depth analysis of their psyche, motivations, and aspirations of conduct. The condition of being of the entrepreneur in a direct relationship with how the work is organized for himself and others involved in the work environment.

Since the middle of the 20th century and, although the global economic crisis has completed ten years in 2018, the economies of developed and developing countries have been indicating growth through investment in technological innovation. For Sousa, Gonçalves, Almeida &Sacamano (2017), this situation is linked to the creation of new technologies and the role played by small and mediumsized organizations in generating jobs and income through entrepreneurship and innovation. According to these authors, innovation would be a new element in the Brazilian public policy agenda, since the Industrial, Technological, and Foreign Trade Policy (PITCE) was implemented only between 2003-2006.

Póvoa (2008) points out that, in Brazil, as in other developing countries, the innovation system is differentiated by being anchored much more in universities than in organizations, since in the developed countries participating in the Organization for Economic Cooperation and Development (OECD) the focus of innovation, mainly in high-tech areas, is on the priority agenda of organizations. According to the Global Brazil has confirmed its Innovation Index (GII), classification thanks to the quality of its universities and the quality of scientific publications. Following the current innovation strategy, Brazil, which ranked 69th out of 128 participating countries in 2014, moved back to 72nd out of 140 participants in 2018 and rose back to 66th out of 129 in 2019.

Analyzing the data of the last 6 years of innovation research in Brazil (Pintec 2014 and 2017) there was a decrease in the innovation rate of the industry by 36% to 33,6%, with investments below 2% of the net revenue of companies, which indicates a significant reduction in investments in innovation in Brazilian industry. An important factor in this scenario in recent years was that the concentration of innovation in the product was 5 points higher than in processes or services, and these innovations were developed more internally than externally, interrupting a trend of outsourcing innovation, with consequent reduction of investments in partnerships with innovation centers. Therefore, Brazil marks an inverse trend in other countries where large companies start to have their "technologies unincorporated" and outsourced. In the same period, there was a marked reduction (Δ -14%) in the percentage of companies that had some incentive from the government for innovation. Excessive economic risks, high costs, the fate of qualified personnel, and the scarcity of funding sources were the main reasons pointed out by the national industry for investment reductions in innovation.

To have a beacon of capital dimension invested in innovation, according to Tigre (2018), in developed countries, investment in P&D exceeds 3% of the local GDP (Gross Domestic Product), while in Brazil only 1,6% of GDP is invested, and 60% of these P&D researches in the country were conducted, according to Pintec 2014, in universities and public institutions. Given this scenario, it is concluded that the development of activities related to innovation in Brazilian organizations is still small and tends to reduce. There are indications of the preponderant role that the incubators of organizations and university technology parks had in the strategy of encouraging and promoting innovative products and services. The speed of response to market demands (volume, cost, and logistics) and the ability to adapt to innovation became crucial for the survival of the business of any country in the world, and Brazil could not be different.New forms of production of goods and services require computerization, automation, robotization, and the increasingly frequent presence of Artificial Intelligence.

In this sense, there were historical indicators, regarding the change of university-organization link from a linear innovation model, to an interactive model, especially through the so-called incubators of organizations linked to universities. Transcending the production and dissemination of research, incubated knowledge is in search of new products and new forms of organization.Incubators have developed ideas of technology and business in several organizations and, to form research centers, are becoming heterogeneous P&D entities. According to Etzkowirtz (2002), addresses developments, if supported by changes in the regulatory environment and government funding programs, would support the tripod university-industry-government.

Historically (Etzkowirtz, Melo & Almeida, 2005) it was from 1987 that the incubation model was formed in Brazil in a "bottom-up" movement – known as the "bottom-up" model, understanding that the movement begins on the operative bases to subsequently regulated – and when the implementation of the "Innovation Law" of 2004, there were already 60 incubators created in the country's universities promoting numerous nascent businesses. Two pillars collaborated for the historical support of incubators, one was the partnership developed between university and government, the other the partnership between industry associations and public agencies to support small and medium-sized organizations (SEBRAE) that used knowledge and experiences from both organizations and technical institutes.

For authors such as Hansen, Chesbrough, Nohria, and Sull (2000) and Peters, Rice & Sundararajan (2004), there is an indication of a change in the standard of services presented by incubators, that is, they would leave and be merely training centers, training, expansion of networking, to become centers of operation helping to reduce costs and time for the beginning of commercial activities.

Concerning the direction of the business of incubators, the National Association of Entities promoting Innovative Enterprises (anprotec) points out that the initial composition had a concentration in innovation focused on information technology, and progressively, from the internal mechanisms, the lines of research and development of universities and incentive policies allowed the inclusion of the most varied areas of technological knowledge.In 2016, there were 369 incubators of organizations throughout Brazil, which in turn brought together about 2.310 incubated startups - dependent on incubators - and e 2.815 graduated startups - survive through their resources. In August 2019, the numbers grew exponentially, indicating the existence of 363 active incubators and 12.790 startups, distributed in different markets. It should be noted that only from 2018 Brazil produced six startups "unicorns" - companies that reached a value of more than US\$ 1 billion.

The *startup* culture is liberal in principle, fitting into the free initiative and broad individual freedom and competition, following the current socio-economic model, searching for opportunities in a constant, cyclical and resilient way, making the entrepreneurial spirit, according to Ries (2012), possible throughout, and making it solely responsible for the ideation and disruptive posture - radical innovation - that depends on the survival of the business, whether in an independent Startup or a Startup belonging to a large corporation. For most authors, experts in the field, it will only be at the end of the nineties that in Brazil, Startups emerged as a mirror of the reality of the United States of America when the appearance of the so-called bubble of the internet – bubble "dot com", when the history of large successful corporations such as Google®, Ebay®, and Amazon®, began at this time.

The so-called "Accelerators" of business (organizations responsible for raising financial resources from the investment market) would guarantee access to the financial market through partnerships with incubators. The significance of the amounts applied by investment and venture capital funds in *Startups* in Brazil between 2011 and 2016 exceeded R\$ 12 billion, according to data from the Latin American Association of Private Equity and Venture Capital.

The Incubators and Startups operate in a business environment still little known from human relations, presenting singularities about the forms of appointment and vocabulary - Startups, Incubators, Accelerators, Angels, Lean Startup, Canvas, Design Business Ecosystem, *Thinking*, etc. – as well as the sense of resilience necessary entrepreneur who participates the in it.The to socioeconomic data presented by the Global

Entrepreneurship Monitor 2017 report elucidate extremely interesting aspects about the profile of entrepreneurs and indicate that, in Brazil, the total rate of entrepreneurship (TTE) was 36,4%, which means that for every 100 Brazilian and Brazilian adults (between18 and 64 years old), 36 were conducting some entrepreneurial activity, and 20.3% were undertaking new or nascent businesses. According to the same report, the motivation of entrepreneurs has linked to two reasons: 59,4% of the initial entrepreneurs undertook by opportunity and 39,9% by necessity. In this perspective, unemployment rates above 12 percentage points, according to the historical series of IBGE/PNAD reports for the years 2016, 2017, and 2018, would be the second indication of the motivation for entrepreneurial action.

V. INNOVATION, DISRUPTION, AND STARTUPS

The understanding and understanding of the universe of entrepreneurship, within a postmodern conception, is linked both to what gave rise to the third industrial revolution and to globalized processes, as well as to what emerges with the search for the anticipation of the needs of consumers through innovation and disruptive innovation. These concepts and definitions will be dealt with below.Entrepreneurship and the innovation process remain active after 100 years of the publication of "The Theory of Economic Development" (Schumpeter. 1912/1982). The innovation process confirms the central character of what it is to be entrepreneurial - considering the evolution in the market economy, technological advances, unprecedented competition and the urgency for innovation imposed for the survival of business in the neoliberal economy - the foundations of an environment conducive to a transformation of the concept of innovation.

Christensen (1995) proposed, for the first time, the concept of Disruptive Innovation in the book Disruptive Technologies: Catching the Wave. Disruptive innovation would happen when an organization launches cheaper, more affordable, and efficient technology, sacrificing profit margins but creating a revolution; leaving obsolete who was once a market leader. This concept has been added some characteristics of disruptive innovations: smaller profit margins, smaller target markets, and simpler products and services, which do not necessarily need to be as attractive as the solutions previously existing. The main dilemma presented by the author would be that traditional and successful organizations would be more susceptible to failure because they would be confident and stuck to their current customers and their demands for incremental technologies, in this way they would pay exclusive attention to these customers, failing to discover new markets and monitoring the threat of new competitors, who in turn would propose the technologies **of rupture** – innovating in a disruptive way.

There is a revisiting of the concept of disruptive innovation when one comes to consider it as a development process focused on both the business model and the product or services offered indicating that in most innovations, disruptor agents tend to focus on getting a business model, not just the product, simply. The case of Netflix, the global provider of movies and television series, via *streaming*, currently with 100 million subscribers, which more video rental services and movie rentals on the physical platform (DVDs) obsolete would be the best example of this conceptual review for Christensen, Raynor, and McDonald (2015).

Another disruptive innovation approach was proposed in "The Blue Ocean Strategy" which comprises market innovation in its most radical form – disruption. The cornerstone of this theory is value innovation - when an organization ceases stops employing effort directed at overcoming its competitors, and begins to focus its resources and commitment to "make competition irrelevant by offering leaps in value to buyers and to the organizations themselves, which have thus pioneered new untapped market spaces." (Kim & Mauborgne, 2015, p.27). The authors present as an applied model of this new strategy the "Cirque du Soleil", neither circus show nor theatrical production, with the delivery of more fun and vibration with intellectual sophistication and the artistic richness of the theater." Um, a new circus concept that broke the value-cost trade-off and created a blue ocean of new market space. "(Kim & Mauborgne, 2015, p.28).

In this context, innovation would be at the service of developing an equally simple and powerful idea, reaching unexplored market spaces that would make irrelevant competition, which could result in the best expectations of outcome for an organization. Innovation gained prominence as a theme of research by official bodies from the beginning of the 1990s, through the Oslo Manual (OECD, 1992), the main systematizing source of the concepts associated with the theme. The definition of innovation has become "an implementation of a new or significantly improved product (well or service), or a process, or a new marketing method, or a new organizational method in business practices, workplace organization, or external relations."(OECD, 2018, p.20).

Disruptive innovation has become part of the competitive differential, which marks a product in such a way as to protect it from other products on the market,

making your brand have an added value. Furthermore, radical innovation would be linked to the agility with which *startups* can respond to what customers offer as *feedback* and not to the finished or watertight product. Thus, both independent *startups* and those allocated in large corporations should work to maintain the client as close as possible, making him an interlocutor in the development of the business. This task would become extremely demanding of the people involved, requiring the maintenance of structural attributes for them: "scarce but safe resources; independent authority to develop their business; personal interest in the outcome." (Ries, 2012, p. 237).

Some people are first-growing inventors, who prefer to work without the pressure or expectations of the later stages of the business.Others are ambitious and consider innovation a path towards the organization's senior management. Others are also especially focused on established business management, outsourcing, maximizing efficiency, and reducing costs. People should find the types of tasks they best adapt to. Entrepreneurship should be considered a viable career plan for innovators within large corporations. (Ries, 2012, p. 237)

Disruptive innovation is present in the daily life of organizations, whether they are established in the market for years or new ventures, without it the risk of survival will always be greater. If for large corporations the challenge lies in how to think outside the narrow parameters of successful results so far; for small organizations or those that are still in the development phase, the challenge begins in testing the disruptive ideas and concepts of new products or services that will still come, without any guarantee of success or financial return. In this way, the universe of *Startups* is presented.

VI. THE STARTUPCULTURE

The concept of *startup* presents itself in different ways, although it maintains a centrality in the idea of being organization information. Table 1 presents the following overview of the main concepts to signal several approaches.

Table 1: Startup Concept Review

| Concept | Author | Year |
|--|---|------|
| A startup is a temporary organization looking for a business model that is repeatable and scalable. | Blank | 2010 |
| <i>A startup</i> is a human institution designed to create products and services under conditions of extreme uncertainty. | Ries | 2012 |
| <i>A startup</i> is a group of people looking for a repeatable and scalable business model, working in conditions of extreme uncertainty | Gitahi | 2016 |
| A startup is defined by three features: are companies under 10 years old, that feature (highly) innovative technologies and/or (highly) innovative business models and that have (strive for) significant employee growth and/or sales. | Hensellek, Kensbock, Kollmann&Stöckmann (SME) | 2016 |
| <i>Startups</i> are temporary organizations looking for a repeatable and scalable business model. From this definition, it is noticeable that startups are extremely flexible organizations, unlike mature companies, which already run a business model, have well-defined culture and hierarchy. | Sousa & Cavalcanti | 2016 |
| <i>A startup</i> would be a temporary organization designed to achieve a scalable and profitable business model to become a company in the future | Magalhães & Teixeira | 2018 |

Note. Prepared by the authors.

Temporality is present in the concept of a *startup* as a form of delimitation of the initial stage of an organization that is being born that, after achieving

market volume and financial stability, could become a mature organization moving, therefore to a business model, through process, methods, defined values, and profitability. (Blank, 2010; Hensellek, Kensbock, Kollmann&Stöckmann, 2016; Sousa & Cavalcanti, 2016; Magalhães& Teixeira, 2018).

Both in the definition of Blank (2010) as for that of Reis (2011), Gitahi (2016) and Sousa & Cavalcanti (2016) it is understood that the term *startup* was created to classify an organization that should be able to face an environment of extreme uncertainty and absence of a previously defined business model. This concept has become one of the most applied for the definition of this type of nascent organization.

By environment of uncertainty, it is understood that the entrepreneur would be proposing something new and disruptive to the consumer market, meeting existing demand, but not perceived until then, whether it is in products or services aimed at the final consumer or along the value chain of a larger organization. It would be up to the consumer to respond positively or reject the new product offered, generating market uncertainty. As for the absence of a previously defined business model, it would be a company structure, concerning the operational and administrative processes for its operation, which would come in response to this new product or disruptive service, and that, for this reason, would also require a new model to be developed and implemented. This business model should be developed as the market response becomes positive to the product or services offered (Reis, 2012).

Magalhães& Teixeira (2018) present a "manual" in which the entrepreneur is defined as the one who dedicates himself to his *startup*, unlike an executive or an employee of an organization, who would work for his monthly salary; would be dedicated to the construction of a business, deposing in this business the dream of changing the world, helping people and selling his product to as many people as possible. There would thus be a greater purpose of the idea of the cause, of a higher reason for being, about other workers. Bill Gates (founder of Microsoft) and Steve Jobs (founder of Apple) are the professional references that bring together the characteristics accepted to the *startup's* entrepreneur profile – the first went 10 years without a vacation and the second was a *workaholic*.

The uncertainty environment of startups can be represented by a recent environment carried out by the Service Brazilian of Support to Micro and Small Enterprises (SBRAE) in 2016, in which it was identified that about 30% of the analyzed *Startups* closed their doors in the last period.

In magazines and newspapers, in the success

stories of cinema and numerous blogs, we hear the mantra of the successes entrepreneurs: with determination, genius, correct timing, and – above all – a great product you can also achieve fame and fortune. There is a powerful mythcreating industry in action to sell us this story, but I came to believe that it is fake. In fact, after working with hundreds of entrepreneurs, I have personally seen how often a promising start leads to failure. The bitter reality is that most *startups* fail. (Ries, 2012, p. 2).

VII. STARTUPS IN THE FACE OF REALITY

Cantamessa, Gatteschi, Perboli&Rosano (2018) undertook research focused on startups that failed in their business trajectory. Using as a basis two specific databases (Autopsy.io and CB Insights), focused on the free recording of the stories of entrepreneurs who failed in their business. The two main reasons that direct startups to failure are related to the absence or failures of the business model, as well as the lack of structuring processes aimed at the development of the business as a whole. The study also points out that the founding entrepreneurs focus their attention on the development of the product or service, dedicating themselves less to a commercial strategy. Also, 21% of startups exhausted their financial resources, which, according to the authors of the research, could be attributed to failure to conduct scheduled investment contributions, or even as a signal that entrepreneurs did not seek adequate technical support to ensure assertive decisions regarding contributions.

In a study by Anprotec (2016) with 65 incubator managers, data similar to the research by Catamessa et al., that is, 71% of the interviewees blamed the entrepreneurs themselves for the failure of *startups*, due to factors related to maturity, difficulties in teamwork, difficulties in composition and corporate management, technical domain over the product under development and lack of managerial experience.

Once these challenges have been identified, most incubation programs, from Brazil and abroad, establish the promotion of diversified actions to contribute to the entrepreneur in his training. It is concluded from there that the success or failure of *startups* would be directly related to the quality of the incubation program, and their ability to make entrepreneurs able to forward their nascent companies maturely, with mastery of techniques and knowledge that will ensure the survival of their business in the market.

Researchers like Teece (1986), Etzkowirtz et al.

(2005), Longhi (2011), Ries (2012), Sousa, et al, (2017) that address the theme of *startups*, do so from their fields of research (economics, engineering, and administration), explaining the failures in the development of organizations and, consequently, proposing methodological alternatives aimed at the correction and success of the enterprises. An analysis of the point of view of human relations and the health of the workers involved in this context would present questions related to how to face reality and the demands presented by innovation, competitiveness, and technology.

VIII. FINAL CONSIDERATIONS

The data provided by the different official bodies in the world and Brazil are impressive, pointing to a trend towards the advancement of mental illnesses and their close relationship with unemployment and/or working conditions. As a consequence, in the country of continental dimensions, the socioeconomic diversities between the federative units, and the social disparities become more evident. The unemployment rate at the level of 12% completes 5 years and remains pointing to an installed crisis of gigantic dimensions. The threat of unemployment makes room for precarious working conditions and relationships, closing a disastrous circle that compromises the mental health of workers. Both the natural increase in the workforce and the increase in technology and the media are increasingly fueling unemployment. The unprecedented economic crisis, the inequalities between poor and developed countries draw the conjuncture of international policies specific to neoliberalism. In this context, decent work is incompatible with the population migration process for the search for survival, and with increasing unemployment, both arising from an economic crisis with negative perspectives. Formal workers threatened by the ghost of unemployment are subjected to a lack of material well-being, economic security, equal opportunities or space for development, increasingly precarious working conditions, becoming increasingly passive to illness. The new modalities of employment contract impose precarious working conditions and the absence of social guarantees. Self-employed workers, formal and informal entrepreneurs, put themselves at maximum risk of work without guaranteeing pay or social security. Young people and inexperienced adults, with less and less chance of placing in the labor market, seek a form of work that can guarantee their identities as socially inserted adults, become susceptible to the seduction of neocapitalist idealism, and undertake in their startups.

It is in the context of this context that technological incubators occupy the space of reception and insertion of these workers in the organizational world. They offer physical space, formal training, and monitoring of business developments, but there are no guarantees in the face of such a challenge: a business still in ideation, *the startup* requires disruptive innovation, its business model, balanced corporate construction and pace of insertion in the market. The fragility of this alternative of insertion in the world of work is shown through the numbers -30% of *startups* close their doors in the first year of existence.

It can be inferred that Brazil presents a movement of forced transfer of its workforce to entrepreneurship by necessity. Transfer justified by the lack of job opportunity and the need for survival, implying aspects of training and professional skills that are not always part of the training characteristic of the population involved.

The contextual fragility of these workers – entrepreneurs of *startups* generates several important questions about relationships and working conditions and how they could affect their mental health.

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Execution Manual and Preventive Maintenance in Residential Works

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Abstract— Despite the continuous growth of civil construction, problems such as lack of maintenance have still been a major reason for disasters. And this process is regulated by rule, because it is part of the system in which it is necessary to correct pathologies and in order to maintain conditions of use of the building. Any and all residences must undergo this maintenance process, whatever the type, and preventive maintenance must be followed in order to maintain routine care to guarantee quality, durability and good performance of the facilities and services. Through a form, which was applied to professionals linked to residential construction, in a descriptive way a manual was developed, which through the results obtained was able to generate important tips as to pay attention to some processes in the execution and the attention that must be taken frequently, and when necessary performing routine maintenance. The most important points that were raised in the manual are the cold water and sanitary installations, services on walls and roofs that generate frequent wear and which causes the loss of the performance of the system as a whole. The intention is to raise the importance of paying attention to these repairs that are repeatedly observed and to be more careful when building with the proper techniques and labor and even after delivery, for the user's responsibility to keep a close eye on the expiration dates of each element inserted in the residence.

Keywords— Maintenance, Pathology, Preventive, Manual.

I. INTRODUCTION

Over the years, the lack of maintenance has been mentioned a lot by the disasters that have been occurring, and maintenance actions need to be seen more than just a repair, an activity scheduled and carried out properly and at the right time.

With the technological evolution, the civil construction had to prepare itself adapting, mainly in the reduction of costs due to the reality of the market when we went through a process of fall. So, the civil construction tries to restructure itself looking for favorable conditions to bring quality in the workforce and in the construction processes.

For such reasons, the NBR (Norma Tecnica) 15,575 of performance seeks to reconcile the reduction of uncertainties with experts regarding the position of the Consumer Protection Code, in order to discipline this union through parameters. And so, to enable the standard to give conditions to develop a quality of the performance of the construction systems in order to leverage the civil construction with quality (ABNT, 2013).

As a form of action in view of the repair needs that emerged from Maintenance Engineering, a way of creating and providing conditions to perform the services properly. One example is the possibility of carrying out an action plan, seeking to reduce the extinction of setbacks and ensure durability and quality of the services then performed. This is how the concept of maintenance management was created.

But we still need to overcome some barriers in the face of evolution. Kardec and Nascif (2009) explains the three maintenance paradigms briefly as:

The paradigm of the past was when the maintenance man was satisfied with the performance of a good renovation service. The paradigm of the present is for men to feel good about preventing the occurrence of failure and thus work. And finally, the paradigm of the future is when man is actually able to avoid unplanned repair work.

Thus, in the search for the leap of companies regarding the paradigm of the future, it will bring greater and better results within the civil construction sector and can carry out reform activities in a planned way in order to solve recurring problems. The use, operation and maintenance manual governed by one of the standards, NBR 14037, has the function of demonstrating that care is needed in the execution, conscious use, that is, in the continuous attention with the residence after the moment of delivery, especially because each service and installation, for example, has a preestablished useful life mainly due to the fact that each material used in any construction stage has a performance and durability, and when it loses workability it must be changed. Not to mention when services are performed in the wrong way, it will possibly highlight the need for repair well ahead of schedule (ABNT, 2011).

The usefulness of the manual is not only to establish deadlines for carrying out services and repairs, but to safeguard each responsibility for the usefulness of the product, which in our case is residence. Both the engineer / builder and the user need to be aware of their obligations.

The objective was to identify and analyze the observation of residential construction professionals, which are the recurrent pathologies, and then the creation of the manual with some instructions for care with execution and preventive maintenance. That through it describe the appropriate processes for the application and correct performance of services and due repairs. Finally, guarantee durability and quality in your home and avoid any problems that may generate discomfort and danger.

II. METHODOLOGY

This article used the means of applying a questionnaire (via google forms) with residential construction professionals from all over Brazil, which obtained qualiquantitative results. The main focus was to understand how professionals point out which pathologies bring major problems to the building, mainly about their contact with preventive maintenance, maintenance management and manual.

The article was carried out in a descriptive way, using bibliographic research methodology, standard articles, laws and books of renowned literature already published, as well as: periodicals, dissertations and magazines.

The survey data was obtained through a form, with objective questions for any professionals who have contact with specifically residential construction.

Therefore, after analyzing the data, it allowed us to build a manual with some guidelines for execution, such as preventive maintenance, the main emphasis of which is on the discussion of the most recurrent pathologies. The objective is to give a general notion to the builders, in important points that we must pay attention to, either during construction or in preventive care, in order to avoid wear, total loss of performance, guarantee greater durability and useful life of the residence.

NBR 5674 explains the importance of the maintenance process for the building, it portrays the responsibilities of both the owner as a service provider, the maintenance system as the attributes of the building universe, guidelines and considerations, as well as explains the importance of basic documentation, budget forecasting, that is, all the essential process that must be observed and that explains how valuable it is to carry out the necessary maintenance (ABNT, 2012).

The creation of the manual and the discussion of results used the basis of some standards such as: NBR-5462 reliability and maintainability, which contributed to the understanding and application of concepts, especially defects. NBR 5674 - Building maintenance in 2012 that helped with the procedure for the provision of building maintenance in matters such as data collection, required basic documentation, design and budgets for the services performed, among others. NBR 14037 - Guidelines for preparing manuals for the use, operation and maintenance of buildings - Requirements for the preparation and presentation of the 2004 contents, which added guidelines for the preparation and presentation of the manual with language issues, minimum content, structure, and among other relevant and considered points, as well as other standards and authors mentioned (ABNT, 1994; ABNT, 2012; ABNT, 2014).

III. RESULTS AND DISCUSSIONS

From a form elaborated with 11 questions, we initially identified about the professions of the interviewees as shown in figure 1, considering that we will have a greater opinion of civil engineers, which leads us to say that we will have a point of view more technical experience of the

graduates.



Fig.1: List of respondents. Source - Author of research.

In the following figures taken from the questions in the form, the interviewee was free to check more than one option and pass on his experience which facilities are the protagonists as well as causing future repairs. Which led to the main two being: cold water and sanitary facilities.



Fig.2: Installations leading to pathologies.

Source - Author of research.

According to NBR 5626, "component: Any product that makes up the building installation for cold water and that individually fulfills a restricted function. Examples: tubes, connections, valves, reservoirs, etc." In order to understand the depth in which exactly part of the installations these problems occur, there was another question and it was identified that in the pipes, according to the professionals, the connections inside the installation and accessories such as the parts of use, bring greater problems and demands of repairs. Check in figure 3 (ABNT,1998).





The installation of cold water is still a service that brings many problems regarding pathologies, which results in maintenance. In preventive maintenance, the intention is to maintain care to avoid total degradation. In order for this not to happen, attention must be paid to the proper execution of services and continuous preventive care.

SINDUSCON-SP, proves that about 75% of the pathologies in civil construction are the result of problems in the hydraulic installation, and that some factors favor

this high index, such as: running the installations without a project, using quality materials and inferior performance with an interest in decrease costs in the work, unskilled labor, and because the facilities are not visible and are in most cases buried. This confirms the analysis of the professionals regarding the attention and the importance of highlighting the hydraulic and sanitary installations in our manual.

In order to describe the conditions of recurrent pathologies in an analysis, we will have a better performance in buildings, ensuring prevention and avoiding the future appearance of new problems like this. And this discussion can result in a significantly positive way in the realization of projects, executions and also favor the user in terms of information and in the administration of both proper use and maintenance (NEVES and MACEDO, 2013).

And talking about maintenance proved to be important because even though the first question showed in their answers that 91.5% know the concept of maintenance, later that 65.1% have worked or work with maintenance practices, question three still showed an index below 59.4% of respondents have already worked or work with maintenance management, which is important in controlling the durability of the system as a whole.

During the research, he was also asked among the elements of the residence, which represent the greatest number of problems over time. And walls and roofs stood out as the first. And to have a better investigation, it was asked what exactly these pathologies are appearing, being highlighted the cracks, cracks and cracks in the walls, as well as leaks, infiltrations and molds that arise due to problems with the roof. The figure below shows how the professionals scored the pathologies according to each element of the construction.



Fig.4: Pathologies in construction elements.

Source - Author of research.

Holanda Jr. (2008) explains that the appearance of cracks is often due to imperfections in the performance of

masonry, which also occur in concrete structures. This pathology occurs when the requesting forces are greater than the material's resistant capacities, as a result of which the opening is caused by the release of tensions. And this type of opening can lead to a failure in aesthetics even in the durability of the building's structural performance.

The pathologies of cracks and fissures are more common, while the structures are moving. Pereira (2005) brings the study of anomalies in non-structural masonry walls and mentions that cracks and cracks occur frequently if the execution does not comply with the requirements that the standard requires, but that there are several reasons for the appearance of cracks and cracks. Nascimento (1993) also brings a study of cracks, but in soil-cement brick walls and explains that mainly when the construction techniques are flawed, this type of problem occurs, and the main intention was the study in order to minimize these pathologies.

| Table 1 - Leak in the roof rain network. Source - Adapted |
|---|
| from KLEIN, 1999 |

| Leak locations | Errors of | Causes | Manifestations |
|----------------------------|-------------|---|--|
| | Project | Insufficient cross section for flow in gutters and | |
| Gutters | Execution | Incomplete or broken welds Little drop for draining water Rails without support Inadequate connections in the fall pipes Insufficient goodwill in downspouts, flashings, etc Insufficient fixation of downspouts on walls | Stains on ceilings and walls Gutters Runoff from the walls |
| | Maintenance | materials used (oxidation of outters) | • Mold |
| Drop tubes (conductors) | | Holes in gutters and conductors Clogging by debris (sheets, paper, etc.) Kneading gutters | • Prevention of vegetation in the gutters |
| | Materials | Low quality | |

Costella, et al (2015) also brings a study of the appearance of cracks in sealing masonry focusing on the rupture stress of the materials used in the restoration of the element that was compromised. Abreu (2019) brings an analysis of the recurrent pathologies of cracks in molded walls on the site. Anyway, there are several studies focused on the use of various types of materials and constructions

that involve pathologies of cracks and cracks, which leads us to realize the importance of this study.

When it comes to pathologies on the roofs, Klein (1999) also highlights the leaks that arise over time, where he indicates the locations, what type of error was identified, the manifestations and their causes (as shown in table 1) which leads us to our figure 5 of the research that he identified in view of the observation of the professionals where exactly it was the errors that generate the changes in the residential construction.



Fig.5: Causes of pathologies.

Source - Author of research.

This result brings us a concern with the execution mainly in the deficiency of the specialized labor and in the preventive maintenance practices, confirming even more the importance of the Use, Operation and Maintenance Manual that must be delivered to the owner right after the delivery of the house. Taking the construction company and the user the responsibilities and care of both parties, valuing the performance and durability achieved as mandated by NBR 15.575, which says that the residence must have a minimum of 50 years of useful life with quality (ABNT, 2013).

In another question on the form, the person responsible for these failures was asked whether it would be a lack of care by the owner, mainly performing routine maintenance or by the construction company that performed the services in the wrong way, figure 6 shows how the professionals scored. Which leads us to question other points, such as in cases where the owner fails to build without projects, buys material of inferior quality than it should, hires unskilled labor, which in both cases can be done by the construction companies, generating pathologies and the lack of Others

responsibility and commitment to the residence. Among these failures do you believe that it is the lack of care of the owner, the construction company for having performed the services incorrectly or both? Both Construction company Owner

Fig.6: Main responsible for such pathologies. Source - Author of research.

Still in terms of awareness regarding maintenance, NBR 5674 concerns the responsibility of the building owner to carry out proper repair care with the techniques established by the standard and in the manual, if any. But the construction company is of the opinion that it should keep this manual ready for the user and declare the importance of periodic care (ABNT, 2012).

In an analysis of the research, it was identified that 59% of the interviewees have already worked or work with maintenance management, which is a positive index, but which needs to increase, since NBR 5674 itself concerns the organization of a whole system that provides material, financial and human resources in order to respond to the necessary maintenance, whether routine, planned (or preventive) and unplanned, but making it possible to reduce unplanned repairs. And finally, guarantee a better development of the building system (ABNT, 2012).

Another debatable fact is that in question two of the form, it was asked whether the professionals work or have worked with any type of manual, unfortunately 60.6% answered that they did not. In agreement with the importance of the manual in civil construction, we have that in question number 11, where the great majority, 97.2% believe that the use, operation and maintenance manual facilitates not only the life of those who will execute it, but also of those who will repair and even the user who can follow this whole process with knowledge of the techniques and pay attention to deadlines. Because it was necessary, the form brought the indispensability of creating a manual with some instructions focused on the recurrent pathologies that can be seen in Appendix 1.

IV. CONCLUSION

The survey obtained a positive result regarding the indication that the interviewees in the majority know the concept of preventive maintenance, have already worked or performed practices of this maintenance and that they know or work with preventive maintenance management, but unfortunately about 61.2% of the interviewees do not work or have never worked with manuals, which may indicate that in most cases repairs are carried out without the technical instruction of the construction companies, or that perhaps these homes are built without projects and technical support.

Also according to the survey data, it made us conclude that the facilities and services mentioned in the manual are deserving more attention in the correct execution of the services, such as maintaining attention in the performance supervision, paying attention to deadlines and performing preventive maintenance, to guarantee performance as well as to achieve the useful life of the entire building processes.

Another conclusion that can be made is that even though 61.2% of the professionals in residential construction, answered that they never worked or work with manual, if there was a positive result that, with 97.1% believe that the use of the User Manual, operation and maintenance will facilitate the continuous monitoring of the owner and user who will receive the residence built and accompanied by a technician and that he will be responsible for constructing the manual, as well as facilitating the life of the repairer, instructing with the appropriate techniques. For this reason, the manual that is exposed in Appendix 1 is necessary, it highlights especially the priorities to pay attention to the execution and maintenance in residential construction, pointed out by professionals.

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V. ÂPENDICE

EXECUTION AND PREVENTIVE MAINTENANCE MANUAL

Dear reader:

This manual was developed from a survey of RESIDENTIAL construction professionals. It contains some services that have in fact been identified recurrent pathologies requiring maintenance.

The main focus is to encourage the execution of these services in an appropriate manner, in the frequent and correct practice of preventive maintenance, thus avoiding total wear and tear, mitigating the loss of services and installations.

The suggestion of this Manual is to bring in a summarized way, the processes mentioned above, with some steps of more effective execution, aiming to reduce maintenance expenses, as well as preventive maintenance care. It is worth remembering that the entire basis was removed from the referenced standards cited, as well as research articles on each item.

Cold water installation

In the cold-water installation, according to NBR 5626, various materials are used for the manufacture of parts, such as metals such as galvanized carbon steel, copper, lead, galvanized cast iron, among others. We also have plastics such as rigid PVC, polypropylene and etc., as well as other materials such as: concrete, fiber cement and other materials that, according to the standard, can be adopted in projects, provided that they meet the principles of the

standard and that the use of each material in its manual to then comply with the requirements of the standard and the manufacturer (ABNT, 1998).

It is worth remembering that according to the aforementioned standard, it respects three main premises to assess the conditions of the materials used in the installation of cold water, as well: due to the direct contact of these materials with the water, potability cannot be compromised, as a consequence of the water characteristics, the components that were used cannot have their performance affected mainly by the action of the environment that it will be inserted in and finally, to meet the expected performance in face of the requests that will be submitted during the use.

The cold-water installation is basically designed to supply directly, which results directly from the supply source, that is, from the public network. The indirect system, on the other hand, comes from the use of the reserve, whether it is reservoirs that are lower or higher and part of it is the distribution of the facilities. Mixed media can also be adopted, with the direct and indirect system. The choice of the appropriate form will depend on several factors, be it the choice of the owner, the designer or the conditions of the place, such as the lack of sufficient slope of the lot for proper distribution.

There is a great diversity of components in the coldwater installation, within the system, as a result, it will be described those that were most suggested as protagonists of future problems within the installation, which are:

- Connections
- Use parts and sanitary appliances

The connections are pieces that help in the conduction of water, be they: curves, knees, tees, gloves, among others. There is a great diversity in terms of connections and the intention is not to cover them in detail in this manual, so this information can be found in manufacturers' catalogs. The important thing here is how they should be performed and in terms of maintenance.

The assembly of each connection varies according to each material and which part will be installed, and which must follow the rules on the assembly of galvanized pipes and connections where it explains the necessary procedures. In NBR 11720, it already explains about the specifications of connections for joining copper tubes by welding or capillary brazing, in NBR 6943 it brings the specification of malleable cast iron connection for pipes, etc. (ABNT, 2010; ABNT, 2016).

The part or accessories for use, mentioned by the standard 5626 as: "Component in the downstream position

of the sub-branch which, through its operation (open and close), allows the use of water and, in certain cases, also allows the adjusting your flow.

The general conditions for installing connections and use parts or accessories are:

- In the joints, the execution must take care of the cleaning, in the removal of sticky materials the ends of the tubes to ensure that they are cleaned internally and free of particles that interfere in the adhesion of the parts.
- The care regarding screw joints must comply with NBR NM ISO 7-1: 2000, where there is the use of materials for the sealing in order to guarantee the tightness in the joints, that is, to prevent leaks with care regarding contamination of drinking water.
- Be careful with the water pressure with flow in operation in the places of use, care must be taken with regard to the flow, to ensure the proper purpose of the parts of use and of the toilets following the plan.
- In case of excessive flow or water obstruction in the part of use, where there is cavitation, it can be mitigated by replacing the part, or by decreasing the pressure in the place that feeds the component. In both cases it must also be modified in the project.
- In the case of copper or alloy connections, their faces must be sanded, using a fine steel brush or sandpaper, and the solder paste must be applied, perfectly covering the faces to be joined. The joints must be heated in order to complete the entire space, and then keep the joint immobile in order to ensure fixation and any excess must have removed, following all the manufacturer's recommendations.
- For connections in rigid PVC material, in welded joints the ends of the pipe will be cut to glue the connections. For a surface with a good finish that ensures that it is perpendicular in the cut to the tube axis, it is necessary that the instrument is suitable for use, the inner and outer corners must be sanded with a file or fixed and finally cleaned. Then the two pieces will receive a plastic adhesive for bonding and one piece will be introduced in conjunction with the other and remain stable for 30 s for the handle and the final recommendations is to remove excess adhesive material, and not use it for at least 5 minutes, remembering that the materials used including the cleaner and the glue must follow the manufacturer's recommendations.

• Finally, to guarantee the service, the leakage test must be carried out, in order to observe possible leaks and already carry out the repairs to be released for use. Normally the test is carried out by releasing the pipe with a hydraulic pressure greater than that foreseen in use, this check is made by section in the pipe and 1.5 times the pressure that will be used in circumstances without flow. In the indirect supply pipeline, the pressure in static condition is predicted in the project, in the direct one it depends on the pressure change of the public network and then it must follow a higher value than the one destined by the company.

Maintenance

In the design phase, it must be provided that the installation meets the conditions of use during its useful life and must comply with the guarantee of easy and economical maintenance, provided that it is carried out correctly and at the right time.

Initially, attention should be paid to the accessibility of all piping, its location must be separated from structures, masonry and coverings, mainly due to the movement that will be caused and possible future pathologies in the walls and / or floors. And the inspection points must be ensured in the project, to take advantage of the maintenance already foreseeing that there are no cuts and damages on the surface. "False walls" or shaft are recommended to hide and facilitate maintenance. It is recommended to inspect movement spaces such as water expansion and contraction together with the installation of mainly plastic and copper materials, remembering that the fixing supports in the pipeline must always have good conditions of use.

It is worth remembering that the inspection activity must follow regularly depending on some factors, such as the diversity of the piping, which must already be planned in the project, but which is the sole responsibility of the owner. And the owner or user, as well as said, must have the necessary information regarding maintenance care with clear details identifying the locations with the pipes and the entire system of the cold-water installation with the notion whether it was embedded or coated.

When verifying the appearance of pathologies that compromise any part, appropriate correction must be carried out, such as: adjustment of moving parts, redoing the sealing or replacement of parts for use and / or connection.

In case of changing parts, you must pay attention to the conformity of the existing one and pay attention to the type of modified joint, mainly from the welding thread. Remember, you should always pay attention to carrying out the appropriate procedure in order to maintain and guarantee the expected performance.

Finally, in any case, the importance of preventive maintenance occurs when compared to repair when the part reaches its degradation and compromise of the system, requiring the transition to a new one, leading the user to understand the frequency and expense when the prevention that must be adopted.

Some precautions must be taken as:

- The supporting elements. Parts of the sink and kitchen countertops must not be removed. And never lean on them which can cause breakage.
- To avoid clogging both the piping and the parts used and toilets, avoid throwing objects in the vases, grease or residues in the sinks, which causes the obstruction.
- In the case of future installations as required by the user, the user must pay attention when the installation is carried out as the other existing ones, in order to guarantee adequate performance without compromising the rest of the pipelines as the existing and expected flows.
- Always pay attention to the manufacturers' requirements, especially in products used in maintenance, such as periodic cleaning.
- Always pay attention to the defined validity periods of each material used as the sealing materials, the internal mechanisms of each set and in the regulation of discharges.
- Always pay attention to the plants in case of changes in the structure of the house, paying attention to the breakage and holes that compromises the installations and even the waterproofing.
- Remember to always check the validity of each service or support element performed, which requires replacement or preventive maintenance such as grouting on walls and floors, silicone and waterproofing and even when changing parts (always taking care when changing parts) or similar in the guarantee of compatibility with that existing in the replacement and in the guarantee of the performance of the part).

Walls

Currently several technologies and materials are used in the construction of walls, either by the method Steel frame, Drywall, or by total in concrete, with ceramic blocks, concrete blocks, with plaster and among other diverse ways of creating walls. The focus in question is the emergence of pathologies such as cracks, fissures and cracks. That according to NBR 9575, 2003 "microcracks are Aperture caused by rupture of a material or component with thickness less than 0.05 mm" where the openings are less than or equal to 0.5mm are considered cracks, an opening between 0, 5mm and 1mm are considered cracks. Above that, it is considered larger cracks or cracks (ABNT, 2010).

Some studies say that masonry and concrete constructions are certain to have occurred this type of pathology, which is a result of the low elasticity of the materials mentioned and when the strength of the material is greater than its resistance, the appearance of cracks occurs to ease the stresses. So, due to occasional movements, the structure is susceptible to openings, and that even if there are repairs, this problem may occur again. For this reason, the importance of an adequate execution and periodic maintenance.

In general, according to NBR 14931: 2004 for the execution of concrete structures, some precautions must be taken regarding the execution of walls, some will be listed that can improve their performance and decrease the appearance of pathologies such as:

- The closer the concrete is cast to its final point, the less the mortar is embedded in the elements of the iron form and structure.
- Still on the launch, appropriate techniques must be adopted in order to eliminate the segregation of materials, and especially to pay attention to the height of the launch. When larger than 2m in slender pieces, the care is greater in the appearance of this separation of materials and in the absence of mortar, which usually appear in pillars and in wall joints.
- The removal of reinforcement and all components for the execution of the wall must be avoided, in order not to compromise the formwork, especially in cases of high elements, and the concrete must be released by free fall.
- Another issue that must be executed and planned in the project are the joints, mainly that the compression forces must be positioned at a normal point and where there are fewer shearing efforts. If concrete is to be laid on structures supported by beams on walls, it must be suspended in a horizontal direction.

• Another precaution is the cure, the standard specifies that care must be taken until the structure reaches its hardness, such as: make sure to form a surface with durability and that reaches the determined resistance and also prevent the loss of water so that its process hardening agent has the best possible performance.

The construction of walls can be done either by structural masonry or by sealing, in any case the necessary care for each case must be taken. NBR 16522: 2016 provides for the construction of walls in masonry structure, and NBR 15270: 2017 discusses sealing masonry, and in general NBR 15575: 2013 portrays the performance of wall structures.

For both cases, the generalities are:

It provides and executes elements such as: Grade beam beam and waterproofing, straps, lintels and against lintels, pillars and lashing beams, or rebar and grouting for cases of structural masonry.

Attention should always be paid to the materials used, such as the performance of the blocks, the correct trace of the mortar, the forecast and use of the reinforcement.

It is necessary to always follow what was foreseen in the project and properly execute the places of exits and ventilation (to execute the lintels and against lintels), the installations (to insert the pipes in the right points) and points regarding the use of water and energy.

After lifting the entire wall, the coatings must be properly cared for using the right products and following the manufacturers' recommendations, especially on façade walls that require waterproofing, adequate mortar and ornamental pieces that have a greater weight of their own.

Maintenance

The emergence of pathologies of cracks and cracks must be carefully analyzed the reasons, here will be mentioned some precautions to be taken that guarantee the recovery of the structure.

In case of foundation repression, the foundation recovery measures must be taken and with the appropriate products to seal the cracks so that as a result of the repair this type of pathology will be healed, which will already avoid problems generated due to infiltration by capillarity. In the execution phase, care must be taken when waterproofing the Grade beam, which will prevent problems like this from appearing on the walls.

Due to climatic variation, the structure normally moves and in order to cause relief of the stresses exposed in it, the structure normally moves and causes cracks and cracks, which would alleviate would be the execution of expansion joints, which as its importance has already been explained, once unforeseen should be performed when this type of problem arises.
Usually with the appearance of cracks, depending on the cause, it is advisable to remove the coating, apply sealant and redo the coating now taking into account the curing times of each coating, this in case of concrete shrinkage.

Always pay attention to the reforms and internal changes in the walls, without consulting the technical manager, especially in cases of structural masonry. And especially in cases of drilling in walls. Always pay attention to the plants and the location of structural elements, pipes, the weight that the fixing equipment will cause in the structure as the unforeseen overload and especially taking care of the equipment used for drilling and fixing.

Inspect and be aware of the deadlines for changing the grout or sealant in expansion joints, because in the absence or loss of performance, the movement in the structure will continue and cause cracks and cracks. Not counting the deadlines for waterproofing and coatings, take into account the change time.

Always check the integrity of the structures and perform the necessary cleaning with the appropriate products, avoiding, for example, the accumulation of molds that generates moisture and infiltration causing pathologies.

Roof and Painting

The next topic will be portrayed together with the two services, which is the execution of roof and painting, because due to pathologies of leaks and infiltrations molds and stains are generated in the painting, and in that sense it will be treated as how to perform in the best way and how to treat this. kind of problem.

The biggest problem on roofs that causes problems is in the installation. Each type of roof and each tile used has its specific method, so this type of service must be performed with specialized labor.

Some problems may arise because they do not obey the specific trim of each tile, the cement and metal have a lower slope and the ceramic and concrete, for example. When these requirements are not obeyed, it can generate river water accumulation, or generate a lot of force in the water, causing problems in gutters and flashings.

Another important observation for a good roof installation is detailing. The project must mention the appropriate way of fixing the entire roof structure, fittings, eaves, trim, that is, contain all the minimum information necessary for a good execution, in addition to taking into account the fixation of the ceiling in the roof, supporting the own weight. And for a good performance of the entire installation, it is expected that any meeting or fixation of its components (mainly screws) is sealed, taking care with regard to infiltration, and paying attention to the elements that assist in the correct flow of rainwater as flashings, gutters and any other element that plays this role. Always remembering to choose and adopt these elements properly for each situation.

For cases in which the project foresees the capture of river waters, perform it properly taking into account especially the appropriate falls in order to avoid installation failures. However, when the project does not foresee this case, use the gutter to drain the water in order to avoid accumulations that cause infiltrations.

Maintenance

Initially, care is taken in the building that can mitigate impacts and future maintenance costs, ceilings as well as paintings are mainly committed to the emergence of infiltration. So, repairs to these services are therefore necessary. Hence the importance of guidelines for how in times of the year such as winter, in cases of poorly ventilated environments molds may occur which generate greater moisture absorption, so keep windows open whenever possible.

And in cases where mold has not been combated with ventilation, remove with specific products, always taking care with the integrity of the coverings.

And in cases where the paint has been worn out, such as the decrease in gloss performance, even peeling, generating cracks, clean it, remove all paint, make any crack treatment that may exist, and finally perform a new finish. Always be aware of the deadlines for a new painting.

On roofs, the first step when identifying any trace of a problem or in case of preventive maintenance is to pay attention to the tiles, each material requires a change or repair time. Some tiles of certain materials over time usually have flaws and cracks due to exposure to bad weather. So, whenever you spot a problem with the parts, make the exchange immediately.

There are cases of repairs to the tiles in which it does not require changing the parts, such as the use of certain materials such as blankets, acrylic paints and other ways to increase the protection of the roof. But there are also cases where fencing does not solve the problem with the roof, so it's up to the professional to analyze and if necessary, redo the roof.

Physical-Chemical Characterization of Peri River, Pontal do Paraná, PR, Brazil

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Abstract— Rivers always went too utilized for the population's benefits, however, environmental impacts caused by humans have resulted in aquatic ecosystems degradation. This fact decreases biological diversity and impairs water availability. Amongst elements which could be quantified to evaluate the impact caused anthropically are phosphorus and nitrogen since the increase of their levels in rivers could result in artificial eutrophication. Thus, the aim of this work was to evaluate the Peri River (Pontal do Paraná – PR) in a spacetime perspective, between 2018 and 2019. It was measured the pH, dissolved oxygen, electric conductivity, total dissolved solids, turbidity, air and water temperature, phosphorus, nitrate, and ammonium in 8 samples points. The majority of the parameters got compatible values with the established with 357/2005 CONAMA's resolution, even the results of the ammonia ion in May 2019 in the points 1, 2, 3, and 4 have shown high values, likely as consequence as leachate from the dump. The parameter pH in point 8, localized in the river source has shown acid values due to soil leaching or the introduction of chemical substances adjacent to this place. As well as past studies, phosphorus has been showing elevated values, which in this set sample collections, data are 50 folds higher than to the established by the CONAMA's resolution, making the Peri River susceptible to eutrophication and environmental deterioration. We concluded that Peri River has been suffering gradually with anthropic impacts, thus, preventive and palliative actions must be taken immediately against the anthropic actions.

Keywords— analytical chemistry, Parana's coast, pollution, water quality.

I. INTRODUCTION

Rivers always went too used to the population's benefits, allowing the development of several sectors, from recreation activities to industrial purposes, being essential for both local community and tourists (Carvalho, Balduino & Figueiredo, 2016). This importance raises a big dependence upon the rivers, resulting in several impacts in it, changing their physical-chemical and biological features (Kramer, Pereira Filho & Faccin, 2018).

Many of these impacts are caused by human activities, which they were intensified since the industrial revolution, promoting the accelerated development of cities and industries, besides the exponential population's growth (Cunha, Lucena & Sousa, 2017). These impacts have been resulting in aquatic ecosystems degradation, which in turn impair the water availability, affecting not only the environment but also the human quality of life (Filho & Nunes, 2017). The Resolution n°357 of the Brazilian National Environmental Council (CONAMA, 2005) dispose of the hydric body classification and the environmental guidelines for their categorization, besides establishing the conditions and patterns of waste release. It is possible through this resolution to verify how much a river has been affected by anthropic activities. In the case of parameter's values be in discordance to established values and substance concentrations, the river could be considered impacted. Amongst the elements that could be quantified are phosphorus and nitrogen.

Phosphorus is a limited element in the atmosphere and part of its soluble available form is removed from the soil to the oceans and rivers by erosion and rock lixiviation (Mekonnen, Mesfin M. & Hoekstra, 2017). Furthermore, this element is a key component of the nucleic acids and it is responsible for energy transport through ATP, being for this reason, much used as a fertilizer in crops (Conley et al., 2009). Besides, it is estimated that about 75 to 90% of the phosphorus utilized

as a fertilizer é carried to the rivers (Sharpley et al., 2003). Together with excessive fertilizer usage, sewage discharge in rivers is another factor that contributes to the increase of phosphorus concentration in aquatic environments (Conley et al., 2009).

Nitrogen in its most steady gaseous form (N₂) is the main substance in the atmosphere, comprehending about 78% of present gases. Its biogeochemical cycle involves the ammonification or mineralization, nitrification, denitrification, fixation, reduction, and synthesis of organic forms steps (Stein & Klotz, 2016). This element has very important functions to living beings because it is an essential component of the nucleic acids and proteins (Conley et al., 2009). Due to its importance to the biota, processes such as production and usage of commercial fertilizes, and energy production, increasing the nitrogen levels in aquatic environments (Vitousek et al., 1997). Nitrogen could be found in rivers as ammonia (NH₃), nitrate (NO₃⁻) and nitrite (NO₂⁻) (Spiro & Stigliani, 2009). The increase of these substances levels with phosphorus concentration could promote the exacerbated populations' growth of plants and algae, culminating in artificial eutrophication, since these substances are limiting factors in rivers (Anderson, Glibert & Burkholder, 2002).

Although eutrophication is a natural process, which occurs the increasing of the algae populations, artificial eutrophication is a process that occurs when there is an increase of the nutrient's concentration due to human activities (Ghaly & Ramakrishnan, 2017). According to Carpenter et al. (1998), the adverse effects of the artificial eutrophication are (1) increasing of the phytoplankton biomass, (2) switch of phytoplankton population to other toxic species, (3) proliferation of the gelatinous zooplankton, (4) increasing of benthonic and epiphytic algae biomass, (5) changes of macrophyte population, (6) death of the coral reefs, (7) diminished water transparency, (8) depletion of oxygen levels and (9) fish species death. Although the artificial eutrophication occurs as a result of a combination among climate, physical-chemical, and biological factors, the availability of nutrients seems to play a key role in this process (Ghaly & Ramakrishnan, 2017).

Thus, the aim of this study was to evaluate the nitrogen and phosphorus species concentrations, besides other physical-chemical parameters of water quality, along the Peri River (Pontal do Paraná-Brazil).

II. MATERIAL AND METHODS

2.1. Area and sample collection

The study was conducted in Peri River, which is localized near to a dumping ground of Pontal do Paraná city. This river is the only affluent placed at the left of the Guaraguaçu River Margin. Guaraguaçu River has extreme importance locally due to fishing activities and its big water supply. Sample collection was done during August and November 2018 and February and May 2019, in 8 different sampling points representing in Figure 1.



Fig 1 – Aerial image of Peri River (Pontal do Paraná – PR/Brazil) and the eight sampling points.

The sampling points 1, 2, 3, and 4 are near to houses and the dumping ground. On the other hand, the 5, 6, and 7 sampling points are near to a road. About the 8 sampling point, it is adjacent to the river's source. During the sampling, the air and water temperature were taken by a digital thermometer and the water samples were conditioned in plastic recipients. The river samples were transferred to plastic bottles of 1,5 litters and, posteriorly, carried to the Laboratory for the Evaluation of Environmental Impacts (LAVIMA) at the State University of Parana.

2.2 Potentiometric and turbidimetric analyses

The potentiometric and turbidimetric assays were performed in 5 replicates in the following equipment: pH determination in a bench pHmeter (PHS-3E PHTEK), water turbidity in a mobile digital turbidimeter (TU430 Lutron), dissolved oxygen in the oximeter (DO5519 Lutron), electrical conductivity and total dissolved solids (TDS) in a conductivity meter (mCA150 MS TECNOPON).

2.3 Spectrophotometric analyses

The official method for the nitrite quantification is the Griess' reaction. In this process, the acid medium allows the reaction between nitrite with sulfanilamide solution's and the naphthyl-1-ethylenediamine dihydrochloride, obtaining a pinky-colored solution. The nitrite concentration was quantified in а spectrophotometer at 540 nm (Green et al., 1982; Moorcroft, Davis, & Compton, 2001; Ramos et al., 2006). We used the same methodology to quantify the nitrate

ion, however, initially, nitrate was reduced to nitrite using metallic zinc, because of this ion does not react with these substances described above (Reis et al. 2015).

Ammonia quantification was done by the indophenol method (Berthelot's reaction), which consists of the reaction of ammonia with phenolic acid, sodium nitroprusside, sodium dichloroisocyanide dehydrate and sodium hydroxide (Staden & Taljaard, 1997). The solution was read at 630 nm (Rice, Baird, Eaton & Clesceri, 2012).

About phosphorus method, orthophosphate ions combine with ascorbic acid, glycerine, ammonium molybdate, and nitric acid solutions, generating the molybdenum blue complex, which is read at 660 nm (Masini, 2008).

III. RESULTS AND DISCUSSION

The water and air temperature measurements are shown in Table 1. Besides the temperature can influence the metabolism of some organisms, it also could be used as an indicator of pollution. When in situ measurements display a big difference between them, it may indicate the occurrence of thermal pollution in the river, which could be a result of the discharge of heated effluents or removing of riparian vegetation (Dallas & Day, 2004). It seems that is not the case, because we cannot see any big difference between them. The higher temperature measurement was seen at P1 (32°C) in February 2019, whereas the minimum value was observed at P5, P6, and P7 in August 2018.

Table 1 – Air and water temperature measurements obtained during the four samplings in Peri River, Pontal do Paraná -

| TEMPERATURE | | | | | | | | |
|-------------|---------|-----------|---------|-----------|---------|-----------|---------|-----------|
| Sampling | Aug/air | Aug/water | Nov/air | Nov/water | Feb/air | Feb/water | May/air | May/water |
| Points | | | | | | | | |
| P1 | 20 | 20 | 26 | 26 | 32 | 32 | 21 | 22 |
| P2 | 19 | 20 | 24 | 24 | 30 | 31 | 21 | 21 |
| P3 | 20 | 20 | 26 | 27 | 31 | 31 | 22 | 22 |
| P4 | 20 | 20 | 27 | 28 | 31 | 31 | 22 | 21 |
| P5 | 19 | 19 | 24 | 23 | 26 | 26 | 20 | 19 |
| P6 | 19 | 19 | 24 | 23 | 26 | 26 | 20 | 19 |
| P7 | 19 | 19 | 24 | 23 | 26 | 26 | 20 | 19 |
| P8 | 19 | 20 | 24 | 24 | 26 | 27 | 20 | 19 |

The pH values are shown in Figure 2. A part of the data oscillated within the recommended by CONAMA's n°357 resolution for continental waters (6.0 to 9.0). The samples obtained values lower than 6.0 could be explained by the influence of some chemical substance or the lixiviation of acid substances in the soil, which is intensified due to the region's pluviometric intensity in some months of the year. According to the Brazilian National Institute of Meteorology (INMET), the months of August and November 2018 were less rainy when compared to February and May 2019, being August 2019 the less rainy period and February 2019 the rainiest month amongst the four samplings taken. We observed at point 8 the most constant values during the year. Although this point is one of the sources of the Peri River, it is localized near to roads, becoming it susceptible to anthropic impacts, once the point 8 has a considerable vehicle flow, including trucks carrying loads of fertilizers and several other chemical substances.



Fig 2 – Space-time distribution of the pH values obtained along Peri River, Pontal do Paraná – PR. Data expressed as mean ± standard deviation

About TDS, we reported that all values are lower than the maximum value recommended by the CONAMA's resolution (500 mg.L⁻¹). The highest

measurements were seen during the windy period, making part of the solid substances were carried to the Peri River. TDS values are represented in Table 2.

 Table 2 - Space-time distribution of the total dissolved solids values obtained along the Peri River, Pontal do Paraná – PR.

 Data expressed as mean ± standard deviation.

| TOTAL DISSOLVED SOLIDS (mg.L ⁻¹) | | | | |
|--|-----------------|--------------|----------------|-----------------|
| Sampling Points | August | November | February | May |
| P1 | 80.77 ± 1.2 | 65.5 ± 1.0 | 115.8 ± 1.5 | 107.2 ± 1.0 |
| P2 | 81.01 ± 0.4 | 78.0 ± 0.8 | 119.6 ± 2.6 | 66.3 ± 0.9 |
| P3 | 82.33 ± 0.7 | 67.5 ± 0.5 | 74.4 ± 1.6 | 66.5 ± 0.6 |
| P4 | 83.30 ± 0.5 | 69.1 ± 0.7 | 74.8 ± 0.6 | 67.3 ± 1.0 |
| P5 | 91.80 ± 1.2 | 74.8 ± 0.3 | 57.1 ± 0.3 | 49.7 ± 0.5 |
| P6 | 97.87 ± 1.1 | 81.4 ± 1.0 | 109.5 ± 1.3 | 52.4 ± 0.5 |

| P7 | 102.47 ± 1.3 | 82.3 ± 0.6 | 56.7 ± 0.8 | 88.2 ± 0.5 |
|----|------------------|--------------|--------------|--------------|
| P8 | 97.17 ± 0.4 | 31.1 ± 0.2 | 93.0 ± 1.9 | 94.1 ± 1.7 |

Electrical conductivity (Table 3) is directly related to the presence of ionic species in the water. These data trend to represent a part of the values linked to the pH and another part linked to TDS. High values of this parameter in summer could be related to domestic and industrial sewage discharge, agricultural run-off, and organic matter, which in turn, increase the ionic concentration of Ca^{2+} , Mg^{2+} . and Cl- (Hassan, Parveen, Bhat, & Ahmad, 2017). Even though there is no maximum or minimum recommended value for this parameter, we observed that, as most of the pH data showed normal results according to the current Brazilian legislation, so, the electrical conductivity also exhibited values considered normal.

| Table 3 – Space-time distribution of the electrical conductivity values obtained along the Peri River, Pontal do Paraná – PR. |
|---|
| Data expressed as mean \pm standard deviation. |

| ELECTRICAL CONDUCTIVITY (µS.cm ⁻¹) | | | | | | | |
|--|-----------------|-----------------|---------------|-----------------|--|--|--|
| Sampling | August | November | February | May | | | |
| Points | | | | | | | |
| P1 | 184.0 ± 1.2 | 151.4 ± 0.6 | 227.2 ± 5.7 | 206.7 ± 1.9 | | | |
| P2 | 184.3 ± 1.1 | 172.8 ± 1.9 | 227.4 ± 2.2 | 126.8 ± 0.9 | | | |
| P3 | 190.2 ± 2.4 | 151.6 ± 0.6 | 144.1 ± 0.7 | 127.1 ± 2.3 | | | |
| P4 | 189.9 ± 1.4 | 153.6 ± 0.6 | 143.6 ± 0.6 | 129.1 ± 1.5 | | | |
| P5 | 276.5 ± 2.7 | 160.9 ± 1.1 | 109.2 ± 0.3 | 95.1 ± 0.7 | | | |
| P6 | 277.8 ± 0.9 | 171.4 ± 1.1 | 210.6 ± 1.8 | 102.2 ± 1.0 | | | |
| P7 | 279.0 ± 2.5 | 173.1 ± 1.3 | 110.8 ± 0.7 | 170.0 ± 2.3 | | | |
| P8 | 127.7 ± 0.3 | 65.8 ± 0.3 | 181.2 ± 4.6 | 185.1 ± 2.7 | | | |
| | | | | | | | |

The turbidity could be understood as a resistance of light passage through a solution, so, if a river was too cloudy, it can inhibit that sun rays pass through the river surface, impairing the photosynthesis (Dallas & Day, 2004). Thus, we observed that all values (Table 4) are below the maximum threshold, which is 50 NTU. The data during the year does not show much seasonal variation, however, at points 5, 6, and 7, which are near to Engenheiro Argus Thá Heyn Road (PR-407), displayed higher values to the other points, by the higher flow of vehicles, dust, and solid residues of the road.

The concentration of dissolved oxygen, as well as other parameters, showed some variations in its values due to seasonal regimen, receiving the direct influence of the amount of rain in certain periods of the year, temperature, and other factors. We reported the most values are above of minimum threshold (6 mg.L⁻¹). When the dissolved oxygen concentration is lower than recommended by CONAMA's resolution, the biota can die by hypoxia (i.e. depletion of oxygen). The data of dissolved oxygen are shown in Table 5.

 Table 4 – Space-time distribution of the turbidity values obtained along the Peri River, Pontal do Paraná – PR. Data

 expressed as mean ± standard deviation.

| | | TURBIDITY | | |
|--------------------|-----------------|-----------------|----------------|---------------|
| Sampling Points | August | November | February | May |
| P1 | 21.0 ± 0.55 | 21.0 ± 1.06 | 22.2 ± 1.7 | 20.52 ± 0.2 |
| P2 | 21.5 ± 0.81 | 27.5 ± 1.10 | 23.1 ± 2.4 | 21.56 ± 0.1 |
| P3 | 21.6 ± 0.64 | 20.5 ± 0.26 | 23.2 ± 1.6 | 22.7 ± 1.0 |
| P4 | 21.8 ± 1.06 | 21.0 ± 0.79 | 21.6 ± 1.0 | 21.8 ± 0.2 |

| Internation https://d | onal Journal of A <mark>x.doi.org/10.221</mark> | JAERS) ISSI | [Voi-7, Issue-5, May- 2020 ISSN: 2349-6495(P) 2456-1908(0 | | | |
|--------------------------|--|------------------|--|----------------|-----------------|--|
| | P5 | 27.6 ± 0.59 | 27.1 ± 1.60 | 27.5 ± 1.6 | 22.88 ± 0.2 | |
| | P6 | 27.8 ± 0.39 | 28.0 ± 1.30 | 26.9 ± 1.7 | 22.7 ± 0.4 | |
| | P7 | $26.7\ \pm 0.48$ | 28.2 ± 0.37 | 26.1 ± 1.6 | 24.32 ± 0.6 | |
| | P8 | 26.5 ± 0.41 | 23.1 ± 0.88 | 20.6 ± 1.1 | 0.0 ± 0.0 | |
| | | | | | | |

Regarding the spectrophotometric parameters, assays with standardized solutions were first performed. For phosphate, concentrations of 0.15 were used; 0.30; 0.60; 0.90; 1.20 and 1.50 mg.L-1. Together with the average absorbance values that were quantified in each of these standard solutions, a standard curve was plotted. Figure 3 shows the data referring to phosphate, in the period of May 2019, where the equation of the straight line obtained was represented by Abs = 0.05309 + 0.1841. [P],

with linear correlation coefficient $R^2 = 0$, 99945. By obtaining the absorbance values of the eight sample points, it was possible to determine the phosphate concentrations in the Peri river. The same procedure was used to quantify ammonium and nitrate, however, with different concentrations of the standard solutions and the reagents used. Subsequently, the mean values of the samples were also determined.



Fig 3 - Representation of the deviation curve of the phosphate, obtained by the molybdenum blue method at 660 nm, in the sampling performed in May 2019.

The ammonia concentration is represented in Figure 4. This ion showed values below to the maximum threshold allowed (3.7 mg.L^{-1} , when pH is lower than 7.5). However, in May 2019 we observed a considerable increase in points 1, 2, 3, and 4, likely by the presence of the apparent leachate in the surface of the river since these points are near to the dumping ground. Besides, it is

worthy to mention that the February 2019 sampling, the river displayed exacerbated smell and foam. Moreover, (Souza, Gonçalves, Carvalho & Rocha, 2019) indicated that Peri River showed a considerable increase of ammonia concentration from one year to the next, corroborating that Peri River has been suffering even more with pollution.



Fig 3 - Space-time distribution of the ammonia concentrations along the Peri River. Data expressed as mean ± standard deviation



Fig 5 - Space-time distribution of the nitrate concentrations along the Peri River Data expressed as mean ± standard deviation

Nitrate data are shown in Figure 5. It is only detectable in anthropogenic-impacted rivers, once it is easily incorporated by the plants. Thus, its presence might be considered as a marker of pollution (Hassan et al., 2017). CONAMA's resolution established that the maximum threshold as 10 mg.L^{-1} for nitrate.



Fig 6 - Space-time distribution of the phosphorus concentrations along the Peri River, Pontal do Paraná - PR. Data expressed as mean ± standard deviation.

Table 5 – Space-time distribution of the dissolved oxygen values obtained along the Peri River, Pontal do Paraná – PR. Dataexpressed as mean \pm standard deviation.

| DISSOLVED OXYGEN (mg.L ⁻¹) | | | | | |
|--|-------------|--------------|-------------|-------------|--|
| Sampling Points | August | November | February | May | |
| P1 | 6.4 ± 0.3 | 9.5 ± 0.3 | 9.8 ± 0.1 | 6.3 ± 0.3 | |
| P2 | 6.5 ± 0.3 | 8.9 ± 0.7 | 9.5 ± 0.1 | 6.3 ± 0.2 | |
| P3 | 6.8 ± 0.6 | 9.8 ± 0.4 | 9.7 ± 0.2 | 6.3 ± 0.2 | |
| P4 | 6.6 ± 0.6 | 11.1 ± 0.4 | 9.6 ± 0.2 | 6.8 ± 0.3 | |
| P5 | 6.8 ± 0.7 | 8.3 ± 0.3 | 9.9 ± 0.3 | 6.5 ± 0.2 | |
| P6 | 6.4 ± 0.8 | 7.5 ± 0.6 | 9.7 ± 0.2 | 6.2 ± 0.2 | |
| P7 | 6.2 ± 0.4 | 10.7 ± 0.4 | 9.4 ± 0.3 | 6.0 ± 0.5 | |
| P8 | 6.5 ± 0.6 | 9.9 ± 0.5 | 9.1 ± 0.2 | 5.9 ± 0.2 | |

In Figure 6, we reported the most phosphorus measurements are about 60 times higher than the maximum threshold recommends by CONAMA's resolution (0.150 mg.L⁻¹). These data are similar to reported by Reis, Cavallet & Rocha, (2011), and Lopes, Carvalho, Gomes & Rocha, (2019), which researches were done in the same coast region of our study. Thus, this high phosphorus concentration can be a consequence not only by the flow of tourists or demographic expansion near to the river but mainly by the mismanagement of transport and storage of fertilizers in the Port of Paranguá, the second biggest in Brazil. Besides of that, previous results

of our research group (Souza et al., 2019) reinforce the hypothesis that these high phosphorus levels are related to the tidal cycle and strong influence of the Paranagua's Port. Finally, Souza, Gonçalves, Carvalho & Rocha (2019) also indicated an additional factor of contamination in Peri River is the presence of the dumping ground, localized adjacent to this river.

IV. CONCLUSION

We concluded that Peri River has been suffering gradually with impacts caused by humans, once

phosphorus has shown extremely high values. Previous studies reported are a result not only by the flow of tourists in summer and domestic waste but also by the tidal action, carrying the fertilizers from the Paranaguá's Port. Although ammonia does not exhibit values higher than the maximum threshold by the local legislation, in the last sampling it was observed a considerable increase in its levels. Researches as ours are important to evaluate the temporal changes in rivers caused by human impacts, and also examine such effects in a spatially-scale.

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Competitiveness Analysis Railway Propulsion System Industry in Indonesia - Pre Feasibility Study

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Abstract— Competitiveness analysis, manufacturing capability and pre-feasibility studies have been carried out in the rail propulsion system industry in Indonesia, particularly the traction motor industry (PT. PINDAD). The results show that currently the propulsion system industry is still less competitive, this is because the price of the products is still expensive. From the pre-feasibility analysis, the unit price of the traction motor for the capacity of 100 kW is still around US \$ 130,000 / unit (with a production capacity of 40 units / year). The high cost of traction motor products of PT. PINDAD is suspected because of a limited market (only domestic), there are still many components imported and the manufacturing process is still not optimal. Therefore, to meet the feasibility scale, the unit price must be reduced to at least US \$ 100,000 / unit (reduces 23%). This can be achieved if the production capacity is at least 100 units per year by penetrating the market and optimizing the production process.

Keywords— competitiveness, Capability, Feasibility, Traction Motor Industry.

I. INTRODUCTION

The railway industry (component industry and integrator) in Indonesia is seen as one of the strategic industries that can support the realization of the provision of rail-based transportation facilities. Strategic enough because the potential of the domestic market is quite promising. The potential is based on plans to develop railway networks in Java, Sumatra, Kalimantan, Sulawesi, Papua, Bali, Batam and Madura. In addition, the development of dual lines and electrification in Java, the construction of rail-based mass transportation in big cities, the construction of airport trains, and the rejuvenation of the fleet by KAI in the medium term (around 900 units to 2019). From this plan it is seen that the mode of rail transportation will increase every year in line with the rise of domestic infrastructure projects (Table 1). Not only has the potential to work on the domestic market, PT INKA also has the potential to meet the demands of foreign markets, especially in the ASEAN region and Africa [1]. Fig. 1. represents the potential of the railway market abroad, especially in developing countries in Africa and Asia.

This potential is a challenge for national industries to increase their ability and competitiveness. The railway industry in Indonesia is currently driven by PT. INKA as its main industry and supported by several component industries that supply materials and components.

This paper examines the manufacturing capability and competitiveness of one of the industries which supplies railway propulsion systems. Manufacturing capability is a system of organizational routines governing the flow of value carrying design information to custumers, and manufacturing site is the place where such flows exist [2] Competitiveness as the ability of firms to compete in markets[3] [4].

| Pesanan Masuk | 2018 | 2019 | 2020 | 2021 | 2022 |
|--|-----------|----------------------|--------------------|-------------------|-----------|
| Proyek Kementrian Perhubungan/Pemerintah | | | | | |
| (PPCW, ZZOW, KA Ukur, K Penolong, TMC, KKBW, K. Inspeksi) | 94.177 | 25.047 | 81,411 | 70.197 | 86.787 |
| Proyek PT KAI (Persero) | | | 1 | | |
| Kereta K3/K1/Sleeper | 1.880.000 | 1.334.297 | 793.376 | 872.714 | |
| LRT Jabodebek | 1.813.500 | | PERMIT | | |
| PPCW (Trans Sumatra, Kalimantan) | | 375.608 | 432.382 | 267.380 | 1,196,448 |
| LRT Bandung | | Could a respectively | 527.936 | | |
| KRL Adi Sumarmo | | | 547.420 | | |
| KRL Juanda | | | 10-000-01-000-02-0 | 1.024.771 | |
| KRL Adi Sucipto | | | | 741.223 | |
| KRL Ahmad Yani | | | | completioned dram | 883.865 |
| KKBW | | | | | 1.546.450 |
| Service & Retail | 80.600 | 189 | 8.673 | | |
| Diluar Kemenhub-PT KAI (Persero) | | | | | |
| TramKot Surabaya | 291,200 | | | | |
| LRT Medan | 351.000 | | | | |
| Produk Pengembangan | | | | | |
| Bus (Kopaja, Mayasari, DAMRI) | 260.000 | 600.000 | 348.000 | 500.000 | 900,000 |
| Lori Listrik Otomatis | | 1.031.162 | • •••••• | 1.305.037 | |
| Coal Container | | 12.000 | | | |
| Total | 4.770.477 | 3.378.303 | 2.739.198 | 4.781.322 | 4.613.550 |

Table 1. Domestic market potential



Fig.1. Overseas Potential

II. METODOLOGI

The method used to see manufacturing capabilities by looking at the machining facilities owned and the human resources involved. while to see the industrial competitiveness of the propulsion system by using the Diamond Porter model approach. As seen in Figure 2.



Figure 1: Porter's Diamond Model of National Competitive Advantage

Fig.2. Porter's Diamond Model of Competitive

There are 6 (six) components, which will be used to analyze the competitiveness of the railway propulsion system industry, namely Chance, Condition Factors, Related and supporting industries, Firm Strategy Structure and rivalry, Demand Condition and Government [5].

Each of the 6 (six) components will be analyzed so that their strengths and weaknesses will be known, so anticipatory steps can be taken to further enhance their competitiveness.

III. INDUSTRIAL RAILWAY PROPULSION SYSTEM

Of the entire propulsion system, the main parts are traction motors and inverters. At present the existence of the traction and investment motor industry in Indonesia is very limited. The current traction motor industry for trains that is still operating, one of which is PT Pindad, which is a State-Owned Enterprise, while the inverter industry that has supplied the inverter is PT. LEN. However, PT. LEN at this time, the research and development of the inverter has not been oriented towards mobility. So that in this discussion more focused on the traction motor manufacturing industry.



Fig.3. Machinery Facilities of PT. Pindad

Source: PT.Pindad

PT. Pindad is basically one of the strategic industries with the status of state-owned BUMN engaged in the

defense equipment. PT.Pindad has land in 2 (two) locations, namely the Ammunition Division located in

Malang, and the Weapon Division, Mechanical Division, Electrical Division, Forging & Casting Division, Stamping Business Unit, and Laboratory Business Unit located in Bandung. The composition of Pindad production is 20% military products and 80% commercial or non military. Pindad's main task is to provide and produce products needed by the Ministry of Defense such as light munitions, heavy munitions and other military equipment to eliminate dependence on others. The second main task is to produce commercial products such as machine tools, forging products, air brake systems, special tools and equipment.

Several machinery and other supporting equipment related to railway infrastructure products are shown in Fig. 3.

The total number of PT Pindad's HR is around 2500 HR with an allocation of 1808 people in the Bandung area and the Railway Forging Division of castors and railway vehicles totaling 238 people (9.52%). HR has professional competencies and abilities according to their fields.

The demand for traction motorcycles that enter PT Pindad only comes from PT. Inka as the only industry providing train facilities and integrators in Indonesia. Traction motor products produced by PT Pindad and other local traction motor industries are still customized (orders) due to the minimal number of requests and have not yet reached the economies of scale so the prices offered are quite high and unable to compete with imported traction mototr products. Most of the components used to produce traction motors (Fig. 3) local industry still use imported components, due to the lack of local traction motor component industries.

IV. ANALYSIS OF COMPETITIVENESS AND FEASIBILITY

An accordance with the Diamond Porter model, the competitiveness analysis of PT. Pindad is carried out by describing it in 6 (six) components, namely Condition Factors, Related and supporting industries, Firm Strategy Structure and rivalry, Demand Condition and Government. The six components are described as set out in Table 2.

| Variable | Excellence (+) | Weakness (-) |
|------------------------------------|--|---|
| Factor Conditions | The initial capital ownership of PT. Pindad as a BUMN comes from the government. Having facilities and infrastructure of a fairly complete traction motor manufacturer Having competent and professional human resources in their fields Located in a strategic area in West Java | The manufacturing facilities only cover the production of 100-250 kwh motorcycles The manufacturing process still uses manual equipment so that production capacity is limited |
| | with an area of 66 hectares. | |
| Related & Supported Industry | • Some components in Tir 1 can already be produced by PT. Pindad, while some of them are subcontracted by PT. Pindad to the local supplier industry | • Components at the Tir 2 level are mostly imported, mainly raw materials. Some import supplier partners include countries: China, Japan, etc. |
| | • Partnered with PT Len (BUMN) in supporting the propulsion system | • Purchase of raw materials & components in unit prices because in small quantities so the price is much more expensive |
| | | • Limited inventory stock due to the purchase of raw materials and components in limited quantities |
| | | • Because most of the supplier's industries import, ordering takes a long time and is expensive |

Table 2. Competitiveness Analysis

| Demand Condition | The potential for special train needs for the development of rail-based urban transportation modes until 2030 as stipulated in Ripnas is increasing. Has a special market / customer, PT INKA. | The demand for railway traction motorcycles is currently very limited and not continuous, only around 40-50 units per year, most of which only rely on requests from PT INKA. Little demand causes idle capacity |
|----------------------------|---|--|
| Firm Strategy & Rivalry | There are no domestic competitors Enter the national strategic industry (BUMN). | Similar competing industries come from abroad. There is no regulation that directs if the rail transportation industry (PT. INKA) must be fully supported by local supporting industries (including PT. Pindad) to meet their needs. Idle production is used for the production of electric vehicle traction motorcycles (motorcycle Gesits) |
| Government | Regulation on the formation of a national strategic industry owned by the government including PT Pindad Plans for developing rail-based urban transportation modes as stipulated in Ripnas Regulations related to TKDN Incentive regulation (research with tertiary institutions) and fiscal incentives in the BMDTP scheme | Implementation of incentive regulations is still considered too complicated and bureaucratic Not yet optimal implementation of TKDN regulations, especially in the calculation procedures that are considered still burdensome for the industry. There is a regulation on the import of used capital goods |
| Chance | • Free trade | • Free trade |

Pre-Feasibility Analysis

Production aspects

Ability to produce domestic propulsion system industry in this case PT. Pindad as a support of traction motors. From the results of the survey conducted to PT. Pindad related to the ability of train traction motor production, obtained data in the capability of PT. Pindad has been able to master the production process of 100-250 kWh traction motor. The following is an overview of the production process of traction motors (Fig.4):





Fig.4. Traction Motor Production Process

From the description in chapter 3, it has been stated that PT. Pindad already has machinery facilities and infrastructure that support the production of traction motors. The ability of PT. Pindad in producing train traction motors began with cooperation with Holec Netherlands for Jabotabek KRL 155 units of 212 units. Here are some types of traction motor production that has been produced by PT. Pindad [6].

| Ta ble | No | PT Pindad Production | Ordering Industry | Years | Number of units | Informtions |
|-----------------------|----|-------------------------|----------------------|------------|--------------------|-----------------------------|
| 3.1ype of Motor | 1 | DMKT 55/18,5, 155 KW | PT. INKA | 1994/ 1999 | 80 | |
| Tracti on PT. | 2 | DMKT 55/17, 180 KW | Kemenhub | 2008 | 48 | repowering KRL BN Holec. |
| Pinda d | 3 | DMKT 55/29, 200 KW | PT. INKA | 2009/2010 | 2 | repowering KRL BN Holec. |
| | 4 | DMKT 55/23,5, 110 KW | PT. INKA | 2011 | | |
| | 5 | DMKT | PT. INKA | 2016 | | LRT Palembang |
| | 6 | DMKT | PT. INKA | 2019 | 1 Train set | LRT Jabodebek |

Source : PT. Pindad

For installed production capacity, currently PT. Pindad in the production of train traction motorcycles (100-250 kwh) ranges from 150 units / year. Following are the assumptions for PT Pindad's production capacity calculation:

- Installed Production Capacity: 150 units / year
- Current average production : 50 units / year (1/3 installed production capacity)
- Idle Capacity : 100 units / year
 - (2/3 installed production capacity)

PT. Pindad experienced several constraints to production limitations, these constraints include:

 Most of the machining facilities currently owned are still manual, so the completion of processing time is longer • The lack of requests due to dependence on orders only on one customer (PT. INKA).

Market Aspects

The potential of the domestic and foreign railway market today and in the future is still very potential, bearing in mind that currently the central and regional governments are developing rail-based transportation modes. This has been stated in the 2010-2030 National Railway Master Plan, as shown in Table 4 [7]. The target of rail-based transportation mode needs in urban areas in 2010-2030 based on Ripnas data is estimated to reach 6229 units or an average of around 311 units per year.

| | Jawa | Sumatra | Kalimantan | Sulawesi | Papua | Nasional |
|-------------|----------------|---------|------------|----------|--------|----------|
| Total Fleet | Bali (unit) | (unit) | (unit) | (unit) | (unit) | (unit) |
| Passenger | 2.585 | 145 | 20 | 71 | 18 | 2.839 |
| Loko | | | | | | |
| Loko item | 1.010 | 760 | 275 | 360 | 70 | 2.475 |
| The train | 25.825 | 1.435 | 185 | 475 | 29 | 27.949 |
| Boxcar | 20.115 | 15.170 | 5.345 | 6.522 | 1.212 | 48.364 |
| Urban Train | 4.038 | 1.586 | | 571 | 34 | 6.229 |
| | | | | | | |

| Table 4. | Potential | Needs | of National | Railway | 2030 |
|----------|------------|--------|-------------|--------------|------|
| ruore r. | 1 otominui | 110000 | or runonui | 1 cull w u y | 2050 |

Source : Ripnas, 2018

Business Aspects

Seeing the potential of the railway market both at home and abroad that is quite promising, it needs to be studied in more depth how much business potential can be created if the development of supporting components of the propulsion system is developed by the domestic industry, given that several strategic industries of BUMN have been able to master the technology.

The propulsion system is a supporting component of the railway which has the largest budget proportion in the value of production and the sale value of the train, but until now the technology has not been fully mastered by PT. INKA. However, if it is able to be developed by domestic industries, it can create promising business potential values. Table 5. shows the calculation of the potential business value that can be generated, if the traction motor industry is built. Assumptions for calculations in Table 5. referring to the product and value of the Palembang LRT contract that PT. INKA by using 100 kwh traction motor. Using these assumptions, the overall business potential for the propulsion system that can be created if the entire product is produced domestically is Rp. 3,547,732,500,000.

For business protection of traction motor products. from the survey and discussion with the management of PT. Pindad, with the current demand conditions, the production carried out cannot produce products with competitive selling power, because the burden of production costs is high so the price of the product becomes uncompetitive.

Estimated calculations that can produce products with competitive selling power in production will be achieved if the demand for tractive motor trains reaches a minimum of 100 units / year (2/3 of installed production capacity). For the record, with the inclusion in economies of scale the price can be reduced by around 23 -25% in order to be competitive with competitor prices (imports). The competitor's price range is currently around U S 100,000 / unit. This will be possible with a note if it is supported by an update on some machinery facilities so that it can support production.

In recent decades, manufacturing and production systems have been gradually supplemented by information technology support instruments, because controlling more and more complex technologies, the demands of multi-site production, and supporting logistic processes have become even more complex tasks. The inevitable role of IT (Information Technology) at companies has transformed both working conditions and efficiency, and its importance is unquestionable [8].

| POTENTIAL OF PROPULSION FOR URBAN TRAIN (RIPNAS DATA 2010-2030 | | | | | | | |
|---|-------------|----------------------------------|-----------------------|--|--|--|--|
| Reference assumption: LRT Palembang 8 trainset contract value: 338 billion | | | | | | | |
| Details | Volume | Unit | Value | | | | |
| Price of Palembang LRT (8 trainset @ 3 cars @ 2 | 8 | Train units (@ 3 cars) | Rp. 338.000.000.000 | | | | |
| propulsion | 1 | Train units (@ 3 cars) | Rp . 42.250.000.000 | | | | |
| Price of complete propulsion unit with electric system (36% of total train price budget) | 2 | Electrical system propulsion | Rp . 15.210.000.000 | | | | |
| | 1 | Propulsion | Rp. 7.605.000.000 | | | | |
| Price of propulsion only (27% of total train budget) | 2 | Propulsion | Rp. 11.407.500.000 | | | | |
| | 1 | Propulsion | Rp . 5.703.750.000 | | | | |
| ESTIMATED NEE | DS OF TR | AIN PROPULSION | | | | | |
| Estimated urban railway requirements for 2010- 2030 ripnas data (20 years) | 6119 | Train Unit | | | | | |
| Estimated average demand per year | 311 | Train Unit | | | | | |
| Assuming 1 train @ 3 cars (LRT type) | | | | | | | |
| Estimated train / propulsion requirements (3 cars) | 2 | Propulsion | | | | | |
| Perkiraan kebutuhan propulsi kereta api 1 tahun | 622 | Propulsion | Rp. 3.547.732.500.000 | | | | |
| POTENTIAL BUSINESS DEVE | LOPMENT | OF TRAIN TRACTION MO | DTOR | | | | |
| Price of propulsion | 1 | Propulsion | Rp. 5.703.750.000 | | | | |
| Price of 100kW traction motorbike (US \$ 130,000, exchange rate of Rp 14,000) | 1 | Traction motor | Rp. 1.820.000.000 | | | | |
| Profit potential if produced 100 units / year (23% | 1 | Traction motor Unit | Rp 418.000.000 | | | | |
| efficiency) | 100 | Traction motor unit | Rp. 41.860.000.000 | | | | |
| Asumsi : | | | | | | | |
| 1. Harga jual motor traksi saat ini dari PT. PINDAD | berkisar US | \$\$ 130.000, rata rata produksi | i 40 unit/tahun | | | | |
| 2. Apabila pproduksi 100 unit/tahun maka harga jual menjadi US\$ 100.000/unit (pengurangan 23%) | | | | | | | |

 Table 5. Calculation of Industrial Business Potential Propulsion system (Motorized Traction Motor)

Source: PIMTE-BPPT Transdar Team, processed

V. CONCLUSION

From the data and description above it can be indicated that :

- In terms of market aspects, the propulsion system is very limited because there is only one customer, PT. INKA
- The local traction motor industry is still unable to compete with imported traction motor products both in price and quality to meet domestic demand. This is related to economies of scale / production capacity.
- From the analysis of the pre-feasibility study, with market potential parameters, the economical scale of

the traction motor industry can be achieved if the sales of traction motor products are at least 100 units / year.

- The selling price can still be lowered again if PT. PINDAD utilizes fiscal incentive policy facilities issued by the government (BMDTP), but this has not been exploited due to the complexity of the bureaucracy
- PT. Pindad needs to improve manufacturing and competitiveness so that its traction motor products can compete both in the domestic and foreign markets

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Survey of Potentially Host Weeds of *Planococcus* **spp. in Coffee Crops**

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Abstract -<u>Planococcus</u> spp. can cause losses close to 100% of the conilon coffee production in highly infested crops. It is a polyphagous pest that affects several cultures and can be present in host plants that appear spontaneously in the cultivation areas. In this context, the objective was to carry out the survey of weed hosts for mealybug in conilon coffee crops relating to the phenological stage of the culture. For this, the survey was carried out in two areas cultivated with conilon coffee in the northwest region of the state of Espírito Santo, Brazil. Weed collections were carried out monthly, in both locations, for a period of 12 months. 17 weed species were found, distributed within 9 different botanical families, being: Asteraceae, Malvaceae, Poaceae, Amaranthaceae, Cyperaceae, Solanaceae, Commelinaceae, Portulacaceae e Cucurbitaceae. Thus, <u>Planococcus</u> spp. it can stay and complete its cycle in weeds, being a source of inoculum that can contribute to infestations in the reproductive phase of the conilon coffee.

Keywords - Alternative hosts, Coffeacanephora, Planococcus spp.

I. INTRODUCTION

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.

The Brazilian production of Conilon coffee has been growing in recent years. This advance has been favored by the increase in productivity due to the greater use of technologies in crops. According to a survey by the National Supply Company (Conab), in 2019 the Brazilian production was approximately 49 million bags benefited, with an estimated increase of 15.9 to 25.8% for the year 2020 [1]. However, the incidence of mealybugs. Planococcuscitri (Risso) and Planococcus minor (Maskell), is becoming more and more frequent in the country, mainly in the state of Espírito Santo. This causes great damage to crops, causing losses to farmers, which consequently affects the economy[2].

Damage can be caused by both nymphs and adult females of *Planococcus* spp. that suck sap from flower buds, young fruits and young shoots of the coffee tree, which can also be found in the root system of plants[3]. The attack of nymphs and adults causes flower buds, flowers and fruits to fall in the early stages of development, giving rise to the "malformed rosette". In late attacks, malformation of grains occurs and fruit development is impeded. In addition, they can cause the coffee region to rot, close to the soil, serving as an entry point for pathogenic microorganism. In highly infested crops, they can cause losses close to 100% of production [2], [3].

However, *Planococcus* spp. it is a polyphagous pest, being registered in more than 27 different families. In Brazil, its occurrence has been reported in anonacea plants, soybeans, sugar cane, cotton, citrus, guava, grapevine, banana, star fruit, coconut, macadamia, mango, pineapple, in addition to some ornamental plants. Its incidence in weed species present in coffee plantations has also been reported [3]. According to Ferrão et al. [4], the incidence of weeds is common in the cultivation of conilon coffee, especially in the first years after planting. This occurs due to the low degree of soil coverage provided by the crop, favoring the germination, growth and development of these plants. Thus, the knowledge of alternative host plants for this insect pest is one of the fundamental requirements for planning integrated management in coffee culture.

According to Ronchi et al. [5], among the weeds that infest coffee trees, the most frequent reported by producers are *Commelina* spp. and *Andropogonbicornis*. These plants interfere with the growth and development of conilon coffee by competing for water, light and nutrients [6]. Furthermore, pests can be alternative host, such as *Planococcus* spp. [2]. However, despite reports about the occurrence of mealybug in weeds, there is little information about host species and the relationship with the attack on coffee plants. In this context, the present work aimed to carry out the survey of host weeds of the mealybug *Plabococcus* spp. in cultivation of conilon coffee, relating to the phenological stage of the culture.

II. MATERIAL AND METHODS

The assays for the survey of host weeds of mealybug in cultivations of conilon coffee were carried out in two locations located in the Northwest region of the state of Espírito Santo, Brazil, in order to obtain greater variability of species of these plants. The first location was at the Experimental Farm of the Capixaba Institute of Research, Technical Assistance and Rural Extension (Incaper), located in the municipality of Marilândia, with geographical coordinates of 19°24'14"S, 40°32'13"O and altitude of 202 meters, and the second in the municipality of Linhares, at Sítio Armani, with geographical coordinates of 19°39'11"S, 40°07'22"O and altitude of 285 meters. The climate of the survey sites is characterized by being Tropical Aw, according to the climatic classification of Köppen[7], with irregular rainfall and high temperatures.

The climatic conditions during the study period were monitored by means of the automatic climatological station of the Experimental Farm of Incaper in Marilândia, recording an accumulated rainfall volume of 824.40 mm and maximum, minimum and average temperature of 35.70°C, 15,52°C and 24.39°C, respectively (Figure 1).



Fig. 1: Precipitation and maximum, minimum and average temperatures for the period from August 2018 to July 2019 in the areas of cultivation of Conilon coffee in Marilândia and Linhares, ES, Brazil.

The survey of weeds at the Experimental Farm of Incaper was carried out in a five-year conilon coffee crop implanted with nine clones of the variety Diamante ES 8112, in a 3.0 x 1.0 m spacing, totaling 3333 plants ha-1. At Sítio Armani, the Conilon coffee crop had eight years of cultivation, implanted with clone 108 of the variety Diamante ES 8112, clones 402, 404, 410 and 411 of the variety Marilândia ES 8143 and clones 306 and 307 of the variety Centenária ES 8132, in the 3.0 x 1.2 m spacing, totaling 2777 plants ha-1. In both areas, crop management was carried out according to Verdin Filho et al. [8] and Prezotti et al. [9] through Programmed Cycle Pruning (PPC) with orthotropic stem renewal every four years, fertilization and chemical control of weeds with systemic herbicide, with mechanical control of these plants sometimes being performed with a brushcutter. It is worth mentioning that during the experimental period, chemical pest control was not carried out. These areas were chosen because, in previous years, they had an incidence of mealybug during the fruiting period.

The weed survey was carried out monthly for a period of 12 months in both study sites. The collections were performed by walking in "zig-zag" between the lines of the coffee tree, manually collecting the different species of weeds present in the area. This survey was carried out from August 2018 to July 2019.

After collecting and verifying in loco the presence of mealybug in the root system and/or aerial part of the weeds, these were packed in paper bags, identified and transported to the Agricultural Entomology and Acarology Laboratory of the Federal Institute of Espírito Santo -*Campus*Itapina(Ifes-*Campus*Itapina). The identification of the host species was carried out by comparing the morphological characteristics of the stem, leaves and inflorescences with the descriptions and illustrations of the identification manual for weed plants proposed by Moreira andBragança[10].

The mealybugs collected from the weeds, after sorting at the Ifes-Campus Itapina Entomology and Agricultural Acarology laboratory using a stereomicroscope, were placed in microtubes containing 60% alcohol and subsequently sent to the Entomology Laboratory of the State University of PhytosanityPaulista (UNESP) for species identification through slide assembly and analysis under an optical microscope. The studied specimens are deposited in the Insect and Mite Reference Collection (CRIA) of the FCAV / UNESP Department of Plant Health.

III. RESULTS AND DISCUSSION

The mealybug species Planococcuscitri and Planococcusminor were identified in 17 weed species, distributed in nine botanical families: Asteraceae, Cyperaceae, Malvaceae, Poaceae, Amaranthaceae, Commelinaceae. Portulacaceae Solanaceae. and Cucurbitaceae (Table 1).

Bastos et al. [11] reported in their study on P. minor in cotton in Northeast Brazil, that the pest was infesting other agricultural species such as: sesame, peanuts, watermelon, guava and some spontaneous plants such as *Sidacarpinifolia* L., Heliotropiumindicum L., Euphorbia hirta L., Amaranthus sp. and Solanum paniculatum L., which shows the great diversity of species that can host this insect pest.

Among the weeds identified as hosts, it is noted that there is a predominance of species belonging to the Asteraceae and Malvaceae families, representing 29.41% and 17.64%, respectively (Figure 2). These families are distributed in tropical and temperate regions, with South America as the center of wealth [12], [13], possibly explaining the greater occurrence of mealybug in species belonging to these families of weeds in coffee plantations. Table.1: Host weeds of Planococcuscitri and Planococcus minor in areas of cultivation of Conilon coffee, in the municipalities of Marilândia and Linhares, ES, Brazil.

| Species | Family | Common name in Brazil (in Portuguese | |
|---|-------------------|---|--|
| | |) | |
| Bidenspilosa L. | Asteraceae | Picão-preto | |
| Ageratum conyzoidesL. | Asteraceae | Picão- branco | |
| <i>Blainvilleaacmella</i> (L.) Philipson | Asteraceae | Picão- grande | |
| Sonchusoleraceus L. | Asteraceae | Serralha- branca | |
| <i>Emilia fosbergii</i> Nicolson | Asteraceae | Falsa- serralha | |
| Sidastrummicranthum (A. StHil.) Fryxell | Malvaceae | Falsa- guaxima | |
| SidarhombifoliaL. | Malvaceae | Guanxuma- preta | |
| Sidaglaziovii K. Schum | Malvaceae | Guanxuma- branca | |
| <i>Digitariainsularis</i> (L.) Fedde | Poaceae | Capim- amargoso | |
| AndropogonbicornisL. | Poaceae | Capim- rabo-de- burro | |
| Amaranthus spinosusL. | Amaranthaceae | Caruru-de- espinho | |
| Amaranthus blitumL. | Amaranthaceae | Caruru- rasteiro | |
| CyperusesculentusL. | Cyperaceae | Tiririca | |
| Solanum americanum Mill | Solanaceae | Maria- pretinha | |
| Commelinabenghalensis L. | Commelinacea e | Trapoeraba | |
| <i>Talinum paniculatum</i> (Jacq.) Gaertn. | Portulacaceae | Beldroega- grande | |
| Momordica charantiaL. | Cucurbitaceae | Melão-de- são-caetano | |



Fig. 2. Percentage of weed species in botanical families identified as hosts of <u>Planococcuscitri</u> and <u>Planococcusminor</u> in the areas of cultivation of conilon coffee, in the municipalities of Marilândia and Linhares, ES, Brazil.

During the survey, specifically in the Asteraceae family, it was observed that the species *Bidenspilosa* L. and *Ageratum conyzoides* L. are more susceptible to the attack of mealybug, since they are easily found with the presence of these insects, even with the diversity of species of weeds present in areas cultivated with conilon coffee. Such observations may suggest a food preference for *Planococcus* spp. for some weeds present in coffee plantations, whether due to physical or chemical attractiveness, corroborating the results obtained by Correa et al. [14].

The occurrence of mealybug in weeds was observed mainly in the root system of host plants, close to the basal region, such as *B. pilosa* and *A. conyzoides* (Figures 3A and 3B), both in the young phase (nymphs), and in the adult phase of *P. citri* and *P. minor*. Similarly, Fornazier[15] observed the presence of *P. citri* in the region of the roots of the species *B. pilosa*, *Lepidium virginicum* L. and *Cucurbita maxima* Duchesne.



Fig. 3. Root system of <u>Bidenspilosa</u> L. (A) and <u>Ageratumconyzoides</u> L. (B) attacked by Planoccocus spp. collected in the studied conilon coffee cultivation areas, Marilândia and Linhares, ES, Brazil.

Santa-Cecília et al. [3] highlight that in the dry season of the year, mealybugs lodge in the soil, feed on the roots of coffee plants and go up to the aerial part, at the beginning of the rainy season and during flowering of the plants, demonstrating that there is a behavior mobility of this insect depending on the time of year and stage of the plant, vegetative and/or reproductive. Fornazier et al. [16], on the other hand, point out that migration, that is, the dissemination from one plant to another, occurs especially by nymphs, walking on the ground, at short distances, or are carried by the wind, or, foretically, being disseminated by ants.

During the entire evaluation period, which culminated in all the phenological stages of coffee, the occurrence of *P. citri* and *P. minor* was observed, both in the root system and in the aerial part of the weeds, proving that this pest can complete its cycle and remain at field level throughout the year, whether in coffee plants [3] or in other host plants.

However, during the reproductive phase of conilon coffee, these insects had a preference for coffee plants, demonstrating the susceptibility of the crop to the pest at this stage. Such observations corroborate the results obtained by Correa et al. [14]. These authors, when studying the biology of scale insects of the genus Planococcus in different tree hosts, observed that the species P. citri and P. minor have a greater food preference for coffee plants. In this way, weeds with the presence of P. citri and P. minor are a source of inoculum and can contribute to mealybug infestations in coffee plantations during the flowering and fruiting phases, and the dissemination is facilitated by the proximity between the plant's weeds and the coffee tree. Thus, the presence of weeds in conilon coffee crops can be a means of survival and reproduction of rosette scale, especially in periods when the coffee tree is not in the reproductive phase, contributing to new infestations in the coffee reproductive phase. conilon.

IV. CONCLUSION

Weeds can be hosts capable of favoring the permanence of mealybug in coffee plantations, being a considerable source of inoculum for conilon coffee crops. Among the species registered as hosts, *Bidenspilosa* and *Ageratum conyzoides* are potentially favorable to the development of *P. citri* and *P. minor*, deserving attention during the monitoring of pests and weed management, in order to minimize the infestation of these pests in crops.

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Mathematical Modeling and Epidemic Prediction of COVID-19 of the State of São Paulo, Brazil

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Abstract— The Coronavirus pandemic, COVID-19, has taken the lives of several thousand people worldwide, causing many regions and countries to order the closure of their borders, with yet unpredictable global consequences. This pandemic represents a global public health emergency that has never been seen in recent times. In this work, we conducted an investigation of the current coronavirus outbreak (COVID-19) in the State of São Paulo, Brazil, from a mathematical modeling perspective. We seek to describe the different paths of dynamic transmission of infection, the size of the epidemic in the State of São Paulo and to emphasize the role of strict isolation policy in the transmission and dissemination of COVID-19. This research is based on a new mathematical model that is an extension of the SEIR family of compartmental models. As a result of the computational simulations, we show how the social measures of isolation, quarantine and treatment/monitoring of the infected individuals can influence the model parameters and change the cases rates of infected individuals and individuals exposed over time. The predictive capacity of this model, like most mathematical models, is limited by the accuracy of the available data. Problems regarding the accuracy, standard and reliability of the available data are beyond the scope of this work.

Keywords— Coronavirus, COVID-19, Epidemic Prediction, Mathematical Modeling, São Paulo.

I. INTRODUCTION

On December 31, 2019, the World Health Organization (WHO) had been alerted by Chinese authorities that the Chinese city of Wuhan, Hubei province, recorded an outbreak of respiratory disease. The new Coronavirus was identified as the causative agent of this disease and was isolated from a single patient in early January 2020 and later found in 16 more patients [1,2]. Coronavirus cases were exported to other Chinese cities and also exported internationally, which triggered a global outbreak of the new Coronavirus. This new virus is believed to have originated at the Huanan Seafood Market, a wholesale market for live animals and seafood in Wuhan, considered the main source of this epidemic, as it was found that 55% of the first 425 confirmed cases were linked to the market [2]. But there is uncertainty about several aspects of the Covid-19 origin story that scientists are trying hard to unravel, including which species passed it to a human. It appears that this is the third zoonotic human Coronavirus emerging in this century. In the years 2002/2003 the SARS-CoV pandemic hit China and spread to 37 countries, and in 2012 the MERS-CoV emerged, which spread to 37 countries and reached 4 continents. The symptoms of COVID-19 include fever, fatigue, difficulty breathing, dry

cough and in the most severe cases, pulmonary infiltration. These symptoms are similar to the symptoms caused by infections by SARS-CoV and MERS-CoV [3].

The National Health Commission of China has developed a system to facilitate the identification and classification of patients. To reduce the spread of the virus, the Chinese government has progressively implemented the Wuhan metropolitan quarantine and several nearby cities since 23 January 2020. Countless airports and train stations domestic, in addition to international airports, have adopted temperature screening measures to detect individuals with fever. On February 10, 2020, more than 42,600 people in China were diagnosed with Coronavirus [4] and the World Health Organization (WHO) formally declared the outbreak of the new Coronavirus a Global Public Health Emergency of International Interest.

In Brazil, the first case of the new Coronavirus was confirmed on February 26, 2020. It was a man, from the State of São Paulo, 61 years old, who was in Italy between February 9 and 21, 2020, period with a significant increase in the number of cases in that country [5]. On February 5, an urgent measure, Brazilians were repatriated and to leave Wuhan, the epicenter of the pandemic, China. On April 17, more than 12,000 people in the State of São Paulo were diagnosed with Coronavirus [6]. On March 24, 2020, the São Paulo government decreed quarantine across the state, ordering the closure of all non-essential trade and services. However, in order to function, the quarantine requires the adherence of state citizens to personal protection and public health interventions, including a reduction of effective contacts in transmission, separation and restriction during quarantine.

What is known so far is that the dynamics of the COVID-19 infection is affected by several factors that add major challenges to the control of the disease, for example, the incubation period of the disease that varies from 2 to 14 days, and during throughout this period, infected individuals may have no symptoms, but are able to transmit the disease to other individuals [7]. Coronavirus is a new virus and there are no antiviral drugs or vaccines available, so the control of this disease is related to the immediate detection and isolation of symptomatic cases. From the point of view of health management, the dynamics of infection of the disease and the prediction of its spread over time is of great importance in saving lives and minimizing the social and economic consequences of this disease. In the scientific community, this problem has been studied by several communities, such as the modeling of biological systems [12] and epidemiological mathematics [9]. Some studies on mathematical modeling have already been performed to describe and understand the COVID-19 pandemic.

Most of the models used in these works have significantly emphasized the human-to-human direct transmission pathway, as is the case of the work by Wu et. al. [8]. In this work they introduced the susceptible exposed - infected - recovered (SEIR) model to describe the dynamic transmission of the disease, and provided an estimate of the size of the epidemic in Wuhan in addition to predicting the extent of the epidemic's risks to domestic public health and global. Wu et. al. [8] also estimated that the basic reproductive number for COVID-19 was around 2,68. Sameni [10] proposed a study based on a mathematical model that is an extensions of the SEIR family of compartmental models, and showed how social measures of isolation and quarantine can alter mortality rates and the number of cases of infected individuals over time. Tang et. al. [11] suggested a deterministic model incorporating the clinical condition of the disease and intervention measures, and found that the reproductive number could be up to 6,47 and that intervention strategies such as intensive contact tracking followed by quarantine and isolation, can effectively reduce reproductive control and the risk of transmission. A computational modeling of possible epidemic trajectories to estimate the size of the

disease outbreak in Wuhan was performed by Imai et. al. [13]. All of these models do not take into account the role of the environment in the transmission of COVID-19, for example, when infected individuals cough, these individuals can spread the virus to the environment through droplets, infecting others who have had contact with same areas. There is still a probability that the virus will survive in the environment for several days, for example, the Coronavirus can survive on inanimate surfaces with plastic or glass for up to 9 days [14], increasing the risk of contamination to the individual when in contact with these types of surfaces [15].

Yang and Wang [16] presented a new mathematical model to investigate the outbreak of COVID-19 in Wuhan, and this new model describes the various routes of transmission in the dynamics of the disease and also emphasizes the environmental assignment in the transmission and spread of the disease. This model has a set of differential equations that in addition to considering susceptible, exposed, infected and recovered individuals, it also has an equation that represents the environmental reservoir, that is, it considers that a susceptible individual can acquire COVID-19 through interaction with the contaminated environment, with an infectious but asymptomatic individual.

In present work, we used the SEIR-A mathematical model proposed by Yang and Wang [16] to carry out the mathematical modeling of the COVID-19 Epidemic in the State of São Paulo, Brazil. This model was applied for an epidemic period from March 24, 2020 to April 24, 2020 and also provides a prognosis of the spread of COVID-19 for the next 250 days in the State of São Paulo. This new model incorporates three transmission routes such as the environment-to-human and human-to-human routes, and in particular, a new differential equation is introduced that represents the concentration of Coronavirus in the environmental reservoir. Several works in mathematical modeling have used constant transmission rates to describe and understand the COVID-19 pandemic. In our work, transmission rates depend on environmental conditions and epidemiology that change over time. For example, when the level of infection is very high, we consider that individuals take necessary measures to reduce contact with infected individuals and with the environment that is contaminated, aiming at the protection of your family and your own protection. These measures lead to a reduction in the average rates of disease transmission. In order to obtain the numerical results, strict control measures were considered, such as quarantine and isolation to reduce contact between individuals, and all these factors are taken as varied transmission rates. Furthermore, in the present work, numerical tests were performed using constant transmission rates to compare the results with variable rates. When compared, the results obtained with constant rates showed an extremely high number of infected individuals and notoriously unrealistic, generating misleading information about infection with the Coronavirus.

II. MATHEMATICAL MODELING

For the mathematical formulation of this model, the total human population was initially divided into four classes:

- *1st class:* susceptible individuals (S), individuals who have not yet acquired the disease;
- 2nd class: exposed individuals (E), individuals who are in the incubation period. They have no symptoms, but are capable of infecting other individuals;
- *3rd class:* infected individuals (*I*), individuals of the infected class and have completely developed symptoms of the disease and are capable of infecting other individuals;
- *4th class:* recovered individuals (*R*), who are the cured individuals and/or individuals who died.

Therefore, with this mathematical formulation, classes E and I of the model contain asymptomatic infected individuals and symptomatic infected individuals, respectively. In SIR models, asymptomatic infected individuals (class E) are not considered.

The mathematical model used in this work to describe the transmission dynamics of the COVID-19 pandemic in the State of São Paulo is given by the following system of ordinary differential equations:

$$\begin{aligned} \frac{dS}{dt} &= \Delta - T_E(E)SE - T_I(I)SI - T_A(A)SA - \mu S \\ \frac{dE}{dt} &= T_E(E)SE + T_I(I)SI + T_A(A)SA - (\alpha + \mu)S \\ \frac{dI}{dt} &= \alpha E - (m_D + \gamma + \mu)I \end{aligned} \tag{1}$$
$$\begin{aligned} \frac{dR}{dt} &= \gamma I - \mu R \\ \frac{dA}{dt} &= \theta_1 E + \theta_2 I - \sigma A \end{aligned}$$

where Δ represents the population inflow and *A* is the concentration of the Coronavirus in the environment. The parameter m_D represents the mortality rate induced by the disease, μ is the natural mortality rate of human hosts, γ is the recovery rate from COVID-19 infection and α^{-1} is the incubation period between infection and the onset of disease symptoms. The parameters θ_1 and θ_2 are, respectively, the rates of exposed and infected individuals that contribute to the Coronavirus environmental reservoir and σ is the removal rate of the virus from the environment. The functions $T_E(E)$ and $T_I(I)$ represent human-to-human transmission rates between infected and susceptible individuals, respectively, and in this work are given by:

$$T_E(E) = \frac{T_{E0}}{1+cE}$$
 and $T_I(I) = \frac{T_{I0}}{1+cI}$ (2)

Where T_{E0} and T_{I0} express the maximum values of transmission rates. The function $T_A(A)$ represents the environmental-to-human transmission rate and is given by:

$$T_A(A) = \frac{T_{A0}}{1+cA} \tag{3}$$

where T_{A0} it expresses the maximum value of this rate and the constant *c* is an adjustment coefficient to the transmission rates.

Specifically, in this work we made the following assumptions:

- $T_E(E)$, $T_I(I)$ and $T_A(A)$ are positive functions;
- The variables that make up infections in this model are the exposed (*E*), infected (*I*) and the concentration of Coronavirus in the environment (*A*). According to Yang and Wang [16] the infection matrix *M* and the transition matrix *U* are given by:

$$M = \begin{bmatrix} T_E(0)S_0 & T_I(0)S_0 & T_A(0)S_0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$
 and

$$U = \begin{bmatrix} \alpha + \mu & 0 & 0 \\ -\alpha & w_1 & 0 \\ -\theta_1 & -\theta_2 & \sigma \end{bmatrix}$$
(4)

Where $w_1 = m_D + \gamma + \mu$. The basic reproduction number \Re_0 is defined as the number of secondary infections that an infected individual can create during his period of infection, since the other individuals are susceptible. In the

model used in this work, the basic reproduction number \Re_0 is defined as the spectral radius of the matrix MU^{-1} (see [17]), thus obtaining,

and this number provides us with a quantification of the risk of the disease. $\Re_0 = 1$ it is a threshold below which the generation of secondary cases is insufficient to maintain infection in the human community. If $\Re_0 < 1$ the number of infected individuals tends to decrease and the disease tends to disappear, however if $\Re_0 > 1$ the numbers of infected individuals tends to increase, and the disease tends to persist. The first terms \Re_1 and \Re_2 measure the contributions of human-to-human transmission routes. The term \Re_1 measures the contribution of transmission from individuals exposed to susceptible individuals, while \Re_2 measures the contribution of transmission from infected individuals to susceptible individuals. The third term of equation (5), \Re_3 , represents the contribution of the environmental-to-human transmission route. These three modes of transmission jointly model the overall risk of infection by the COVID-19 outbreak.

III. NUMERICAL RESULTS

The results were obtained from the numerical simulations performed with the mathematical model proposed by the system of equations (1). For numerical validation and computational simulations of the model, we used data from the epidemic in the State of São Paulo, published daily by newspapers and other sources [5,6], data daily reporting new cases of COVID-19, cumulative cases and deaths caused in the State of São Paulo, Brazil. The model was implemented in the mathematical software SCILAB and we performed numerical simulations for an epidemic period starting on March 24, 2020 until April 24, 2020. The estimated population for the State of São Paulo is over 45 million habitants and the State was placed quarantine on March 24, 2020, by the current governor. The preventive measure requires the closure of trade and maintains only essential services, such as health, food and security. In our simulations we will consider that only a relatively "small" number of people have traveled to the State of São Paulo since the beginning of the quarantine, and thus the inflow rate (Δ) of the model is based only on the number of newborns in the state. The average recovery period is approximately 15 days according to [18], and so we define the recovery rate from the disease as $\gamma = 1/15$ per day. The values of transmission rates T_{E0} and T_{I0} can be found in a recent work by Tang et. al. [11]. Some members of the Coronavirus family can survive in the environment since a few hours to several days [14], and we assume the value of 1 day in our work, that is, the virus removal rate is daily ($\sigma = 1$). The incubation period of the infection varies between 2 and 14 days, with average values of 5 to 7 days [18], and so we assume $\alpha^{-1} = 1/7$. As we know, the state government has implemented a strict isolation policy and medical care has been offered to confirmed cases, so the chance of infected individuals spreading the Coronavirus to the environment can be considered low, and in this way, we consider in this paper that $\theta_2 = 0$ and $\theta_1 > 0$ it is so $W_1 \theta_1 > 0$. These and other remaining parameters, their values and respective sources are given in Table 1.

However, three other parameters need to be determined: the adjustment coefficient (c), the rate (θ_1) and the environment-to-human transmission constant (T_{A0}) . Emphasizing that most of the published works do not consider the environmental composition for infection by COVID-19 and, therefore, the value of these three parameters are not available in the literature. In addition, most of these studies consider transmission rates constant over time in their simulations. In the present work, the values of these three parameters are estimated similarly as done in [19], so that the model was adjusted to the cases of COVID-19 infection reported daily to the State of São Paulo from March 24 to April 24, 2020 using the least squares method. The initial conditions (Ci) for our system of ordinary differential equations is defined as: Ci = (S(0), E(0), I(0), R(0), A(0)) = (45919049, 800, 810, 10, 10000), according to data reported in the media daily.

Figure 1 shows the number of cumulative confirmed cases in the period from March 24 to April 24, 2020 in the State of São Paulo versus the adjustment curve obtained by adjusting data using the least squares method. The values of the parameters and their respective confidence intervals are shown in Table 2. The mean square error obtained for the adjustment of the data was 0.00831.

We can see in Figure 1 that the SEIR-A model based on the dynamic propagation of COVID-19 has a good agreement between the numerical solution obtained via mathematical modeling with the real data for the number of confirmed cases. In addition, the adjustment curve for the number of confirmed cases is quite consistent with the reported data.

| Parameters | Definition of parameters | Estimated mean value | Source | | | | |
|------------|--|-----------------------------------|------------|--|--|--|--|
| T_{E0} | Transmission constant between S and E | 6.02x10 ⁻⁹ /person/day | [11] | | | | |
| T_{I0} | Transmission constant between S and I | 1.22x10 ⁻⁹ /person/day | [11] | | | | |
| T_{A0} | Transmission constant between S and A | fitting by data | - | | | | |
| С | Transmission adjustment coefficient | fitting by data | _ | | | | |
| $	heta_1$ | Virus shedding rate by exposed people | fitting by data | _ | | | | |
| $	heta_2$ | Virus shedding rate by infected people | 0 per person per day | _ | | | | |
| Δ | Influx rate | 1659.26 | [21,22,23] | | | | |
| m_D | Disease-induced death rate | 0.0372 per day | [24,26] | | | | |
| μ | Average natural death rate | $3.5x10^{-5}$ per day | [27] | | | | |
| α-1 | Average incubation period | 7 days | [18] | | | | |
| γ | Recovery rate from disease | 1/15 per day | [18] | | | | |
| σ | Removal rate of virus from the environment | 1 per day | [20] | | | | |

Table 1: Definition and values of parameters used in computational modeling.

Table 2: Estimated parameters obtained by data fitting.

| Parameters | Fitting value | Confidence Interval |
|------------|--------------------------------|----------------------------------|
| T_{A0} | $6.39x10^{-10}$ | $(0, 1.086x10^{-9})$ |
| С | 7.48 <i>x</i> 10 ⁻⁵ | $(3.793x10^{-5}, 9.351x10^{-5})$ |
| θ_1 | 4.026 | (1.225, 24.322) |



Fig. 1: Cumulative confirmed cases in the period from March 24, 2020 to April 24, 2020 for the State of São Paulo, Brazil. Note: Solid line, in red, denotes the result of the computer simulation and the asterisks, in blue, denote the reported cases of COVID-19.

We also used the SEIR-A model to predict the spread of COVID-19 in the State of São Paulo, for the next 250 days. Using computational mathematical modeling, we obtain the trend for the development of the number of cumulative cases of infected individuals (I) and for exposed individuals (E), as shown in Figure 2. For this

numerical simulation, we use the transmission rates given in the equations (2) and (3), the parameters of Table 1 and the results of data adjustment presented in Table 2.



Fig. 2: Results of the numerical simulation to predict the cumulative number cases of Coronavirus in the State of São Paulo, Brazil.

Based on the results presented in Figure 2, we believe that the infection level would continue increasing approximately for about 70 to 80 days from March 24, 2020, marked as day zero / initial day in our simulation, and the cumulative number of confirmed cases by the Coronavirus in the State of São Paulo reach a peak value around 39,000 infected individuals at June 2, 2020.

Therefore, after the cumulative number of confirmed cases reaches 39,000 infected individuals on June 2, 2020, new cases may not appear, provide that a strict policy of social isolation continues to be implemented and followed in the State of São Paulo. To better understanding of the spread of COVID-19 in the State of São Paulo, the transmission rates of the new Coronavirus was analyzed. We can see in equations (2) and (3) that transmission rates are related to the number of exposed individuals (E), infected (I) and the concentration of new Coronavirus in the environment (A) that change according to the time. From there, the transmission rate trends for the State of São Paulo over time were obtained, as shown in Figure 3. The transmission rates of the Coronavirus continue to decrease among susceptible-exposed individuals (S-E), susceptibleinfected (S-I) and between susceptible-environment (S-A). We believe that this fact may indicate that the emergency intervention and isolation measures imposed by the government of the State of São Paulo and also medical resources offered in the affected areas in the initial stage of the transmission of COVID-19 played a crucial role in reducing the spread of the disease epidemic.



Fig. 3: Behavior of Coronavirus transmission rates in the State of São Paulo, Brazil.

Using equation (5), the parameter values given in Table 1 and the adjusted parameter values presented in Table 2, the basic reproduction number (\Re_0) was obtained. Specifically, we find the following values:

 $\Re_1 = 1.9344, \Re_2 = 0.3113$ and $\Re_3 = 0.8288$

thus obtaining the basic reproduction number $\Re_0 = 3.0745$. In this case, as $\Re_0 > 1$, the numbers of infected individuals tend to increase and the disease tends

to persist in the State of São Paulo, Brazil. Among the three components, the greatest value \Re_1 comes from the transmission of exposed individuals to susceptible individuals since the exposure of these individuals has no symptoms and they can easily spread the infection to other people when in contact. The component \Re_2 comes from individuals to susceptible infected transmitting individuals. It is observed that \Re_2 it is the least valuable component, probably due to the strict policy of isolation of infected symptomatic individuals imposed by the state governor. The component \mathfrak{R}_3 represents the contribution of the environmental - human route, and it can be seen that this component is making a significant contribution to the overall risk of infection in the State of São Paulo, Brazil.

3.1. Variation study of the θ_2 parameter

In the SEIR-A model, the θ_2 parameter represents the rate of infected individuals that contribute to the Coronavirus environmental reservoir. As is well known, the State of São Paulo was placed in social isolation from March 24, 2020, determining the closure of all trade and non-essential services. To function, the social isolation requires the adherence of citizens of the State to personal protection and public health interventions, including a reduction of effective contacts in transmission, separation and restriction during social isolation. With a strict isolation policy and medical care being offered to confirmed cases, the chance of infected individuals contributing to the Coronavirus environmental reservoir can be considered low, that is, $\theta_2 = 0$. The results obtained with the numerical simulation computational for different values of the parameter θ_2 are presented in Table 3 and Figure 4. Table 3 presents numerical results obtained for different values of the parameter θ_2 for some specific dates that were compared with real data from cases confirmed by COVID-19. Figure 4 shows the simulation of the parameter θ_2 for the period under study (March 24) to April 24, 2020), comparing the decrease in the isolation policy with the increase in confirmed cases of infected individuals in the State of São Paulo, Brazil.

When comparing the results obtained in the numerical simulations with the real data from confirmed cases, it is clear that the mathematical modeling makes a very satisfactory prediction of the cases that occurred in the period from March 24 to April 24, 2020, as shown in Table 3. In particular, the predictions on April 20 and 24, 2020 are 14276 and 17840 cases, respectively, values very close to the actual number of confirmed cases of 14267 and 17826.

| Date | 25/03 | 30/03 | 05/04 | 11/04 | 16/04 | 20/04 | 24/04 |
|---|-------|-------|-------|-------|-------|-------|-------|
| Predicted confrimed cases $\theta_2 = 0$ | 860 | 1657 | 4661 | 8057 | 11132 | 14276 | 17840 |
| Predicted confrimed cases $\theta_2 = 1$ | 860 | 1680 | 4781 | 8251 | 11391 | 14541 | 18265 |
| Predicted confrimed cases $\theta_2 = 5$ | 862 | 1757 | 5142 | 8813 | 12057 | 15255 | 18890 |
| Predicted confrimed cases $\theta_2 = 10$ | 863 | 1827 | 5437 | 9245 | 12550 | 15765 | 19366 |
| Real data of confirmed cases | 862 | 1537 | 4620 | 8216 | 11043 | 14267 | 17826 |

Table 3: Predictions of the confirmed cases for differents values of θ_2 *parameter.*



Fig. 4: Effects of the policy of social isolation and medical care for confirmed cases of infected people in the State of São Paulo, Brazil, between March 24 and April 24, 2020.

It is verified for the parameter $\theta_2 > 2$ that the duration and reduction appropriate social isolation interferes with the number of infected individuals. For example, for $\theta_2 = 1$ the predicted cases are 18265 on April 24, 2020, a slightly distant value from the current number of confirmed cases of 17826, with a difference of 439 infected individuals. When the value of θ_2 even more is increased, that is, when there is a shorter social isolation duration, we can observe a discrepancy between the predicted cases and the real confirmed cases. For example, for $\theta_2 = 10$, the predicted cases are 19366 infected individuals while the real confirmed cases are 17826. Therefore, according to our mathematical modeling it is clear that the appropriate duration of social isolation has significantly decreased the number of infected individuals in the State of São Paulo, Brazil.

3.2. Variation study of the σ parameter

Finally, an analysis is made of the removal rate of Coronavirus from the environment using the SEIR-A model. Figure 5 shows the change in the number of confirmed cases of infected individuals in the State of São Paulo. In this figure we compare the increase in the removal rate of Coronavirus from the environment with the decrease in confirmed cases of infected individuals.



Fig. 5: Effects of the removal rate of Coronavirus from the environment in the State of São Paulo for confirmed cases of infected people.

The change in the removal rate of Coronavirus from the environment changes the number of confirmed cases of infected individuals (Figure 5). For example, when the removal rate of Coronavirus from the environment is 10% $(\sigma = 0.1)$, predicted cases are 19823 infected individuals on April 24, 2020, while the real number of cases confirmed are 17826. We can observe a discrepancy between the predicted cases and the real confirmed cases, with a difference of 1997 infected individuals. When the removal rate is 100% ($\sigma = 1$), in this case the Coronavirus survival rate is around 24 hours according to [19], and the predicted cases are 17840 infected individuals, a number very close to the actual number of confirmed cases. Therefore, it is observed that when the removal rate of Coronavirus from the environment increased from 10% to 100%, the predict cumulative number of infected individuals decreased in 1983 individuals. According to the results of this numerical simulation, we believe that more Coronavirus tests should be carried out and in this way the sources of infection could be dealt with more quickly. Subsequently, in addition to treating individuals with positive diagnoses, perform continuous tracking of new cases, placing them in strict isolation, thus reducing contact with the environment and thus increasing the rate of removal of the Coronavirus.

The results presented in Figure 6, are equivalent to a numerical test that was performed using constant transmission rates in numerical simulations, that is, c = 0 was taken in equations (2) and (3). Therefore, in these simulations were used:

 $T_E(E) = T_{E0}, T_I(I) = T_{I0} \text{ and } T_A(A) = T_{A0}$



Fig. 6: Result of the numerical simulation for the size of the Coronavirus epidemic in the State of São Paulo using constant transmission rates.

However, it is still necessary to find the values of the rate (θ_1) and the environment-to-human constant transmission rate (T_{A0}) estimated by adjusting the data. In this case, we used the same set of data provided in Table 1 and we found the following values: $\theta_1 \cong 4.026$ and $T_{A0} \cong 6.39 \times 10^{-10}$, with a normalized mean square error of 0,0327.

Figure 6 shows a prediction of epidemic size in the State of São Paulo considering rates constant of transmission. Comparing Figure 6 to Figure 2, the higher existence of infected individuals is clearly observed; mainly the value found for the peak of the infection which is around $9x10^6$ infected people which is an extremely high value and notoriously unrealistic. This result, obtained in the computer simulations, proves that the use of constant transmission rates can overestimate the severity of the Coronavirus epidemic and generate misleading information, because when using constant transmission rates, the control measures that are ongoing in the State of São Paulo are not taken into account.

IV. DISCUSSION

In this study we use computational mathematical modeling to research the Coronavirus epidemic that is underway in the State of São Paulo - Brazil, and we carried out a detailed analysis of the epidemic using publicly We adopted a model to clarify the released data. transmission dynamics of the new Coronavirus and we analyzed the impact caused by the interventions taken by the government of the State of São Paulo, to decrease the number of infected people. The model adopted in this study uses non-constant transmission rates that change with the epidemiological status and with the conditions of the environment, reflecting the impact of the control measures implemented in the State. Another characteristic of this model is the incorporation of a new differential equation that represents the environmental contribution to the dynamics of disease transmission.

Through numerical simulation, an estimate was obtained for the basic reproduction number, $\Re_0 = 3.0745$, which consists of three parts and represents different transmission routes, namely, the route of exposed individuals, the route of the infected individuals and the route from the environmental reservoir to susceptible individuals. In particular, we observed that the contribution of the environmental reservoir, measured by \Re_3 , is significant for the overall risk of the disease.

It is worth mentioning that through numerical simulation, a very satisfactory predictions of confirmed cases of infected individuals was obtained from the 24th of March to the 24th of April 2020. In this simulation, we anticipate the appearance of an epidemic peak that will occur around 2 June 2020 with approximately 39,000 infected individuals, after which the level of infection will decrease and approach an endemic state in the long term. Our study has important practical implications for those responsible for public health. The high level of reproduction of the Coronavirus suggests that the outbreak may be more serious than reported to date, given the growing social contacts and the breakdown of social isolation and effective and rigorous health measures in some places in the state.

In this work, we also perform some numerical simulations using constant transmission rates. The results showed an excessively larger epidemic peak that does not match reality. These unrealistic results were caused by the fixed transmission rates that do not reproduce the result of the isolation and control measures of the infected people in progress in the State of São Paulo. We believe that the use of dependent rates can generate more practical and reliable results, resulting in an estimate close to the current reality of the epidemic of the new Coronavirus in the State of São Paulo.

Analyzing the results obtained in our mathematical modeling, in particular with our simulations computational, the results suggest that Coronavirus infection should be combated for a longer period than the current epidemic, in order to reduce the endemic burden and potentially eliminate the disease. Vaccines, which are currently under development, are other intervention strategies for the new Coronavirus.

Finally, we emphasize that our mathematical modeling was based on the confirmed cases of infected individuals for the State of São Paulo from March 24 to April 24, 2020. Therefore, our predictions regarding the duration and size of the new epidemic Coronavirus should be interpreted as applicable only to confirmed cases in the State of São Paulo, data reported daily by the Ministry of Health. Problems regarding the accuracy, standard and reliability of confirmed cases of infected individuals are beyond the scope of this study.

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Reuse of expanded Polystyrene for waterproofing production and Application in Civil Construction

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Abstract— The expanded polystyrene known commercially as proportional, is very present in our daily lives, showing great uses, in this way, it has become a very popular element. Because it has high volumetric features due to its composition of 98% air and only 2% polystyrene, the recycling becomes unattractive to disrupt the environmental effects caused by its misuse. Currently, the use of technologies in conjunction with alternative inputs, such as styrofoam, are considered major innovations for the civil engineering market, with a tendency to provide cheaper construction, achieving excellent results. This work aims to reuse expanded polystyrene for the production of waterproofing using solvents and vegetable oil. The present work has shown positive results capable of protecting the building elements and components against harmful water actions.

Keywords—Expanded polystyrene, Styrofoam, EPS, recycling.

I. INTRODUCTION

Currently, planet Earth has been suffering from changes caused by a series of human activities, as well as burning, use of fossil fuels, deforestation, and improper waste disposal. This environmental problem is also related to a growing product, known commercially as Isopor®, the expanded polystyrene (EPS), considered by NBR 10004: 2004 a non-hazardous waste belonging to class II, but this product becomes a villain of nature for having a long decomposition time. According to Coelho, Manzanares, Menedez,(2014), despite the EPS being a recyclable material, companies and people end up improperly disposing, because they find its recycling impracticable, since it is a material composed of 98% air and 2% polystyrene, having a large volume for low mass. Taking this issue into account, this work aimed to reduce the extraction of raw material and as a measure to combat the impacts caused by the waste, reusing EPS in the manufacture of a new waterproofing material, initially intended for civil construction, as according to BORGE, GONÇALVES, MOURA. (2008). The main cause of pathologies in structures and finishes is due to some action that water causes. The polymers are composed of long wires being linear or branched, their structure influences according to the temperature causing a rearrangement of atoms, (SOUZA, 2019). Thus being able to regroup to form

a new material. Polymers due to their size are recognized by macromolecules, they have materials that are easy to process, in addition to being light, resistant and of good performance in thermal and electrical insulation, it has low investment value, so it became viable to develop the areas of electronics, appliances, even civil engineering (SPINACÉ; PAOLI, 2004).

EPS exhibits very peculiar properties and characteristics, making it a very advantageous material for civil construction, presenting attributes capable of providing thermal and acoustic insulation, in addition to showing a material with good mechanical resistance despite being very light, it is not a hygroscopic material providing good resistance to water and moisture (MEDEIROS et al.,2011).

According to NBR 9575/2010 Waterproofing -Selection and design, states that waterproofing is a constructive technique, consisting of one or 15 more layers in order to protect the building elements and components, against the harmful action of fluids and moisture. The waterproofing materials have two classifications, rigid (waterproof and polymeric mortar), used more in static structures because it does not support movements, and flexible (based on acrylic membranes, thermoplastics, among others), capable of adapting according to the requirements of the structure VOTORANTIM, (2017).
Therefore, this work has developed a flexible waterproofing product, resulting from the recycling of EPS and the addition of solvents, fibers and oils in order to protect from water actions, contribute significantly to the mechanical and abrasive resistance of the surface to be applied.

II. METHODOLOGY

The research is of an experimental and exploratory character, through experiment and field test.

The present study was carried out in the laboratories of Instituto Presidente Antônio Carlos (ITPAC) and in the Federal Institute of Science and Technology Education of Tocantins (IFTO) in the municipality of Porto Nacional -TO, located 60 km from the state capital, Palmas as shown in figure 1.



Fig. 1: Location of the municipality of Porto Nacional. Source: (BALDUINO et al., 2018).

Parts of isopores were improperly discarded to the environment, this collected material went through a process of cleaning with water and liquid soap, this act is extremely important because the contaminated material can compromise the results affecting color and uniformity.

For the dilution of the expanded polystyrene, some solvents were used, such as station alcohol, thinner and kerosene. In addition to Styrofoam as a solute, the addition of PVA glue and fiberglass were tested, to acquire plasticity, soy oil was used.

After collecting the material, using a loofah, rub gently with liquid soap, removing all existing impurities. Then 4 types of mixture were made.

Mixture 01 - In a 600 ml beaker, 100 ml of thinner, 30 grams of expanded polystyrene were added, constantly stirring until all the material was diluted.

Mixture 02 - In a 600 ml beaker, 100 ml of thinner, 30 grams of expanded polystyrene, 5 ml of soybean oil and 15 ml of PVA glue were added in constant agitation until all the material was diluted.

Mixture 03 - In a 600 ml beaker, 100 ml of thinner, 30 grams of expanded polystyrene and 30 ml of kerosene

were added in constant agitation until all the material was diluted.

Mixture 04 - In a 600 ml beaker, 100 ml of thinner, 30 grams of expanded polystyrene and glass fiber were added in constant agitation until all the material was diluted.

Mixture 04 - In a 600 ml beaker, 100 ml of thinner, 30 grams of expanded polystyrene and glass fiber were added in constant agitation until all the material was diluted.

III. RESULTS AND DISCUSSIONS

First, several solvents were tested to analyze which one has the best performance in dissolving the expanded polystyrene. Dissolution using hydrated ethanol and kerosene did not have a desired effect on EPS, kerosene behaved like an oily solution, being applied together with the thinner performing a binder function.

The cleaning process proved to be necessary because the poor execution of this step generated unwanted results in its coloring.

Samples were applied to fabrics to analyze mobility, strength and measure permeability, as well as tiles and plastered walls.

Solution 1 proved to be a robust material, making it difficult to apply it homogeneously on the surface, a

plasticizer material where the thicker layers were opaque and the thinner transparent as shown in figures 2, 3 and 4.



Fig2. Thinner and Styrofoam on fabric.



Fig 3. Thinner and Styrofoam on tile.



Fig 4. Thinner and styrofoam on the wall.

In solution 2, the substances were not homogeneous, highlighting more particles of expanded polystyrene in the middle of PVA glue according to figures 5, 6 and 7.



Fig 5. Thinner + Styrofoam + PVA Glue + Oil on Fabric.



Fig 6. Thinner + Styrofoam + PVA glue Oil on the tile.



Fig 7. Tiner + Styrofoam + PVA Glue + Oil

Solution 3 proved to be more moldable with the presence of kerosene, facilitating uniform application, with transparent and shiny coloring according to figures 8, 9 and 10.



Fig 8. Thinner + Styrofoam + Kerosene in the fabric



Fig 9. Thinner + Styrofoam + Kerosene on the tile



Fig 10. Thinner + Styrofoam + Kerosene on the wall

Substance 4 showed to be a firmer material, gaining mechanical resistance properties after drying, according to figures 10,11 and 12.



Fig 11. Thinner + Styrofoam + Fiberglass on fabric



Fig 12. Thinner + Styrofoam + Fiberglass on the tile



Fig 13. Thinner + Styrofoam + Fiberglass on the wall

| PROPERTIES | MIX 1 | MIX 2 | MIX 3 | MIX 4 |
|---------------------------|-----------|----------|-----------|------------------|
| TOUGHNESS | Hard | Moldable | Hard | Very hard |
| COLORING | Colorless | opaque | Colorless | Partly opaque |
| WATERPROOFIN G ABILITY | Great | Good | Great | Great |

| Fable 1. | Charac | cteristics | of | mixtures. |
|----------|--------|------------|----|-----------|
|----------|--------|------------|----|-----------|

IV. CONCLUSION

All the tests carried out with the different mixtures showed characteristics according to their composition, regardless of that any of the substances presented satisfactory results before the humidity. However, the use of PVA glue and oil influenced both the color and the water resistance, among the four mixtures it was the one that presented less resistance forming a white layer, an unwanted characteristic for waterproofing, another negative point in the mixtures was the immediate application of the product. which formed some bubbles, requiring the complete evaporation of the gases present in the substances. Substances 03 and 04 were the ones that had the best results, mixture 03 showed a transparent coloring with excellent resistance to humidity, whereas mixture 04, in addition to these characteristics, showed a resistance gain due to the presence of fiber, leaving opaque only in the areas that have fibers.

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Sociodemographic and clinical profile of women from Rondônia, Western Amazon (Brazil), diagnosed with the main types of cancer

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Abstract— Objective: To analyze the sociodemographic and clinical profile of women from Rondônia, Western Amazonia (Brazil), diagnosed with the main types of cancer, over a period of 3 years. Materials and Methods: The methodological design followed the characteristics of a documentary, transversal and descriptive study, based on the raw data produced and sectorized, according to the methodological model recommended by Paraguassú-Chaves et al [4]. We used an instrument developed by Paraguassú-Chaves [5], semi-structured, divided into two blocks: (a) Block I - sociodemographic profile of women with cancer and (b) Block II - clinical profile of women with cancer. The research coordinator asked the Human Research Ethics Committee to waive the Free and Informed Consent Term. The research works with primary data from an official source of the public health service in Rondônia. Results: The age group from 40 to 59 years old prevailed, brown skin color, little education, married women, smokers and 89% referred by SUS. Breast, cervical and skin cancers were the most common. The oncology clinic was responsible for the entry of 89.6% of women with cancer. At the entrance to the oncology clinic women without treatment and advanced stages of the disease predominated, with a diagnosis confirmed by histological examination and with a single primary tumor. It prevailed "Other therapeutic procedures used. 23.8% of women with cancer have a family history of cancer. At the end of the 1st treatment, 71% of the patients have the disease in progress. 6.3% of women diagnosed with cancer died. Cancer of the stomach, liver, bronchi and lungs, breast and cervix caused deaths in women in Rondônia. Conclusions: The results presented are in accordance with the data of most studies carried out by Paraguassú-Chaves et al [3], [4], [6] and Paraguassú-Chaves [5] in Rondônia. In recent years, there has been an exponential growth of cancer in women in Rondônia. What is expected is that this research can serve as a basis for planning, executing and evaluating actions to promote, prevent, control and treat cancer in women in Rondônia.

Keywords— cancer in women. sociodemographic profile. clinical profile. Rondônia. Western Amazonia.

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I. INTRODUCTION

According to the National Cancer Institute (INCA), cancer is the main public health problem in the world and is already among the four main causes of premature death (before the age of 70) in most countries. Cancer incidence and mortality are increasing worldwide, partly due to aging, population growth, as well as changes in the distribution and prevalence of cancer risk factors, specially those associated with socioeconomic development [1].

Currently, there is a transition of the main types of cancer observed in developing countries, with a decline in the types of cancer associated with infections and an increase in those associated with the improvement of socioeconomic conditions with the incorporation of habits and attitudes associated with urbanization (sedentary lifestyle, inadequate nutrition, among others) [2].

In the most recent world estimates, INCA [1], points out that in 2018, there were 18 million new cases of cancer in the world (17 million not counting cases of non-melanoma skin cancer) and 9.6 million deaths (9.5 million excluding non-melanoma skin cancers). And, according to Bray *et al* [2] in women, the highest incidences were breast cancer (24.2%), colon and rectum (9.5%), lung (8.4%) and cervix (6.6%).

The adjusted rate of cancer incidence in women, excluding non-melanoma skin cancer, was 175.6 per 100.000, varying between different regions of the world. In countries with the highest Human Development Index (HDI), incidence rates were two to three times higher than in countries with a medium or low HDI index. In women, breast cancer rates predominate regardless of the HDI. Colon and rectal cancer has the highest adjusted rates in countries with high HDI; while, in countries with low and medium HDI, the second most incident is cervical cancer [2].

In Brazil, an estimate for each year of the 2020-2022 triennium indicates that 625 thousand new cases of cancer will occur (450 thousand, excluding cases of nonmelanoma skin cancer) [1]. The most common types of cancer in women, except for non-melanoma skin cancer, will be breast (29.7%), colon and rectum (9.2%), cervix (7.4%), lung (5.6%) and thyroid gland (5.4%). Nonmelanoma skin cancer represents all cancer cases in 29.5% in women. Incidence rates adjusted for age, with the exception of non-melanoma skin cancer, in women (145.00 / 100 thousand) are considered intermediate and compatible with those presented for developing countries. Female breast cancer has one of the highest adjusted rates for all geographic regions of Brazil and its magnitude is about two to three times higher than the second most frequent, except in the North Region where the adjusted rates for breast and cervix are very close [1].

The North Region (where the State of Rondônia is located) is the only Brazil where the rates of breast and cervical cancer are equivalent among women. For the State of Rondônia (North Region of Brazil, Western Amazonia), as shown for the year 2020 of the gross and adjusted rates for the incidence of 100 thousand inhabitants and number of new cases of cancer, according to sex and historical location, are: breast cancer with 220 new cases (crude rate 24.07 and adjusted rate 29.30), cervix with 130 new cases (crude rate 14.44 and adjusted rate 17.22), trachea, bronchi and lung with 70 new cases (gross rate 7.72 and adjusted rate 9.21), colon and rectum with 70 new cases (gross rate 8.11 and adjusted rate 10.40), stomach with 40 new cases (gross rate 4.57 and adjusted rate 5, 98), ovarian cancer with 30 new cases (gross rate 3.14 and adjusted rate 3.72), thyroid gland with 30 new cases (gross rate of 3.22 and adjusted rate of 4.04) and skin cancer with melanoma with 20 new cases (gross rate of 1.88 and adjusted rate of 2.11) [1].

According to Paraguassú-Chaves et al [3], one explanation for the significant increase in the incidence of cancer lies in the greater exposure of cancer risk factors. The redefinition of living standards, based on the standardization of working conditions, nutrition and consumption triggered by the global industrialization process, important repercussions has on the epidemiological profile of populations. Demographic changes, with reduced mortality and birth rates, indicate a prolonged life expectancy and an aging population, leading to an increased incidence of chronic-degenerative diseases, mainly cardiovascular and cancer. Thus, cancer constitutes a public health problem for the developed world - and also for developing countries, in which the sum of new cases diagnosed each year reaches 50% of the total observed in the five continents, as already registered in 2002 by the Pan American Health Organization (PAHO).

In Brazil, the distribution of different types of cancer suggests an ongoing epidemiological transition. With the recent aging of the population, which projects the exponential growth of the elderly, it is possible to identify a significant increase in the prevalence of cancer. This situation requires the managers of the Unified Health System (SUS) to make an immense effort to offer adequate care to the population. This perspective makes clear the need for major investment in health promotion, in the quest to modify the patterns of exposure to risk factors for cancer. While there is a clear increase in the prevalence of cancers associated with the best socioeconomic status breast, prostate and colon and rectum -, simultaneously, we have high incidence rates of tumors generally associated with poverty - cervix, penis, stomach and oral cavity [3].

In this scenario, resources and efforts must be directed to guide cancer prevention and control strategies at all levels (health promotion, early detection, patient care, surveillance of cancer and its risk factors, training of human resources, communication and social mobilization, research and management of the Unified Health System (SUS).

In this context, the Hospital Cancer Registry (RHC) represents an extremely important tool for the knowledge and monitoring of cancer morbidity and mortality. The basic requirements of RHC are: (local) support to the manager, government, available resources, collaboration with the main data providers, used hardware and software equipment, customized installations, trained personnel, and cooperation with other public and international registries. Its use is to provide the clinical staff and the hospital administration with information on the frequency and possible trends of the most varied types of cancer diagnosed and / or treated in health units and estimates of patient survival.

To compose this picture, the state government of Rondônia implemented the High Complexity Assistance Unit - UNACON, in 2007, at the Hospital de Base Dr. Ary Pinheiro, in the city of Porto Velho, capital of the state of Rondônia. UNACON identifies and catalogs the data to support the Hospital Cancer Registry Information System -SISRHC / INCA, with systematic sources of information from the medical record regarding the registration and follow-up of admitted cases, assessing the extent, quality of survival and indirectly, the quality of the service provided at the institution. The information is a primary source for epidemiological research on determinants of cancer and also for planning prevention, diagnosis and treatment of the disease.

The greatest evidence of cancer as a public health problem in the state of Rondônia is the installation of the Barretos de Rondônia Hospital, the so-called Hospital do Amor Amazônia, the largest and most important health unit specialized in neoplasms in the Amazon. Reference hospital in oncology in the Brazilian Amazon, where medical assistance is free and linked to the Unified Health System (SUS).

In Rondônia, research, Epidemiological profile of cancer in Rondônia: Brazilian Amazon, by Paraguassú-Chaves *et al* [4] and Epidemiology of cancer in Rondônia,

by Paraguassu-Chaves et al [3] has highlighted key points for understanding cancer in Rondônia, such as the description of the distribution and magnitude of cancer in the population of Rondônia (who became ill, type of cancer, in what situation the disease occurred, etc) both at the municipal level and across the entire state of Rondônia; the systematization of essential data for the planning, execution and evaluation of cancer promotion, prevention, control and treatment actions in Rondônia, as wel as for the establishment of priorities; the approximation of the identification of the etiological factors in the genesis of cancers in Rondônia; the provision of an educational tool and product that can be used as instructional material for teaching purposes at the reach of all people regardless of the level of school or cultural education; the availability of data and information to support the development of studies and applied research on the production and distribution of cancers in Rondônia.

The objective of this study is to describe the sociodemographic and clinical profile of women from Rondônia, Western Amazon (Brazil), diagnosed with the main types of cancer, over a period of 3 years.

II. MATERIALS AND METHODS

2.1 Study Type

The methodological design followed the characteristics of a documentary, transversal and descriptive study, based on the raw data produced and sectorized, according to the methodological model recommended by Paraguassú-Chaves *et al* [4]. The primary data were organized by the Hospital Nucleus of Epidemiology - NHE of the largest public referral hospital in the state of Rondônia, based on the diagnoses made at the Cancer Specialized Hospital, for a period of three years.

2.2 Model of Semi-structured Instrument Paraguassú-Chaves [5].

We used an instrument developed by Paraguassú-Chaves [5], semi-structured, was divided into two blocks: (a) Block I - Sociodemographic profile of women with cancer in Rondônia, with the following variations: age at diagnosis, race / color, education level / education, marital status, activity / occupation, origin of referral, smoking, alcoholism, origin, distribution of the 10 main neoplasms in women by race / color, distribution of the 10 main neoplasms by age group, distribution of the 10 main neoplasms by grade school distribution of the top 10 smoking neoplasms, distribution of the top 10 neoplasms due to alcoholism, distribution of the top 10 neoplasms by activity, distribution of the top 10 neoplasms by status; (b) Block II - Clinical profile of women with cancer in Rondônia, with the following variations: proportional distribution of more frequent neoplasms in women analytical and non-analytical cases; distribution of the top 10 neoplasms by entry clinic, distribution of the top 10 neoplasms by family history of cancer, distribution of the top 10 neoplasms by type of treatment, distribution of the top 10 neoplasms after initial treatment, distribution of the top 10 neoplasms by death / cancer.

These data were inserted in statistical platforms, reviewed, (re) classified, (re) interpreted, (re) analyzed and correlated according to the descriptive and analytical methods, using frequency distribution and proportional percentages in the statistical representations, according to instrument developed by Paraguassú-Chaves *et al* [6].

2.3 Sampling Number

The research was carried out with the database of 2.758 women diagnosed with cancer in Rondônia, corresponding to the period of 3 years.

2.4 Inclusion and exclusion criteria

Complete protocols with data or more than 80% of the variables were included. Cancers of the hematopoietic and rediculoendothelial system were excluded due to their extreme frequency in children and adolescents.

2.5 Ethical Aspects

The research coordinator asked the Human Research Ethics Committee to waive the Free and Informed Consent Term, because the study did not require patient intervention or collection of biological material and there was no possibility of constraints for the patient and his family. The research works with primary data from an official source of the public health service in Rondônia.

III. RESULTS

In 3 years of studies, 5.149 cases of cancer were diagnosed in the State of Rondônia. Of these, 2.758 (53.56%) were diagnosed in women.

3.1 BLOCK 1 - SOCIODEMOGRAPHIC PROFILE OF WOMEN WITH CANCER IN RONDÔNIA

3.1.1 Sociodemographic profile of all women with cancer in Rondônia.

Sociodemographic aspects and their indicators allow us to know the characteristics of a specific population and its evolution over time in the territory. In the health sector, this information supports the decision-making process, since it helps in the knowledge about health conditions, mortality and morbidity, risk factors, population; gender ratio; demographic conditions, among others [7], [8].

The age at diagnosis was predominant in the 40 to 49 age group, with 21.1%, and in the 50 to 59 age group, with 24.9%. These two age groups account for 46% of all types of cancer in women in Rondônia. After this age, there was a decrease to 18.7% (between 60 and 69 years), 10.9% (between 70 to 79 years) and 3.7% (equal to or greater than 80 years). It became evident that the age group under 29 years old has a lower incidence of cancer in relation to the other age groups, with an accumulated frequency of 7.3%, according to [9]. In this age group, cancer must be studied separately, as it has different primary sites, histological origins and clinical behavior. (Table 1).

As can be seen in Table 1, which exposes the proportional distribution of cancer according to skin color, brown color is predominant in the State of Rondônia and the one with the highest incidence, making a total of 64.4% of all neoplasias.

The frequency of 43.3% of women who have not completed elementary school is statically very significant, followed by women with no educational instruction, with 19.7%. With complete elementary school there is 17.9%, complete high school, 13.4% and complete higher education, the lowest frequency of cancer, with 5.7%. In this study, the higher frequency of cancer in women with little education is evident.

Referring to the distribution of cancer patients according to marital status, married women predominated, with 72.9% of new cases. Then, single women with 16.2% of cases, followed by widows with 7.3% and legally separated / divorced and divorced with 3.6%.

To confirm the performance and importance of SUS, 99.2% of female patients admitted to referral hospitals specializing in cancer treatment were referred by the Unified Health System - SUS. Only 0.2% of all registered cancer cases did not originate from referral by SUS. 89% of women with cancer are smokers and 11% are ex-smokers. 81% of women diagnosed with cancer have never consumed alcoholic beverages and 11% are exconsumers. 74% of women diagnosed with cancer were born in other states in Brazil and 21.5% are from the state of Rondônia. (Table 1).

| Sociodemographic variables | Fr % | Sociodemographic variables | Fr % |
|------------------------------|------|----------------------------|------|
| Age at diagnosis | | Race / Color | |
| <29 years | 7.3 | White | 19.5 |
| 30 to 39 years | 13.4 | Brown | 64.4 |
| 40 to 49 years | 21.1 | Yellow | 0.5 |
| 50 to 59 years | 24.9 | Black | 3.0 |
| 60 to 69 years | 18.7 | Indigenous | 0.6 |
| 70 to 79 years | 10.9 | No information | 12 |
| 80 years or older | 3.7 | | |
| Degree of Education | | Marital Status | |
| Illiterate | 19.7 | Married | 72.9 |
| Incomplete elementary school | 43.3 | Single | 16.2 |
| Complete elementary school | 17.9 | Separated / divorced | 3.6 |
| Complete high school | 13.4 | Widow | 7.3 |
| Graduated | 5.7 | | |
| Smoking | | Alcoholism | |
| Yes | 89 | Yes | 8 |
| Never | 0.0 | Never | 81 |
| Ex-consumer | 11 | Ex-consumer | 11 |
| Forwarding source | | Source | |
| SUS | 99.2 | Rondônia | 21.5 |
| Not SUS | 0.2 | Other states | 74.4 |
| Others | 0.6 | Foreign | 0.8 |
| | | No information | 3.3 |

| Table 1. Summary of the relative frequ | ency (%) of the sociodemogra | phic variables of all women | n with cancer in Rondônia |
|--|------------------------------|-----------------------------|---------------------------|
|--|------------------------------|-----------------------------|---------------------------|

Fr % Relative frequency.

3.1.2 Sociodemographic profile of women diagnosed with cancer among the 10 main neoplasms in women in Rondônia.

Age is still one of the most important risk factors for cancer in women. Incidence rates increased rapidly after the age of 40. In Rondônia, the age group of cancer in the 40 to 59 age group reaches 48.8% of the 10 main types of cancer in women.

Breast cancers and cervical cancer have the highest frequency in women aged between 30 and 59 years in the state of Rondônia. Breast cancer maintains a high frequency from the age group of 30 to 39 years (21.64%), 40 to 49 years (49.21%), 50 to 59 years (37.05%), 60 to 69 years (32.19%) and 70 to 79 years (21.05%). Cervical cancer has a higher age group in women under the age of 29 years (52.27%) and in the age group from 30 to 39 years (41.79%) different from the high frequencies frequent in women with breast cancer. Cervical cancer has a considerable increase in the age group from 70 to 79 years old (22.80%).

With the increase in this age group, it is possible to notice a decrease in cervical and breast cancer, and an increase in skin cancer in women aged 60 and 80, with emphasis on women aged 60 to 69 years (20.54%) and

older than 80 years with 47.82%. Stomach cancer has an increase in age from 70 to 79 years (17.54%) and liver cancer increases in the age group older than 80 years with

21.73%. Women in the age group under 29 and those over 80 are less frequent in diagnosing cancer. (Table 2).

| Table 2: Distribution of the 10 main neoplasms of women in the State of Rondônia by age at diagnosis of cancer. | Rondônia / |
|---|------------|
| Brazil. | |

| Age Range | <29 | 30 - 39 | 40 - 49 | 50 - 59 | 60 - | 70 - 79 | > 80 | Others |
|-------------------------|-------|---------|---------|---------|------|---------|-------|--------|
| Cancer Diagnosis | years | | | | 69 | | years | |
| breast cancer | 4.5 | 21.6 | 49.2 | 37.0 | 32.2 | 21.1 | 8.7 | 66.7 |
| cervical cancer | 52.3 | 41.8 | 19.9 | 15.7 | 15.1 | 22.8 | 8.7 | 0.0 |
| skin cancer | 15.9 | 8.2 | 7.9 | 14.2 | 20.5 | 14.0 | 47.8 | 0.0 |
| thyroid gland | 4.5 | 8.9 | 1.6 | 6.1 | 3.4 | 1.7 | 0.0 | 0.0 |
| stomach cancer | 4.5 | 4.5 | 4.7 | 3.0 | 8.2 | 17.5 | 4.3 | 33.3 |
| colon cancer | 0.0 | 4.5 | 4.7 | 5.6 | 4.8 | 5.3 | 4.3 | 0.0 |
| ovarian cancer | 2.3 | 6.7 | 6.3 | 4.1 | 1.4 | 5.3 | 4.3 | 0.0 |
| bronchi and lungs | 0.0 | 0.7 | 1.6 | 3.0 | 6.8 | 3.5 | 0.0 | 0.0 |
| rectal cancer | 2.3 | 2.2 | 3.7 | 4.6 | 5.5 | 7.0 | 0.0 | 0.0 |
| liver cancer | 4.5 | 0.7 | 0.5 | 6.6 | 2.1 | 1.7 | 21.7 | 0.0 |
| Fr % | 5.5 | 16.9 | 24.0 | 24.8 | 18.3 | 7.2 | 2.9 | 0.4 |

Fr % Relative frequency.

Table 3 shows the distribution of the 10 main neoplasms in women in the State of Rondônia by Race / Color. Neoplasms diagnosed in brown (64.2%) and white (30.9%) women are more frequent than in other ethnicities, such as: yellow, black and indigenous. In brown women, these diagnoses were the majority, as they present a large percentage of women with breast cancer (36.8%), cervix (20.1%) and skin (12.7%), while in white

women they are also breast cancer (39.4%), cervix (15.9%) and skin (16.5%). Black women were more frequent in breast (44.4%), cervix (27.8%) and colon (11.1%) cancers. Yellow women had the highest frequencies of breast cancer, thyroid gland cancer, stomach cancer, bronchi and lungs, while in indigenous women the highest frequencies were breast, stomach, rectum and liver cancer. (Table 3).

Table 3: Distribution of the 10 main neoplasms in women by Race / Color.

| Ethnicity / Color | Brown | White | Black | Yellow | Indigenous |
|-------------------|-------|-------|-------|--------|------------|
| breast cancer | 36.8 | 39.4 | 44.4 | 40.0 | 25.0 |
| cervical cancer | 20.1 | 15.9 | 27.8 | 0.0 | 0.0 |
| skin cancer | 12.7 | 16.5 | 0.0 | 0.0 | 0.0 |
| thyroid gland | 3.7 | 3.5 | 5.5 | 20.0 | 0.0 |
| stomach cancer | 5.4 | 4.7 | 5.5 | 20.0 | 25.0 |
| colon cancer | 4.8 | 4.1 | 11.1 | 0.0 | 0.0 |
| ovarian cancer | 5.7 | 5.3 | 0.0 | 0.0 | 0.0 |
| bronchi and lungs | 3.1 | 3.5 | 0.0 | 20.0 | 0.0 |
| rectal cancer | 3.9 | 3.5 | 5.5 | 0.0 | 25.0 |

| liver cancer | 3.7 | 3.5 | 0.0 | 0.0 | 25.0 |
|--------------|------|------|-----|-----|------|
| Fr % | 64.2 | 30.9 | 3.3 | 0.9 | 0.7 |

Fr % Relative frequency.

The educational level of women diagnosed with cancer is (38.3%) with incomplete elementary school, (23.0%) with complete elementary school and (19.5%) illiterate.

According to (Table 4), it is possible to identify which cancer rate in women with less education is much higher than the cases diagnosed in women with a higher level of education, in which to understand how information is also an effective way to prevent and treatment of the disease, however, breast cancer had an independent participation in the level of education, with 32.7% of illiterate women, 35.9% with incomplete elementary school, 38.5% with complete elementary school, 40% with high school and 57.1 % with higher education. The high frequency of cervical cancer also does not depend on the level of education. Cervical cancer corresponds to 14.5% of illiterate women, 18.5% with incomplete primary education, 21.5% with complete primary education and 20% with complete secondary education. The highest frequencies of skin cancer were diagnosed in illiterate women (16.7%), complete elementary school (15.4%) and complete high school, with 20%. Colon cancer is more frequent in women with complete elementary school education (10.2%) and complete higher education (21.4%). (Table 4).

| Degree of Education | Illiterate | Incomplete | Complete | Complete | Graduated |
|------------------------|------------|------------|----------|--------------|-----------|
| Euucation | | school | school | ingii school | |
| breast cancer | 32.7 | 35.9 | 38.5 | 40.0 | 57.1 |
| cervical cancer | 14.5 | 18.5 | 21.5 | 20.0 | 7.14 |
| skin cancer | 16.7 | 7.40 | 15.4 | 20.0 | 0.0 |
| thyroid gland | 1.81 | 1.85 | 6.15 | 7.5 | 0.0 |
| stomach cancer | 10.90 | 4.62 | 4.61 | 2.5 | 0.0 |
| colon cancer | 0.0 | 10.2 | 1.53 | 5.0 | 21.4 |
| ovarian cancer | 5.45 | 8.33 | 3.07 | 2.5 | 7.14 |
| bronchi and lungs | 3.63 | 4.62 | 3.07 | 0.0 | 0.0 |
| rectal cancer | 9.09 | 4.62 | 3.07 | 2.5 | 0.0 |
| liver cancer | 5.45 | 4.62 | 3.07 | 0.0 | 7.14 |
| Fr % | 19.5 | 38.3 | 23.0 | 14.2 | 5.0 |

Table 4: Distribution of the 10 main neoplasms in women by level of education.

Fr % Relative frequency.

The distribution of the 10 main types of cancer in women shows that married women have the highest frequencies (73.6%), followed by single women with 16.3%. According to the marital status of each patient, it is possible to notice a big difference between the diagnoses of cancer in married women when compared to single women and other conjugated states. The highest

frequencies of breast cancer were 38.0% in married women and 22.7% in single women. In the case of cervical cancer, there is an inversion of values, 26.0% in married women and 38.2% in single women. In the case of separated / divorced women, both breast cancer with 53.8% and cervical cancer with 30.8% have a significant frequency. (Table 5).

| Marital Status | Married | Single | Widow | Separated / |
|-------------------|---------|--------|-------|-------------|
| | | | | Divorced |
| breast cancer | 38.0 | 22.4 | 32.6 | 53.8 |
| cervical cancer | 26.0 | 38.2 | 5.9 | 30.8 |
| skin cancer | 9.6 | 13.2 | 17.6 | 0.0 |
| thyroid gland | 3.2 | 3.9 | 2.9 | 0.0 |
| Stomach cancer | 7.3 | 1.3 | 8.8 | 0.0 |
| colon cancer | 3.5 | 5.3 | 11.8 | 7.7 |
| ovarian cancer | 4.4 | 5.3 | 2.9 | 7.7 |
| bronchi and lungs | 2.0 | 1.3 | 2.9 | 0.0 |
| rectal cancer | 2.3 | 2.6 | 8.8 | 0.0 |
| liver cancer | 3.5 | 6.6 | 5.9 | 0.0 |
| Fr % | 73.6 | 16.3 | 7.3 | 2.8 |

Table 5: Distribution of the 10 main neoplasms in women by conjugal state.

Fr % Relative frequency.

The relative incidence of women who declared smokers was 89.3% and 10.7% ex-smokers. There were no records of women who had never smoked before. 38% of women smokers were diagnosed with breast cancer and 20% of smokers with cervical cancer. 34.4% of women diagnosed

with breast cancer and 16.4% diagnosed with cervical cancer are ex-smokers. 34.9 of women diagnosed with colon cancer and 11.5% diagnosed with lung cancer are ex-smokers. (Table 6).

| Smoking | Yes | Ex-consumer | Never |
|-------------------|-------|--------------------|-------|
| breast cancer | 37.97 | 34.42 | 0.0 |
| cervical cancer | 20.15 | 16.39 | 0.0 |
| skin cancer | 12.13 | 6.55 | 0.0 |
| thyroid gland | 4.50 | 3.27 | 0.0 |
| stomach cancer | 6.84 | 3.27 | 0.0 |
| colon cancer | 4.89 | 34.91 | 0.0 |
| ovarian cancer | 5.08 | 0.0 | 0.0 |
| bronchi and lungs | 1.95 | 11.5 | 0.0 |
| rectal cancer | 3.71 | 9.83 | 0.0 |
| liver cancer | 2.73 | 9.83 | 0.0 |
| Fr % | 89.3 | 10.7 | 0.0 |

Table 6: Distribution of the 10 main neoplasms in women by smoking.

Fr % Relative frequency.

According to table 7, considering all types of cancer in women, alcoholism is not a determining factor for cancer in women in the state of Rondônia. Of the women diagnosed with cancer, 8.3% use alcoholic beverages. The frequency of women who have never consumed alcoholic beverages is 81.2% and 10.5% of ex-consumers. As a negative aspect, women who use alcoholic drinks stand out, with 36.2% diagnosed with cervical cancer, 25.5%

| Alcoholism | Yes | Ex-Consumer | Never |
|-------------------|------|--------------------|-------|
| breast cancer | 25.5 | 30.0 | 39.7 |
| cervical cancer | 36.2 | 20.0 | 17.9 |
| skin cancer | 2.1 | 6.7 | 12.5 |
| thyroid gland | 2.1 | 1.7 | 5.2 |
| stomach cancer | 10.6 | 6.7 | 6.3 |
| colon cancer | 6.4 | 6.7 | 4.7 |
| ovarian cancer | 14.9 | 0.0 | 4.5 |
| bronchi and lungs | 0.0 | 6.7 | 2.4 |
| rectal cancer | 2.1 | 13.3 | 3.4 |
| liver cancer | 0.0 | 8.3 | 3.2 |
| Fr % | 8.3 | 10.5 | 81.2 |

Table 7: Distribution of the 10 main neoplasms in women due to alcoholism.

with breast cancer, 14.9% with ovarian cancer and 10.6% with ston

with stomach cancer. (Table 7).

Fr % Relative frequency.

Women who work in agriculture represent 43.4% of the cases diagnosed with cancer, followed by women who occupy in commerce, transport and other occupations with 21.7%, women at home (16.1%) and independent professionals (11.3%). In women by occupation in agriculture, rectal cancer with 28.3%, ovarian cancer with 19.6% and cervical cancer with 17.4% predominated. Women with a professional occupation in the industry and diagnosed with cancer were more frequent with 40% of cervical cancer, 40% of skin cancer and 20% of colon cancer.

In women working in commerce, transportation and other activities, they had cancer of the cervix (26.0%), ovary (30.4%) and cancer of the rectum (21.7%). There was a predominance of stomach cancer with a frequency of 33.3% and ovary cancer with 66.7% of women diagnosed with cancer and who work in the public service. Among liberal professionals, skin cancer (16.7%), thyroid gland (25%) and ovarian cancer (41.7%) predominated. In women who work at home, 35.3% of cervical cancer and 41.2% of ovarian cancer were diagnosed. (Table 8).

| Table | ο. | Distribution | ofthe | 10 | | | : | | L. | a a a com a ti a ta |
|-------|----|--------------|--------------|----|------|-----------|----|--------|----|---------------------|
| rable | ο. | Distribution | <i>oj me</i> | 10 | main | neopiasms | ın | women, | υy | оссиранон. |

| Professional | Agriculture | Industr v | Commerce, Transport and Others | Public agent | Independent Professional | Works at Home |
|-------------------|-------------|--------------|-----------------------------------|-----------------|-----------------------------|------------------|
| occupation | | J | und Others | ugent | 1 Toressional | Home |
| breast cancer | 6.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| cervical cancer | 17.4 | 40.0 | 26.0 | 0.0 | 8.3 | 35.3 |
| skin cancer | 4.3 | 40.0 | 4.3 | 0.0 | 16.7 | 5.9 |
| thyroid gland | 6.5 | 0.0 | 0.0 | 0.0 | 25.0 | 5.9 |
| stomach cancer | 0.0 | 0.0 | 0.0 | 33.3 | 0.0 | 5.9 |
| colon cancer | 2.2 | 20.0 | 0.0 | 0.0 | 0.0 | 5.9 |
| ovarian cancer | 19.6 | 0.0 | 30.4 | 66.7 | 41.7 | 41.2 |
| bronchi and lungs | 6.5 | 0.0 | 13.0 | 0.0 | 8.3 | 0.0 |
| rectal cancer | 28.3 | 0.0 | 21.7 | 0.0 | 0.0 | 0.0 |
| liver cancer | 8.7 | 0.0 | 4.3 | 0.0 | 0.0 | 0.0 |
| Fr % | 43.4 | 4.7 | 21.7 | 2.8 | 11.3 | 16.1 |

Fr % Relative frequency.

3.2 BLOCK 2 – CLINICAL PROFILE OF WOMEN WITH CANCER IN RONDÔNIA

In Rondônia, in the 3 years of studies, 2.758 new cases of cancer were diagnosed in women. Table 01 shows the distribution of neoplasms with the highest incidence in the state of Rondônia. Following the trend in Brazil, breast cancer is the one with the highest number of new cases registered in the State of Rondônia during the studied period. Breast cancer is more frequent with 35.5% of new cases, followed by cervical cancer with 22.6% of cases and skin cancer with 16.5% of cases. Cancer of the thyroid gland (6.7%), stomach (5.6%), colon (4.1%), ovary (3.8%), bronchi and lungs (3.3%), rectum (1, 4%) and liver (1.2%) make up the picture of the 10 most common neoplasms in women in Rondônia. (Table 9).

| Table 9: | Proportional distribution of the 10 most |
|----------|--|
| | frequent neoplasms in women. |

| Primary Tu | mor Fr % |
|-------------------|----------|
| Location | |
| breast cancer | 33.5 |
| cervical cancer | 22.6 |
| skin cancer | 16.5 |
| thyroid gland | 6.7 |
| stomach cancer | 5.6 |
| colon cancer | 4.1 |
| ovarian cancer | 3.8 |
| bronchi and lungs | 3.3 |
| rectal cancer | 1.4 |
| liver cancer | 1.2 |

Fr % Relative frequency.

Cases of cancer of the hematopoietic system and reticuloendolthelial system (prevalence of cancer in children and adolescents aged 0 to 19 years) were excluded.

The oncology clinic was responsible for the entry of 89.6% of women with cancer in Rondônia. The other

important entry clinics were gynecology and mastology. 35.4% of women with breast cancer, 25% of cervical cancer and 15.2% skin cancer were admitted to the oncology clinic, while 40.8% of women with breast cancer, 22.4% of the cervix and 13.2 of skin cancer were admitted by other clinics. Women with thyroid gland cancer and liver cancer were not admitted to any of these clinics. (Table 10).

| Table 10: Distribution of the 10 main neoplasms | in |
|---|----|
| women by entry clinic. | |

| Entrance Clinic | Oncology Clinic | Other Clinics |
|-------------------|-----------------|---------------|
| breast cancer | 35.4 | 40.8 |
| cervical cancer | 25.6 | 22.4 |
| skin cancer | 15.2 | 13.2 |
| thyroid gland | 0.0 | 0.0 |
| stomach cancer | 6.4 | 6.6 |
| colon cancer | 4.7 | 6.6 |
| ovarian cancer | 4.7 | 5.3 |
| bronchi and lungs | 3.2 | 1.3 |
| rectal cancer | 4.4 | 3.9 |
| liver cancer | 0.0 | 0.0 |
| Fr % | 89.6 | 10.4 |

Fr % Frequencia relativa.

The oncology clinic registered 94.4% of women entering the 3 main entry clinics. Entry by the oncology clinic predominated, according to the diagnosis and previous treatment with the following situation in decreasing order: women with diagnosis and without treatment (62.9%), with diagnosis and with treatment (25.2%) and without diagnosis and without treatment (11.9%).

The entry of women through the gynecology / obstetrics and mastology clinics corresponds to 2.9% and 2.7% of the entry clinics, respectively. In the same way, the entry of women with diagnosis and without treatment prevailed, 62.1% in the gynecology / obstetrics clinic and 55.6% in the mastology clinic. (Table 11).

| Entrance Clinic | With Diagnosis / With Treatment | With Diagnosis / Without Treatment | Without Diagnosis / Without Treatment | Fr % |
|----------------------------|------------------------------------|---------------------------------------|--|-------|
| Clinical Oncology | 25.2 | 62.9 | 11.9 | 94.4 |
| Gynecology / Obstetrics | 15.9 | 62.1 | 22.0 | 2.9 |
| Mastology | 20.6 | 55.6 | 23.8 | 2.7 |
| Fr % | 20.6 | 60.2 | 19.2 | 100.0 |

Table 11: Distribution of cancer by the three main entry clinics, according to previous diagnosis and treatment.

Fr % Relative frequency.

The distribution of cancer by clinical stage, according to previous diagnosis and treatment, has a higher relative prevalence (41%) in the "no internship". Stages II with 17.5%, III with 16% and IV with 15% represent the frequencies affected by clinical staging. Stage I, with only 10.5%, represents the lowest relative prevalence. Women with diagnosis and without treatment with 44% at stage I, 46.1% at stage II, 46.6% at stage III, 49.1% at stage IV and 48.1% at stage, prevailed in all stages. (Table 12).

Table 12: Distribution of cancer by clinical stage, according to or previous diagnosis and treatment.

| Internship | With Diagnosis / With Treatment | With Diagnosis / Without Treatment | Without Diagnosis / Without Treatment | Fr % |
|---------------|------------------------------------|---------------------------------------|--|-------|
| Stage I | 48.3 | 44.0 | 7.7 | 10.5 |
| Stage II | 45.1 | 46.1 | 8.8 | 17.5 |
| Stage III | 46.6 | 46.6 | 6.8 | 16.0 |
| Stage IV | 37.6 | 49.1 | 13.3 | 15.0 |
| No internship | 22.4 | 48.1 | 29.5 | 41.0 |
| Fr % | 40.0 | 46.8 | 13.2 | 100.0 |

Fr % Relative frequency.

It was possible to analyze only 254 cases regarding the distribution of cancer by primary tumor location, according to the clinical stage of the disease. Due to a failure in the information system or changes in data filling, 1.986 protocols have "no information" about the location of the primary tumor and the stage of the disease.

The distribution of cancer by primary tumor and the stage of the disease is very delicate. There was a gradual

growth from stage I (7.9%) to stage II (17.7%), from stage III (17.7%) to stage IV (20.5%) and non-stage (36.2%). Primary tumors are diagnosed in advanced stages of the disease. Breast cancer with stage II (34.2%), stage III (34.2%), stage IV (17.7%) and cervical cancer with stage II (44.8%) and stage III (34. 5%) and also bronchial and lung cancer with 90.9% in stage IV is very significant to demonstrate the stages of primary tumors in women in Rondônia. (Table 13).

Table 13: Proportional distribution of cancer by primary tumor location, according to clinical stage.

| Internship / Primary Tumor | brea st canc er | cervical cancer | skin canc er | thyroi d gland | stoma ch cancer | colon cancer | bronchi and lungs | Ot her s | Total |
|----------------------------------|--------------------------|--------------------|--------------------|----------------------|-----------------------|-----------------|-------------------------|----------------|-------|
| Stage I | 13.9 | 17.2 | 28.6 | 16.7 | 0.0 | 0.0 | 0.0 | 1.0 | 7.9 |
| Stage II | 34.2 | 44.8 | 14.3 | 0.0 | 0.0 | 30.0 | 0.0 | 1.1 | 17.7 |
| Stage III | 34.2 | 34.5 | 14.3 | 16.7 | 28.6 | 10.0 | 9.1 | 1.1 | 17.7 |

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| No 0.0 internship | 0.0 | 42.8 | \$ 50.0 | 14.3 | 0.0 | 0.0 | 90. 4 | 36.2 |
|----------------------|-----|------|---------|------|------|------|----------|------|
| Stage IV 17.7 | 3.5 | 0.0 | 16.6 | 57.1 | 60.0 | 90.9 | 6.4 | 20.5 |

Fr % Relative frequency.

In the distribution of cancer in women, according to the number of diagnoses and primary tumors, 99.2% had their diagnosis confirmed by primary histological examination. 99.9% had a single primary tumor. The absolute majority of the diagnoses confirmed by the primary tumor histology exam and the one diagnosed as a single primary tumor are evidenced (Table 14).

Table 14: Proportional distribution of cancer, according to diagnosis and number of primary tumors.

| Basis of Diagnosis | Fr % |
|--------------------------|------|
| Clinic | 0.1 |
| Clinical research | 0.3 |
| Examination by Image | 4.8 |
| Tumor Markers | 1.6 |
| Cytology | 1.0 |
| Primary Tumor Histology | 92.2 |
| Number of Primary Tumors | |
| Single Primary Tumor | 99.9 |
| Multiple Primary Tumor | 0.1 |

Only 795 protocols were made available for access. Therefore, the analysis of the distribution of the 10 main neoplasms in women according to the type of treatment considered only the protocols correctly completed in all mandatory fields. Among the types of treatment and therapeutic procedures, "Other therapeutic procedures used" prevailed with an absolute prevalence of 337 cases (42.4%) of the 1st treatment received by the patient.

The second highest absolute frequency is surgery with 127 cases and the relative incidence of 16%, followed by chemotherapy with 68 cases (8.6%) of the first treatments received by women diagnosed with cancer. Due to inconsistency in filling out patient registration and follow-up forms, 241 (30.3%) of the procedures were discarded as ignored. (Table 15).

Fr % Relative frequency.

| Treatment | Surger | Surgery and | Chemoth | Radiothe | Immunothe | Others | Ignored |
|----------------------|--------|--------------|---------|----------|-----------|--------|---------|
| Туре | У | Chemotherapy | erapy | rapy | rapy | | |
| breast cancer | 20.5 | 33.3 | 44.1 | 8.3 | 0.0 | 39.8 | 28.6 |
| cervical cancer | 23.6 | 11.1 | 13.2 | 25.0 | 100.0 | 19.3 | 31.5 |
| skin cancer | 22.8 | 0.0 | 8.8 | 0.0 | 0.0 | 11.9 | 14.5 |
| thyroid gland | 2.4 | 11.1 | 0.0 | 8.3 | 0.0 | 5.0 | 5.8 |
| stomach cancer | 5.5 | 33.3 | 7.4 | 16.7 | 0.0 | 5.3 | 5.0 |
| colon cancer | 5.5 | 0.0 | 8.9 | 16.7 | 0.0 | 3.8 | 4.2 |
| ovarian cancer | 5.5 | 0.0 | 7.4 | 0.0 | 0.0 | 4.4 | 3.7 |
| bronchi and lungs | 4.7 | 11.1 | 2.9 | 8.3 | 0.0 | 3.0 | 0.8 |

Table 15: Distribution of the 10 main neoplasms in women by type of treatment.

| International Journa <u>https://dx.doi.org/1</u> | national Journal of Advanced Engineering Research and Science (IJAERS) ://dx.doi.org/10.22161/ijaers.75.43 | | | ERS) | [VoI-7, Issue-5, May- 202 ISSN: 2349-6495(P) 2456-1908(| | | |
|---|---|-----|-----|------|--|------|------|--|
| rectal cancer | 3.9 | 0.0 | 4.4 | 8.3 | 0.0 | 3.9 | 4.2 | |
| liver cancer | 5.5 | 0.0 | 2.9 | 8.4 | 0.0 | 3.6 | 1.7 | |
| Fr % | 16.0 | 1.1 | 8.6 | 1.5 | 0.1 | 42.4 | 30.3 | |

Fr* % Frequencia relativa.

At the oncology clinic, the main entry clinic for diagnosis and treatment, the time in days, elapsed, second median, between a first consultation and the diagnosis was 15 days, a median between diagnosis and the start of treatment was 49.5 days and median between enrollment (1st consultation) and the start of treatment was 1 day. (Table 16).

 Table 16: Time interval (in days) elapsed, according to the median, between: 1st consultation - 1st diagnosis; 1st diagnosis - start of treatment; 1st consultation and start of treatment, according to the clinic responsible for the care.

| Description of the Entrance Clinic | Median Registration / Diagnosis | Median Diagnosis / Treatment | Median Registration / Start of Treatment |
|---------------------------------------|---------------------------------------|------------------------------------|--|
| Clinical Oncology | 15 | 49.5 | 1 |
| Gynecology / Obstetrics | 5.5 | 41 | 1 |
| Mastology | 19 | 36.5 | 12 |
| Time (days) | 13.2 | 42.3 | 4.7 |

Among the 10 main neoplasms in women with a family history of cancer, 23.8% of women with cancer have a family cancer history. 46.% do not link cancer with family history and 29.8% are not considered due to lack of information, thus being ignored. 37% of women with breast cancer have a family history of cancer. In the case of cervical cancer, this relative ratio is 18%. (Table 17).

| Family Cancer | Yes | Not | Ignored |
|-------------------|------|------|---------|
| History | | | |
| breast cancer | 37.0 | 40.7 | 18.98 |
| cervical cancer | 18.0 | 20.6 | 31.64 |
| skin cancer | 9.0 | 11.9 | 20.67 |
| thyroid gland | 6.9 | 3.5 | 4.21 |
| stomach cancer | 5.8 | 6.5 | 5.06 |
| colon cancer | 6.9 | 4.3 | 3.79 |
| ovarian cancer | 5.3 | 4.1 | 4.64 |
| bronchi and lungs | 3.0 | 1.9 | 3.79 |
| rectal cancer | 5.1 | 3.5 | 3.37 |
| liver cancer | 3.0 | 3.0 | 3.79 |
| Fr % | 23.8 | 46.4 | 29.8 |

Table 17: Distribution of the 10 main neoplasms in women by family cancer history.

Fr % Frequencia relativa.

For the analysis of the distribution of the 10 main neoplasms in women after the first treatment, the record with an absolute frequency of 776 women was used. Regarding the state of the disease at the end of the 1st (first) treatment, it can be seen that patients with progressing disease represent 71% (551 new cases), followed by those with partial remission with 14.2% (110 cases) and stable disease with 12.9% (100 cases).

Only 1.9% (15 cases) had complete remission of the disease, that is, without evidence of disease. Breast cancer with 46.7% is the best representation of the total remission of the disease. (Table 18).

| Cancer | Progressi | Stable | Total | Partial |
|-----------------|-----------|--------|----------|----------|
| | on | | Remissio | Remissio |
| | | | n | n |
| bronchi and | 5.6 | 11.0 | 0.0 | 0.9 |
| lungs | | | | |
| cervical cancer | 19.0 | 14.0 | 13.3 | 29.1 |
| colon cancer | 5.1 | 7.0 | 6.7 | 2.7 |
| stomach cancer | 5.6 | 14.0 | 0.0 | 5.5 |
| liver cancer | 3.3 | 10.0 | 0.0 | 0.9 |
| thyroid gland | 4.1 | 7.0 | 13.3 | 3.6 |
| breast cancer | 33.7 | 12.0 | 46.7 | 36.4 |
| ovarian cancer | 5.8 | 6.0 | 13.3 | 6.4 |
| skin cancer | 14.0 | 13.0 | 6.7 | 11.8 |
| liver cancer | 3.8 | 6.0 | 0.0 | 2.7 |
| Fr % | 71.0 | 12.9 | 1.9 | 14.2 |

Table 18: Distribution of the 10 main neoplasms in women after the first treatment.

Fr % Frequencia relativa. *Deaths were excluded.

It was possible to analyze 796 cancer cases among the 10 types of cancer in women. The difficulties are in the failure to complete the protocols. Of this sample, 50 women, that is, 6.3% of women diagnosed with cancer in Rondônia, died from the disease. The main victims of deaths were women with cancer of the stomach, liver, bronchi and lungs, breast and cervix. (Table 19).

Table 19: Distribution of the 10 main neoplasms in women by death / cancer.

| Death / Cancer | Yes | Not |
|-------------------------------------|-------------|--------------|
| breast cancer | 16.0 | 34.22 |
| cervical cancer | 12.0 | 24.02 |
| skin cancer | 4.0 | 14.49 |
| thyroid gland | 2.0 | 4.83 |
| stomach cancer | 20.0 | 4.96 |
| colon cancer | 6.0 | 4.56 |
| ovarian cancer | 4.0 | 4.56 |
| bronchi and lungs | 16.0 | 1.87 |
| ovarian cancer bronchi and lungs | 4.0 16.0 | 4.56 1.87 |

| rectal cancer | 0.0 | 4.29 |
|---------------|------|-------|
| liver cancer | 20.0 | 2.14 |
| Fr* % | 6.3% | 93.7% |

Fr % Frequencia relativa.

IV. DISCUSSION

The present study allowed know the to sociodemographic and clinical profile of women diagnosed with the main types of cancer in the State of Rondônia, Western Amazon (Brazil). In the 3-year period, a total of 5.149 new cases of cancer were diagnosed in both sexes, an annual average of 1.716 new cases. Considering that the State of Rondônia has an estimated population of 1.800 inhabitants, the annual frequency of new cases of cancer represents approximately 1% of the total population of Rondônia. The research was carried out with the database of 2.758 women diagnosed with cancer in Rondônia. Therefore, cancers in women represent 53.56% of all cancers diagnosed in Rondônia. This frequency is very close to that found by ParaguassuChaves *et al* [5] and Paraguassu-Chaves [6], also in the State of Rondônia.

Breast cancer has the highest number of new cases, followed by cancer of the cervix, skin cancer, cancer of the thyroid gland, stomach, colon, ovary, bronchi and lungs, rectum and liver. According to INCA [1], an estimate for the year 2020 of new cancer cases in women in Rondônia follows in decreasing order: breast cancer (220 new cases), cervical cancer (130 new cases), bronchi and lungs (70 new cases), colon and rectal cancer (70 new cases), stomach cancer (40 new cases), ovary (30 new cases) and thyroid gland (30 new cases) and melanoma skin cancer (20 cases new).

According to the study by Paraguassú-Chaves *et al* [3], the proportional distribution of more frequent neoplasms in women in the years 2014 and 2015 reported in the base hospitals Dr. Ary Pinheiro and Barretos / RO, had breast cancer as the highest incidence in the State of Rondônia, with 466 new cases. The ten most common neoplasms in women were in decreasing order: breast cancer (466), cervix (311), skin cancer (251), thyroid gland (111), stomach (77), colon cancer (53), bronchi and lungs (50), ovary (48), uterine body (28) and cancer of the hematopoietic and reticuloendothelial system with 27 cases.

There was a predominance of age at diagnosis in the age group of 40 to 59 years (45%), brown skin (64.4%), married women (72.9%), women with low schooling (43.3% with incomplete elementary school) and 99.2% referred by the Unified Health System. Soares *et al* [10] found that 68.1% of the population of women with cancer are from the Public Health System and Mascarello *et al* [11] found that 84.2% of cancer patients are referred by the Unified Health System (SUS).

Eighty-nine percent of women are smokers, 81% have never consumed alcoholic beverages and 74.4% are from other states in Brazil. These findings corroborate the results found by Paraguassu-Chaves [5] in the Diagnosis of Cancer in Women in Rondônia: Study of Medical Geography, by Paraguassú-Chaves *et al* [6] in the Epidemiological Profile of Rondônia, Paraguassú-Chaves *et al* [4] in the Epidemiological profile of cancer in Rondônia: Brazilian Amazon, Paraguassú-Chaves *et al* [3] in Epidemiology of cancer in Rondônia.

This study identified that breast cancer is the most frequent in 35.5% of new cases, followed by cervical cancer with 22.6% of cases and skin cancer with 16.5% of cases. Thus, the analysis with the adopted variables will focus on the 3 main types of cancer and the description will focus on the 10 most common neoplasms in women

from Rondônia. At this stage, the 10 most common types of cancer diagnosed in women in the state of Rondônia (Brazil) will be described.

According to Bray *et al* [2] in "Global Cancer Statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 types of cancer in 185 countries" and Ferlay *et al* [12] in "Estimating incidence and mortality global cancer in 2018: GLOBOCAN sources and methods ", in the world, breast cancer is the most incident among women. In 2018, there were 2.1 million new cases, equivalent to 11.6% of all estimated cancers. This value corresponds to an estimated risk of 55.2 / 100 thousand. For these same authors, the incidence of breast cancer is configured among the first positions of female malignancies, regardless of the country's socioeconomic condition.

According to the INCA [1], there has been a decline in the incidence rate in some countries, part of which is attributed to hormone replacement treatment in women after menopause. Also according to INCA [1], the most common histological type for female breast cancer is cell epithelial carcinoma, divided into in situ and invasive lesions. According to American Cancer Society [13], Bray *et al* [2], Ferlay *et al* [12] and Stewarte, Wild [14] the most frequent carcinomas are ductal or lobular.

According to INCA (15) in Brazil, 16.724 deaths from female breast cancer occurred in 2017, or the equivalent of a risk of 16.16 per 100 thousand. There is not only one risk factor for breast cancer, however, age over 50 is considered the most important [1]. According to Bray *et al* [2], Ferlay *et al* [12], other factors that contribute to the increased risk of developing a disease are genetic factors (mutations of the BRCA1 and BRC2 genes) and hereditary factors (ovarian cancer in the family)), in addition to late menopause (hormonal and reproductive factors), obesity, physical inactivity and frequent exposures to ionizing radiation (environmental and behavioral factors).

Cervical cancer is one of the most frequent tumors in the female population and is caused by persistent infection with some types of human papillomavirus (HPV) [1]. Genital infection with this virus is very common and does not cause disease most of the time. However, in some cases, cellular changes that can progress to cancer. These changes are easily discovered in the preventive exam (also known as the Pap smear) and are curable in almost all cases [1].

For Bray *et al* [2] and Ferlay *et al* [12], a worldwide estimate points out that cervical cancer was the fourth most frequent worldwide, with an estimate of 570 thousand new cases, representing 3.2% of all cancers. This value corresponds to an estimated risk of 15.1 / 100 thousand women. According to INCA [15] in Brazil, in 2017, there were 6.385 deaths and the crude mortality rate due to cervical cancer was 6.17 / 100 thousand. Still according to INCA [1], other factors that increase the risk of developing this type of cancer are: early onset of sexual activity and sexual partners; smoking (disease directly related to the amount of cigarettes smoked); and prolonged use of birth control pills.

According to Bray *et al* [2] and Ferlay *et al* [12] of all diagnosed malignancies worldwide, non-melanoma skin cancer is the most common type in both sexes. They are more common in people with fair skin over 40, with the exception of those already with skin diseases. INCA [1] points out that this age profile has been changing with a constant exposure of young people to sunlight. According to the American Cancer Society (13), the main types of non-melanoma skin cancer are: squamous cell carcinoma; basal cell carcinoma - which is the majority of cases -; and melanoma skin cancer (which forms in melanocytes), which grows and spreads more quickly, although it is less common.

In Brazil, in 2017, 949 deaths occurred in women at risk of 0.92 / 100 thousand [1], and for melanoma skin cancer, there were 804 deaths in women, with a risk of 0.78 / 100 thousand [15]. The main risk factors for skin cancer are prolonged exposure to the sun (ultraviolet rays - UV), especially in childhood and adolescence, exposure to tanning beds and family history of skin cancer [1], [13].

In 2018, there were 567 million new cases of thyroid cancer, or the equivalent of 3% of all estimated cancers that occupy a position in the world. Predominantly, the cases are female with 436 thousand new cases (11.5 per 100 thousand) and in countries with high HDI [2], [12].

In Brazil, in 2017, there were 526 deaths from breast cancer in women, this value corresponds to the risk of 0.51 / 100 thousand [15]. History of neck irradiation, low-dose radiation therapy (mainly in childhood), family history of thyroid cancer and low iodine diet are the main risk factors for the development of the disease [1, 13, 14]. Other risk factors for developing diseases are: obesity, smoking, hormonal exposures and environmental pollution [16].

The most frequent stomach cancer is the type of adenocarcinoma, responsible for 95% of cases. Other types of tumors, such as lymphomas and sarcomas, can also occur in the stomach [1]. Worldwide, 350 thousand new cases in women were estimated, with an estimated risk of 9.3 / 100 thousand [1].

In Brazil, in 2017, there were 5.107 deaths in women, values corresponding to a risk of 4.93 / 100 thousand [15].

Helicobacter Pylori infection is the main risk factor for stomach cancer [1].

However, other risk factors that are related to the development of stomach cancer are: overweight and obesity; consumption of preserved foods without salt; food with low intake of fruits, vegetables and whole fiber, excessive consumption of alcohol and tobacco, some occupational exposures, such as, for example, an exposure of agricultural and pesticide farmers; and an exhibition for rubber production [1]. In addition to the hereditary factors that contribute to the development of this cancer, such as: diffuse hereditary gastric cancer, gastric adenocarcinoma and a proximal polyposis of the stomach [1].

Colon and rectal cancer includes tumors that start in the part of the large intestine (called the colon) and in the rectum (end of the intestine, just before the anus) and anus. According to INCA [1] colorectal cancer is amenable to treatment and, in most cases, it is curable, when detected early and has not yet reached other organs. The most recent worldwide estimate points out that, in women, 800 thousand new cases of colorectal cancer occur, being the second most incident tumor among all cancers with an incidence rate of 21.8 / 100 thousand [1].

In Brazil, in 2017, 9.660 (9.33 / 100 thousand) women died of colorectal cancer [15]. The main factors related to a higher risk of colorectal cancer are: age 50 years or older, obesity, physical inactivity, prolonged smoking, high consumption of red or processed meat, low calcium consumption, excessive alcohol consumption and poor diet in fruits and fibers. There are factors of hereditary origin that increase the risk, including family history of colorectal cancer and / or adenomatous polyps, some genetic conditions such as familial adenomatous polyposis and hereditary colorectal cancer without polyposis, history of chronic inflammatory bowel disease (colitis ulcerative or Crohn's disease) and type 2 diabetes, in addition to factors such as occupational exposure to ionizing pollution [1, 13].

Most new cases of ovarian cancer are formed by epithelial cells, or the remainder by germ cells and stromal cells [1]. Ovarian cancer is the eighth most common cancer among women in the world. In Brazil, in 2017, 3.879 deaths from ovarian cancer occurred, a risk equivalent to 3.75 / 100 thousand women [15].

According to the [1, 13], the main risk factors associated with ovarian cancer are: age (epithelial carcinoma) and family history of ovarian and breast cancer (mutations of the BRCA1 or BRCA2 genes). Other risk factors that are also important are: reproductive and hormonal, early menarche, late menopause, obesity and

smoking. Historically, the most common histological types are non-small cell, large cell, squamous cell, adenocarcinoma and oat cell carcinomas [14].

In the world, lung cancer is among the main ones in incidence, occupying third position among women [1]. The estimated total of new cases of this disease, in 2018, worldwide, represents 725 thousand new cases in women, corresponding to an estimated risk of 19.2 / 100 thousand.

In Brazil, in 2017, there were 11.792 deaths from lung cancer in women, values that represent an estimated risk of 11.39 / 100 thousand women [15]. Smoking and passive tobacco exposure are the main risk factors for the development of lung cancer. Eighty-five percent of diagnosed cases are associated with tobacco consumption [1]. Other risk factors are occupational exposure to chemical or physical agents (asbestos, silica, uranium, chromium and radon) and high doses of beta-carotene supplements in smokers and ex-smokers [1,13].

The incidence of liver cancer has more than tripled since 1980 [13]. Liver cancer mortality rates have increased by almost 3% a year since 2000. In Brazil, the National Cancer Institute (INCA) does not provide estimates for liver cancer.

Among the 10 main neoplasms of women by age in Rondônia, breast cancer has the highest frequencies between 30 and 79 years, distributed in the relative frequencies of 21.6% (30-39 years), 49.2% (40-49 years), 37 % (50-59 years), 32.2% (60-69 years) and 21.1% (70-79 years). Cervical cancer has a high frequency in women under 29 years old (52.3%), aged between 30 and 39 years (41.8%) and aged between 70 and 79 years old (22.8%). Skin cancer increases the frequency in women aged 60 to 69 years (20.5%) and over 80 years (47.8%), while stomach cancer has an increase in the age of 70 to 79 (17.5%) and liver cancer increases in the age group above 80 years (21.7%).

In a research on cancer in the State of Rondônia, Paraguassú-Chaves *et al* [3] found in women with cancer, the relative frequency in the age group of 45 to 59 years (35.7%) in the first phase of the research and 45.8% in the age range 45 to 64 years old in the second phase (second year).

For Mascarello *et al* [11] the cases of cancer in women predominant in the age group from 40 to 59 years old (49.3%). In the research by Ribeiro *et al* [17] in a city in the Northeast of Brazil, the highest incidences were found in women aged 40 to 49 years (20.6%) and 50 to 59 years old (21.5%). Segundo According to INCA (18), the incidence of diseases is evident in the age group between 20 and 29 years old and whose risk increases until reaching its peak, in the general age group between 45 and 50 years old. Approximately 80% of new cases occur in developing countries where, in some regions, it is the most common cancer in women.

Another variable considered in the research was the distribution of the 10 main neoplasms in women by race / color. Neoplasms diagnosed in brown (64.2%) and white (30.9%) women are more frequent. In brown women, breast cancer (36.8%), cervix (20.1%) and skin (12.7%) predominate, and white women, breast cancer (39.4%), cervix (15.9%) and skin (16.5%). Black women were more frequent in breast (44.4%), cervical (27.8%) and colon (11.1%) cancers. In indigenous women the highest frequencies were breast, stomach, rectum and liver cancer. The studies by Beleza *et al* [19] corroborates these findings. In the study by Mascarello *et al* [11], non-white color predominated (76.8%).

Paraguassú-Chaves *et al* [4] when studying the distribution of cancer on skin function, at Base Pinheiro hospitals Dr. Ary Pinheiro and Barretos de Rondônia, found the brown color with the highest relative frequency (46.9%) of the total universe studied, followed by the color white (21.6%), black (3.3%), yellow (0.6%) and indigenous (0.5%).

In the research by Paraguassú-Chaves *et al* [3] brown color predominated (68.5%) and white (21.4%) in the first year of study. In the second year of study, brown (46.9%) and white (21.6%) predominated, noting that in this last year, 27% did not report skin color. The predominance of brown color is justified by the greater concentration of people with brown color in Rondônia and in the Northern region of Brazil.

Araújo *et al* [20] recommend the race / color variable to be used as a demographic marker of health inequalities as exposed social groups. It is, therefore, a variable that should be used as a social marker more related to the factors to which this woman is exposed. than to genetic factors.

Another important variable considered in the research was the distribution of neoplasms by educational level. The educational level of women diagnosed with cancer is low, which represents people with a low level of education. However, breast cancer had an independent participation in the level of education, as well as the high frequency of cervical cancer also does not depend on the level of education. The highest frequencies of skin cancer were diagnosed in women with low education, while colon cancer is more frequent in women with complete elementary education and complete higher education. In the study by Mascarello *et al* [11] there was a predominance of cancer in women with incomplete primary education (70.9%).

The studies by Paraguassú-Chaves *et al* [3] patients with complete and / or incomplete primary education represent 54.2% of the cases of notified cancer, complete and / or incomplete higher education 6.6%, medium level 10.6%, those who did not register an information added to the one without any information total 28.5%.

According to Leite *et al* [21] and Ramos *et al* [22], women with low education have a higher risk of developing cervical cancer and, according to Peres, Santos [23], the lower the education level, the greater the diagnostic risk advanced stage of these tumors. For Souza *et al* (24), the educational level of the patients was satisfactory. There was a prevalence of secondary education (68%), followed by complete higher education (13%) and incomplete higher education (8%). Amorim *et al* (25), demonstrate that the low level of education makes it difficult to capture information about the prevention and early detection of diseases, in addition to making access to health services more difficult.

According to Schneider, d'Orsi (26) in a historical cohort study carried out in Santa Catarina, women with incomplete elementary education were 3.76 times more likely to die than those with higher education, while illiterates were at risk 7, 40 times bigger. Dugno *et al* (27) argue that the low school level affects the patient's level of knowledge and increases as the school level increases.

The highest frequencies of breast cancer were 38.0% in married women. While cervical cancer, it prevails with 38.2% in single women. Separated / divorced women, both breast and cervical cancer have a significant frequency. In the research by Soares *et al* [10] there was a predominance of breast cancer in married patients (59%). In the survey by Mascarello *et al* [11] with patients with cervical cancer, they predominated as married patients (48.3%). Leite *et al* (21) in Diagnosis of breast cancer: socioeconomic, clinical, reproductive and behavioral profile of women, observed that the marital status of women was 43.4% married or living mariatally.

According to Soares *et al* [10], when studying the characteristics of women with cancer treated at referral services, they observed a predominance of married women (58.6%). Palmer, Lythgoe, Smith (28) and Lannin *et al* [29], do not consider marital status as an important factor, although the authors consider these studies necessary for a complete assessment of the patient's profile. Lannin *et al* [29] in a controversial study with American patients show that the risk of developing breast cancer at an advanced stage increased almost three times in women who were

never married, however, Croft, Sorkin, Gallicchio [30] argue that the marital factor is not considered a risk factor for the development of the disease, but the fact of having a partner is associated with better social support, optimization and quality of life among surviving women.

In this study, the distribution variable of the 10 main neoplasms in women and their relationship with smoking was also considered. Thirty-eight percent of women smokers were diagnosed with breast cancer and 20% of smokers with cervical cancer. Thirty-four percent of women with breast cancer and 16.4% with cervical cancer are ex-smokers. Approximately thirty-five percent of women with colon cancer and 11.5% with lung cancer are ex-smokers. In a study by Haddad, Carvalho, Novaes [31] active smoking (current or previous) was present in 40.7% of participants (vs. 59.3% non-smokers). In the research by Dugno et al [27], non-smoking and non-alcoholic individuals also prevailed (78% and 96.7%). Seventy-eight percent of the patients in this study claim never to smoke and no relationship was found between tobacco and disease staging [27].

In the study by Souza et al [24] 29% of women with cancer were smokers - a factor studied over time with contradictory results, but currently recognized by the International Cancer Research Agency (IARC), a carcinogen with a limited incidence of increased risk of breast cancer in humans. Luo et al [32] claim that most researchers agree that there is no consistent evidence to determine the influence of smoking on the development of breast cancer. Cancer in women is often confused by the effect of tobacco consumption associated with alcohol consumption, according to the Collaborative Group on Hormonal Factors in Breast Cancer [33]. Dossus et al [34], in a recent multicenter cohort study carried out in European countries (EPIC Study), shows that smoking (active or passive) increases the risk of developing a disease, being harmful between menarche and the first pregnancy.

This research considered the Distribution of the 10 main neoplasms in women due to alcoholism. The frequency of women who have never consumed alcoholic beverages is 81.2% and 10.5% of ex-consumers. There was alcohol consumption, with 36.2% in women with cervical cancer, 25.5% breast cancer, 14.9% ovary cancer and 10.6% stomach cancer. Souza *et al* [24] in a study on breast cancer in young women in northeastern Brazil, 57% of women with cancer consume alcohol. According to Nirmala *et al* [35], international studies show that this represents a relevant risk factor for breast cancer in both pre-menopausal and post-menopausal women. In the study

by Haddad, Carvalho, Novaes [31] alcohol consumption (current or previous), was declared by 37.3% of women against 62.7% who did not use alcohol. In contrast, Iwasaki, Tsugane [36] point to a prospective populationbased study in Japan, showing how people who consume alcoholic beverages are at a greater risk of developing breast cancer. For Pirhardt, Mêrces [37], the use of alcohol is associated with a proportional increase in the development of cancer in women, that is, the more it is consumed, the greater the chances of its appearance.

One of the research questions was to know the occupational activities of women diagnosed with cancer. Women who work in agriculture represent 43.4% of the cases diagnosed with cancer, followed by women who occupy in commerce, transport and other occupations with 21.7%, women at home (16.1%) and independent professionals (11.3%). In women by occupation in agriculture, rectal cancer with 28.3%, ovarian cancer with 19.6% and cervical cancer with 17.4% predominated. Women with a professional occupation in the industry and diagnosed with cancer were more frequent with 40% of cervical cancer, 40% of skin cancer and 20% of colon cancer. In women working in commerce, transportation and other activities, they had cancer of the cervix (26.0%), ovary (30.4%) and cancer of the rectum (21.7%). There was a predominance of stomach cancer with a frequency of 33.3% and ovary cancer with 66.7% of women diagnosed with cancer and who work in the public service. Among liberal professionals, skin cancer (16.7%), thyroid gland (25%) and ovary (41.7%) predominated. In women who work at home, 35.3% of cervical cancer and 41.2% of ovarian cancer were diagnosed.

In the research by Paraguassú-Chaves et al [3], the proportional distribution of cancer in Rondônia, according to occupation or professional activity, patient profile based on professional occupation, the highest frequency was among multipurpose agricultural workers and similar workers (farm worker), followed by working women traders (wholesale and retail trade). In another study by Paraguassú-Chaves et al [4], the most frequent patients were agricultural workers and similar workers (farmer), agricultural workers not classified in other categories (farmer), health workers and similar professionals, industry professionals, teachers and civil servants. The incidence of cancer in women who work in their own homes is very significant and representative in this Amazonian context. According to Paraguassú-Chaves et al [5], the female sex with a high incidence of cancer is represented by the class of workers linked to agriculture and agricultural services, commerce and related activities, independent or autonomous professionals, teachers and

public employees in general. It is worth mentioning that, in this context, information about professional activity should be prioritized by the health professional, in order to better classify the main risk factors for cancer and establish the patient's profile in the State of Rondônia. The evaluation of the activities of the population is extremely important, as it also identifies the nutritional, environmental, biological, structural risk and allows the practice of an adequate treatment the chance of maintaining or recovering the patient.

Note that in this study the oncology clinic was responsible for the entry of 89.6% of women with cancer in Rondônia. Entry to the oncology outpatient clinic predominated, according to the diagnosis and previous treatment, with the following situation in decreasing order: women with diagnosis and treatment (62.9%), with diagnosis and treatment (25.2%) and without diagnosis and without treatment (11.9%). According to Soares *et al* [10], the prolonged time between clinical suspicion and confirmation of the diagnosis, diagnosis and non-immediate treatment are factors that more efficiently hinder the resolution of the disease.

Studies of Richards et al [38] "Influence of delay on survival in patients with breast cancer: a systematic review", Gullatte, Phillips e Gibson [39] "Factors associated with delays in screening of self-detected breast African-American women, changes in Ramirez, Westcombe, Burgess [40] "Factors predicting delayed presentation of symptomatic breast cancer: a systematic review", Olivotto et al [41] "Influence of delay to diagnosis on prognostic indicators of screen-detected breast carcinoma", Gebrim e Quadros [42] "Breast cancer screening in Brazil", Rezende et al [43] "Causes of delay in the diagnostic confirmation of breast lesions in women seen at a referral center of the single health system in Rio de Janeiro" and Trufelli et al [44] "Analysis of the delay in the diagnosis and treatment of breast cancer in a public hospital" suggest that factors such as the lack of access to health services, delays in investigating suspected breast lesions and in the effectiveness of the treatment of the affected disease contribute to late diagnosis and, consequently, to cancer mortality in women.

Rezende *et al* [43] conducted a study and highlighted that delay in diagnosis is the main cause of disease progression and diagnosis in advanced staging. This statement is corroborated by the authors [45], [46]. É comprovado que o diagnóstico precoce favorece o tratamento da doença e traz maiores possibilidades de cura, sendo assim de extrema importância o investimento em políticas públicas e técnicas que auxiliem no aumento da taxa de diagnóstico em estágios iniciais [45], [46] and confirmed by [47].

There was a gradual growth from stage I (7.9%) to stage II (17.7%), from stage III (17.7%) to stage IV (20.5%) and non-stage (36.2%). Primary tumors are diagnosed in advanced stages of the disease. Stage II breast cancer (34.2%), stage III (34.2%), stage IV (17.7%) and cervical cancer with stage II (44.8%) and stage III (34.5%) and also bronchial and lung cancer with 90.9% in stage IV.

According to Soares *et al* [10] in 47.6% of women, the diagnosis was late (stages III and IV). Studies by Rezende *et al* [43] identified 51% of women diagnosed with cancer between states II and IV. According to Gonçalves *et al* [48] Stage III represents one third of Brazilian women admitted to oncology services with breast cancer. Thuler's research, Mendonça [47] reveals that 87.7 of the women diagnosed with breast cancer are between stages II and IV, with stage II with 42.8%, stage III with 32.6% and stage IV with 12.3%. These same authors concluded in their study that the median percentage of patients in Brazil between stages II and IV was 45.3%, different from the median of 12.1% found in the United States.

Our findings reveal that 99.2% of diagnoses were confirmed by primary histological examination and 99.9% had a single primary tumor and that among the types of treatment and therapeutic procedures, "Other therapeutic procedures used" prevailed, with a prevalence of 42.4% of the 1st treatment received by the patient, followed by surgery. Studies by Paraguassú-Chaves et al [3] on the distribution of cancer, according to diagnosis and number of primary tumors - analytical and non-analytical cases reveal that 89% of diagnoses were confirmed by histological examination of the primary tumor, 7.2% by exams of images and 2.6% by tumor markers. The study shows 100% evidence of a single primary tumor. In the second phase of the research, one year later, 95.1% of the diagnoses were confirmed by histological examination of the primary tumor, followed by the lowest percentage of imaging tests (2.2%) and tumor markers (0.7%). In 100%, single primary tumors were found.

Another variable reveals that in the oncology clinic, the median between the first consultation and the diagnosis was 15 days, the median between diagnosis and the start of treatment was 49.5 days and the median between registration (1st consultation) and the start of treatment was 1 day. In the study by Soares *et al* [10], the time interval above 6 months between a clinical suspicion and a diagnostic confirmation prevailed. There is a strong association between the time interval between suspicion

and diagnostic confirmation with cancer staging and diagnosis (Adjusted R = 2.97 and 3.04) [10]. This interval was longer than 6 months in almost half of the women (42.7%), it changed in the studied period, due to the slowness of the health system.

In the studies by Paraguassú-Chaves et al [3], in the first phase of the research, the average time since enrollment / diagnosis is 17 days, the period of diagnosis / treatment can reach 62 days and the maximum duration of 2.883 days. In the second phase, if the average enrollment / diagnosis time was 22 days, the diagnosis / treatment period can reach 99 days of average duration and reach a maximum time of 2.005. According to Paraguassu-Chaves *et al* [3], one of the factors in assessing the quality of care of a reference institution in cancer treatment is the time interval between the three most important moments in patient care: an admission data , a diagnosis data and a data from the beginning of the treatment.

The survey also sought to identify whether the main neoplasms in women in Rondônia have a family history of cancer. Approximately 24% of women with cancer have a family history of câncer. Thirty-seven percent of women with breast cancer have a family history of cancer. In the case of cervical cancer, this relative proportion is 18%. The study by Soares *et al* [10] showed a family history of breast cancer, reported by 20.1% of women, also showed an association with the degree of stage at diagnosis. Hoskins *et al* [49] claim that up to 20% of women with breast cancer have a positive family history.

In cross-sectional studies conducted in the United States with an adult female population, 5% to 10% reported a family history of first degree breast cancer, suggesting that these women inherited a genetic mutation that presented an increased risk for the development of breast cancer and ovarian cancer [49].

Researchers Pinho and Coutinho [50] found prevalence rates ranging from 3.7% to 13.10%. Other important studies are those by Pharoad, Day and Duffy *et al* [51] and Maiser *et al* [52]. The first study demonstrated a risk estimate (RR) associated with a family history of cancer of 2.0 (CI = 1.8-2.1) for mother, 2.3 (CI = 2.1-2.4) for sister and 3.6 (CI = 2.5-5) for mother and sister. The second study says that the risks increased when the first degree was diagnosed with cancer before the age of 50. In the research by Souza *et al* [10], regarding cancer cases in the family, 52% of women had some type of cancer. Of these, 14% were 1st degree relatives, 21% 2nd degree and 17% 3rd degree.

According to INCA [53, 54], family history increases the risk of developing breast cancer by 2 to 3 times. In the study by Haddad, Carvalho, Novaes [31], 53.3% of women had a family history of breast cancer. Nelson, Zakher, Cantor *et al* [55] in "Risk factors for breast cancer in women aged 40 to 49 years: a systematic review and meta-analysis" observed an association between the family history of breast cancer in first-degree parents with the increased risk of developing a disease. Hoskins *et al* [49] in Assessment and counseling for women with a family history of breast cancer: a guide for doctors states that up to 20% of women with breast cancer have a positive family history, while Molina [56] states that, in women with a family history of first degree of breast cancer and who live in places of high incidence, there is an increased risk of 13.3% higher for the development of breast cancer than in those who do not have these characteristics.

Patients with progressive disease represent 71%, followed by patients with partial remission with 14.2% and stable disease with 12.9%. Only 1.9% had complete remission of the disease, that is, without evidence of disease. Breast cancer with 46.7% is the one that best represents the total remission of the disease. The findings of Paraguassú-Chaves et al [3] and Paraguassú-Chaves [5] confirm these results.

As for the distribution of the top 10 neoplasms in women who died of cancer, 6.3% of women diagnosed with cancer in Rondônia, died from the disease. The main victims of deaths were women with cancer of the stomach, liver, bronchi and lungs, breast and cervix.

In the case of breast cancer, Soares et al [10], state that while in the more developed countries the standardized mortality rates for breast cancer showed a reduction, in Brazil there was an increase in breast cancer death rates in their study (from 8.57 to 11.18 / 100.000 women).

According to Berry et al [57]; Coleman et al [58] unlike most developed countries, in recent years, Brazil has registered an increase in breast cancer mortality rates, mainly due to the late diagnosis and the delay in the implementation of adequate treatment, since this neoplasm is considered curable if diagnosed and treated early. According to Parkin et al [59], cervical cancer presents itself as an important public health problem worldwide, especially in the least affected regions, as they present 83% of the total incidence coefficients and 86% of mortality. Ferlay et al [60] in "cancer incidence and mortality worldwide" describe that for all neoplasms, cervical cancer has one of the highest potentials for prevention and cure, in addition to a good prognosis when diagnosed early. However, the diagnosis made late may be the main responsible for maintaining the high mortality rates.

Despite the downward trend observed worldwide, cancer mortality rates among women in Brazil are still high, mainly due to late diagnosis [61].

V. CONCLUSIONS

In 3 years of studies, 5.149 cases of cancer were diagnosed in the State of Rondônia. Of these, 2.758 (53.56%) were diagnosed in women.

The age at diagnosis was predominant in the age group of 40 to 49 years old and from 50 to 59 years old. These two age groups represent 46% of all types of cancer in women in Rondônia. Skin color, brown is predominant with 64.4% of all neoplasms. The highest frequency of cancer (43.3%) in women with little education (who did not finish elementary school). Married women predominate, with 72.9% of new cases.

Ninety-nine percent of patients admitted to referral hospitals specializing in cancer treatment were referred by the Unified Health System - SUS. Eighty-nine percent of women with cancer are smokers and 11% are ex-smokers. 81% of women diagnosed with cancer have never consumed alcoholic beverages and 11% are ex-consumers and 74% of women diagnosed with cancer were born in other states in Brazil and 21.5% are from the state of Rondônia.

Breast cancer is more frequent (35.5%), followed by cervical cancer (22.6%) and skin cancer (16.5%) of new cases. The oncology clinic was responsible for the entry of 89.6% of women with cancer in Rondônia. 35.4% of women with breast cancer, 25% of cervical cancer and 15.2% of skin cancer were admitted to the oncology clinic, while 40.8% of women with breast cancer, 22.4 % of the cervix and 13.2% of skin cancer were admitted by other clinics.

The oncology clinic registered 94.4% of women entering the 3 main entry clinics. Entry by the oncology clinic predominated, without treatment (62.9%), with diagnosis and with treatment (25.2%) and without diagnosis and without treatment (11.9%). Women with diagnosis and without treatment with 44% at stage I, 46.1% at stage II, 46.6% at stage III, 49.1% at stage IV, prevailed in all stages.

Primary tumors are diagnosed in advanced stages of the disease. The main primary tumors diagnosed in an advanced disease process can be represented by stage II breast cancer (34.2%), stage III (34.2%), stage IV (17.7%), cervical cancer, stage II (44.8%), stage III (34.5%) and also bronchial and lung cancer with 90.9% in stage IV, according to the results found in the research.

99.2% of primary tumors had their diagnosis confirmed by primary histological examination and 99.9% had a single primary tumor.

Among the types of treatment and therapeutic procedures, "Other therapeutic procedures used" prevailed with an prevalence of cases (42.4%) of the 1st treatment received by the patient. The second highest frequency is surgery with 16%.

The median between the first consultation and the diagnosis was 15 days, the median between the diagnosis and the beginning of treatment was 49.5 days and the median between registration (1st consultation) and the beginning of treatment was 1 day. Compared to other types of cancer, the median of cancers in women is still the best presented in hospitals specializing in cancer. 23.8% of women with cancer have a family cancer history.

Thirty-seven percent (37%) of women with breast cancer have a family history of cancer and 18% in the case of cervical cancer. At the end of the 1st treatment, patients with disease in progress represent 71%, with partial remission 14.2% and stable disease with 12.9%. Only 1.9% with complete remission of the disease. 6,3% of women diagnosed with cancer in Rondônia, died from the disease. The main victims of deaths were women with cancer of the stomach, liver, bronchi and lungs, breast and cervix.

The results presented are in accordance with the data of most studies carried out by Paraguassú-Chaves *et al* [3], [4], [6] and Paraguassú-Chaves [5] in Rondônia. In recent years, there has been an exponential growth of cancer in women in Rondônia. The installation in Rondônia of the largest cancer hospital in the Amazon is a strong indication of cancer as a public health problem. What is expected is that this research can serve as a basis for planning, executing and evaluating actions to promote, prevent, control and treat cancer in women in Rondônia.

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Viscosity Control of Vegetable Oils Applied to the Diesel Cycle Generator Group in an isolated community in the Amazon

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Abstract — This article proposes a sustainable way to generate electricity for isolated communities in the Western Amazon, using vegetable oil, heated in a heating tank, as a fuel to diesel cycle generators. Vegetable oil under high temperatures reaches a viscosity like diesel oil and does not cause damage to the generator's starting and fuel injection systems. Through mathematical and computational models, it is possible to control the temperature and the oil viscosity through sensors to reach a complete combustion of the fuel. All of this contribute to the development of the population of isolated communities that suffer without access to electricity.

Keywords—Diesel cycle, Isolated Communities, Renewable energy, Vegetable oil, Sustainability.

I. INTRODUCTION

Brazilian electricity matrix is mainly composed by renewable sources, with emphasis on the hydraulic generation that accounts for 65.2% of all domestic supply.

Renewable sources account's for 80.4% of the domestic supply of electricity in Brazil, which is the result of domestic production and imports, which are essentially from renewable sources [2].

Electricity energy production and transmission are coordinated by the National Electric Operator - NEO. Only 1.7% of the country's energy production is outside the NEO. This portion is composed of small isolated systems. There are approximately about 250 isolated locations in Brazil, most of them in the Amazon region.

The great distances involved, plus the access difficulties and the low power demand, results in those isolated systems.

Diesel generator are the main source of power on those isolated systems.

This difficulty in supplying electricity does not allow the development of economic activities and the generation of jobs in isolated communities. Electric energy represents a way of improving the living conditions of the population and social inclusion for isolated communities, through the possibility of creating productive means in these areas [3].

The use of local natural resources to generate electricity allows the creation of jobs, the qualification of the local labor force, the fixation of man in the countryside, and the enhancement of local biodiversity.

Brazil has a huge diversity of oil plants, both native and exotic, admirably adapted to Amazon due to favorable climatic conditions. Highlighting some cultivable species such as oil palm, *Elaeis guineensis*, an exotic species of African origin, perfectly adapted to Amazon's climatic conditions, has the advantage of having high oil productivity (3 to 5 tons of oil per hectare). Babassu is a species that can be found on average 200 plants/ha, where each plant has bunches with about 150 to 300 fruits. The average productivity of babassus is about 5 tons of fruits/ha/year, being possible to extract 400 kg of vegetable oil/year.

Buriti has an average fruit production of 200 kg, making it possible to obtain 20 kg of oil/plant/year. Considering the average of 250 plants/ha, an annual total of 5.000 kg of vegetable oil/ha/year can be obtained.

The use of vegetable oils starts by extracting them. The seeds are dehydrated and taken to hydraulic presses. After

the extraction of vegetable oil, filtration is carried out. The vegetable waste produced by the pressing process can be used to feed animals or to make charcoal to be burned in kilns, bakeries, and so on. Thus, the demand for firewood is reduced, avoiding deforestation.

The direct use of vegetable oils in diesel engines causes problems due to their high viscosity and low volatility. The high viscosity is responsible for the incomplete combustion of the oil, resulting in the formation of carbon deposits on the injector nozzles and on the cold walls of the cylinder. To circumvent these problems, thermochemical processing is used, in which transesterification and cracking stand out. It is also possible to use a mixture of diesel oil with up to 30% vegetable oil in conventional diesel engines with relative success, without the need to make mechanical changes to the engine [1], [3].

There is only one engine, developed by the German firm DMS, with Elsbett technology, which directly uses vegetable oil without the need for thermochemical processing. This multi-fuel engine, which is just a diesel engine with some modifications to the cylinder geometry and the fuel injection system, has already been used in some locations with relatively satisfactory results. However, the hours of continuous operation have not yet been counted to know the real performance of this engine with this type of fuel. [3].

This article introduces a vegetable oil viscosity control device *in natura* avoiding mechanical problems in the engine, such as nozzle clogging, incomplete fuel burning.

It is a low cost, simple and easy solution that can be handled by the local community. Thus, it represents one of the possible alternatives for supplying electricity to isolated systems. Vegetable oil has characteristics that allow partial and even total replacement of conventional diesel oil in engines that generate electricity.

II. MATHEMATICAL MODELING OF THE HEATING TANK

To reduce the viscosity of vegetable oil and avoid mechanical problems in the engine, just heat the oil to the appropriate temperature to reduce the viscosity and the oil and air mixture becomes richer in fuel. The viscosity and temperature of fluid are intrinsically related. Thus, in order to preheat the fluid, in order to avoid cold starting and to guarantee a constant viscosity and adequate for the proper functioning of the diesel cycle engine, a tank is used in which, initially, the fuel will be heated through electrical resistances and, later, by the exhaust gases of the engine. Depending on the physical-chemical characteristics of the oil, the heat that must be offered to the tank will sometimes be higher, and sometimes it will be lower, in addition, climatic conditions, such as ambient temperature, will also be a variable to consider. The analysis of a dynamic system, that is, investigating and analyzing the behavior of a process in response to various types of variable inputs could, in this case, be carried out by annotating the results through an empirical process, changing the inputs of the variables and verifying the changes in the output. However, for chemical processes, such as changing the viscosity of the oil, once the system has been disturbed, it would take a long time before the oil could return to similar initial conditions and, again, introduce different amounts of heat to obtain other viscosity values. Mathematical modeling then emerges as an alternative to represent the dynamic process and, although theoretical analyzes only provide knowledge about the behavior of the idealized process, it proved to be especially useful in understanding and characterizing real behavior.

Therefore, it is important to be familiarized with the mathematical tools that allow the description of the equations of the dynamic system and dimension the variables, in addition to determining the transfer function of the process.

To develop a mathematical model for heating a tank, the following situation is considered: an oil of initial temperature T_i is available at a mass input rate, ρF . It is desirable to heat this oil to a higher temperature T_r .

The oil flows into a well-stirred tank, equipped with a heating device. It is assumed that agitation is sufficient to ensure that all the oil in the tank will have the same temperature, T, which is the outlet temperature and is related to the kinematic viscosity, v_c . The heated oil is removed from the bottom of the tank at the same inlet flow rate, ρF , now as the product of the present heating process. Under these conditions, the oil mass retained in the reservoir remains constant over time, and the oil outlet temperature is the same as that of the oil in the tank. For a satisfactory project, this temperature must be the desired temperature at the outlet, T_r .



Fig.1 - Heating tank stirred. Source: [11].

It is assumed that the variation in the amount of oil heat, the specific density and the latent heat of vaporization, Cp, ρ and λ , respectively, do not vary significantly with temperature, that all the heat from the heater is transferred to the oil and none heat is retained in the serpentine and that the thermal losses to the atmosphere are negligible.

Where:

• T, $T_i e T_r = Exit$ temperature, inlet temperature, and reference temperature, respectively, given in Kelvin (K);

• ρF = Input mass rate = Output mass rate, given in kg/s.

• C_p = Variation in the amount of heat: $Q_{1,2} - Q_0 / T$ - T_i , given in J/K.

- ρ = Specific density, given in kg/m³
- λ = Latent heat of vaporization, given in J/kg.
- $v_c = Kinematic viscosity, given in m^2/s.$

The general mass balance equation is given by:

- Mass rate accumulated in the tank $=\frac{d}{dt}(\rho V)$
- Mass entry rate = ρF
- Mass output rate = ρF

As there is no mass generation or consumption in this system, the general mass balance equation will be given by:

$$\frac{d}{dt}(\rho V) = \rho F - \rho F \tag{1.0}$$

And based on the assumption that the specific density $\boldsymbol{\rho}$ is constant:

$$\frac{dV}{dt} = 0 \tag{2.0}$$

Therefore, it is concluded that the volume of the fluid, V, given in m^3 , will be constant in the dynamic process considered, since, in the same way, it is assumed that the mass rates of entry and exit are equal.

For this system, we must note that, although the total energy is the sum of the internal energy, the potential energy, and kinetic energy, the rate of energy accumulation involves only the rate of change of the internal energy. This is due to the simple reason that the tank is not in motion, thus eliminating the participation of any kinetic energy and since there is also no change in the position of the tank, the rate of change of the potential energy will also be zero. Thus, it is assumed:

Rate of energy accumulation in the tank

$$\rho C_{p} \frac{d}{dt} [V(T - T_{r})]$$
(3.0)

Input heat rate

$$\rho FC_p(T_i - T_r) \tag{4.0}$$

- Rate of heat input through heating steam λQ (5.0)
- Output heat rate

$$\rho FC_{p}(T-T_{r}) \tag{6.0}$$

Thus, the general energy balance equation is:

$$\rho C_p \frac{d}{dt} [V(T - T_r)] = \rho F C_p (T_i - T_r) + \lambda Q - \rho F C_p (T - \frac{7}{2})^n$$

Simply put, we have:

$$\rho C_p V \frac{dT}{dt} = \rho F C_p (T_i - T) + \lambda Q \tag{8.0}$$

From the mass balance, it is known that V is constant, so the equation can be simplified to:

$$\frac{dT}{dt} = -\frac{1}{\theta}T + \frac{\lambda}{\rho V C_p}Q + \frac{1}{\theta}T_i$$
(9.0)

Where $\theta = V/F$ is the residence time of the tank.

Equation 9 is a model of a differential equation that represents the temperature variation over time inside the agitated heating tank as a function of the inlet temperature, the latent heat rate of vaporization, the residence time of the tank, among other parameters physicists. The model in terms of deviation variables must be considered in the modeling.

A process is considered to be in steady state when none of the variables are changing over time.

In the desired steady state, the energy balance throughout the heating process can be written as follows:

$$0 = -\frac{1}{\theta}T_s + \frac{\lambda}{\rho V C_p}Q_s + \frac{1}{\theta}T_{is}$$
(10.0)

Where the subscript *s* is added to indicate a steady-state value. And defining the variables in equation 10 by the deviation variables:

$$\mathbf{d} = \mathbf{T}_i - \mathbf{T}_{is}$$
; $\mathbf{u} = \mathbf{Q} - \mathbf{Q}_s$;

Subtraindo a equação 9 da equação 10:

$$\frac{dx}{dt} = -\frac{1}{\theta}x + \beta u + \frac{1}{\theta}d$$
(11.0)

Where x(0) = 0 is the initial condition itself, if $T = T_s$ and t = 0. Note that this case is a tank heating model in steady-state, so the output variable y is equal to variable x, that is, y = x.

Rewriting the mathematical model in terms of deviation variables and considering the model in steady state causes the initial conditions of the deviation variables to be zero. Thus, the Laplace transform can be performed without absorbing external values related to the initial conditions.

The Laplace transform of equation (4.12) will be,

$$sy(s) = -\frac{1}{\theta}y(s) + \beta u(s) + \frac{1}{\theta}d(s)$$
(12.0)

Now, this is a mathematical model for the dynamic system of the heating tank, in the transform domain, and can be rearranged to become an algebraic expression of y(s) in terms of its dependencies u(s) and d(s)

$$y(s) = \left(\frac{\beta\theta}{\theta s+1}\right)u(s) + \left(\frac{1}{\theta s+1}\right)d(s) \tag{13.0}$$

If we introduce the following equations:

$$g(s) = \frac{\beta\theta}{\theta s + 1} \tag{14.0}$$

$$g_d(s) = \frac{1}{\theta s + 1} \tag{15.0}$$

Soon Equation (4.13) becomes:

$$y(s) = g(s)u(s) + g_d d(s)$$
 (16.0)

Equations 14 and 15 are called transfer functions and equation 13 is a model of the transfer function for agitated heating tanks. Equation 16 is a general expression for transfer function models in the Laplace transform domain.

The vegetable oil heating tank will use a probe called Lambda, which is a sensor that performs the measurement of gases, and these data are used by the injection module to obtain the stoichiometric point. That is the ideal mix between vegetable oil and oxygen.

The model description assumes that the chemical reactions are in equilibrium and that the exhaust gases obey the Law of Ideal Gases:

$$pV = nRT \tag{17.0}$$

R is assumed to be 8,314 J / mol. K (universal gas constant), that the total pressure of the system remains constant and that pressure is called p, that the temperature of the ambient air is equal to the temperature of the exhaust gas and remains constant at a temperature T = 973,15 K.

To determine the oxygen concentration, the molar fraction of the gas composed of 6 gases is used, Equation 18.

$$X_{H_2} + X_{O_2} + X_{H_2O} + X_{CO} + C_{CO_2} + X_{N_2} = 1$$
(18.0)

$$X_i = \frac{n_i}{c} \tag{19.0}$$

Where n_i is the molecular density of gas i; X_i as the molar fraction of the gas; and c is the total number of molecules per unit volume (concentration of the total molecule).

It is assumed that the molar fractions on the electrode surface are in a steady state as long as they do not vary with time. Diffusion through the porous layer, also called the transport problem, is described by the following diffusion equation:

$$\nabla^2 X_{O_2} = \nabla^2 X_{H_2} = \nabla^2 X_{CO} = \nabla^2 X_{CO_2} = \nabla^2 X_{H_2O} = 0$$
(20.0)

Through the Fick's Law, one can calculate the N_X flow of the various exhaust gases X through the porous layer:

$$N_{O_2} = -\frac{CD_{O_2}}{\tau} \nabla X_{O_2},$$
 (21a)

$$N_{CO_2} = -\frac{CD_{CO_2}}{\tau} \nabla X_{CO_2}, \qquad (21b)$$

$$N_{H_2} = -\frac{CD_{H_2}}{\tau} \nabla X_{H_2},$$
 (21c)

$$N_{H_2O} = -\frac{CD_{H_2O}}{\tau} \nabla X_{H_2O},$$
 (21d)

$$N_{CO} = -\frac{CD_{CO}}{\tau}\nabla X_{CO}.$$
 (21e)

The diffusion coefficient D_i of the various components i of gases depends on the shape of the molecules and the physical properties of the porous layer, such as tortuosity (τ) and width (l).

To understand how the lambda probe works, it is assumed that the exhaust gases contain only four types of gases: O_2 , CO, CO_2 e N_2 . Assuming that nitrogen is inert, platinum catalyzes the reaction:

$$CO + \frac{1}{2}O_2 \leftrightarrow CO_2 \tag{22.0}$$

The molar fraction of each species depends on the air and fuel ratio provided by the engine. This relationship is parameterized by λ , an amount selected so that, for this model, the oxygen concentration is half the carbon monoxide concentration occurring at $\lambda = 1$.

The partial differential equations that describe the various concentrations of gases in the porous ceramic layer of the probe:

$$\frac{\partial(cX_i)}{\partial t} = -\frac{\partial N_i}{\partial x}$$
(23.0)

Where X_i is the molar fraction of the total gas concentration for each species I, N_i [mol/cm²s] is the molar flow and c [mol/cm³] is the total concentration of all gas species. Fick's Law of chemical diffusion establishes that in situations where the chemical species in diffusion are not affected by the others, the N_i flux is proportional to the gradient for the molar concentration:

$$N_i = -\frac{D_i}{\tau} \cdot \frac{\partial(cX_i)}{\partial x}$$
(24.0)

Where D_i [cm²/s] is the chemical diffusibility of gas i and τ is the tortuosity of the pores of the ceramic layer. In this way, a diffusion equation system is obtained:

$$\frac{\partial(X_i)}{\partial t} = \frac{\partial}{\partial x} \left(\frac{D_i}{\tau} \cdot \frac{\partial(X_i)}{\partial x} \right)$$
(25.0)

A solution is sought for the differential equations in steady state. For the one-dimensional model, Ni and c are assumed to be constant in this way:

$$\frac{\partial X_i}{\partial x} = constante \tag{26.0}$$

In the platinum electrode, it is assumed that, at steady state, the rate at which CO_2 , CO, and O_2 are being created and destroyed must be balanced by the inlet flows of these types of gases. This is,

$$r\left(K_{I}\sqrt{p}X_{CO}X_{O_{2}}^{\frac{1}{2}} - X_{CO_{2}}\right) = \frac{cD_{CO_{2}}}{\tau} \cdot \frac{\partial X_{CO_{2}}}{\partial x}$$

$$r\left(K_{I}\sqrt{p}X_{CO}X_{O_{2}}^{\frac{1}{2}} - X_{CO_{2}}\right) = -\frac{cD_{CO}}{\tau} \cdot \frac{\partial X_{CO}}{\partial x}$$
(27.0)
$$\frac{r}{2}\left(K_{I}\sqrt{p}X_{CO}X_{O_{2}}^{\frac{1}{2}} - X_{CO_{2}}\right) = -\frac{cD_{O_{2}}}{\tau} \cdot \frac{\partial X_{O_{2}}}{\partial x}$$

To obtain the boundary conditions for the equation describing the diffusion of the types of gases through the porous layer, note that equation 27 leads to:

$$D_{CO_2} \frac{\partial X_{CO_2}}{\partial x} = -D_{CO} \frac{\partial X_{CO}}{\partial x}$$

$$D_{CO_2} \frac{\partial X_{CO_2}}{\partial x} = -2D_{O_2} \frac{\partial X_{O_2}}{\partial x}$$
(28.0)

As [18] it is possible to work at an operating point, neglecting parameters whose derivative is constant. Thus, the simplified lambda probe model can be described in the equation below as:

$$X_{O_2}^{exh} = \frac{1}{2} X_{CO}^{exh}$$
(29.0)

Therefore, when stoichiometry occurs, in $\lambda = 1$, as shown in Figure 2, the stoichiometric oxygen exchange occurs at $\lambda = 0.999433$, generating a potential difference in the sensor electrodes, shown in Figure 3.



Fig.2 - Molar fractions of exhaust gases. Source: [18]



Fig.3 - Voltage through the oxygen sensor for the simplified model of Fick's Law. Source: [18].



Fig.4 - Asymptotic voltage as a function of λ . Source: [18].

Based on Figure 4, for Oxygen, the voltage displayed by the lambda probe if when $\lambda < 1,01197$, the air-fuel mixture rate is said to be rich, since the exhaust gas is more combustible than oxygen, and the voltage generated on the lambda probe it will be approximately 0.9 V, whereas when $\lambda > 1,01197$ the rate is considered poor where the lambda probe voltage will be approximately 0.05 V.

III. EXPERIMENTAL DEVELOPMENT

To preheat the vegetable oil in favorable conditions of complete combustion in a diesel cycle generator, a tank was made, made of stainless steel, that could be coupled to the generator group. The tank is coupled to a 10 HP internal combustion engine for compression testing. The tank has a coil that runs through it, shown in figure 5.0. It has an internal diameter of 35.40 mm and an external diameter of 38.51 mm, shown in figures 6.0 and 7.0, through which the exhaust gases will pass and a resistance of 3 kW figure 8.0, which will initially heat the oil, coupled in the part center of the tank.



Fig.5 - Serpentine through which the exhaust gas passes.





Fig.6 - Exhaust gas tube internal diameter.

Fig.7.0 - Outside diameter of the exhaust gas pipe.



Fig.8– Electrical Resistance 3 kW

The heating tank has external dimensions of 258.54 mm high, 102.39 mm wide, and 550 mm long, figure 9.0.



Fig.9- Heating tank overview

The oil viscosity control variables are identified by thermal and oxygen sensors. The thermal sensors for this case are the thermocouple sensors type J and K and the oxygen sensor will be the lambda probe.

The function of the thermal sensors is precisely to act as a thermometer for vegetable oil (sensor type J) and for exhaust gases (sensor type K), indicating to the controller if the oil is at the appropriate temperature in which it is assumed that in that interval, the oil will show kinematic viscosity similar to that of diesel oil. And what is the temperature of the exhaust gases to control the opening of the valve that controls the gas flow in the coil that exchanges heat with oil, so that, according to the physical properties, the conducted heat is sufficient for the oil to maintain its temperature as close as possible to the reference temperature.

The type J thermocouple sensor was chosen to measure the temperature of the vegetable oil in the heating tank, as its use is recommended for temperatures ranging from -200 to 790°C and as it is desired that the oil reaches temperatures between 80°C and 120°C, the reduced scale and close to the desired values reduces the percentage of measurement error. Furthermore, the J-type thermocouple is composed of iron, copper, and nickel and as it is difficult to obtain iron wires with high purity content, the J-type becomes cheaper.

The type K sensor operates between -200°C and 1200°C, having a sensitivity of approximately $41\mu V/°C$.

The lambda probe is also used to control the viscosity of the oil because it identifies the amount of oxygen in the exhaust gases, this means that the burning of the fuel is incomplete, therefore, the ratio of the air and fuel mixture is "poor" and a probable reason is the higher than ideal viscosity of the oil, which would make it difficult to atomize the oil particles with the combustion chamber air. Figure 10.0 shows the Lambda probe installed at the exhaust gas exhaust outlet.



Fig.10- Lambda probe installed at the exhaust gas exhaust outlet.

IV. VISCOSITY CONTROL

For the vegetable oil viscosity control system to work, a data acquisition interface was developed in LabVIEW. Figure 11.0 shows the user interface where the information obtained from the vegetable oil temperature is verified, based on the signals conditioned by the type J thermocouple sensor and the Lambda probe.



Fig.11 - User Interface.

Figure 12 shows the block diagram of the data acquisition system, the simplicity of the language can be noted, the blocks for configuring the channels and data acquisition can be seen.



Fig.12- Block diagram of the data acquisition system.

To control the temperature of the vegetable oil heating tank, a controller from National Instrument - NI, MyRio 1900 was used. The purpose of this controller is to activate the internal heating resistance of the tank and the valve to release the exhaust gases from the engine to the internal serpentine of the heating tank. Figure 13 shows the upper and lower limits and the LEDs to activate the outlet valve that releases the exhaust gases to the serpentine inside the heating tank.

| Channel Read | |
|--------------------------|--|
| Temperatura Sonda Lambda | |
| 139- E 125- | Limita Superior Temperatura Limita Infenor |
| Confidences | Limite Superior Temperature |
| 6- 9638 Amostras | 9741 Limite Inferior Temperatura |
| nitionia Domonia | |

Fig.13- Upper and lower limits of the oil temperature in the tank.

Figure 14.0 is the block diagram of the controller in real-time of the signals collected and conditioned by the data acquisition system. The controller makes decisions based on the logic between temperature and lambda probe.

This system composed of sensors, controllers, and data acquisition allows the control of the viscosity of vegetable oil by means of temperature, through an innovative process using the lambda probe as a burning parameter.



Fig.14- Block diagram of the Controller in real-time of the collected and conditioned signals.

V. CONCLUSION

The use of vegetable oils as a fuel source for the operation of diesel engines is a viable alternative for power generation on isolated communities, where the raw material can be easily obtained at a low cost. Another incentive to this type of fuel, in addition to generating jobs and income, is to promote a better life quality to the community.

On the environmental side the use of vegetable oil in engines results on the reduction of greenhouse effect gases emissions and on the recovery of degraded areas by reforestation with oilseed species, containing the erosion and making a better carbon balance. The vegetable oil viscosity was an impeditive factor for this application, however, this article demonstrated that it is possible to use vegetable oil as a fuel, reducing its viscosity through the complete burning control and the heating tank temperature control.

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Influence of the Operating Temperature and the Solar Irradiation in a Photovoltaic Panel: An Experimental Analysis

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Abstract— The search for real solutions that meet the growing demand for energy in the global scenario has been the subject of studies around the world for the scientific community. Renewable sources and technologies are investigated for the replacement of fossil fuels, non-renewable and with high potential for environmental degradation energies. Renewable energy that highlights in the area of sustainability is solar energy, due to environmental, social and abundance aspects. Despite obtaining electricity directly from the solar incident in a photovoltaic system, approximately 80% to 90% of the incident energy is converted into heat. This heat results in an increase in the operating temperature of the photovoltaic panel cells, causing a 0.45% decrease in panel yield for each degree Celsius [°C] added from the standard test conditions: 25 °C, 1 kW/m² and 1.5 kg of air. In the present paper, an experimental analysis of the influence of the operating temperature and the solar irradiation in the voltage generated by a photovoltaic panel was presented, in order to understand the importance of the control of the operating temperature of a photovoltaic panel. A rise in solar irradiation elevates the produced voltage. However, the increment of the operating temperature of the panel results in a gradual loss of voltage produced.

Keywords— operating temperature, photovoltaic panel, solar energy, voltage.

I. INTRODUCTION

The demand for energy has been growing every year. It is estimated that world energy consumption will grow by more than 30% by 2040 considering all sectors that need energy, such as industrial, agricultural, medical, transportation and domestic [1].

The search for real solutions that supply the growing demand for energy on the global stage has been the subject of studies around the world for the scientific community. Renewable sources and technologies are investigated to replace fossil fuels, non-renewable and with high potential for environmental degradation energies [2].

One form of renewable energy that highlights in the area of sustainability worldwide is solar energy, due to environmental, social and abundance aspects. In 2014, solar energy counted out approximately 30% of the new energy capacity from renewable sources worldwide [3].

The cost of solar systems still high, but this investment has become more viable in recent years due to rising fossil fuel costs and the evolution of solar technology. Data from Ren21 [4] show that photovoltaic energy already reaches 505GW of total global capacity, which a decade earlier was 15GW.

Brazil is one of the largest countries in the world in terms of territory and, according to the Brazilian Atlas of Solar Energy 2017, due to its geographical position, it has a high rate of solar radiation. Thus, photovoltaic electricity generation has great potential in Brazil throughout the year [5]. The intensity of the sun's rays depends on the geographical latitude of the area and the season (inclination of the earth's axis). Figure 1 shows the global annual average solar radiation in the Brazilian territory, respectively.

Solar energy can be easily converted to another form of energy basically by two systems, thermal and photovoltaic. The thermal system transforms solar energy into heat. Already the photovoltaic system converts the solar irradiation in electricity [6]. Photovoltaic systems transform the incidence of sunlight on the surface of Silicon into electrical energy. Electrons are excited and generate a d.d.p. in the panel by the photovoltaic effect.



Fig. 1: Global solar radiation in Brazil, the annual average [5]

Although electricity is obtained directly from sunlight in a photovoltaic system, approximately 80% to 90% of the incident energy is converted into heat. This heat results in the increase of the cell operating temperature of the photovoltaic panel, promoting a yield reduction of 0.45% for each Celsius degree [°C] added from standard test conditions: 25° C, 1 kW/m² and 1.5 kg of air [7]. Panel performance drop is due to a significant reduction in the voltage produced with increasing temperature. At the same time, its current undergoes a small increase, but almost negligible, which does not compensate for the loss caused by the decrease in voltage, reducing the power produced by the system.

In this context, the present work analyzed experimentally the influence of the operating temperature and solar radiation on the voltage generated by a photovoltaic panel. Therefore, the importance of controlling the operating temperature of a photovoltaic panel can be understood.

II. METHODOLOGY

The experimental apparatus utilized for tests were divided into two sections, an external and an internal. The external sector, exposed to irradiation, was composed of a photovoltaic panel with polycrystalline cells (*China Solar LTD*TM Kaxidy KS-P10W), a pyranometer (*Kipp & Zonen*TM) and a table with tilt adjustment, as shown Fig. 2. The characteristics of the photovoltaic panel are presented in Table 1.



Fig. 2: External experimental apparatus

| Table.1: Characteristics | s of China So | $lar LTD^{TM}$ | Kaxidy | KS- |
|--------------------------|---------------|----------------|--------|-----|
| P10W | photovoltaic | panel | | |

| Parameters | Panel | |
|---|-------|----------------------------|
| Power | 10 W | |
| Open Circuit Voltage | | 21.6 V |
| Open Circuit Current | | 630 mA |
| Solar Cell Type | | Polycrystalline Silicon |
| Nominal Operating Temperature | | $45^{\circ}C\pm2^{\circ}C$ |
| Temperature Coefficient in Open Voltage | | (-0.34%/°C ± 0.01) |
| Temperature Coefficient in Short-circuit Current | | (0.045%/°C ± 0.01) |
| Operating Temperature | | - 40°C up 85°C |

Figure 3 shows the experimental apparatus used indoor that was composed of a data logger ($Agilent^{TM}$ 34970A with 20 channels) and a laptop ($Dell^{TM}$), so the electronic equipment was protected from solar radiation.



Fig. 3: Indoor experimental apparatus

In the evaluation of the thermal performance of the photovoltaic panel, three K-Type *Omega Engineering*TM thermocouples were used. A temperature sensor was attached to the upper surface of the panel and one to the lower surface. Also, a thermocouple evaluated of the ambient temperature.

The photovoltaic panel was tested experimentally at an inclination of 25° , which is the city latitude of the test realization (Ponta Grossa/PR: 25° 05' 42" South).

III. RESULTS AND DISCUSSION

The results present the experimental behavior of a 10W photovoltaic panel. The test was realized during 6 (six) hours, in order to use the maximum solar radiation. Data were acquired every 10 (ten) seconds by the data acquisition system and recorded on the computer using the software $Agilent^{TM}$ Benchlink Data Logger 3. Subsequently, the data were processed to assess the performance.

The behavior of solar irradiation as a function of exposure time is shown in Fig. 4. As soon as sunlight directly reaches the photovoltaic panel, irradiation rises dramatically.



Fig. 4: Solar irradiation during the test

The operating temperature in the photovoltaic panel and the voltage generated by the panel over the panel as a function of time, are shown in Fig. 5 and Fig. 6, respectively.



Fig. 5: Operating temperature of photovoltaic panel versus time.

The voltage increases with rising solar radiation and gradually decreases with the increasing operating temperature of the photovoltaic panel. As soon as the panel was exposed to solar radiation, the maximum voltage value in an open circuit was reached, but as the temperature of the panel increased, the value of voltage produced by the panel decreased. In this way, a cooling system for the photovoltaic panel can reduce its operating temperature, improving the performance and increasing the production of electrical energy from solar energy.



Fig. 6: Produced voltage versus time

IV. CONCLUSION

In the present work, the influence of the operating temperature and the solar irradiation in the voltage produced by a photovoltaic panel were evaluated experimentally. The purpose of this study is to understand the importance of temperature control for photovoltaic panels. The results prove that the generated voltage is directly connected to the operating temperature of the photovoltaic panel. A rise in solar irradiation elevates the produced voltage. However, the increment of the operating temperature of the panel results in a gradual loss of voltage produced.

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Impact behaviour of partially replaced Sea Shell (Cockle Calm) as Manufacturing Sand in Concrete

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Abstract— The main objective of this research goal is to investigate the impact behavior of cockle calm as fine aggregate in concrete under drop weight impact test. In this study,cockle calm is used in the ratio of 0%, 10%, 20% and 30% in the weight of fine aggregate in concrete matrix. Water Cement ratio was 0.42 for compressive test and drop weight impact test. Four slabs were casted in the dimension of 500mmX500mmX50mm and 6mm diametersteel bars were used with 90mm center to center spacing. The Impact testing machine was self-fabricated. The test results indicate the failure pattern of the slab by visible observation of First crack and final crack occur in the slab. The cracks length, width, depth were observed in every blows.

Keywords— Cockle calm, Drop weight Hammer, First Crack, Final Crack, Impact test.

I. INTRODUCTION

Now a day, the research on control the crack on concrete are plays a main role in research. Cracks on concrete have a several reasons such as temperature, elongation, durability, bonding etc. [10], [2]. An overview of some of these research areas includes the applicability of mollusc shell ash-blended cement for concrete production, and partial or full application of periwinkle, cockle, and ovster shells as coarse aggregates in constructed concrete facilities. The use of shell in lime production for sustainable masonry applications is one major application for affordable housing. It is evident that the natural resources consistently deplete while the demand for concrete constituent materials still re-mains increasingly high. In this study, the impact resistance of cockle calm as fine aggregate in concrete. It will be helpful to extenduse of sea shells and further clarifies the nature of impact behavior of sea shells.

II. EXPERIMENTAL CAMPAIGN

2.1 Material Used and Properties of the material:

OPC 53 grade cement, fine aggregate size of below 2.36mm, coarse aggregate were used. Cement had specific gravity 3.56; Fine aggregate had specific gravity 2.6, fineness modulus 2.2 and water absorption 2.2%. Course aggregate had specific gravity 2.59, water absorption 2.1%. Super Plasticizer was Polycarboxylate Ether 0.1% of weight of cement was used which is ordered from TECHNY CHEMY, in Tiruchirapalli, Tamil Nadu.Cockle Calmadded in the ratio of 0%, 10%, 20% & 30% by the weight of fine aggregate. Water cement ratio is 0.42.

2.2Mix Design and Fabrication of Concrete

For compressive strength 150x150x150mm specimen was used. Impact test for slab specimen size of 0.5x0.5x0.05m with 90mm center to center spacing and provide 6mm diameter of bars in main reinforcement and distribution reinforcement as shown in Figure1. The mix design done as per Indian Standards IS10262:2009.



Fig.1: Reinforcement Details for Slab

| Table | 1: | Mix | Design |
|-------|----|-----|--------|
|-------|----|-----|--------|

| Materials | Quantity (kg/m ³) |
|------------------|-------------------------------|
| Cement | 492 |
| Fine Aggregate | 780 |
| Coarse Aggregate | 992 |

2.4 Impact Test

The drop weight impact machine was self-fabricated with the height of 1m and drop hammer weight (steel ball) was 4.5kg. The slab is placed in the base plate. The slab is subjected to simply supported, the four sides are not clipped. The drop weight hammer was permitted for free fall on the concrete slab at center point on the slab. Number of blow was noted and observes the first crack and final crack in the specimen and also measures the crack length, width and depth for every blow to calculate the crack resistance of the concrete.



Fig.2: Self-Fabricated Impact Instrument

III. RESULT AND DISCUSSION

3.1 Compressive Strength of the concrete:

Aftercasting the concrete, the specimens are in rest for 24hrs, and thenproceed o 28 days of curing to attain strength. M0 represents 0% Cockle Calm in the concrete matrix, M10 represents 10% Cockle Calmwas added by the weight of Fine

Aggregate. Similarly, M20 and M30 represent 20% and 30% of Cockle Calmadded by the weight of fine aggregate in the concrete matrix. M0, M10, M20 and M30 had the compressive strength of 36.2N/mm², 42.47N/mm², 44.5N/mm² and 39.9N/mm². Compare to the M20, other mix ratio was lower strength. M20 mix was the higher compressive Strength.



Fig.3: Compressive Strength (N/mm²) after 28days of curing

3.2 Impact test on Slab and Crack resistance:

The drop weight hammer is free fall from 1000mm height as shown in figure 2. The slabs are simply supported at the ends. The impact energy is calculated by statically [2], [4]. The first crack and final cracksare observed visually.From the experimental surveillance, M0 concrete gives low impact energy than others; also have minimum crack with minimum blows and length of the crack also long, wider than other concrete matrix. M10 concrete matrix have higher impact energy ratio with six number of crack and also resists more blows. M10 has more cracks compare to other concrete matrix but impact resistance is high. M20 resist more cracks butblows are minimum compare to M10 concrete.M30 resist more cracks and minimum number of crack and crack length, width of cracks also minimum compare to other matrix but has minimum blows compared to M10 and M20. Impact energy formula,

----- (1)

Impact Energy U = mxgxHxN

m = Mass of the drop weight hammer (kg),

g = Acceleration due to gravity (m/s²)

H= height of free fall of steel ball (m)

N= Number of blows for First and Final Crack

The ultimate crack resistance concrete Ru,

Calculation,

Impact Energy U= 4.5x9.81x1x6 = 264.87 N-m

Ultimate crack resistance,

$$\operatorname{Ru} = \frac{U}{\operatorname{Lc} x \operatorname{dc} x \operatorname{wc}} \quad ----- (2)$$

U = Impact Energy of First Crack N-mm

Lc = Maximum length of Crack, mm

dc = Depth of the crack, mm

wc = Maximum width of the crack, mm

$$Ru = \frac{264870}{500x\,50\,x\,1} = 10.59 \text{N/mm}^2$$

The crack resistance of the concrete matrix Cr,

$$Cr = \frac{Ru}{fcu} ----- (3)$$

Ru =ultimate crack resistance concrete (N/mm²)

fcu = Compressive strength of concrete (N/mm^2)

$$Cr = \frac{10.59}{36.2} = 0.29$$
 (No Unit)

3.3 Failure Pattern:

M0 had low impact resistance and crack resistance ratio. M0 has two crack and failure in minimum blow compare to other ratio slab. M10 has many numbers of cracks and give maximum impact Energy.M10 given many crack to indicate the failure. M10 and M20 hadonly 8 & 10cracks but, failure is quickly happened in M10 compare to M20. M30 had developed only three cracks but failure in 21st blow and has resist minimum blow, failure is happened suddenly with minimum number of crack.



Fig.4: Total no.of cracks in slab up to ultimate failure

3.3.4 Maximum crack length details:

M0 has only 6 cracks, in that the maximum crack length is 500mmand width is1mm.Compare to other the concrete matrix M0 has max. Crack length and width. M10has 240mm but it has high impact energy.M20and M30 had only 500and 250 mm lengths but it had sudden failure M30.M20 indicate the failure but M0and M30 are not indicate the failure before they fail.



Fig.5: Maximum length of crack on slab up to ultimate failure

| Ratio | No. of | f Blows | EI sta | tics, N-m | No. of cracks up to Final blows | Max. crack depth (dc),mm | Max. crack length (lc),mm | Max. crack width (wc),mm | Ultimate crack Resistance (Ru), N/mm ² | Crack Resistance Ratio (Cr) |
|-------|--------|---------|--------|-----------|---|-----------------------------------|------------------------------------|-----------------------------------|---|-----------------------------------|
| | First | Final | First | Final | | | | | | |
| | Crack | Crack | Crack | Crack | | | | | | |
| MO | 6 | 22 | 264.8 | 971.19 | 3 | 50 | 500 | 1 | 10.59 | 0.29 |
| M10 | 8 | 34 | 353.1 | 1500.93 | 5 | 50 | 240 | 0.5 | 58.86 | 1.39 |
| M20 | 10 | 36 | 441.4 | 1589.22 | 7 | 50 | 500 | 0.5 | 35.32 | 0.79 |
| M30 | 7 | 21 | 309.0 | 927.045 | 3 | 50 | 250 | 0.25 | 98.88 | 2.47 |

| Table 2: Impact Energy | , Ultimate Crack Resistance, | Crack Resistance Ratio Detail |
|------------------------|------------------------------|-------------------------------|
|------------------------|------------------------------|-------------------------------|



Fig.6: Impact Failure Pattern of Slab with Crack Details



Fig.7: Impact Resistance at first crack in N-m



Fig.8: Impact Resistance at final crack in N-m



Fig.9: Crack Resistance Ratio (Cr)

IV. CONCLUSION

Based on the experimental test results, conclusions are drawn as follows:

- a) As the result suggest,M0 gives maximum crack length compare to other sea shell concrete matrix but M20 resist maximum impact energy compare to other concrete matrix.
- b) M20 indicate thefailure by forming a number of cracks in slab but other only for two or four hair line cracks and failure suddenly.
- c) M10 has maximum crack resistance but impact energy is low compare to M20.
- All the calm shell concrete plays good compare to conventional concrete. M20 has the maximum impact resistance and indicate the failure before ultimate failure by number of visible cracks.

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Use of Shear Wall Member at Corners to Enhance the Stability Using Different Grades: An Immense Review

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Abstract— The use of the shear wall at corners focuses the view of structural stability in present era and its use as dual system in a multistoried structure, since the major focus is to reduce the lateral loads acting on it. The research topic to reduce the lateral load in the current trend has increasing day by day. This trending expansion leads to the result in safe high rise structures. To contribute something in this, the current work shows the survey of the research works presented in shear wall usage and concrete core topics in dual structures as per Indian Standards. This study deals with the comparative analysis of the research trend on the current topic and after the survey, comprehensive outcomes are provided in conclusions that forms the objectives of the additional study.

Keywords— Concrete Grade, Dual system, Lateral load capacity, Optimization, Shear Wall.

I. INTRODUCTION TO SHEAR WALL

To reduce the lateral load over the structure and to optimize the structures has now been the new and latest ways to make the structure stiff and efficient. The trend follows all the economic customs to make cost effective structures. Stability of the structures is a tough task and it loose the above economic trend, since it requires heavy sections, it needs some additional stiffness resisting members and also need extra cost to make the same seismic free. Shear wall is the basic need of the modern tall structures. It not only stabilizes the tall structures but also protect the same from seismic disasters; on the other hand, it is a heavy R.C.C. additional component that increases the overall weight of the structure along with its base shear. Overall project cost ultimately increases with the usage of shear wall.

An additional structural component used to resist lateral force effects on a structure consist of a stiff R. C. C. wall. This R.C.C. vertical wall starts from foundation base to the top of the building. As per Indian Standard, the Shear wall is classified into two types viz. Ordinary RC structural walls and Ductile RC structural walls. The former one doesn't meet the special detailing requirements for ductile behavior as per IS 13920 and the later one meet the special detailing requirements for ductile behavior as per IS 13920.

II. TYPES OF SHEAR WALL



Fig. 1: Structure with Simple Rectangular type Shear Wall at Corner

There are various types of shear wall each of them has its own importance. The various types of shear wall are as follows:-

- 1 Simple rectangular type shear wall
- 2 Coupled shear wall
- 3 Rigid frame shear wall
- 4 Framed walls with infill frame

- 5 Column supported shear wall
- 6 Core type shear wall



Fig. 2: Simple Rectangular type Shear Wall

III. REVIEW OF LITERATURE

Emphasize given on the opening effect of core type shear wall had been become a main criteria in structural engineering. Researchers made an effort to obtain the beat building with opening area effect of shear wall. They have taken 11 cases which were divided into two parts; the former one consisted of five cases abbreviated as Core 1 to Core 5 under single core usage head. The latter one was consisted of six cases abbreviated as Dual Core 1 to Dual Core 6 under dual core usage head. All the eleven cases have rested on medium soil under seismic Zone III. They have analyzed their structural cases by software approach and also provided the views of the structure. For each head conclusions have drawn separately. For single core usage, Core case 5 had evolved as best case among all 5 cases. For dual core usage, Core case 6 evolved as the best case among all the 6 cases. (Gagan Yadav et. al.).

The authors in this work put emphasis on the usage of wall belt supported system used in multistoried building. This work compares the various possibilities of the demand and supply of stability enhancement system, since review has done. The lateral load handling capacity has evolved as the main criteria in this work. They secretly revealed their upcoming work with total 14 cases with the usage of response spectrum analysis will be used under Zone 5 with zone factor 0.36 respectively. The Shear wall at corners with belt connecting over its periphery column members was the main idea of their research. After reviewing the various researchers they conclude that their main focus will

be shear strip which was the modified part of the concrete wall system. After than their outline of the proposed work was pointed out. In this, they pointed out if the width and thickness were kept fixed and if the height at which the shear strip behaves effective will be their optimum case (Neeraj Patel et. al.).

The research work draws attention to again the stability enhancement system consists of outrigger and belt truss supported system. They have shown the results in technical point of view. The figure in their work shows the effective approach to the stability system applied over a multistoried building. They have performed a software approach with total seven cases created and abbreviated as Case S1 to Case S7 respectively. Fundamental Natural period for the structures were taken as 1.2978 seconds with subjected to the structure rest over hard soil with importance factor is equal to 1. Response spectrum method was used in this of earthquake analysis. Their tabular approach representation was really good since in each of the tables, worst case has shown subjected to the maximum values of the parametric case. After the results performed and showed as per various objectives, conclusions have been drawn. They conclude Case S4 shows the least values among all the seven cases and should be recommend the same (Archit Dangi et. al.).

Research revealed that the interaction of shear wall in connection with the multistoried building under seismic loading was the main criteria of the research. They have described the various possibilities of the location of the shear wall along with the criteria of shear wall type. This increases the stability of the structure with only shear wall at a particular location. The research done with the aim of taking G+9, G+18, G+27 and G+36 storied models conducted over a software approach. They have selected 20m x 20m plan area just to perform the analysis with frames abbreviated as Frame 1 to Frame 12 in each storey. Firstly they showed that what is the meaning of shear wall with its types. Total 48 frames have been constructed and all the structures are supposed to be rested over medium soil at earthquake zone V. After the analysis, conclusions have been drawn. The result proves that the frame 10 i.e. + shaped shear wall at center with flab slab proves to be the best of all (Sagar Jamle et. al.).

Researchers in this research work points out the reviewed approach on the effect of the different concrete grade in outrigger and wall belt supported dual structural system. Since same grade approach has been a major part of the work now a days but this kind of approach have been proved the numerous possibilities of the research work in different grades of concrete. Firstly they have shown the concept of multistoried buildings in the urban areas. Then they described the value of outrigger system and after than the belt supported system and the combined effective approach to the general building as per stability point of view. They have conducted numerous literature review related to the same topic and after than conclusions have drawn. The conclusion part has combined with an approach to the outline of the proposed work. They proposed that grade change in outrigger and wall belt supported system will become the major technical part of their study and will going to be major research work (Mohammad Bilal Rasheed et. al.).

This particular work brings out the review effort drafted on shear wall opening criteria of a multistoried building. In introduction, the author described the criteria's to fulfill the earthquake requirements is to make a dual system building which was considered in Indian Standardization too. Shear wall description with its types have also been discussed. The main emphasize has done to classify the core type shear wall viz. single core shear wall and dual core shear wall. Then he clearly described the types of opening in shear wall provided with figuratively approach. After then the numerous reviews on the shear wall usage, its importance and the opening criteria of shear wall was discussed. Lastly, they draw the conclusions and outline of the proposed work, that there should be a criterion describing the percentage deduction of the shear wall area and the percentage usage of the wall area. Their technical work will show the percentage elimination of the same (Gagan Yadav et. al.).

The Exposure of extra load beyond the calculated load over the multistoried building under seismic loading was the worst case taken in their analysis. The authors suggested the optimum location of rooftop telecommunication tower along with its various fixtures and attachments. In introduction, they have suggested the importance of rooftop telecommunication tower in urban areas. Since the working approach was technical findings, they have discussed and set an aim by the various objectives consist of Base shear, axial forces, shear forces, moments and displacements. These parameters selected for both X and Z direction. Then they have described the methodology adopted for seismic analysis. After than the structure modeling has performed with total 5 cases selected and abbreviated as CASE A to CASE E with different telecommunication tower location. G+ 12 storied residential apartments have selected and all the structures have rested over medium soil at seismic zone 4. After the results, conclusions have been drawn suggested that on comparing all the cases, case D shows optimum amongst all (Suyash Malviya et. al.).

The paper highlights the insight of concrete which can cure itself where the shortage of the water in such areas. The agent used in their research work was polyethylene glycol abbreviated as PEG 400. This particular chemical was replaced by the percentage of cement in their research by 0%, 0.8%, 1.5%, 2.4% and 3.2%. The grade of concrete chosen was M20 and M25 grade of concrete. Both compressive and flexural strength test have been performed since this research work has done first in lab then the results were computed in tabular form and represented by graphical form. The work specially emphasize on 28 days curing results. Total 5 types of replacement mixed have made by replacement of cement and abbreviated as Mix-1 to Mix-5. They have concluded that For M25, 1.6% PEG Mix is efficient and for M20 Grade, 2.4% PEG Mix suited the best (Prakash Mandiwal et. al.).

This particular work give emphasis to the analytical approach of multistorey building wen shear wall is used at different locations and also for different heights. Authors in this work firstly show why we have to implant the structural stability feature when different height of the structure used. UBC analysis was also described in it. Also, they described the importance of providing the shear walls with stiffness and aspect ratios. Advantages of shear wall have also discussed. In methodology section, they provided various input parameters that were used in their work. There were basically three structures viz. G+10, G+20 and G+26 structures rested over medium soil for the analysis. Finite element approach in calculation of stresses of only shear wall have discussed in their approach. Different approached were found out and finally future scope has provided (Priyanka Soni et. al.).

IV. CONCLUSIONS AND OUTLINE OF PROPOSED WORK

The conduction of the literature survey has done by reviewing and learning data objectives of various research papers it has now cleared that there should be a proper analysis before going further in any topic to find out the current research done. The current trend has also been obtained in dual configuration structures. Therefore it is necessary to increase the stiffness at particular locations in the building to make an optimized one to resist the same from lateral loading.

The conclusive outcomes drawn from the study are enlisted below:

1. The study is conducted for both the directions viz. lateral and longitudinal direction.

- 2. The dual structural configurations should be necessary to overcome the lateral effects in the form of displacements to any tall structures.
- 3. Strength criteria of the soil also play an important role in structural stability. Soil type should also be checked as per Indian Standardization IS 1893-2016 (part 1).
- 4. Earthquake analysis should be checked in particular zones or cities to analyze the data in different manner.
- 5. Checking of the analysis of different parameters and its validation as per Indian Standards is necessary along within the limits.

The main focus is to check the dual system with grade change in concrete with fixed thickness of shear wall members at corners that has going to be a major part of the study for upcoming proposed work.

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Enzyme-Assisted Extraction of Lycopene from Watermelon Fruits: Effect of Hydrolysis Parameters on Lycopene Yield

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Abstract— This study aims to explore influence of process parameters on lycopene recovery from watermelon fruits. Investigations were carried out with respect to lycopene content as the main indicator following randomized single factor routine. Examined hydrolysis parameters included used enzyme, enzyme concentration and hydrolysis duration. In addition, physicochemical measurements of the watermelon fruit was also performed. Results showed that the highest lycopene content (14,125±0.271 µg/ml) could be attained at enzyme concentration of 2.4% (v/v), hydrolysis time of 60 min under cellulose enzyme treatment. The enzymatic treatment was also shown to be capable of significantly lowering viscosity and improving lycopene yield.

Keywords—lycopene, enzyme, watermelon, extraction.

I. INTRODUCTION

Carotenoid represents a pigment class consisting of valuable bioactive compounds with diverse applications in pharmaceutical and functional food industry. Among carotenoids, lycopene is a typical compound known for its strong antioxidant activity and red color due to its structure having eleven conjugated double bonds. Lycopene has been pointed out to exhibit preventive effects against several cancer diseases including stomach cancer and prostate cancer [1-3]. Other beneficial functions of lycopene may include inhibition of cholesterol synthesis, boosted production of low-density lipoprotein[4] and prevention of atherosclerosis and myocardial infarction. Lycopene exists predominantly in red-colored plants such as tomato, watermelon, papaya and red guava. Notably, watermelon has been shown to be a promising source of lycopene, amounting to 4532µg per 100gr of watermelon pulp [5].

Enzyme-assisted extraction has been one of the most well-studied approaches to obtain lycopene from plant materials[6]. The technique involves the use of enzymes to penetrate cells ofplant material, allowing for better expulsion of carotenoids and phenolics[7]. While enzymatic extraction

has certain drawbacks including high cost and susceptibility to degradation, its meritsjustify the technique in industrial applications. Recent investigations have demonstrated superiorities of enzyme-assisted extraction over conventional methods including more efficient extraction, reduced solvent and power usage, renewability and specificity[8,9]. Kong et al. has reported that, in comparison with conventional techniques, significant improvement of up to 20 times in lycopene recovery could be attained via enzymatic extraction [10]. Against tomato tissue, it was found that enzymatic extraction of lycopene is particularly effective due to pectinolytic, cellulolytic and hemi cellulolytic activities of certain enzymes, possibly giving rise to a 6-fold improvement over lycopene yield of the unhydrolyzed sample [8].

Apart from process conditions, enzyme selection plays a crucial role in enzyme-assisted extraction. Depending on the substrate and the desired compound of extraction, different individual enzymes or a multi-enzyme system could be utilized. For example, hydrolytic enzymes such as pectinase and cellulase have been shown to be effective for extraction of carotenoids from chili pepper [11], lutein from marigold flowers [12], and flavonoids from Ginkgo biloba [13]. Particularly for tomato substrates, pectinase has been suggested as a suitable enzyme in industrial scale production of lycopene [14-16], enabling further possibilities for combining multiple enzymes or multiple extraction methods simultaneously [6, 16-18].

To the best of our knowledge, enzyme-aided recovery of lycopene from watermelon substrate has not been fully explored. In this study, we attempted the extraction process and examined effect of several process parameters including used enzyme (cellulases, pectinases and viscozyme), enzyme concentration and hydrolysis duration on the extracted lycopene content.

II. MATERIALS AND METHODS

2.1. Plant materials and reagents

Selected plant materials are watermelon (*Citrullus lanatus*) fruits of Hac My Nhan variety, originating from Long An province, Vietnam. Selected fruits were intact, dark green in color and had uniform hardness. Fruits were harvested after 25 - 30 days after pollination or after 65 - 70 days after cultivation. Harvested fruits were maintained at 2-8 °C for not more than 48 hours and then dehulled, deseeded and pressed to afford the pulp.

Enzymes used in this study including Viscozyme L, Pectinex Ultra SPL and Celluclast 1.5L (700EGU/g, 60 FPU/ml). All were obtained from Novozymes Company. Chemicals including lycopene, acetone, ethanol, n-Hexan and BHT (Butylated Hydroxy Toluene) were obtained from Sigma-Aldrich.

2.2. Enzymatic treatment of watermelon pulp

The enzymatic treatment commenced with homogenization of pulp materials for 5 min using a blender. Then, a pre-determined amount of enzyme with specific concentration was added into 0.2 M acetate buffer. Following that, 3 g of material was introduced into a container sealed with aluminum foil followed by addition to the mixture and blending for 2 min. The incubation was carried out under 55°C for samples treated with cellulase and under 60°C for samples treated with pectinase. After incubation, the filtrate obtained from the mixture was extracted with solvent extraction using 20 mL of hexane and acetone (1:1 v/v). The residue obtained from the mixture was extracted using 30 mL of hexane and acetone (1:1 v/v), followed by double extraction with 10 mL of hexane and acetone (1:1 v/v) each. Separation funnel was used to discard

the lower aqueous phase to obtain the upper phase, which consists of lycopene and other lipophilic carotenoids. Lycopene extracts from the filtrate and the residue were then mixed and passed through desiccant and 1 g of sodium sulphate. Final samples were stored at 2-8°C. Control samples were prepared identically but without enzyme treatment.

2.3. Determination of lycopene

To determine lycopene content, a method adapted from a previous study (Ranveer et al., 2013) was employed. First, extraction of sample was carried out using acetone (containing 0.05% w/v BHT) ethanol and hexane (1:1:2 (v:v:v) ratio). The mixture was then agitated at 100 rpm and added with deionized water under shaking. Phases of the mixture were separated by allowing the mixture to cool to room temperature and collecting the upper solvent phase. The collected solvent was diluted with hexane 1:50 ratio (v:v) before being spectrophotometrically measured for absorbance at 503 nm. The lycopene content was determined as in equation 1:

$$H = \frac{OD_{503}X\,31.2\,Xn}{m}$$
(1)

H: lycopene content (mg/kg pulp);

OD (503): absorbance at the wave length 503nm

31.2: coefficient

N: dilution factor;

m: gram of sample

The lycopene extraction yield of each experiment was calculated as in equation 2:

$$G = \frac{HxM}{1000} \tag{2}$$

G: lycopene extraction yield (mg/kg whole watermelon)

M: g of obtained pulp after centrifugation.

2.4. Determination of moisture content, ash content and viscosity

Moisture of the material was determined by drying at 75°C. Ash content was determined via heating (550-600°C). The remain was then weighed to calculate the ash content. Viscosity was determined using capillary tube viscometer and calculated based on the time the fluid takes to pass through the viscometer following Hagen-Poiseuille equation.

III. RESULTS AND DISCUSSION

3.1. Proximate analysis

Several indicators of the sample were presented as shown in Table 1 and Table 2

Table 1. Mean weights of watermelon fruits

| Indicator | Mean |
|------------------------------|-------------------------|
| Moisture content (dry basis) | 10.224±0.5 |
| Ash content (%) | 0.285 ± 0.005 |
| Viscosity (Pa.s) | 0.001046 ± 0.000001 |

Table 2. Proximate composition of the watermelonpulp

| | Mean | % Total weight |
|---|-------------------------|-------------------|
| Total weight of watermelon fruit (g) | $2411,\!67 \pm 10,\!40$ | 100,00 |
| Weight of shell (g) | 565,89 ± 35.83 | 23,46±1,49 |
| Weight of seeds (g) | $36.92 \pm 6,25$ | 1,25±0.25 |
| Weight of pulp prior to enzyme treatment (g) | 1640.28±99.2 | 68.01±9.53 |

3.2. Effect of used enzyme on the obtained lycopene content

Figure 1 demonstrated lycopene contents with regard to different used enzymes, showing significantly improved contents in enzyme-treated samples. The nonenzyme treated sample (control sample) showed the lowest lycopene content at 4.906 $\pm 0.124 \mu g/ml$. The peak lycopene content was observed in sample treated with cellulase enzyme, at 8.502 ±0.301µg/ml. Those results suggest that enzyme could aid in breaking down of fruit tissues, accelerating the release of cells into the medium. ANOVA results also confirms the influence of cellulase and pectinase enzyme on lycopene content with confidence intervals of 95% (p<0.05). LSD multiple range test comparing influences of the three enzymes also indicates that cellulase gave higher and significant improvement in lycopene yields in comparison with other enzymatic treatments. This could be explained by the cellulolytic nature of the enzyme. To be specific, cellulase could act as a catalyst facilitating the breakdown of cellulose, which is present in primary walls, into glucose, cellobiose and higher glucose polymers. For comparison, obtained results are different from another study

[14] who found that lycopene, rather than cellulase, gave superior lycopene content with materials of tomatoes.



Fig.1. Lycopene content in relation to different enzymes

3.3. Effect of enzyme concentration on the obtained lycopene content

Figure 2 demonstrated variations in lycopene contents with different concentrations of cellulase enzyme. Rising the concentration from 0.8 to 2.4% induced a significant improvement in lycopene content, from 7.05 to approximately 14.054 ±0.271µg/ml. However, rising concentration higher than 2.4% seemed to cause no clear improvement in the lycopene content. Pre-treatment of watermelon juice with cellulase assists in breaking of cellular structure, in turn facilitating the release of lycopene into the solvent media. These results are further confirmed by ANOVA test, indicating that enzyme concentration significantly affected lycopene in watermelon juice (p<0.05). LSD multiple range test also indicated that at 2.4% enzyme concentration, the lycopene content peaked and was significantly indifferent to the content achieved at 3.2%. The strong influence of enzyme content on the first stage of the reaction could be explained by the accelerated enzymification that improved the release of lycopene out of cells. However, at higher enzyme concentration, due to substrate saturation, increasing enzyme content is no longer impactful on reaction speed. Another explanation for the phenomenon was proposed by Cinar [19] and Ranveer [16] suggesting that, in a given duration of reaction, more release of lycopene may lead to increased oxidation of hydrolysate, in turncausing lycopene to remain stagnant at very high enzyme concentration [16, 19].



Fig. 2. Lycopene content in relation to different enzyme concentrations

In comparison with previous reports, our results showed many differences. A previous study showed that to hydrolyze the whole tomatoes, pectinase with the concentration of 0.5% was required[14]. Meanwhile, Ranveer et al. reported the pectinase concentration of 2% for efficient recovery of lycopene from tomato wastes[16]. The differences with current results (2.4% of cellulase enzyme) could be attributed for differences in raw materials and used enzyme. Therefore, enzyme concentration of 2.4% will be used for subsequent experiments

3.4. Effect of hydrolysis duration on the obtained lycopene content



Fig 3. Lycopene content in relation to different enzyme treatment periods

Figure 3 illustrated effect of duration on obtained lycopene content. In general, the increasing trend of the content could be observed in the first 60 minutes. The highest lycopene content, $10.687 \pm 0.231 \mu g/m$ l, was achieved

at the duration of 60 min and gradually decreased thereafter. ANOVA results indicated significant influence of duration on lycopene content (p<0.05) and LSD test also confirmed that differences between lycopene obtained at 60 min and those obtained at other durations were statistically significant.

These results suggest that cell-walls tend to degrade rapidly within the first 60 min of hydrolysis. Furthermore, extending the duration from 60 to 80 min did not seem to cause any noticeable improvement in obtained lycopene. This is explained by the increased quantity of hydrolysable substrate under longer durations, resulting in improvements in lycopene content. However, eventual depletion of substrate occurring when carrying out hydrolysis in a very long period may reduce the reaction speed, causing lycopene loss. In addition, long hydrolysis time may also cause spoilage, which also contributes to decreased recovery efficiency. Alternatively, other studies also suggest the decline in lycopene under long hydrolysis time may be attributable to generation of cleavage products having shorter wavelengths than that of lycopene[14, 20]. Current hydrolysis time results are similar to the findings of Lavecchia and Zuorro [15] showing lycopene yield from tomato peels could be improved by enzymatic treatment within 1 hour[18]. Therefore, one hour is selected as the optimal time.

IV. CONCLUSION

The present study has attempted the enzyme-aided recovery of lycopene from pulp of watermelon fruits and optimized the parameters of the said process. It was shown that the assistance of enzyme (Cellulase 1.5L and Viscozyme L) could greatly enhance the lycopene yield of the recovery process. Optimal hydrolysis conditions consisted of 2.4% (w/w) of enzyme concentration, incubation time of 60 min and treatment with cellulase enzyme. These conditions corresponded with the highest lycopene yield, at 14.125 μ g/ml. Further studies should explore the possibility of a larger scale extraction system and attempt on other enzymes and watermelon varietiesfor determining more efficient lycopene recovery.

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Agroecology and Empirical Knowledge in Brazilian Quilombol Communities

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Abstract—Agroecology has presented itself as an excellent research tool in understanding the countless ways that people relate physically, culturally and spiritually to the environment. However, little attention has been given to ecologically sustainable alternative practices as ways to reduce the impacts generated by traditional production and that cause damage to biodiversity, especially in quilombola (slave-refugee) communities, where the human-plant relationship is very intimate. In this context, the present work aimed to carry out a survey of agroecological practices developed in Brazilian quilombola communities, which are communities where direct descendants of the slaveswho were brought to Brazil, at the time of their colonization by the Portuguese, live. The research consists of a literature review with a qualitative approach, in which articles available on the Google Scholar platform were selected. Thus, in light of the studies analyzed, it was possible to describe agroecological practices present in quilombola communities, such as: Management of heirloom seeds; Use of the moon phases for guidance on plantations; Production of native seedlings, and even verifying the efficiency of the application of participatory methodologies such as Agroecological exchanges in backyards to learn about the practices and limitations encountered by residents in food production.

Keywords—Agroecological practices; Traditional communities; Traditional knowledge.

I. INTRODUCTION

Agroecology can be understood as a science that respects ecological and socio-cultural diversity, and that defends the need to generate systemic, holistic knowledge, contextualized from local cultures, as a way of rethinking the way of life, production and consumption of communities. These ecologically sustainable practices inspire countless reflections to get closer to a reframed knowledge of the alliance-relationship between man and nature. According to Cotrim and Dal Soglio (2016), the process of building scientific knowledge must take into account a set of essential elements: a holistic and systemic view of science, immersion of family and community social relations including traditional peoples, social construction of the actors involved in this process, dialogue of empirical knowledge, ecological principles of agriculture, a market embedded in social relations, and the participatory method.

Quilombos, or quilombolas (refugee-slave communities) have been part of the history of Brazil since the 16th century, and were called mocambos. The term 'quilombo' appears in the late 17th century, and in the 18th century both terms were adopted in colonial documents to characterize fugitive communities. In the 19th century, there are records that quilombos were located not only in rural areas, but also in urban areas, in the suburbs of slave cities (Gomes, 2015).

There are more than 2500 quilombola communities throughout the brazilian territory, of which 500 are distributed in several municipalities in the state of Bahia (Palmares, 2018). Most of these communities preserve the culture and knowledge of their ancestors accumulated over the centuries, bringing valuable information on the use of natural resources, in addition to valuing traditional knowledge (Oliveira 2015).

The social composition of Brazil has a permanent mark from the African matrix, while Afro-descendants still

suffer the terrible legacy of black slavery. The State's recognition of the identity of contemporary quilombolas, after so many centuries, shelters the recovery and appreciation of Afro-descendant cultures in a social system that is still exclusive and discriminatory (Pereira, 2012).

Quilombola populations are culturally differentiated groups that have their own social, cultural and economic conditions, maintaining specific relations with the territory and the environmentin which they are inserted. They have knowledge accumulated over centuries and close contact with the environment, which facilitates obtaining information about the use of natural resources. (Pinheiro & Monteles 2007). In addition to this traditional knowledge being the basis of agroecology, it also reaffirms the peasant identity through political organization and articulated actions based on ethnicity, inserting itself in agroecological transition processes coupled with cultural rescue. It is of great relevance that the agroecological knowledge is transmitted to the present generation, seeking its survival under physical, cultural and economic aspects, ensuring the principle of sustainability for the next generations (Brazil, 2014).

These practices that have been used for several generations by quilombolas through empirical knowledge are transmitted through parents and grandparents, such as the use of medicinal plants to prevent and treat common illnesses in their community, since such knowledge is inserted in their culture (Guimarães et al., 2019).

The knowledge about agroecology and traditional knowledge of these communities is configured as a process of coproduction between man and the ecosystem, emphasizing that these groups have knowledge built over time in interaction with the environment, strengthening the construction of agroecology, and have high socioeconomical scientific relevance, and contribute to the conservation and management of vegetation (Toledo 2015), by highlighting the ability to maintain biodiversity in their territories.

This study aimed to conduct a survey of agroecological practices present in Brazilian quilombola communities, examining the future perspectives of man with the territory transformed by modernization in the countryside.

AGROECOLOGY AND POPULAR KNOWLEDGE

The 19th century was marked by events that directly influenced the agricultural context, among which we highlight the movement called the Green Revolution. This program aimed to achieve an increase in world agricultural productivity through experiments in the field of plant genetics and the development of agricultural techniques. (Brum, 1988). However, what was verified is that negative externalities originatedfrom this movement, such as, social exclusion, destruction of biodiversity and overvaluation of monoculture to the detriment of the diversification of crops (CAPORAL, 2008).

In light of this scenario of depletion of essential resources for the most varied of human activities, Rodrigues, Neto, Galvão (2019) emphasize the importance of changing the attitude of the human being. Thus, agroecology is highlighted, as it is concerned with the balance of nature and the production of sustainable food. According to Altieri (2004), it is an approach that integrates socioeconomic principles linked to those of agronomy and ecology to understand the effects of technologies on agricultural systems and society in general.

This paradigm is presented with a holistic view considering environmental and human issues (Aquino, Assis, 2005).

Agroecology aims to promote the dialogue between knowledge, providing a relationship between traditional knowledge and scientific knowledge (Altieri, 2012). In this perspective, it encourages researchers to understand techniques used by farmers in agricultural management, such as the development of traditional calendars for programming agricultural activities (Altieri, 2004).

As an integrating science, Agroecology recognizes and feeds on popular knowledge, knowledge and experiences of farmers, indigenous peoples, forest peoples, fishermen, quilombola communities, as well as other social actors involved in rural development processes, incorporating the endogenous potential, that is, present in the "area" (Caporal and Azevedo, 2011).

Agroecology, by incorporating understandings and popular knowledge, goes beyond the simple approximation between agronomy and ecology, which allows a fundamental methodological pluralism for the scientific knowledge offered by different disciplines for the design of more sustainable agro-ecosystems and agriculture, which is what matters from the point of view of planet conservation and species survival. (Feiden, 2005).

Agrobiodiversity, in the agorecological context, is essentially a product of human intervention, based on inventiveness and creativity in the interaction with the natural environment. However, cultural processes, knowledge, practices and agricultural innovations developed and shared by farmers are key components in this process that determines and conditions it (Silva and Junior, 2018). According to Altieri (2012), it is through ethnoagricultural research that this traditional knowledge is rescued and considered as the primary source for agroecological practices. Popular wisdom in cultivating is inherent to those who practice it, regardless of methods, techniques, technologies or terms applied, after all , when knowledge is passed from generation to generation, one is aware of what is being accomplished (Rosa and Freire, 2010).

Thus, there are agroecological practices that are very present in quilombola communities, according to Pinheiro and Monteles (2007), the remaining quilombola communities (RQC) are culturally differentiated groups that have their own social, cultural and economic conditions, maintaining specific relations with the territory and with the environment, in which they are inserted.

Currently, they live in a permanent context of threats due to the pressure of capitalist exploitation superimposed on their traditional material and immaterial territories (Haesbaert, 2007). Most of the many rural black communities spread across the country, in conflict for the recognition of the traditional possession of collective lands, are mostly identified as "lands of black", not always associated with the classic historical idea of the quilombo.

The productive and cultural values of quilombolas must be part of the culture of an entire generation and these groups present knowledge, built over time in the interaction with the environment that articulate aspects to be considered and valued in the strengthening and construction of agroecology (Loures, 2011). It is noteworthy that these groups have knowledge built over time in the interaction with the environment. Furthermore, what the quilombolas say is that it is not possible to think about the world without considering that everything on earth has water. It can be said that the world of water condenses the reciprocal relationships of communitieswith nature (Mirales, 1998).

In the context, RQCs can provide important contributions to the conservation of socio-cultural and biological diversity of species known to traditional populations (Guimarães, 2019). For the process of insertion of a culture to take place, it is necessary to consider the various dimensions of culture, the valuing not only of the individual process, but also of the collective and the dialogue with other cultural perspectives.

The remnants of quilombos, having as their central argument the protection of culture and also of traditional knowledge (Matteo, et al, 2016), the modes of production of traditional peoples and communities used in planting, breeding, hunting, fishing, extractivism and handicrafts, are associated with kinship and crony relations and are based on relationships of exchange and solidarity between families, local groups and communities.

In this way, the foundation of agroecology is based on the ancestry of these peoples, to strengthen the commitment to society that intends to have a sustainable development, having as reference the principles that guide the collective construction that are founded on knowledge on the basis of agrocology, as stresses Seville Guzmán (2001, p.39), "local eco-evolution has a logic for the functioning of the agro-ecosystem, in those areas where traditional historical management has shown conditions of sustainability".

Toledo and Barrera-Bassols (2015) point out the importance and value of traditional knowledge, being an essential component used by the farmer for the appropriation of nature, perception and conception of the use of natural resources.

It is known that the act of preserving cultural heritage brings with it the idea that it is necessary to save something that is in danger of disappearing and being forgotten. In this process of understanding the world, it is expected that society as a whole can develop skills in order to effectively interfere in the direction of present and future society, with a broad view of what is happening on the planet; who can know the importance of discovering and developing responsibilities in themselves, so that, as future adults open to relationships and differences, they can contribute to a balanced and specifically processed transformation, in favor of a sustainable future.

This new common cultural movement, which has as its core the awareness of the serious situation in which humanity and the planet are, of the responsibility of all citizens in the face of the problems generated by capitalist society and, particularly by the ruling class; the urgent need to train new generations in a completely opposite perspective, centered on the social reality in which they live, without questions of race, color, social class, etc; the importance of scientific and technological knowledge for the construction of a just, democratic and peaceful society for all human beings, without exclusions or privileges (Morin, 2002). In this context, knowledge about the principles of agroecology in traditional communities, especially in quilombolas, becomes even more relevant to expand and conserve the socio-cultural and biological diversity of species known to traditional populations.

II. MATERIALS AND METHODS

The research is configured as a literature review, which aims to recognize, select, classify and synthesize the relevant evidence available in research (Cordeiro et al., 2007) being carried out from October to November 2019, and includes published articles in the period from 2010 to 2019. available the platform on https: //scholar.google.com.br. It was opted for this platform, because the reports of experiences in quilombola communities are published in public congresses, so this information is not presently available in databases. The key words used in the search were: quilombola community, traditional knowledge, agroecology, which after analysis, 7 articles were selected for the study that deal with agroecological practices carried out in Brazilian quilombo communities.

III. RESULTS AND DISCUSSIONS

After reading the title and abstract, 7 articles were identified that directly addressed the researched theme (Chart 1).

The article "Agroecological practices in peasant and quilombola communities" (Mendonça, 2015), presents agroecological experiences with rescue, production and conservation of heirloom seeds, built by farmers from Peasant and Quilombola Communities in the Citizenship Territories of Chapada dos Veadeiros and Vale do Paranã, Goiás, Brazil, reducing dependence on the multi-seed market. According to Silva and Junior (2018), the valuing of local knowledge and the application of agroecological principles in agriculture are strategies for the conservation, use and improvement of genetic diversity, since ancient forms of management served as the basis for different forms existing agriculture.

The second article, entitled "Quilombola communities in the Velho Chico territory" (Barbosa, Almeida, Santos, 2015), refers to a report, which portrays the experience of students of the Postgraduate course in Social Innovation with Emphasis on Solidary Economy and Agroecology at the Federal Institute of Education, Science and Technology-IF Baiano, in quilombola communities of Lagoa do Peixe, municipality of Bom Jesus da Lapa in the state of Bahia, Brazil.

In this experience, it was found by the authors that these peoples use traditional knowledge in some agricultural practices, such as: Use of specific techniques to combat insects; The orientation of the phases of the moon for conducting plantations. Such empirical knowledge is passed on from older people in the community and to younger people.

The study by Mota Dias (2012), entitled "Quilombolas and medicinal forest resources in southern Bahia, Brazil" aimed to interpret the traditional knowledge of a quilombola community about the use of plant species for therapeutic purposes. Through interviews and field observations, the researchers identified respondents in the indications for these plants. This knowledge proved to be "an efficient socio-environmental-cultural tool for the practice of handling several species of plants from the most varied botanical families and also included a vast knowledge of sustainable and conservation of forest species for local use" (Mota Dias, 2012, p.158).

The report of experience, presented by Barbieri et al (2018), aimed to describe the experiences of Project Women sowing agroecology, developed by women from Quilombola communities in the Caroá region in the state of Pernambuco, Brazil.

The project was led by a young woman who was part of the "Agroecological training program for young farmers in Pernambuco" that began in 2016, in which young people participate in workshops in order to be mobilizers and trainers of other young people of their communities, through the "young to young" methodology focused on the formative process in agroecology.

In the project Women Sowing Agroecology, activities are developed that aim to: strengthen and rescue traditional knowledge; application of new knowledge for agroecological transition in food production; implementation of an agroforestry system in the community and discussion of feminism related to politics, socioeconomic aspects, gender violence, and sexual division of labor.

The experience reported by Trindade, Souza, Barros (2017), entitled "Quiandeua Community - Ipixuna do Pará", comes from a technical visit, with forest engineering students, from the Federal Rural University of the Amazon campus Paragominas (UFRA-PA) in a quilombola community in the municipality of Ipixuna in the state of Pará, Brazil. During this visit, some agroecological practices were observed in the community, such as: Preservation of the agroecosystem; Shared land use; Agroforestry management.

| TITLE / AUTHOR | DESCRIPTION OF ACTIVITIES |
|--|--|
| AGRICULTURAL PRACTICES IN PEASANT AND QUILOMBOLA COMMUNITIES (Mendonça, 2015) | Heirloom seed management |
| QUILOMBOLA COMMUNITIES OF THE VELHO CHICO TERRITORY | Use of moon phases for guidance on plantations. |
| (Barbosa, Almeida, Santos, 2015) | Use of specific techniques to combat insects. |
| QUILOMBOLAS AND MEDICAL FOREST RESOURCES IN SOUTHERN BAHIA, BRAZIL (Mota Dias, 2012) | Cultivating medicinal plants in backyards. |
| WOMEN SOWING AGROECOLOGY: anexperienceof living withthesemiarid in quilombola communities in the caroá region– PE (Barbieri et al ,2018) | Strengtheningandrescuingtraditionalknowledge. Applicationof new knowledge for agroecologicaltransition in foodproduction. Implementationofanagroforestry system. Discussiononfeminismrelatedtopolitics, socioeconomicaspects, genderviolence,and sexual divisionof labor. |
| QUIANDEUA COMMUNITY - IPIXUNA DO PARÁ: reportsonstrength, resilienceandunionof quilombola peoples (Trindade, Souza, Barros, 2017) | Preservationoftheagro-ecosystem. Sharedland use. Agroforestry management. |
| AGROECOLOGY, UNION AND INNOVATION: theproject "fishon table, plant in theforest " (Garcia-Prado, 2015) | Productionofnativeseedlings. Organicoliveoil. |
| TRANSITION OR RECOGNITION OF AGRICULTURAL PRACTICES IN THE QUILOMBOLA COMMUNITY COLONIA DO PAIOL (Valente et al ,2015) | Reuse ofgarbage. Variouscrops in backyards, withoutthe use ofchemical inputs. |

Chart 1: Identified works that address the studied theme

In this study, the authors also conclude that this moment provided students and teachers with a broad perception of these practices mentioned above, in which the community members put themselves in the role of transmitting knowledge. According to Feiden (2005), by preserving local knowledge, we seek to preserve the identity, customs and traditions of each people, enabling the conquest of social rights and the improvement of the quality of life of these populations, instead of focusing

only on production by production, forgetting the desires of the men responsible for this.

The experience report entitled "Agroecology, union and innovation" (Garcia Prado, 2015), exposes the experience of an extension project entitled "Fish on Table, Plant in Forest", developed by the author of the report, who had as one of its objectives to encourage community integration and technical qualification of quilombolas in the Espírito Santo and Rio Preto communities, in the municipality of São Mateus in the state of Espírito Santo, Brazil.

Initially, meetings were held with rural producers with an agroecological profile belonging to quilombola To facilitate this communities. initial dialogue, participatory methodologies were used, thus identifying the longings and weaknesses of members of these communities. From this initiative, there was an articulation with various sectors of society, such as Universities and the municipal secretary of agriculture, in order to meet the identified demands. Thus, lectures and qualification courses in psiculture, organic olive oil, production of native seedlings and generation of solar energy took place for all rural producers of the properties of the communities interested in these activities.

The work developed in the quilombola community Colônia do Paiol by the Cooperative Organization of Agroecology (OCA) in partnership with the Center for Agroecology Ewè of the Federal University of Juiz de Fora (UFJF), was reported by Valente et al (2015). OCA is "a cooperativework in agroecology, which, with a multidisciplinary team, seeks to work on values and practices of good living, contributing to the autonomy, sovereignty and economic and socio-cultural empowerment of communities" (Valente, 2015, p. 02). Several visits to the community were made in order to identify the potentialities and the present problems. Project members used participatory methodologies such as Agroecological exchanges in backyards to learn about the practices and limitations encountered by residents in food production. The Tree methodology was also used in order to identify the collective problems of the community (root), dreams (canopy) and discuss proposals to solve problems and make dreams come true (stem).

According to Altieri (2012), the dialog of knowledge is an essential condition for the development of a truly ecological agriculture, in which the people who have the knowledge must be part of the planning process. In this way, local skills can be mobilized through participatory development approaches, combining local popular knowledge with the knowledge and skills of external agents in the design and dissemination of appropriate agricultural techniques.

In view of these applied methodologies, they suggested several reflective questions that addressed several themes, among which the destination of the garbage produced in the community was highlighted, and a workshop was held that addressed the reuse of garbage. Thus, the actions that were carried out in the community, included a holistic approach about the problems, desires, relationships and processes of knowledge construction in the community. In view of the existing complexity in the various situations encountered, Aquino and Assis (2005) approach agroecology as an emerging paradigm with a holistic approach, which encompasses environmental and human issues.

IV. CONCLUSION

From the literature review, which aimed to carry out a survey of agroecological practices developed in quilombola communities in Brazil, scientific articles and reports of experiences that pointed out such practices were identified. These experiences in the communities occurred from educational actions of educational institutions that sought within the experience of quilombola peoples an exchange of knowledge between popular knowledge and academia.

In the agroecological practices observed, activities that involve the handling of heirloom seeds and the cultivation of medicinal plants stand out. In addition, empirical knowledge is evidenced by means of practices, such as: the use of the phases of the moon for orientations in plantations and specific techniques for combating insects; preservation of the agro-ecosystem; shared land use; agroforestry management; reuse of garbage and various crops in backyards, without the use of chemical inputs.

In view of the above, we find that the empirical knowledge of quilombola peoples is present in the most varied activities, and its development is important for strengthening agroecology, since the dialogue between popular knowledge and scientific knowledge is one of the foundations in maintaining this paradigm.

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Neuromarketing and Psychology of Cors in the process of Making Purchase

Felipe Neris Torres de Sousa, Maria Erilúcia Cruz Macêdo

Abstract— The present work is a qualitative research, with the intention of improving the measurement or the reach of the results used as a data collection procedure or focus group, or that had a team of participants participating in a non-research sample. probabilistic in performance with the research objectives, striving for the heterogeneity of the group. Did a research try to answer a starting question like neuromarketing and a psychology of the nuclei that are influencing the purchase decision making? A general research aimed to identify the influence of Neuromarketing and core psychology on consumer behavior, and how to define criteria that show the concept of neuromarketing, expose the perception of the influence of core psychology and diagnosis the effect of neuromarketing on the behavior of consumer using a use of colors. Through oras a result of the focus group, it is not allowed how the nuclei can influence the decisive buying process of a particular individual, since the nuclei remain unaware of consumers and can be triggered as a mind trigger, using the tools and methods of neuromarketing.

Keywords—Neuromarketing . Psychology. Colors. Consumer.

I. INTRODUCTION

Neuroscience is an area of relatively new knowledge within the vast field s performances, and became of paramount importance for the understanding, development and functioning of the brain, which drives human behavior and its peculia authorities regarding the s choices, motivations, decision making and nervous impulses.

Based on this assumption and the need to better understand consumer behavior in relation to the market, to understand fact res key, Motivation will intrinsic and preferences cie ntificamente proven, comes the junction of neuroscience to marketing, thus constituting neuromarketing.

Neuromarketing through the use of color psychology shows an immediate effect on consumers' perception, creating emotional and empathic ties, which makes it easier to have knowledge about the target audience's preference. Such knowledge , may allow to work strategically the ones closest to reach the sales potential and to understand how the marketing techniques influence the consumers through the perception of colors.

Neuromarketing, understood as science, has been gaining space in the business sector, opening up new branches of business strategies, with a higher level of competitiveness, allowing high performance for commercial activities. In a society born of INFORMATION s as of today, the individual 's change of opinion quickly. Thus, the need arises to compreen der and entend er consumer behavior, a thorough soaking on motivation and customer preference to make an assertive purchase and satisfactory for both parts company / client.

Thus, this paper aims to achieve answers to the central issue of this study, which is how the Neuromarketing and psychology of colors are influencing n making purchasing decision?

Based on this , the article seeks to explain the power of neuromarketing, to understand the logic of consumption, and why color psychology is intrinsically interconnected in the consumer's perception. However, it should be noted that the study of neuromarketing, however recent, deserves to be studied and debated in universities and companies regardless of its segment, as it tends to limit new lines of research and business tools, being fundamental for professionals marketing and / or managers, since it focuses on helping the segment to finalize an assertive negotiation for both parties.

The study has the general objective, i dentificar the influence of N Euromarketing and psychology of colors in consumer behavior, and specific objectives introduce the concept of neuromarketing, and xpor the perception of the psychology of influence of colors and diagnose the effect of neuromarketing consumer behavior through the use of colors. Referring to textual organization of that work, and ncontra is not the first to ing the concept of neuromarketing and their respective technical definitions and exhibitions bringing the use of the same in the second under the light of the thought of some authors sought -If hold a brief understanding about the psychology of colors, in the third, a conversation was held between the authors to better understand consumer behavior through neuromarketing strategies and the psychology of colors. After the mentioned sections, the work describes the methodological path adopted for this study, leaving the experience report with the Focus Group in a playful way .

II. THEORETICAL FOUNDATION

2.1 NEUROMARKETING: CONCEPT AND TECHNIQUES.

According Kottier (2014), the neuromarketing is the central idea of the brain mechanism study, to accurately grasp the pulse behavior of a consumer, eager to develop new marketing strategies, best applicable to the market.

Like Matos (2018), on euromarketing is done by the association of marketing and neuroscience [3], in perspective enables r marketers with information assertions about the customers. Still according to the aforementioned author, neuromarketing techniques are simple and easily replicable forms that allow for coherent and highly economical decision making, which otherwise the methods would not be viable. Redivo and Gouveia (2018), emphasize that Neuromarketing is an extremely contemporary subject for the academic and business world, which started at Harvard University in the late 90s, based on neuroscience and neuroeconomics[4], seeking to support the discoveries of preferences and motivations of potential consumers and impotences of a determined market segment.

Vidigal Filho (2018) , stresses that Neuromarketing, even though it is a recent tool for business managers , it tends to grow immensely in the organizational environment, bringing several benefits to the company / customer relationship so troubled in sales negotiations. It is observed that neuromarketing has blossomed with the useful need to understand in depth not only what the consumer says, but also what he can measure positively about the company's brand .

Given that the famous search s commercial satisfaction, often fail to measure real and objective data on the actual consumer opinion , organizations are seeking explores r increasingly communicating with the subconscious of individuals in the use of techniques in neuromarketing

For Silva (2018), there are some techniques necessary to enable a better understanding of the human brain, in order to understand the decision process studied by neuromarketing.

| Técnica | Sigla | Medida |
|---|-------|---|
| Imageamento por Ressonância Magnétca Funcional | fRMI | Nível de oxigenação de sangue no cérebro |
| Tomografia por Emissão de Positrons | PET | Utiliza substâncias para rastreio das funções do organismos |
| Eletroencefalograma | EEG | Atividade elétrica |
| Magnetoencefalografia | MEG | Campo Magnético |
| Rastreador Ocular (Eye Tracking) | | Foco no olhar |

Fig.1 - More traditional methods and techniques in neuromarketing

Source: Silva (2018).

For the author, the functional magnetic resonance technique is the most common technique for scanning the human brain in neuromarketing. Thus, the functional magnetic resonance imaging has become a technique in which use is made of magnetic waves and radio to create high-quality brain imaging , which enable a better understanding of the actions taken by individuals .

In the view of Ferreira (2018), The neuromarketing fills gaps of tax methods are the traditional marketing,

bringing in context factors that may influence the behavior and the customer's perspective. So you can not otar that neuromarketing as well as seeking to know the customer, he understands that it is essential to seek and ntender what consumers feel m, which are mares pains and fears, what you s drives m to buy a product / service, but also what they feel m to invest your money, always seeking to balance the sense of win-win in the relationship business and customer.

Monge (2017), defends the position that society has been going through a process of cognitive changes, which directly affects its values, behaviors, perspectives and emotions, leaving a "gap" for companies to reach society with the power of persuasion applied by neuromarketing, increasing the possibilities of organizations to make more assertive negotiations, in order to reinforce the customers' consumption decision.

According to Silva (2018), neuromarketing has strategies that can create a desire to buy in people, directly influencing their power to decide whether or not to buy a product or service in a given organization, yet according to the author, such strategies are associated with human senses, with in order to influence the subjects to make certain choices.

And ompanies are of appropriating targeted strategies to reach your target audience uses n of neuromarketing, using in their campaigns advertising actions of emotional appeal, working intensificamente with colors, sounds and smells, as well as with subliminal messages, in order to attract and maintain the emotional bond with customers.

Authors such as Vidigal Filho (2018) and Ferreira (2018), r eforçam the neu romarketing is an analysis tool that brings support for managers identify the desires and customer consumption motivations, through your feelings and sensations produced by unconscious, raising the sales potential by companies in order to bring more efficiency and effectiveness in the negotiation process.

It should be noted that the consumer is more active and selective when deciding where to buy, whether for products or services. The bserva up with it the evolution of the decision-making power to buy the client, on the other hand the companies are in the process of empowerment strategies and methods to reach these consumers, some methods was m unthinkable by managers there years ago.

Neuromarketing has entered the business processes to strengthen the company / customer bonds, worn out in the once win-lose relationship, where the customer leaves with the feeling of loss when closing a deal. Thus, neuromarketing seeks to understand the desires of the human mind in order to directly reach the consumer's desire, need and longing, to undo the win-lose feeling and transform it into win-win.

2 .2 PSYCHOLOGY OF COLOR: A BRIEF UNDERSTANDING

Denotes is that the communication means will are going through a time where Happens transformations in quickly, so , it is possible to note that consumers are increasingly concerned with the developed advertising and advertising by organizations, many times using the colors to influence your target audience to consume your product / service.

This perception VE is that the colors used so harmoni the a can be a tool for high performance for such strategies . According to Figueirêdo (2016), 84.7% of consumers find colors more important than other factors when choosing a certain product, yet according to him 93% of consumers observe the visual aspect to choose a product, as well as 60% acceptance or rejection of a product / service is directly interconnected with colors.

The fact is that color is present in all marketing strategies. D this way is up to the professional marketing understand the psychology of colors to create a direct relationship with the audience Often target. these professionals use m such resources in advertising campaigns understand that any failure in the choice of color can put all your strategy to lose.

According to Faganello (2015) , Barbosa and Bazzani (2015), the human being since his childhood is already taught to differentiate colors, becoming something so natural that the preference for colors is in the subconscious of each person , both authors reinforce that color studies come from antiquity, but the most relevant discoveries for communication and marketing are new. Ma s , to understand with the color affect the subconscious of the human being, it is necessary one to profundamento in psychology.

The colors develop a very important role in the visual assessment of the customer, one time that it plays an influence on consumer decision-making, and so can awaken different sensations and effects both under psychological as FisioLogic the individuals (M OTA, 2016).

As Oliveira (2016), the psychology of c ores has a key role in the and ntendimento the meaning of these, and how cad color can be used to mod the the Bailout to increase sales, whether in physical stores or *e-commerce*, thus the psychology of colors contributes to influence the decisions of potential customers.

According to Nunes (2016), the psychological studies n the color is a sensory reality in which does not go unnoticed , with no possibility of escape these realities imposed s the psychology of colors, in which will work the emotional part of people can agree on a compulsive desire for involvement produced by colors. F ica observed that it is an involvement complex the , conditional on s influences suffered by the culture and pel the condition of psychological individuality of each individual , always accompanied by a function unconscious and

suggestive by which s color s present the key access to the individual's subconscious.

To Zylberglejd (2017) , the Psychology of Color refers to a state d the human brain in an attempt to identify the transfor Mac s, sensations and feelings through them , this study aims to understand persuasion because of the colors, and how feelings and emotions are directly involved in their perception by individuals . The connection of colors with feelings is not by chance, they are strategies developed to develop a deep emotional relationship between product and consumer.



Fig.2 - Psychology of Colors, sensation emitted by colors.

Source: Adapted from Pereira Junior et al, 2016.

Thiel (2018), confirms the ideals too, when he says that the psychology of colors is the science that seeks to understand how the colors can cause interference in human behavior, since the human brain is programmed to develop the same or similar functions as consuming, process and digest visual information more quickly. The author reinforces that colors, worked in a harmonious way, can boost emotions.

To Cavazana (2018), the s colors always will play sensations harsh on people, varying from person to person

both in relation to the s senses Psychology cos as visual. Thus, when talking about color psychology it sums intrinsically to explain r and interprets r the effect on each individual, however the preferred p these apparent colors to be something relative, it is noted involvement psychological on the preference of a color or another, since each human being understands the stimuli of the outside world through their experiences.

The psychology of colors within the language of developing strategies to increase sales, is therefore a vehicle of communication that companies have with their customers and is increasingly becoming a high performance tool and of fundamental relevance to outline strategies and create psychological and emotional bonds with your consumers.

2.3 CONSUMER BEHAVIOR THROUGH NEUROMARKETING AND COLOR PSYCHOLOGY

In the view of Oliveira et al (2019), To enter into the merit of understanding consumer purchasing activities, it is of fundamental importance to seek to identify and understand the true stimulus factors that drive the individual's purchasing behavior, given that certain stimuli they can have a positive or negative impact on the customer's view of the product and / or service, so this factor can influence the decision-making process.

According to Crespo (2018), retain the understanding of consumer behavior is to understand how customers are consuming ing and researching the products and services offered by a particular company, such knowledge is fundamental and crucial to keep the organization alive in the market, this behavior influences the purchase decision. C up-ompreende , that the behavior of people are understanding s that will induce methods and procedures to assist the consumer's path in the buying process.

According to Soares (2018), the mere way of changing the production process and transforming it into a broader experience for the consumer , totally demystified from the central idea of only trying to supply the consumer's need, becomes an extremely strong point for the development of sales in the view of consumers , even often using emotions to enable a greater range of wishes to be fulfilled.

It is observed that colors can be a very useful tool in the neuromarketing process to help create an emotional bond with the consumer, since colors have been part of people 's lives since their childhood.

Colors are present are in human life on several occasions, given that the first stimulus brain occurs by

sight. In this perspective, colors are very important basic communication tools for companies, since customers stop buying products because they are unable to please their visual presentation. (FAGANELLO, BARBOSA and BAZZANI, 2015).

According Crespo (2018), the color in its pure and real essence, goes far beyond a simple optical phenomenon, since the colors have a specific personal meaning, and has an impact on the individual intimately and variable from person to person the caused sensations . In this perspective, color psychology is essential in neuromarketing, since it seeks to explain how the consumer will behave in the face of that proposed color , this is due to chromatic stimuli, which may reflect on sales.

Soares (2018), reiterates that in the case n Euromarketing, is essential to understand the psychology of colors, since the operation right influ and INSTANCE thinking and behavior of consumers, so that the brain human has the ability to understand and comprehend the colors and their shades. However, it is crucial to know how to interconnect the meaning of colors and the sensations transmitted by each one of them, because only then will it be possible to make a favorable bridge to reach the consumer.

In Silva's view (2018), the most relevant advantage of neuromarketing is clearly the ability certain information to find that was hidden in the customers' minds . The author stresses that the effects of neuromarketing to organizations and society are vital to growth of an engagement relationship the and that this relationship takes trust. once an engagement potential purchase, which directly involves taking decision. Such possibilities proposal s by neuromarketing can cover results ever achieved with the use of traditional marketing.

III. METHODOLOGY

The methodology adopted in the present work is characterized by bibliographic , survey and ethnographic research . The literature review aimed to verify the literary review s in articles, books, websites and periodicals, so that f pray selected studies published in the database bases *Scientific Electronic Library* Online (SciELO) and G oogle Academic within 10 / 0 8/2019 30 / 11/2019, with inclusion criteria at the time , fo ram articles studied from 2014 to 2019 for developing the theoretical framework.

P ara Medeiros (2019), the survey research is a type of research that takes place with the data retention order or

information about characteristics or opinions of a group, being selected as a representative of a population. The study is of a basic nature, and the approach adopted was qualitative, the classification regarding the objectives of the research is to be descriptive , according to Mezzaroba and Monteiro (2017), the descriptive research does not suggest explanations, it describes in a simple and simple way reliable phenomena as the researcher notes, however, this does not imply that the data is not interpreted.

To obtain primary data collection was used the *focus group* (focus group). Vergara (2004), believes that the focus groups are of a qualitative research technique based on group interviews, which is based essence l, the involvement of individuals in collective group, seeking to answer relevant aspects of certain phenomenon, so generate meaningful data to support a research.

As collecting secondary data, i nstrument used to survey the socio - demographic data constituted an objective

questionnaire, where the response parameter obeyed the scale Likert , being one of the most used to reach the information. According to Silva (201 0), it is a low-cost technique, since it presents the same questions to everyone involved, guarantees the confidentiality of the interviewee and may contain questions to answer the exclusive purpose of the research.

As for the tabulation process of the sociodemographic questionnaire, it was done using the Microsoft Excel program, version 2010 and the data were analyzed using a relative frequency distribution.

As for the sampling process, non- probabilistic or intentional sampling took place in compatibility with the research objectives , whose inclusion criteria were defined by the researcher (Table 01) , where the recruitment of volunteers was through successive indications of people belonging to the target population of the study.

| Criteria recruitment d oa volunteers | | | | | | |
|---|-------------------------------|---|------------------------------------|--|--|--|
| Graduate Student in Business Administration | Marketing Graduate Student | Professionals working in the marketing area | Managers without academic training | Managers with academic backgrounds | | |
| Titles | | | | | | |
| Student 01 | Post Graduating 01 | Professional 01 | Manager without graduation 01 | Graduated Manager 01 | | |
| Student 02 | Graduate Student 02 | Professional 02 | Manager without graduation 02 | Graduated Manager 02 | | |

Table 1 - Inclusion criteria of the research subjects

Source: Research Data (2019).

For <u>authentication</u>, <u>legalization</u> and comparison of data collected within the focus group, it was decided to effecting two meeting s to be able to create an interaction Aute semantics and true the resulting collected using the me s hands criteria, but with different individuals, creating so a method called one by one, to look up a broader reading of the data collected, but also bring greater veracity to the result and more likely to achieve the objective s proposed s.

In order to promote the reliability of the study, as the field research, was contacted the s volunteers for esclarec ent on the study, with their consent s, then there was the realization of the research, after it was clarified the statement of objectives, and request signature in the Informed Consent Form - TCLE. For this was guaranteed to researched complete confidentiality regarding the information obtained without the influence of the researcher and easily and quickly, considering all the ethical and legal aspects, mainly in and the established in resolution 510 /201 6 of the National Health Council (CNS), which govern research involving human beings.

3.1 DESCRIPTION OF THE STRUCTURE OF THE FOCUS GROUP

In addition to having a previously structured script, the researcher adopted some preparatory measures that worked satisfactorily to enable the outcome of the focus groups. For the development of the focus groups, the researcher chose a moderator to conduct the questions and dynamics, who did not outline his opinion on the questions, but transformed the environment into a reliable and safe space for the volunteers to feel free to report what in fact, he was thinking about that question, a co-moderator , to replace the first in his absence or to serve as a support if necessary. A person was also invited to support the audio recording equipment, with the prior authorization of the volunteers.

The First focus group (FG) took place on December 11, 2019 Cidade de Icó - CE, with 10 volunteers for the research. According to the authors Mendonça and Gomes (2017), a large number of participants can hinder the effective participation of all components, so it suggests an amount of 6 (six) to 15 (fifteen) people for each meeting. In both FGs , sought -If heterogeneity among invited to participate, as a feature based there to better match the purpose small website of the research in question.

There were three FGs with different volunteers, the first of which was only used as a pilot group, which provided a reference for the others, thus allowing the researcher to check the script, the devices used and the best application of the dynamics, as well as the delimitation of the answer time for each question, the volunteers of this referred FG, became aware of the test.

For all meetings, the same technical procedures were adopted for the script, using Gui's (2003) script as the basis for a focus group on applied qualitative research: intersubjectivity and construction of meaning, adapted by the researcher (2019).

Just start the group with everyone present;

The moderator initiates the FG, leaving the environment safe and reliable;

Thanks for everyone's participation;

Obtain the authorization to carry out the process of recording the audio, deixan of course the same is not serião cited at work, where the identity of all would be maintained in secrecy, the recordings only serve as the basis to transcribe the results by the researcher, and that after such a description of the data, the audios would be deleted;

Information that after completing the work, the researcher would be available to present the results obtained;

Both were aware that they were chosen for convenience, meeting the inclusion criteria of the research;

Before the questions, there was a dynamic where chocolates wrapped in primary colors were made available on a table : red, blue, yellow and secondary : orange, green and violet, in order to understand the preferences of the colors in a non-inductive way, where they pretended he was m buying the s chocolates, being knowledgeable that the taste would be the same;

Discussion of questions moderated by the moderator without intervening in his opinion, remaining neutral;

Explanation of Objectives with the focus group.

IV. THE EXPERIENCE WITH THE FOCAL GROUP : RESULTS AND ANALYSIS



Table.2 - Social indicators of volunteers

Table01exposethesocialindicatorsofrespondents,wherethebserva

is one heterogeneity among volun addressees in that focus group, in relation sexual gender 60% of those involved were

Source: Research Data (2019)
men and 40% women ranging from 18 to 41 years most prevalent between 26 and 33 years.

To start the activities of the focus group, the volunteers were directed to a table containing 60 (sixty) chocolates packed with pa peis of primary colors and secun would you give the same s simulated s purchase s, aware that everyone had m flavors equal, being that, each one could buy up to two candies according to his will, it would not be allowed more, buying only one unit.

It was noted that the volunteers tried to simulate the purchase of chocolates by the colors of the mentioned packages, each participant had the possibility to buy 2 (two) chocolates, it was seen that 6 (six) participants took the 2 (two) chocolates of the same color, 3 (three) participants of different colors, and 1 (one) was undecided because there was no longer the color he wanted, so the participant chose only one candy.

This situation called the attention of the group, since understanding and understanding the stimulus and impulse of purchases are part of studies in neuromarketing, however, according to Soares (20 18), the psychology of colors needs to be interconnected with neuromarketing in order to reach the consumer, explains Cavazana (2018), the color develops different sensations and emotions from person to person, however the preference s by the apparent colors m be something related to the same to influence the decision-making process of buying.

It was observed that the dynamics of opening had a fundamental importance in two aspects, first it helped to break the ice of the group and leave the volunteers at ease, since they are not part of the same circles of friendships and proximity. According served as the impetus for the first question of the GF, as well as the simulation helped volunteers indirectly making calls the color preferences with the pulse s needs to buy goods and services being persuaded by the colors.

It was noticed that the volunteers simulated the purchases of chocolates selectively, trying to choose the same s by the colors of the packages, such actions were noticeable when they were at the chocolates table, as well as in their speeches in the first question, one of the volunteers stressed in his speech:

> "When everything about the meeting was explained and that we needed to go to a table that was on the side of the room, imagining that the chocolates were being sold, since they were all of the same flavor, only the color of the packaging changed, I was desperate because that boy had already taken two of the red color, think that there

was no more in the red color ". (Woman, profession al 01, 27 years old).

After all the opening ritual of the Focal Group, the moderator asked: Does this particular color of the chocolate packaging that you bought influence you at the moment that you are buying a product / service?

"Yes, when I'm going to buy mainly clothes, I always look for pieces that have yellow details, I don't really understand why, but it brings me peace, I feel good, a little crazy, right? (laughs). " (Woman, manager without graduation 02, 38 years old)

"Most of the time, yes, because I think the color red wears well, but the funniest thing I like to buy kitchen products and utilities in this color, even more than clothes, the vast majority of the pots at home are red, even the handles of the spoons are (laugh) let me show you a picture. [...] in short, without a doubt, the colors influence when I'm at the store and I see something, I'm automatically there to pass the card "(Woman, professional al 01, 27 years old).

"No, I am not a fan of primary or secondary colors, but I believe that colors directly influence, I simulated the purchase of chocolates without interference in colors, but I believe in what has already been debated that almost 90% are impelled to realize or acquire a good or services due to the impact of colors ". (Male, manager with graduation 02, 41 years old).

"I believe too, used an Internet service provider that always called the color of the logo it the slowness of it, to and then started to use the BrisaNet by think r the half color orange juice conveyed me more strength and power, do not know where I took this, even because I searched on google about the color orange and it totally goes against what I think, but for more than 5 years using this company service and whenever I see that orange logo I feel good about paying for the service ". (Man, student 01, 30 years old)

By the statements, denoted the power of persuasion that colors can cause us consumers, is in line psychology of colors and the neuromarketing as tools able to create and develop assertive strategies for attracting new customers and closing sales.

According to Matos (2018), Neuromarketing presents itself in the form of contributing to the professionals of the area regarding the decision-making process of consumers, seeking to understand their preferences and desires, in a simple way, so that traditional marketing would not be able to reach .

[...] "It becomes easier to pay for a product when, in addition to supposing a need, it brings a sense of familiarity due to its color, my dream has always been to have a yellow room, very yellow, but society has put in my parents' mind that yellow, it would not be an ideal color to put in a boys room (laughs), like when I live I will only buy buckets of yellow paints and various yellow objects, I will have the purchasing power in my hands ". (Male, student 02, 19 years old)

It was possible to identify that in a select group the vast majority make direct connections with colors, being influenced by Neuromarketing techniques, so once understanding the preferences of colors and how to apply correctly, managers and professionals in the field of marketing can m achieve greater results in sales of services and products offered.

Thus it is noticeable that some consumers determined their choices being driven by colors, which the author Figueirêdo (2016), reaffirms in his research, where 84.7% of consumers find colors more important than other factors when choosing a certain product.

It was clear that the volunteers were engaged and participating in the development of the debate, even with such heterogeneity in the choice of participants in 15 minutes of conversation, the environment became familiar to everyone, so that the space became safe to walk through the other questions.

In the following question, two responses caught the attention of the focus group, when asked: Do the colors contain any sensation, feeling, memory ?

"I particularly have a terrible feeling with the blue color, because when I was a child I witnessed a murder of a lady, where she was sitting on a sidewalk leaning against an all blue wall, then a man on a motorcycle arrived and fired 2 shots at her, the wall was with traces of blood, so when I see the blue color on walls and clothes always Freely me to this situation, give just creating resistance to blue. (Male, manager without graduation 01, 33 years old)

"I was here thinking about the power that colors have over people, I have a strong memory of my childhood about the colors that came to me, I had a green sheet, that very sweet and clear green, it helped me to sleeping, I loved that color, it brought peace and comfort to my nights, I went to study abroad and ended up leaving him at my mom's house . Some time passed by I got married and all my bed sheets I bought light green, something led me to buy that color, and at the time I didn't even remember this situation that happened to me in childhood , it seemed that it was in my sub conscious ". (Woman, Graduate 02, 35 years old)

Analyzing the two responses, a peculiarity was found in the justifications, the two volunteers expressed feelings and sensations arising from things that happened many years ago, even from their childhood, emotions that helped or hinder the purchase decision process, because they are emotions of comfort and rejection that were created by the colors in question.

Both responses , the demonstrates m that some people bring the preferences and rejections by certain colors since his childhood , as they get in your sub conscious, being used as mental triggers in time to make a purchase .

Such results found corroborates m with s thought s authors Faganello, Barbosa and Bazzani (2015), when they say that the colors are present s in people's lives since his childhood, thus contributing to their preferences regarding color, according to the authors, in order to understand better with colors, they began to influence people since their childhood, making it necessary to study more deeply within the psychology of colors.

> "Colors change feelings, sometimes I believe that it can even manipulate people's mood". (Male, student02, 19 years old)

> "This is so incredible, that when I see anything pink, I automatically remember my sister who loves that color. I was recently in Belo Horizonte, and I spent more than R \$ 2,000.00 (two thousand) only on bullshit , because I found a store that sold many pink things and was stronger than me ". (Woman, Graduate 02, 35 years old)

> "I have a very funny memory, my first girlfriend broke up with me in a green shirt, you believe that I have nothing green. I ended up creating a feeling of rejection ". (Male, graduated manager 02, 41 years old)

The moderator took up the attention of the focus group and questioned: In a hypothetical situation, see you people come out to buy a piece of clothing in a particular store, arriving there, the color of the piece that you like is more car to about 30%, you would make the purchase ? "Look, I would buy without a doubt, I've been in a similar situation but the item in question was a motorcycle, I paid a little more but the feeling of accomplishment was stronger, we feel good, the boy explained to me that he was more expensive, I don't remember at the moment, more I paid, and the happiness was so great that I took two friends to the store later ". (Male, professional 02, 31 years old).

"Only 30%? I would pay even more, people here talking about the influences of colors, the thought came to me several times that I stopped buying certain things because it was not the color I identify with ". (Male, manager with graduation 01, 26 years).

Consumers are willing to pay more expensive for products the s which are identified, and the price does not become a key factor in the decision of consumers , thus being able to win such customers with strategies involving the psychology of colors.

> "I am considered a cow hand person, more of this situation I would know why? If it is not in the color that I like, I would not wear it, so it would end up being more expensive. " (Woman, Graduate 01, 29 years old).

> "I believe that we created an identity with colors from a very early age, this makes people not think twice about closing a purchase, when they find something in the color they like". (Woman, professional 01, 27 years old).

For Monge (2017), the positioning of society has changed, with that the perspective of the cognitive scope is now different, the behavior and emotions became more evident, which left gaps for companies to reach these people, in order to reinforce the consumption decision.

Continuing the discussion with a group, they were faced with the last question: V oc onth can identify the marketing activities used by companies to focus on attracting customers and sell products / services by the colors?

"I can identify in companies large sizes , but understand how difficult it is to make this miracle in small businesses , as we used to do marketing, very traditional and very high costs, such as pamphlets and banners, more always using only the color standards any company that is on the rise at the moment, I never stopped to think about asking customers' market research the question do you feel good about which colors? Or which color you like best, so you would have tools to do virtual actions too [...] "(Male, professional 02, 31 years old).

"I'm in the last year of college, I've been through all the marketing courses, I honestly can't identify it, something so simple that it's not available in the academic environment yet, as the guy said, we understand a lot of the traditional that maybe not so much effects". (Man, student 01, 30 years old)

"I do, I always analyze this mainly when I'm at the mall and I see several stores with strategies for garments with similar colors, I don't know if there was any research in this field, but I think it's a marketing action using the colors as a contribution". (Woman, Graduate 01, 29 years old)

"Sometimes, yes, in advertisements, I will use this now in my work and seek more knowledge of techniques and applications, as I was often caught in this without knowing it. I never answered a marketing survey that talked about colors, always trying to lock our profiles by age, sex and salaries ". (Woman, profession al 01, 27 years old).

"No, I think that in the bigger picture the focus is on price, but it's something to think about urgently, so I noticed here everyone has an affinity for something for different reasons, so this can help us sell more, and let customers more satisfied." (Male, manager with graduation 01, 26 years).

"[...] More honestly no, we are dragged to do as disclosures have always been done and we don't understand why sales have been dropping for some years, maybe doing simple actions like these can help us understand and understand our customers, not the fault and the crisis, our fault for living in a box ". (Male, manager without graduation 01, 33 years old).

Strategic actions using the colors , according to the speech s seems to be something still far from the reality of some professionals and like - minded people d the area , however it is understood that neuromarketing is still something very new, especially when used together with the psychology of colors, they are visible and replicable strategies for organizations, measuring their reach and impacts on consumers.

Thus for Silva (2018) , one of the most apparent advantages of neuromarketing and finding certain

information, which are intrinsically in the minds of consumers, so that organizations can act in reliable actions and which provides a win-win sensation.

This line of understanding the responses of volunteers, the psychology of colors can enter as a language understanding of the senses and can be used by professionals as Weird atégias to increase sales, and also as a way to improve the communication that the hyd sas has with consumers.

V. FINAL CONSIDERATIONS

We tried to measure the use of the focus group in the scope of a qualitative research , to answer the problematic proposed by the present work . As a result, the experience with the focus group was extremely rich to reach the general objective , in this way it became noticeable how on euromarketing and the psychology of colors applied in an associated way can influence the decision-making process of consumers.

Such influence is given by the factor that the colors emit sensations, emotions and feelings in consumers who leave prone to con vanish products and services, much sometimes without even taking into account their monetary value, on the other hand, the n Euromarketing measures and evaluates the impulses that strategic marketing used s with subsidies d psychology d colors can affect consumers, since understood that each individual responds differently by the sensations of colors.

With analysis s of the experimental results with focus it was possible to groups understand why, the individuals carry with them some prefer is TRENDS colors, which can in fluenciar in the buying process or "boycotting" the p lanos consuming any product. Such preferences are intrinsically intertwined with situations, emotions and feelings inferred from childhood, situations that often remain as mental triggers in your subconscious, which influence or bar the consumer in the decision-making process.

This research provided understanding the large possibilities that companies have to earn a dialogue directly with their customers and consumers power i s a more interactive and dynamic way, can operate in their research markets and marketing research with requirements basic, as their color preferences. But he was ní had in the interviewees one bit of knowledge about neuromarketing themes and color psychology.

According to Vidigal Filho (2018), the most recent neuromarketing is already used in several organizations, an

example of which is the Colombian advertising company Z + carried out an advertising campaign in 2010, for the Avianca airline using the ne uromarketing techniques to achieve your goals.

Also according to the author mentioned above, the Coca-Cola company is also one of many known for the use of actions with footprints of neuromarketing *insights*. Appropriating neuromarketing strategies and the psychology of colors, he has stupendously strengthened his brand as well as associating the color red directly with his company, making the color red in the perception of consumers the key point and for the organization to communicate with consumers.

Thus, it is hoped that future research in this area will seek to understand what the causes and effects of such actions and strategies can directly have on the consumers' brains, and whether these actions can harm the future perception that consumers have about these organizations. It is suggested for future research, measure the ethical uses of s within the neuromarketing actions as c onvém warn, however, the need for professionals to keep re m ethics and the code of conduct in the developed actions.

It is recommended for the professional marketing area include in their market research questions such as preferences for colors, and seek ownership of new till techniques and tools available for the development of ACA, trying to leave estratégi traditional currently no longer arises m both in effect and in the past, as consumers' perceptions have changed, gradually boosting the need to think outside the box.

The focus group as a funding instrument data and information for this survey was proficient, however, it requires taking some precautions need s as the number of people involved, since it can lead to a dispersion of the volunteers and the answers become biased repetition by influences of the first to respond on.

The time for the questions to be discussed and the general time spent in the group were fundamental to keep the participants engaged in the process, another crucial factor was the number of questions and the clarity of the questions, the large number of questions and the complexity can cause research feasibility, direct and objective questions are advised only so that the answers will flow naturally.

Considers was found that this research has helped to increase the knowledge of a subject that is in constant growth and adaptation in the market, it is understood that the use of neuromarketing and psychology of colors can still far from reality in some small businesses, but with the technological advancement and the vast dissemination of knowledge, in a short time, both will be present and accessible to any companies. It emphasizes the importance of managers and professionals to seek more knowledge and information on new market trends .

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Use of Assistance Protocols for the Screening of Diabetic Neuropathy in Primary Care: An Integrative Review

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Abstract— The objective was to conduct a survey on scientific evidence regarding the screening for diabetic neuropathy and the use of care protocols in the period from 2015 to 2018. It is an integrative review, with a search for articles in the LILACS, SCIELO, BDENF and databases MEDLINE. Twelve articles were selected, from 2015 to 2018, analyzed using Strauss and Corbin and the IRaMuTeQ software. The largest number of publications occurred in 2017, with 9 (75%) on MEDLINE, all publications (100%) are quantitative in nature, there was a predominance of 9 articles (75%) with Level of Evidence 4. The majority, 11 (91.6%) highlighted the importance of the effectiveness of the association of sociodemographic data and lifestyle, neurological tests and the use of questionnaires. In the Word Cloud, the three most cited words were Peripheral (64), Diabetic (45) and Neuropathic (43). The most cited tests were Monofilament (8) and Tuning Fork (3) and the type of evaluation was the Michigan Neuropathy Screening Instrument MNSI (7). Four categories were identified, namely: "Important risk factors in the screening for Diabetic Neuropathy (DN)"; "ND and associated factors"; "Prevention of diabetic foot" and "Application of MNSI for screening of DN and evaluation of muscle strength for degree of impairment of DN". It is concluded that there is an approach on the forms of neuropathic screening, however the presence of assistance protocols was not identified, which would aim to facilitate this screening. It is hoped that this study can contribute to the formulation of care protocols for the screening of DN. Keywords—. Diabetic Neuropathy, LILACS, SCIELO, BDENF, databases MEDLINE.

I. INTRODUCTION

Diabetes Mellitus (DM) is a chronic pathology of multiple etiology, due to the absence and / or inability of insulin to perform its functions properly, generating chronic hyperglycemia, often accompanied by dyslipidemia, arterial hypertension and endothelial dysfunction^[1].

According to data from the International Diabetes Federation (IDF) in the year 2017, Brazil was in the 4th position among the countries that contained a greater number of people in the age group between 20 and 79 years with DM, about 12.5 million, behind only from China, India and the United States. A projection of 20.3 million is expected for 2045^[2].

DM can develop complications when untreated and tracked from the beginning of its evolution due to persistent hyperglycemia ^[3]. Among these complications, diabetic neuropathy (NP) stands out, considered a more prevalent microvascular complication, since at least half of

individuals with DM will develop this neuropathy in some circumstances of their clinical evolution. Therefore, more attention is needed for measures to avoid this condition^[4].

To avoid diabetic complications, it is essential that nurses encourage and assist the person in the development of their care plan and periodically monitor these individuals, guiding them on care with glycemic control, eating habits, physical exercise and, especially, greater attention to the feet, in order to evaluate them, so that they exercise effective self-care, in addition to giving general guidelines on hygiene care, proper footwear and nail cutting, and indication for the treatment of wounds^[5].

Early screening and follow-up after the diagnosis of the diabetic patient is essential, since comprehensive and longitudinal care are some of the pillars of primary care. Supporting and encouraging Changes in Lifestyle, in addition to glycemic control, are part of the treatment and prevent or present complications of DM^[6]. In this context, the presence of protocols, known as guides that outline

detailed actions and help to arrive at a diagnosis and appropriate interventions, considered fundamental in the assistance, is essential^[7].

Given this scenario, the objective of this study was to conduct a survey of scientific evidence on the screening of diabetic neuropathy and the use of assistance protocols in the period from 2015 to 2018.

II. METHODOLOGY

It is a descriptive study, of the type Integrative Literature Review (RIL), considered a method composed of phases, developed according to the purposes of Evidence-Based Practice (EBP) that is configured as a standard of research excellence promoting expressive contributions for science and clinical practice^[8]. Described in 6 stages of the RIL^[9], namely: Elaboration of the guiding question, sampling in the literature, data collection procedure, critical analysis of the included studies and discussion of the results.

The following guiding question was chosen: What is the scientific evidence on screening tests for diabetic neuropathy and what can be applied in primary care? In the selection of articles, the inclusion criteria were: original articles, in Portuguese, Spanish or English, available in full, that brought a partial and / or full approach to the guiding questions, published in the time frame between 2015 and 2018. The Latin American and Caribbean Health Sciences (LILACS), Scientific Electronic Library Online (SCIELO), Nursing Database (BDENF) e a Medical Literature Analysis and Retrieval System Online (MEDLINE).

The search strategies were guided by the Health Sciences Descriptors^[10]. The selected terms were: Diabetic Neuropathies, Protocols and Nursing. They were crossed with each other and, based on the descriptor chosen as the main "Diabetic Neuropathies", productions were sought, using the Boolean "and" in the search for productions:

"Diabetic Neuropathies" AND "Protocols"; "Diabetic Neuropathies" AND "Nursing". Data collection was carried out from November 2019 to January 2020.

Data analysis was performed using the theory based on data by Strauss and Corbin^[11], considered to be qualitative, which allows the classification of the conceptual ordering, based on open and axial coding. In the open stage, the IRaMuTeQ *software* was used, the analysis of statistical choice being the Word Cloud and Descending Hierarchical Classification (CHD). IRaMuTeQ allows you to reveal different types of analysis; optimize data organization; in addition to providing maximum methodological rigor in the analysis process, generating more consistent data in the research ^[12].

In addition, we sought to classify articles according to levels of evidence (LE), in line with the classification of the Agency for Healthcare Research and Quality^[13] and in Hughes's perspective^[14], the classification of the studies are: LE1 corresponds to the meta-analysis of multiple controlled studies; the LE 2, individual studies with experimental design, that is, randomized. The LE 3 covers research with quasi-experimental design, such as studies without randomization, with pre and post-test groups, longitudinal studies or case control, the LE 4 corresponds to non-experimental studies, namely: correlational, qualitative descriptive or case studies. LE 5; Case reports or program evaluations and, finally, the LE 6 are studies that present the opinions of experts, respected in the area and information not based on research.

III. RESULTS

1.427 articles were found with the descriptors "Diabetic Neuropathies", "Diabetic Neuropathies" AND "Protocols and" Diabetic Neuropathies "AND" Nursing "in the years stipulated from 2015 to 2018, in the LILACS, SCIELO, BDENF AND MEDLINE databases, as viewed in table 1.

| Descriptors | LILACS | SCIELO | BDENF | MEDLINE | Total |
|--|--------|--------|-------|---------|-------|
| "Diabetic Neuropathies " | 35 | 14 | 6 | 1.344 | 1399 |
| "Diabetic Neuropathies " AND "Protocols"; | 0 | 0 | 0 | 5 | 5 |
| "Diabetic Neuropathies " AND "Nursing". | 6 | 2 | 4 | 11 | 23 |
| Total | 41 | 16 | 10 | 1360 | 1427 |

Board 1: Identification of descriptors and number of articles in the databases, 2019

Source: Prepared by the authors, 2020.

In total, 63 articles were pre-selected, which answered the research questions. Therefore, articles that did not meet

the inclusion criteria were excluded, adding the themes that were distant from the objectives of the present research, namely: publications related to neuropathic pain, animal studies and research on Diabetic Neuropathy that are not applicable in primary care. Thus, after screening the articles, a comprehensive study of the sample that comprised this review was carried out. At the end of this selection, the final sample consisted of 12 articles, being 1 (8.4%) from 2018, 8 (66.6%) from 2017, 2 (16.6%) from 2016 and 1 (8.4%) in 2015. Board 2 shows the title, author, year, journal, type of study, objectives, database and level of evidence.

| | Year | Kind of study | Objective |
|---|--|--|---|
| Order of Articles Title | Periodical Data base Level of evidence | | |
| 1 st - Assessment of the risk of ulceration in diabetic individuals. | 2018 ^[15] <i>Rev Bras Enferm</i> LILACS; SCIELO; BDENF LE 4 | As for nature: Observational, As for development over time: transversal. As for the Approach: Quantitative, classified in analytical | To identify risk factors for foot ulceration by screening for peripheral diabetic neuropathy and peripheral arterial disease in type I and II diabetic patients assisted in reference centers in the Federal District, Brazil. |
| 2 nd Prevalence and factors associated with peripheral neuropathy in individuals with diabetes mellitus | 2017 ^[16] J. res .: fundam. care. online BDENF LE 4 | As for nature: observational. As for development over time: transversal. As for the approach: quantitative, classified as analytical | To estimate the prevalence of polyneuropathy (PND) in type 2 diabetic individuals assisted at the Hiperdia Health Care Center, in Viçosa / MG and to identify factors associated with a positive diagnosis of PND through the score of neuropathic symptoms and sensitivity tests. |
| 3 rd Assessment of the degree of risk for diabetic foot in individuals with type 2 diabetes mellitus | 2017 ^[17] <i>Rev. Enfer. UFPE on</i> <i>line;</i> BDENF LE 4 | As for nature: observational. As for development over time: Transversal. Approach: Quantitative, classified as descriptive | To evaluate the characteristics of the feet, the degree of risk for diabetic foot and the presence of indicative of neuropathy in individuals with type 2 Diabetes Mellitus. |
| 4 th A comparison of screening tools for the early detection of peripheral neuropathy in adults with and without type 2 diabetes | 2017 ^[18] Journal of Diabetes Research MEDLINE LE 4 | As for nature: Observational study As for development over time: transversal. Approach: quantitative | Examine the efficacy of the 128 Hz tuning fork, two monofilaments and Norfolk's quality of life diabetic neuropathy (QOL-DN) as tools for the early detection of diabetic peripheral neuropathy (PND) in overweight, obesity and adult inactivity (OOI) or with pre-diabetes (PD) or type 2 diabetes (T2D). |
| 5 th Screening tests for symmetrical distal polyneuropathy in Latin America patients with type 2 diabetes mellitus | 2017 ^[19] Arch EndocrinolMetab. MEDLINE LE 4 | As for nature: observational. As for development over time: transversal. Approach: quantitative | This cross-sectional study aimed to evaluate two bedside tests (Neuropad and VibraTip) as screening tools for distal symmetric polyneuropathy (DSPN) in Latin American patients with diabetes mellitus (T2D). |
| 6 th Control of grip strength and hand dexterity are impaired in individuals with diabetic peripheral neuropathy 7 th Prevalence and rick | 2017 ^[20] <i>Neuroscience Letters</i> MEDLINE LE 3 2017 ^[21] | As for the nature: case-control observational. As for development over time: transversal. Quantitative approach | The objectives of this study were to examine and compare GF control during a simple waiting task as well as GSMax and manual dexterity in individuals with TLD and healthy controls. |

Board. 2: Identification of articles in evidence.

| factors for diabetic peripheral neuropathy in young people with type 1 and type 2 Diabetes: RESEARCH for diabetes in the youth study | <i>Diabetes Care</i> MEDLINE LE 4 | for time: longitudinal and Prospective Cohort type. Approach: quantitative | factors for diabetic peripheral neuropathy (PND) in young people with type 1 diabetes (DM1) and type 2 diabetes (DM2) enrolled in the Youth Diabetes RESEARCH. |
|---|---|--|--|
| 8 th Cell phone- generated vibrations used to detect diabetic peripherals neuropathy | 2017 ^[22] <i>Foot and Ankle</i> <i>Surgery</i> MEDLINE LE 3 | As for the nature: case-control observational. Quantitative approach | This study seeks to assess whether vibrations generated from a cell phone can be used to track diabetic peripheral neuropathy patients. |
| 9 th The association between pulse wave velocity and peripheral neuropathy in patients with type 2 diabetes mellitus | 2017 ^[23] Journal of Diabetes and Its Complications MEDLINE LE 4 | Nature: observational; as for development over time: transversal. Quantitative approach | In this study, we examined the association between OPV and presence, as well as severity of DPN in individuals with DM2. |
| 10 th Cross-cultural adaptation to Brazilian Portuguese of the Michigan Neuropathy Screening Instrument: MNSI-Brazil | 2016 ^[24] <i>ArqNeuropsiquiatr</i> SCIELO MEDLINE LE 6 | Nature: observational; Development over time: transversal. Qualitative approach | Cross-culturally adapt the Michigan Neuropathy Screening Instrument (MNSI) to Brazilian Portuguese, verifying its reliability. |
| 11th Efficacy of clinical nerve alternatives Conduction Studies for Screening Distal Diabetes Symmetrical polyneuropathy: a multicenter study | 2016 [25] Diabetes Research and Clinical Practice MEDLINE LE 4 | Nature: observational, development in time: transversal; approach: quantitative | This study explored the possibility of developing an alternative, simple and rapid test for the screening of distal symmetric polyneuropathy (DSPN), for use in local primary care facilities. |
| 12 th Prevalence of neuropathy in type 2 diabetic patients and its association with other complications of diabetes: the Verona diabetic foot screening program | 2015 [26] Journal of Diabetes and Its Complications MEDLINE LE 4 | Nature: observational; Quantitative approach | To determine the prevalence and clinical variables associated with somatic neuropathy, using a simple screening method. |

Source: Prepared by the authors, 2020.

The largest number of publications occurred in 2017 with 8 (66.6%) and the most found database is MEDLINE with 9 (75%). The analyzed articles are distributed in 11 journals, only one journal presents more than one article in this study, the Journal of Diabetes and Its Complications 2 (16.67%). Regarding the methodological approach, all 12 (100%) are of a quantitative nature.

Regarding the classification (EL1 to EL6) of the quality of published articles, there was a predominance of levels of evidence: EL 6, 1 article (8.3%); El 4 articles, 9 (75%); and El 3, 2 articles (16.67%). Levels 1, 2 5 and 6 were not found in this research. The analysis of scientific publications included the approach of the following themes: neurological tests applied to screen for DN and description of sociodemographic data, life habits, neurological tests and questionnaires as sources of investigation of DN.

It was found that the majority, 11 (91.6%) publications (articles 1,2,3, 4,5,6,7, 9,10, 11 and 12), highlight the importance of the efficiency of the association of sociodemographic data and lifestyle habits, neurological tests and use of questionnaires. As for the initial data, the importance of collecting the following data was identified in the articles: gender, age, race, marital status, education, type of DM, year of DM diagnosis, presence of Systemic Arterial Hypertension, use of insulin, glycohemoglobin,

dyslipidemia, previous ulcer, obesity, smoking or alcoholism, anamnesis of the feet to identify the dry skin, calluses, edema, interdigital mycoses, cracks and loss of protective sensitivity. Among the neurological exams mentioned in the articles, the following stand out: thermal sensitivity; monofilaments, 128 hz tuning fork, Vibratip and Achilles reflex.

With regard to the assessment instruments, there are: the Neuropathic Symptom Score, Neuropathic Commitment Score, the Michigan Neuropathy Screening Instrument (MNSI) score and the Norfolk Quality of Life-Diabetic Neuropathy (QOL-DN) questionnaire, which associates decreased quality of life due to risk of neuropathy. Only 1 (8.64%) article (number 8) highlights only the use of neurological tests to identify neuropathy, namely: 10g Semmes-Weinstein monofilament, 128Hz tuning fork and a vibrating cell. For the analysis of the data collected in the RIL, the IRaMuTeQ *software* was used, which made it possible to establish a relationship between the linguistic context found in each research contained in the RIL sample and the representation of diabetic neuropathy in the context of health care its early identification and the importance of paying attention to this complication of Diabetes Mellitus.

The Word Cloud was used, as shown in figure 1, which allowed the identification of the most cited words in the studies, based on the combination of words according to their frequency. Thus, the most frequent words found were: Peripheral (64), Diabetic (45), Neuropathic (43), Motor (34), Sensory (34), Polyneuropathy (34). In relation to the most cited tests are: Monofilament (8) and Tuning fork (3) and in relation to the most frequent evaluations carried out is the Michigan Neuropathy Screening Instrument MNSI^[7].



Fig.1: Word cloud - Analysis of the Results of the Integrative Review.

Source: IRaMuTeQ, 2020.

The analysis of the linguistic context was also carried out using the descending hierarchical classification (DHC) method. Words were selected for their significant frequency and higher Chi-square values. The analyzed corpus of the research was composed of 12 initial context units (UCI) corresponding to the 12 results of each research analyzed in the RIL sample, which the program divided into 168 segments of elementary context units (UCE), which contained 1256 words or distinct forms that occurred 5673 times, followed by the number of slogans: 1036. Regarding the frequency in percentage of each class: class 4 (22.6%); class 3 (27.4%); class 2 (28.6%) and class 1 (21.4%).

The filogram, format from the Descending Hierarchical Classification (DHC) dendrogram, as shown in figure 2.



Fig.2: Descending Hierarchical Classification

Source: IRaMuTeQ, 2020.

The four classes proved to be stable, that is, composed of Elementary Context Units (ECU) with similar vocabulary. In class 4, the most representative words were: hand, test, grip, strength, reveal, result; and, to a lesser extent: obtain, use and minor. As for class 3, the most evident words were: man, symptom, foot and patient, followed by: MNSI, score, evaluate, report, clinical, sign, present, study. In this lexical focus group, two important points must be considered: the prevalence of patients in relation to the male sex and evaluation using the MSNI score.

Class 2 of the dendrogram revealed the following most expressed words: protector, diabetic, diabetes mellitus (DM), relationship, arterial, peripheral, pain, plant; followed by the least evident: ulcer and year.

Regarding class 1, the most frequent semantic range of words in the text was: young, DM 1; DM 2; Hba1c; disease and those that were less prominent: age, value, phase, level, plus, low, Area under the curve (ASC), LDL, different, data and associated. This result refers to the characteristics of the population in the studies and data that emit risk factors for diabetic neuropathy. Much of the research uses information on time and type of DM, associated diseases and glycated hemoglobin (HbA1c) values.

IV. DISCUSSION

In view of the results found in the Word Cloud, the most repeated word was "peripheral", the most cited test was the monofilament test and the most frequent instrument for evaluation was the Michigan Neuropathy Screening Instrument (MNSI). In this context, NP affects the components of the peripheral and autonomic nervous system, in which the pathophysiological process is configured, which can lead to ulceration and amputation of the lower limbs ^[27].

The monofilament test is considered essential for screening for DN. The Nylon Monofilament test is the gold standard for screening diabetic neuropathy, in addition to being a viable resource to be used in primary care because it is low cost^[28]. The isolated 10 g monofilament, although capable of indicating a decrease or absence of protective sensitivity, does not conclude the diagnosis of diabetic

neuropathy, which reveals the need for further tests for its screening^[29].

Among the multiple clinical instruments that can be used for screening for DN, includes the Michigan Neuropathy Screening Instrument (MNSI), as listed in this research. The MNSI consists of a questionnaire and physical examination, ranging from zero to thirteen. A score of eight or more characterizes the individual as a neuropath^{[30], [31]}. In a survey carried out to assess the presence of DN, through the MNSI and by the esthesiometry test, the presence of DN was identified in the majority of those evaluated. The use of the two instruments has a significant correlation^[31].

It is important to note that there are other screening tests, namely: the Neuropathy Disability Score (NDS), or also known as the Neuropathic Impairment Score, and Neuropathy Symptom Score (NSS), Neuropathic Symptoms Score. They serve to assess signs of neuropathy and the number of neurological symptoms presented by the patient, respectively. The first includes assessment of the Aquileu reflex and vibratory, painful and thermal sensitivities in both lower limbs, the second analyzes symptoms related to changes in sensitivity^[32].

As for the categorizations, from the analysis of the category 4 filogram, it is strongly marked by forms associated with the aspects and factors that lead to reflect on the consequences of diabetic peripheral neuropathy (PND) affecting the sensory function of the hands and dexterity^[33]. This study corroborates with research that states that, although the most serious consequences of NP are evident in the lower limbs, the hands are also affected by the loss of sensory information, since neuropathy is characterized by sensory and even motor deficits, therefore, it is possible for diabetics to show problems in performing manipulative tasks^[34].

As for category 3, two important points must be considered: the prevalence of patients in relation to the male gender and evaluation using the MSNI score, which are fundamental elements in the analysis for the prevention of diabetic foot. It is known that there are countless risk factors associated with the progression of diabetic polyneuropathy, among which the following stand out: advanced age, male gender, longer duration of diabetes, insulin therapy, clinical conditions, among others. Thus, it is relevant to observe in studies, the prevalence of DN between genders due to risk factor ^[35].

Diabetes in patients with DN is more prevalent in elderly individuals over the age of 60 years, especially among men^[36]. Regarding the MNSI-Michigan Neuropathy Screening Instrument, a type of instrument with a DN screening questionnaire, composed of scores, it is important for the assessment of neuropathy^[37]. Several articles in the present study addressed this statement^{[18], [21], [24], [26]}.

Category 2 of the dendrogram, categorized as "Diabetic neuropathy and associated factors", stands out that the word arterial, which is related to some studies that addressed the screening for DN and peripheral arterial disease (PAD) in diabetic individuals type I and II, as the presence of PAD can be found in diabetic patients. The association of ND and PAD tests are considered to be evaluations recommended both nationally and internationally, as they are factors directly related to foot ulcers^[38]. It is noteworthy that the word ulcer, even if less prominent, matters because it directly refers to the consequence of diabetic neuropathy that should be avoided from primary care, since neuropathy is the main risk factor for foot ulceration in individuals with diabetes^[39].

With regard to category 1, entitled: "important risk factors in the screening of DN", it refers to the characteristics of the population of the studies and data that emit risk factors for Diabetic Neuropathy. Much of the research uses information regarding the time and type of DM, associated diseases, and glycated hemoglobin (HbA1c) values. In this context, the studies that most highlighted and described these factors mentioned in the corpus^[16], ^[18], ^[19], ^[21], ^[23], ^[26], ^[38], ^[39] stand out. It is worth noting that the association of the word youth seen in category 1 is related to DM1, because it is one of the most evident chronic pathologies in childhood and has its greatest incidence in the period of adolescence ^[40].

Regarding other risk factors for DN, it is important to highlight that glycated hemoglobin (HbA1c) is the most suitable test to quantify the risk of chronic complications such as DN in diabetic patients^[41].

The duration of diabetes mellitus and the patient's advanced age are relevant factors associated with the monofilament test to detect the presence of neuropathy among diabetic patients and those, with loss of plantar sensitivity by the monofilament test, also showed worse metabolic control, corroborating the need to identify risk factors for the complete screening of diabetic neuropathy^[42].

V. CONCLUSION

The objective of the research was the identification of care protocols used in the identification of Diabetic Neuropathy, however, it was found that there is a general approach to neuropathic screening tests, however there are no descriptions regarding care protocols, which would aim to facilitate the screening for disease prevention, in addition to allowing greater flexibility for health professionals. The improvement in the organization of work based on the application of care protocols can allow the empowerment of the user regarding the importance of self-care in controlling DM and improving quality of life, in addition to adherence to treatment to avoid complications.

It was identified that the survey of sociodemographic data and lifestyle habits are important and that the use of tests for screening should be applied. In view of the results, the most elucidated test was the monofilament and the most frequent instrument for evaluation was the Michigan Neuropathy Screening Instrument (MNSI). Among the highlighted complications are not only changes in the feet, but also in the hands, the pathology mainly affects the male gender, people of older age and longer duration of DM. The presence of associated pathologies, such as PAD, in diabetic patients must be evaluated, as well as the records of blood tests.

It is hoped that this study can contribute to the formulation of assistance protocol for the screening of the complication of DM, diabetic neuropathy, preventing the user from reaching other points in the health care network, thus preventing the worsening of the clinical condition, as in the case of diabetic foot, in addition to the costs of hospitalization.

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Physiological Quality of Maize Hybrid Seeds Treated with Copper Nanoparticles

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Abstract— In corn, several factors determine productivity, especially those inherent in planting and the quality of seeds. Nanoparticles that contain some essential element in plants are classified as nanofertilizers, which are allegedly more efficient than traditional fertilizers. The experimental design used was the Randomized Block Design (DBC), in a factorial scheme (5 x 5) with 3 repetitions. The seeds of corn hybrids treated with copper nanoparticles were subjected to germination and seed vigor tests. The data were submitted to Analysis of Variance (ANOVA) by the F test ($p \le 0.05$), for the nanocopper doses, regression analysis ($p \le 0.05$) was performed with the choice of mathematical models through the coefficient of determination (R2). Differences between means were compared using the Tukey test ($p \le 0.05$). Seed vigor was assessed by testing the first count and germination speed. Corn hybrids showed an average of 95.6% in relation to normal plants, not expressing a significant difference between them. The results indicate an optimum value for the seed treatment time and for the concentration of copper nanoparticles in the reaction medium. The longer the seed treatment time and the higher the concentrations in the reaction medium, it is possible to incorporate higher amounts of nanoparticles to the seeds without the treatment. The presence of nanoparticles in the seeds did not affect the germination speed per hybrid. This indicator shows that nanoparticles do not interfere with metabolic mechanisms in the germination phase.

Keywords— Corn hybrids, copper nanoparticles, physiological quality.

I. INTRODUCTION

Corn is characterized by being a crop with a low plant so production can be significantly population, compromised by being attacked by pests and diseases during the period of seed germination and seedling emergence. For this reason, it is extremely important that all the seeds sown germinate and ensure, the desired number of plants at the time of harvest and the good yield of the crop [1]. In the quest to raise current income levels and reduce corn production costs in Brazil, new technologies have been incorporated into production systems. Among these, we highlight the use of nanoparticles of nutrients applied via seed treatment (TS), which is considered a promising agronomic strategy, as it guarantees success in establishing the respective crop, enabling plants to have a greater capacity to resist biotic stresses (caused by pests and diseases) or abiotics

(depending on environmental conditions and nutrition) during the definition of the yield components.

In corn, several factors determine productivity, especially those inherent in planting and the quality of seeds. For example, if the physiological potential, represented by germination and vigor, determines the capacity of the seed to produce a normal seedling, that potential can be compromised in the production process because of factors such as genotype, in which cultivars of the same species can have vigor and different longevity. As well as adversities in the development of seeds (availability of water and nutrients, temperature, occurrence of diseases and insects, etc.) can affect their performance, the procedures adopted in harvesting, processing and storage significantly influence their physiological potential [2].

The growing need for food production and the risk of depleting the mineral reserves of fertilizers, are driving the

search for new products to optimize plant nutrition and reduce losses by leaching and volatilization, which make the production system more expensive, in addition to contaminating natural resources. The micromineral copper (Cu) nanoparticles have potential for use as fertilizers, as they present less solubilization than the conventional source, reducing losses due to fixation [3].

Nanoparticles that contain some essential element in plants are classified as nanofertilizers, which are allegedly more efficient than traditional fertilizers [4]. However, for use in agriculture it is essential to understand not only its efficiency as a fertilizer, but also the effects of these products on plants and their behavior. For Zhao et al. [5], the physiological responses of plants exposed to nanoparticles are often used to elucidate their effects on growth, development and toxicity [6].

The physiological process of germination and root growth are indicators of toxicity widely used in studies of the interaction between nanoparticles and plants [7]. For Pokhrel et al. [8], in addition to inhibiting the germination process, structural changes in primary cells and reduced root growth may occur after exposure to nanoparticles, an effect attributed to plant growth. Thus, the present research is justified, with the objective of evaluating the physiological aspects in corn hybrids submitted to TS with Cu nanoparticles.

II. MATERIALS AND METHODS

The study was conducted in the Technology and Seed Production laboratory of the Agronomy Course at the University of the West of Santa Catarina in the municipality of São José do Cedro / SC.

The experimental design used was the Randomized Block Design (DBC), in a factorial scheme (5 x 5), and in factor A the corn hybrids were allocated (H1: 22S18 TOP2®; H2: 20A30 VIPTERA®; H3: 20A80 TOP2®; H4: 22S18 TOP3® and H5: 20A20 TOP2®) and in factor B, Cu nanoparticles doses were allocated via TS (D1: control; D2: 100.00 mg.L-1; D3: 300.00 mg.L-1; D4: 900.00 mg.L-1 and D5: 2700.00 mg.L-1), with 3 repetitions. The seeds of corn hybrids treated with copper nanoparticles, were obtained through a master's research in Technology and Innovation Management at the Community University of the Region of Chapecó - UNOCHAPECÓ, entitled "Agronomic aspects in corn hybrids submitted to seed treatment with Copper Nanoparticles"[9].

The seeds of corn hybrids treated with copper nanoparticles were subjected to germination and seed vigor tests on hydrated paper towel substrates (Germitest) with a volume of solution equivalent to three times its mass. For each made roll, three sheets of paper towels were used. Seed vigor was assessed by testing the first count and germination speed. The germination test was conducted with four sub-samples of 50 seeds for each treatment, according to the criteria established in the Rules for Seed Analysis (Figures 1 and 2). The prepared rolls, with three sheets of paper towels, were placed in a B.O.D. (model MA 415), regulated to maintain a constant temperature of 25 ± 2 °C [10].



Fig.1 - Sub-sample of 50 seeds for each treatment of the experiment (São José do Cedro, SC - Safra 2018/2019) Source: prepared by the author.



Fig.2 - Packaging of the sub-sample of 50 seeds for each treatment of the experiment (São José do Cedro, SC -Harvest 2018/2019)

Source: prepared by the author.

According to the same author, the evaluation of the first germination count was performed on the fourth day after the test was installed. The final germination count (second count), obtained by adding the first germination count, was performed on the seventh day after the test was

installed (Figure 3). The data were converted to percentage of normal seedlings.

From the first count and germination speed an indicator of the seed vigor was obtained and with the final count the viability. The germination speed was calculated using the Edmond and Drapala equation [11].



Fig.3 - Evaluation of the germination test for each treatment of the experiment (São José do Cedro, SC - Safra 2018/2019)

Source: prepared by the author.

The data collected were submitted to Analysis of Variance (ANOVA) by the F test ($p \le 0.05$), for the nanocopper doses, regression analysis ($p \le 0.05$) was performed with the choice of mathematical models through the coefficient of determination (R2). Differences between means were compared using the Tukey test ($p \le 0.05$). The computational application used was SISVAR - System of analysis of variance for balanced data [12].

III. RESULTS AND DISCUSSION

3.1 Percentage of normal seedlings

The analysis of variance revealed a significant effect ($p \le 0.05$) of the factor of doses of Cu nanoparticles in relation to the variable response percentage of normal seedlings, that is, there is a mathematical model that explains the influence of variable X (doses of nanoparticles of Cu Cu) in relation to variable Y (percentage of normal seedlings) (Figure 4).

As shown in figure 04, it can be seen that there was a cause and effect relationship between the variable nanoparticle doses and the percentage percentage of normal seedlings, that is, the doses of Cu nanoparticles influenced 96.93% in the percentage of normal seedlings, respectively, presenting a quadratic behavior.



Fig.4 - Percentage of normal seedlings in the experiment in relation to the factor of doses of Cu nanoparticles (São José do Cedro, SC - Safra 2018/2019)

Source: prepared by the author.

In the present study, it can be noted that in relation to the growth of normal seedlings, the dose that showed the best results was 900mg / L-1 of nanocopper, influencing 96% in the seed germination of the corn hybrids. The increase in the number of normal seedlings can be considered an added benefit due to the treatment process and the presence of copper nanoparticles in the seed.

These results are strong indications that the presence of copper nanoparticles in corn seeds does not induce a great effect of toxicity to the seeds. Although there may be a negative effect of the nanoparticles due to their toxicity to plant cells, this effect should be small, to the point of impairing the physiology of the cells and generating abnormal seedlings, but not to the point of leading the seedlings to death.

In the study by Stampoulis, Sinha and White [13], it was found that seeds exposed to 100mg L-1 of Cu, germinated normally, although root growth was compromised.

In the research by Wu et al. [6], Cu nanoparticles did not inhibit the germination of tomato seeds (Solanum lycopersicum) in the tested doses (100-500mg L-1), data that are equivalent to this study. Less tolerant crops such as lettuce, radish and cucumber, treated with Cu suspension in water, had a 50% reduction in germination when the concentration in the suspension reached 13, 398 and 175mg L-1 of Cu respectively.

In corn seeds treated with 100mg L-1 of Cu, despite the lack of effect on germination, there was inhibition of seedling growth, compared to the source of Cu [5].

Using doses of 0-1000mg L-1 of copper nanoparticles in cucumber plants (Cucurbita pepo), after centrifugation, to remove supernatant particles during the germination period, they observed a significant increase in biomass compared to plants grown in non-centrifuged solution, suggesting a phytotoxic effect of nanoparticles [12].

In the germination of mung beans and wheat in a concentration of 1000mg L-1, but they reduced root growth [17]. With soybean seeds (Glycine max) and chickpeas (Cicer arietinum L.) exposed to the suspension of Cu nanoparticles (0-2000mg L-1) in a Petri dish germination test, they also did not have an inhibitory effect on germination. , although root growth has been completely inhibited [14].

The analysis of variance did not reveal a significant effect (p>0.05) of the hybrids in relation to the variable response percentage of normal seedlings (Figure 5).



Fig.5 - Percentage of normal seedlings of the experiment in relation to the hybrid factor (São José do Cedro, SC -Crop 2018/2019)

Means followed by the same letter do not differ significantly by Tukey's test ($p \le 0.05$) Source: prepared by the author.

The analysis of variance revealed a significant effect (P \leq 0.05) of the factor of doses of nanoparticles of

Cu in relation to the variable response speed of germination, that is, there is a mathematical model that explains the influence of variable X (doses of nanoparticles of Cu) in relation to variable Y (germination speed) (Figure 05).

Corn hybrids showed an average of 95.6% in relation to normal seedlings, not expressing a significant difference between them.

It can be seen that all tested hybrids have germination values above the commercialization standard, which is 80% established by the Ministry of Agriculture, Livestock and Supply in Normative Instruction 45 [15], thus guaranteeing the necessary quality for the establishment of culture in the countryside.

3.2 Germination speed

The analysis of variance revealed a significant effect ($p \le 0.05$) of the factor of doses of nanoparticles of Cu in relation to the variable response speed of germination, that is, there is a mathematical model that explains the influence of variable X (doses of nanoparticles of Cu) in relation to variable Y (germination speed) (Figure 6).





Source: prepared by the author.

As shown in Figure 06, it is noticed that there was a cause and effect relationship between the variable nanoparticles doses and the variable germination speed, that is, the doses of Cu nanoparticles influenced 98.79% in the germination speed, respectively, presenting a quadratic behavior. From the 4th day of the germination process, it can be observed that all seeds germinated, that is, the nanocopper did not harm the process, with emphasis on the dose of 900 mg L-1 that demonstrated greater effectiveness in the vigor of the seedlings.

The results indicate an optimum value for the seed treatment time and for the concentration of copper nanoparticles in the reaction medium. The longer the seed treatment time and the higher the concentrations in the reaction medium, it is possible to incorporate higher amounts of nanoparticles to the seeds without the treatment. Thus, the increase in normal seedlings is due to the presence of nanoparticles available for the seed inside.

The analysis of variance did not reveal a significant effect (p > 0.05) of the hybrids in relation to the germination speed response variable (Figure 7).



Fig.7 - Germination speed of the experiment in relation to the hybrid factor (São José do Cedro, SC - Safra 2018/2019)

Means followed by the same letter do not differ significantly by Tukey's test ($p \le 0.05$)

Source: prepared by the author.

The presence of copper nanoparticles in the seeds did not affect the germination speed by hybrid. This indicator shows that nanoparticles do not interfere with the metabolic mechanisms of seeds in the germination phase.

IV. CONCLUSION

The copper nanoparticles did not have a negative influence on germination or on the speed of this process,

on corn seeds, since if there is a toxic effect it is small and will not compromise the metabolism of the seed. Likewise, the availability of copper for corn plants should occur at future stages of development, that is, vegetative and reproductive.

DECLARATIONS

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User perception of the interpersonal relationship with the nurse about the assistance received in the HiperDia program

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Abstract—The objective was to identify the user's perception of the interpersonal relationship with the nurse regarding the assistance received in the consultation of the Hiperdia program, based on the different roles that the nurse can assume, in the light of Peplau's theory of interpersonal relationships.Descriptive research, with a qualitative approach, carried out with 20 users registered in the Hiperdia Program of a Basic Health Unit, in the city of Belém, Pará, Brazil. The theory based on data from Strauss and Corbin and the IRaMuTeQ software were used. Resolution 510/2016, approved in CAAE: 14945819.8.0000.0018, was respected.Most participants were female 16 (80%), incomplete elementary school 14 (70%) and over 60 years old 11 (55%). Four categories were identified: 1) The user-nurse bond in the health service; 2) User-nurse interaction in the identification of risk factors and care regarding Chronic Noncommunicable Diseases; 3) Health education activities to improve the quality of life of users with Chronic Non-Communicable Diseases; 4) How the user deals with the disease and the nurse's help in understanding the problem.All were correlated with the roles played by the nurse, according to Peplau's theory.Realize that the nurse's roles are intertwined, as they are sequential steps. In research, the role of the stranger was the only negative point, as it still remains a reality in primary care.

I. INTRODUCTION

According to the World Health Organization, Chronic Noncommunicable Diseases (NCDs) are the biggest cause of death worldwide. In Brazil, in 2016, 74% of deaths in people aged between 30 and 69 years were due to NCDs^[1]. Among these pathologies are Diabetes Mellitus (DM) and Systemic Arterial Hypertension (SAH). The Risk Factors Surveillance System for chronic non-communicable diseases showed that Brazil has seen an increase in the prevalence of DM and SAH in recent years. The prevalence of DM went from 5.5% in 2006 to 7.4% in 2019, an increase of 34.5% in the period, while SAH in 2006 had a prevalence of 22.6%, changing to 24.5 % in 2019^[2].

In this scenario, the Hiperdia program has been an important instrument in Primary Health Care in assisting users with these pathologies^[3]. However, in order to promote more effective assistance, it is necessary to have an interpersonal relationship with the user. In this context,

the nurse becomes an important professional in monitoring users with DM and SAH, since the profession needs a development of skills that allows an interpersonal relationship in the search for systematic and comprehensive care^[4]. Thus, Hildegard Elizabeth Peplau's Theory of Interpersonal Relationship is adequate as a theoretical contribution to nurses who work with users with DM and SAH.

Peplau's theory qualifies good practices, since, through the phases it proposes, care is directed and the nursing professional recognizes, through interpersonal relationships with the patient, their difficulties, and develops care in response to these identified needs. The patient, on the other hand, when recognizing his clinical condition provided by interpersonal relationships, participates in his own care^[5].

According to Peplau, there are four sequential phases in interpersonal relationships that are interrelated and overlap, namely: Orientation, Identification, Exploration and Resolution^[6]. The interpersonal process, on the other hand,

consists of 6 roles that nurses must play, namely: strange role, resource provider, teacher, leader, substitute, advisor^[7] ^[8].The theory was chosen because Peplau is concerned with the experiences that the individual may have in relation to his chronic non-communicable pathologies, which are irreversible and the individual needs to adapt to his real situation, therefore, non-adherence to treatment is often related to lack of interpersonal relationship between the nurse and the user.

In view of the above, this study aims to identify the user's perception of the interpersonal relationship with the nurse about the assistance received in the consultation of the Hiperdia program, based on the different roles that the nurse can assume, in the light of the theory of interpersonal relationships of Peplau.

II. MATERIALS AND METHODS

This is a descriptive, cross-sectional study with a qualitative approach. Twenty users registered in the Hiperdia Program of a Basic Health Unit, located in the city of Belém, Pará, Brazil, participated in the research. To delimit the sample, the saturation technique was performed, considered a sampling process by theoretical saturation in which the collected data are interrupted when there are no new elements^[9].

The inclusion criterion was the participation of users diagnosed with DM and / or SAH, registered in the Hiperdia Program, aged 18 years or over and as an exclusion criterion users with less than 1 year of follow-up by nurses in the Program Hiperdia, who has communication difficulties or cognitive deficits. The research was carried out through a semi-structured interview, divided into two parts: I) User identification regarding age, gender and level of education for social characterization and; II) Guiding questions about the user's perception regarding the interpersonal relationship with the nurse, in the light of Hildegard Elizabeth Peplau's theory. In this second stage, the guiding questions are related to the roles that must be developed by nurses in caring for the user, based on the interpersonal relationship of Peplau's theory. Data collection took place from October to November 2019.

Data analysis was performed using the theory based on data by Strauss and Corbin (2008), which allows the classification of the conceptual ordering and the IRaMuTeQ software (R interface for the Multidimensional Analyzes of Textes et Questionnaires) that makes possible different types of analysis of textual data, the vocabulary distribution can be organized in an easily understandable and visually clear way with graphic representations based on lexicographic analyzes^[10].

The analysis by Strauss and Corbin (2008) is used in qualitative research. The technique was only for carrying out the conceptual ordering of ideas, based on open and axial coding [11]. In the open step, the IraMuTeQ software was used, the analysis of statistical choice being the Descending Hierarchical Classification (DHC) through the Dendogram that allows to regroup the corpus according to its similarity to each other. After this survey, axial coding was performed to make the relationship between the classes formed by IraMuTeQ and the construction of the categories. After identifying the categories, a thorough reading of the categories and the speeches of each one was carried out to make a correlation with the roles played by nurses, according to Peplau's theory, namely: role of stranger, provider of resources, substitute, teacher, leader, substitute, advisor.

The research followed Resolution No. 510, of April 7, 2016 and Resolution No. 466, of December 12, 2012. Data collection started after approval by the Research Ethics Committee (CEP) of the Health Sciences Institute UFPA, opinion 3,579,897; CAAE: 14945819.8.0000.0018. All participants signed the Free and Informed Consent Form (ICF). Participants had their anonymity preserved, codenamed E1, E2 and E20.

III. RESULTS

The total number of study participants was 20, of whom 16 (80%) were female and 4 (20%) were male. As for education, most had incomplete primary education 14 (70%), secondary education 3 (15%), higher education 2 (10%) and illiterate 1 (5%). Regarding age, most were over 60 years old 11 (55%), followed by 6 (30%), between 50-59 years old and 3 (15%) between 30-49 years old.

The Descending Hierarchical Classification (DHC) through the Dendogram, allowed the identification of the statistical analysis, as shown in Figure 1.



Fig.1 - Descending Hierarchical Classification through the Dendogram: Categorization of Classes. Fonte: IRaMuTeQ, 2020.

In category 1, represented by the color red, it obtained 21.9% of the responses of the interviews. The most repeated words in this category were; consultation (24), schedule (5), time (6), treatment (3), month (3), schedule (3), get (9), consult (8). This category addresses the difficulty of obtaining a nursing consultation. In category 2, identified by the color green, it is represented by 28.1% of the responses of the interviews. The most repeated words were: question (39), diabetes (21), pressure (15), nurse (15) family (10), problem (10), disease (9). The category groups information about family and personal findings as risk factors and the nurse's interpersonal relationship with the user and their role in guiding doubts.

In category 3, identified by the color blue, it presents 27.6% of the responses of the interviews. The words that appeared the most were: taking (41), time (14), physical (11), exercise (9), right (24), time (10), walking (7), food (7), medication (13), walking (10). This category addresses the guidelines provided by nurses regarding physical exercise, medication and food; and category 4, identified by the color purple, represents 22.4% of the responses to the interviews. The most repeated words were; thanks (7), god (9), front (4) diabetes (4), explain (11), disease (19), accept (9), live together (3). It refers to the answer about the acceptance of the disease, help from the nurse to the user and guidance on the disease.

In the axial coding of Strauss and Corbin (2008) and the classes identified in IraMuTeQ, the textual domains and interpretation of meanings were identified, thus, the following categories emerged: 1) The bond between the user-nurse in the health service; 2) User-nurse interaction in the identification of risk factors and care regarding Chronic Noncommunicable Diseases; 3) Health education activities to improve the quality of life of users with Chronic Non-Communicable Diseases; 4) How the user deals with the disease and the nurse's help in understanding the problem.

When correlating the categories found, the roles played by nurses were identified from the user's perception, according to Hildegard Elizabeth Peplau's theory, namely: role of stranger, resource provider, teacher, leader, substitute, advisor.

THE STRANGE'S ROLE

IraMuTeQ relates the speeches only in two categories: category 1 and 2, however, the two categories are not directly related to each other, but are interconnected in general. Both show factors that influence the interpersonal relationship and that the reception of the professional influences the acceptance of the treatment. It was found that the role of stranger was identified by several statements by the participants. The following are some extracts from the corpus on the factors that hinder the development of an interpersonal relationship with the nurse:

"I'm ashamed to ask a question, you know, I seem to stop when I ask" (E3).

"sometimes we schedule a day, but when I arrive there is no one, then I go back and there is no one, so we reschedule" (E8).

"[...] in six months I am already dead [...] first, consultations were scheduled every month and not now" (E10).

"Not at the moment, because I haven't been back with her in a while" (E20).

ROLE OF THE PROVIDER

IraMuTeQ lists the statements in 2 categories: 1 and 4. The two categories are not directly related, but they are interconnected because they point out that for users the nurse welcomes and talks about their health conditions, helps in the understanding of Chronic Noncommunicable Diseases and in the best way of coping with the disease. The user perceives the nurse as the professional who can offer resources to them to understand their current situation, identifying the role of resource provider, as shown in the extracts below:

"I have all this freedom to ask or answer, because the nurse gives me the opportunity, and we are in a place that not everyone wants to do that" (E1).

"Take the right medicine, ne, when I'm feeling something, I tell her" (E4).

"She is great. The first time I met her, she served me very well and so far she's being a caring person with me, she explains everything correctly "(E5).

"I feel comfortable, yes, to express myself to her and say what I am feeling" (E10).

"So, what I feel, I pass on to her and she advises me" (E17).

"This is happening to me, how can you help me" (E18).

ROLE OF TEACHER

IraMuTeQ lists the statements in 2 categories: 3 and 2. These categories are directly related and show that the user highlights the nurse's concern and guidance regarding the health-disease process, a situation that can be observed in the following strata: "She says like this, look, this is not a seven-headed bug, that everything has a way that we can live life as it was before, without having the problem" (E5).

"She explains what can happen if we don't take care, not lowering glucose can make us blind, lose part of our foot" (E14).

"Well, I know, because I know that we don't want to accept, we don't want to accept the disease, but what can we do. She talks to me, says I have to raise my head "(E18).

LEADER'S ROLE

IraMuTeQ lists the statements in 3 categories: 1, 3 and 2. Categories 1 and 3 are directly related and point out the role of the nurse as a leader in the health education process and active participation of users in whom the presence of bond, according to the strata below:

"Look at the physical exercise, she speaks well, but we just have to put it on our heads because if we don't do it, we are the ones who are harmed because she clarifies, but sometimes it is the patient" (E3).

"She says how it is for me to take the medicine, how it is for me to relax, you know [...] she tells me not to take the medicine all together, it is to take it as prescribed" (E10).

"Vindo para consultas ne, porque se eu não vir eu não vou aprender e saber se eu to fazendo alguma coisa de errada, né" (E12).

"Ela me dá o conselho e eu faço tudo direitinho, eu não sou dessas pessoas que são relaxadas, eu tenho que fazer sempre certinho" (E20).

Despite identifying the role of leader, it appears that health education is more focused on basic questions about lifestyle. Category 2 is separate from the previous ones, but the nurse also appears as a leader when he values the user's need, according to the extract, below:

"Well, she asks what we are feeling and I think this is very important" (E3).

SUBSTITUTE ROLE

The IRaMuTeQ lists the statements in 2 categories: 4 and 2. The two categories are directly related and are interconnected and address the representativeness that the nurse has in conducting the monitoring of users. Thus, the extracts show the presence of the interpersonal relationship between the user and the nurse and the affectionate feeling, as shown below:

"Look at my relationship with her and very good, yes, she asks everything I have" (E6).

"I like her, she is a very caring person, she explains what we have, that we have to take medicine, because otherwise we will cause more inconvenience" (E12). "I certainly feel very comfortable with this nurse, she gives me the opportunity to feel comfortable with her, she certainly asks everything" (E13).

"Good, every time I come she always welcomes me [...] I have a good relationship" (E14).

ROLE OF ADVISOR

IRaMuTeQ lists the main statements of 2 categories: 3 and 1. These categories are directly related and generally address the same thematic axis and talk about the health education activities carried out by nurses and the presence of the creation of a bond between users and professional for the treatment and better quality of life of the patient. In the extracts below, the role of advisor to allow nursing care is verified, by identifying the guidelines received by the user regarding food, physical activity, use of appropriate medication, blood pressure and capillary blood glucose checks:

"Look, the food has to be adequate, you know, she guides me" (E1).

"Checks blood pressure and blood glucose" (E2).

"Look, she said it was for me to go for a walk, not to eat too much greasy food and salt, which is the main thing, these things" (E3).

"She told me to take the right medicine, not to stop when it's running out (E16).

IV. DISCUSSION

In the present study, the majority of participants were female 16 (80%), had incomplete elementary education 14 (70%) and 11 (55%) over 60 years old. It is an aspect that the search for health services occurs mainly by women, about 2.43 times in relation to men^[12]. The presence of users with low education confirms what has already been announced by the Brazilian Society of Arterial Hypertension, being individuals with a higher prevalence of Chronic Non-Communicable Diseases^[13].As for age, most users who follow the Hiperdia program are elderly, as there is a higher prevalence of NCDs in individuals over 50 years of age^[14].

Regarding the Descending Hierarchical Classification (DHC) through the Dendrogram, category 2 presented greater representativeness and the most related one in the discussions regarding the roles of nurses, showing the importance of the interaction between the user and the professional in the care provided to users with NCDs.

Communication is directly associated with the quality of the results found in terms of maintaining adequate health for the user. The lack of an interpersonal relationship means that there is a greater possibility of limitations regarding communication with professionals, making the user concerned with reporting only the clinical manifestations presented without realizing that psychosocial conditions directly influence health and the way can lead to chronic diseases^[15]. Peplau's theory highlights the importance of psychological aspects in the face of nursing interventions^[16].

Quanto à identificação dos papéis do enfermeiro com base na teoria de Hildegard Elizabeth Peplau, sabe-se que estes são fundamentais para manter um relacionamento interpessoal. A teoria de Hildegard Peplau aborda seis papéis fundamentais que a enfermagem desempenha: o papel de estrangeiro, provedor de recursos, professor, líder, orientador e substituto^[8].

Regarding the role of stranger, the research showed negative points for its effectiveness, the lack of therapeutic was communication one of them. Therapeutic communication strengthens the bond, mutual respect, trust, receptive listening and interpersonal relationship. Therefore, the lack of recognition by health professionals, of the importance of using this tool in interpersonal interaction, makes it difficult to establish the bond^[17]. The possibility of influencing a person is directly related to the type of bond developed and the possibility of reducing the suffering of the other regarding the diagnosed pathology and its possible complications^[4].

Another point identified in the role of stranger was the difficulty of making an appointment and the temporal distance between them, which was reported to be 3 to 6 months, which makes interpersonal relationships difficult, such a situation is a reality, as the appointments scheduled in primary care have a waiting time between the day of the appointment and the day of the consultation, which can often last for a year of waiting time^[18].

In the study, the research participants perceive the nurse as a professional provider of resources, being considered a positive result, since the users identified him as someone who has the answers to their doubts and trust him to help them. As a resource provider, the nurse must offer specific responses to assist the user in understanding their needs. When the professional meets the user's requests, a feeling of trust in the health service develops. strengthening the bond, in addition to becoming socially participant in the socio-political process^[8]. In this case, it is necessary for nurses to be aware of the users' demands, promoting qualified listening and guaranteeing comprehensive and quality care, seeking to reduce the cases of complications of the disease^[19].

In the role of the teacher, it was demonstrated that nurses are concerned with the acceptance of the users' health-disease process. The nurse, in addition to developing nursing care, has in her work process teaching through health education activities that promote injury prevention, in addition to being a fundamental instrument to motivate people to have positive attitudes towards health. their health and to be protagonists of their care^[20].

It is known that, the diagnosis of chronic diseases generates strong physical and emotional wear, reaching mainly the emotional one^[21], therefore, it is the health professional's responsibility to help the user to understand his disease to learn to live with the pathology and have a good quality of life.

In the role of leader, it was noticed that the nurse seeks the active participation of users in order to change their lifestyle, however, one should not only work on basic changes such as diet, physical activity and medications, but also making the user understand that these changes are continuous and gradual. Changing attitudes and developing self-care should be promoted^[22].

The guidance on changes in life habits must come from a two-way process, characterized by the exchange of knowledge and experiences, in which the user has an active role in dialogue and decision-making, thus, the conditions must be appropriate. of life, beliefs and preferences of the user, making him the protagonist of his self-care^[23]. In this context, communication is essential so that nurses can survey relevant problems and set goals for the development of their consultation^[24].

In the role of substitute, it is noticed that the nurse manages to develop a good relationship with the user and makes him feel welcomed by him. Thus, the creation of a bond of trust, the use of available resources, mobilization of internal resources, resilient resolution are the results of this good interpersonal relationship, since understanding the user's feelings and having empathic attitudes during the interpersonal process are strategies that provide the active participation of users in the therapeutic process, making the patient resilient in coping with the disease^[16].

Regarding the role of advisor, it is clear that the nurse is able to perform his assistance in practice. For Silva et al. (2015) nursing interventions involve both the research area and guidelines such as food, physical activity, medication use, among others^[8].

V. CONCLUSION

This study made it possible to achieve the intended objective regarding the roles developed by nursing, from the perception of the assisted user in the Hiperdia Program. There is a reflection on the importance of using Peplau's theory to patients with chronic diseases, as nurses acquire a broader view of the care process, when they understand their roles in conducting the monitoring, not only regarding the physical aspect, but also related to the psychological aspect.

Considering the roles developed by the nurse, in the light of Peplau's theory, it appears that they are intertwined because they are sequential steps. In research, the role of the stranger still remains a reality in primary care, hindering a better interpersonal relationship and the search for better treatment. The roles of resource provider, teacher, leader, substitute and advisor were identified through the extracts. It is noteworthy that there is little national and international research on the use of the theory for patients with chronic diseases, and it is necessary for nursing to invest in the application of the theory, as it allows the professional to know himself about his assistance, understand the importance of the experience of the patient. together and perceive the health situation and improvement in quality of life.

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Objective Structured Clinical Examination (OSCE): Perceptions of Nursing Students in Tuberculosis Diagnosis

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Abstract—Objective: Evaluate the perception of nursing students from a public university regarding the Objective Structured Clinical Examination (OSCE) on the topic of tuberculosis diagnosis. Method: Quantiqualitative research, carried out in the Nursing Undergraduate Course of a public university, in june 2019, with the participation of 30 nursing students, who answered a self-administered questionnaire. It was used percentage and Pearson's Chi-square for statistical analysis. For the analysis of qualitative data, the free word evocation technique was used. Results: The study shows that 73.3% of academics reported that the scenario developed in the OSCE exam contributed to the exercise of nursing in the face of tuberculosis diagnosis, 76.7% considered it necessary that Nursing Courses should modify the preparation of academics in relation to tuberculosis and 76.7% recommend developing greater skill for nursing consultations and home visits to patients. Conclusion: It is concluded that the exam's potentialities were highlighted, discussing its benefits in relation to learning needs.

Keywords—Evaluation. Teaching. Nursing. Tuberculosis. Diagnosis.

I. INTRODUCTION

Tuberculosis (TB) is still a serious and challenging global public health problem. Worldwide, in 2018, about ten million people became ill from tuberculosis and 1.5 million people died from it, with TB being the leading cause of death from a single infectious agent. The disease disproportionately affects males, young adults and lowincome countries, pointing to the association between the occurrence of TB and socioeconomic factors (BRASIL, 2020).

The delay in diagnosis is an important factor for the worsening of the clinical picture, hinders proper management and favors a poor prognosis. The disease has been diagnosed late, in an advanced stage and by hospital institutions, which results in high mortality. According to the national health policy, the responsibility for the diagnosis and treatment of the disease lies with the Primary Care teams (SALZANI et al., 2017).

One of the factors regarding the delay in the diagnosis of TB is the difficulty in the academic training of health professionals, since teaching and learning about TB has not been considered an easy task, in which there is a need to incorporate new methodologies to improve skills of undergraduate and graduate students in the health field. Studies found weaknesses in undergraduate nursing education regarding Directly Observed Treatment of TB, as this is one of the priority strategies of the National Tuberculosis Control Program. Among others, the fragility of teaching will have a negative impact on both the management of the program and the assistance to people with the disease (GRECCO et al., 2014).

Investment in education needs to be provided from the academy, through meaningful learning, regarding the teaching-learning of TB, it is emphasized that the use of active methodologies, capable of integrating different teaching strategies, is paramount to develop critical and reflective thinking (BITTENCOURT, 2011).

The nurse needs to master specific skills that comprises four stages: engagement, evaluation, intervention and completion. According to the literature, each stage requires three types of skills called perceptual, conceptual and executive. Perceptual ability is related to the nurse's ability to make observations that are important. Conceptual skill refers to the ability to assign meanings to what has been observed. In turn, executive skill refers to interventions performed by nurses (SANTOS et al., 2017). Thus, the importance of acquiring clinical competences and skills for nursing practice in the diagnosis of tuberculosis is highlighted.

The National Curriculum Guidelines for health courses encourage the use of different teaching-learning scenarios and integration between content, moreover to the fact that several strategies have been tested and compared as methods for teaching various pathologies, such as traditional classes, based on readings of clinical cases, workshops, among others, but the demands of the world of work require new teaching methods. Therefore, the teaching-learning process is implemented through different tools and new successful methodologies have been described (OLIVEIRA NETO, 2015).

In higher education, assessment assumes a social role, as the goal of teaching is to meet the demands of the labor market. Therefore, as a pedagogical tool, the evaluation process requires constant reflection and revision of its instruments. Once it is a teaching-learning strategy, the evaluation process needs to be understood as an integrating act, with a tendency to rescue the ethical, social and political meanings of the evaluation, seeking the qualification of the educational process (NEVES et al., 2016).

In this study, the Objective Structured Clinical Examination (OSCE) was used as an evaluation tool, which consists of a circuit of stations, which contain standardized patients, one or two evaluators, and specific tasks in each of the situations. The stations can only evaluate procedures, contain questions related to the previous station, or the two models can coexist in a single moment (NEVES et al., 2016).

Pedagogically, the use of OSCE has the benefit of being an objective, standardized and simulated method, minimizing the risks for the patient and the evaluated student (NEVES et al., 2016).

In this evaluation modality, the student applies both the reasoning and decision-making process and makes use of motor skills to perform procedures, furthermore, to exercising their attitudes to serve the simulated patient, configuring a competency assessment. Thus, the exam covers the third level of the Miller pyramid, in which the student demonstrates how to execute a command and / or procedure, which is tested before entering the internship field (NEVES et al., 2016).

As a disadvantage, the OSCE demands large logistics and workforce, requiring ample prior planning, a sufficient number of evaluators and stations per number of students evaluated, moreover to physical space to accommodate university students awaiting the moment of evaluation. Organization is required to rotate between stations, so that, at the end of the exam, everyone is evaluated with respect to the same items (NEVES et al., 2016).

Thus, this study aimed to evaluate the perception of nursing students from a public university regarding the OSCE on the topic of tuberculosis diagnosis.

II. METHOD

This is an exploratory research with a quantiqualitative-descriptive approach, developed on the premises of the Undergraduate Nursing Course of a public university, carried out in June 2019, with the participation of 30 students.

The inclusion criteria for the participants were to be enrolled in the 5th year of the Nursing Course and who were attending or have attended the curricular component Supervised Internship in Public Health. Participants with a locked registration or who were away for any reason were excluded.

After academics had traveled through five OSCE stations on the topic of tuberculosis diagnosis, they participated in the feedback moment, in which a joint evaluation was carried out between teachers and students. An instrument for data collection was used, which is a self-administered questionnaire with open and closed questions and then socialized their experiences.

The quantitative analysis was based on the percentage distribution and measures of central tendency. Pearson's Chi-square statistical tests for nominal variables were used for statistical analysis of the data, in order to indicate whether the observed frequencies showed a significant trend. To perform the test, a significance level of p-value <0.05 was adopted, that is, if p-value <0.05 is accepted H1 = The observed frequencies differ significantly for the different groups.

In this way, the collected data were tabulated, interpreted, processed and analyzed using descriptive and inferential statistics. For data analysis, computing resources were used, through processing in Microsoft Excel and Statistic Package for Social Sciences (SPSS) version 24.0, all in Windows 7 environment.

For the analysis of qualitative data, the free word evocation technique was used. Initially, we typed all the words evoked by the participants after the presentation of the stimulus word, in a text editor in "plain text" (txt) format. Then, we processed the text on the website https://www.jasondavies.com/wordcloud/#%2F%2Fwww.j asondavies.com%2Fwordcloud%2Fabout%2F and obtained a word cloud, which highlights the most evoked words.

The strengths and weaknesses highlighted by academics were organized in tables, and repeated items were excluded.

This study was approved by the Ethics Committee on Research with Human Beings, obeying Resolution No. 466/12 of the National Health Council by the number: CAAE: 12062919.6.0000.5170.

the OSCE exam contributed to the exercise of nursing in the face of TB diagnosis, the majority (23; 76.7%) considered it necessary that Nursing Courses should modify the preparation of academics in relation to TB,

III. RESULTS AND DISCUSSION

After the clinical skills test, students were given feedback using the debriefing technique in which the team of evaluating professors highlighted the most relevant points observed during the test, in order to generate reflections in the students regarding the conduct towards patients.

The results show that in the opinion of the majority of nursing students (22; 73.3%) the scenario developed in

furthermore, the majority (23; 76.7%) of academics recommend developing greater skill for nursing consultations and home visits to patients with TB, as noted in table 1.

 Table 1: Distribution of nursing students from a public university according to the evaluation after examining clinical skills.

 Belém - Pará (2019).

| Assessment after examination of clinical skills | Ν | % | P-Value ⁽¹⁾ |
|---|----|-------|------------------------|
| The developed scenario contributed to the practice of nursing in the face of TB diagnosis | | | |
| Yes | 22 | 91,6% | 0.000* |
| No | 0 | 0,0% | - |
| Partly | 2 | 8,3% | - |
| Believes it necessary that Nursing Courses should modify the preparation of academics in relation to TB | Ν | % | |
| Yes | 23 | 95,8% | 0.000* |
| No | 1 | 4,1% | - |
| What recommendations do you suggest | Ν | % | |
| Emphasize teaching about tuberculosis in the basic disciplines (bacteriology, immunology, epidemiology, etc.) | 20 | 83,3% | 0.000* |
| Strengthen teaching on tuberculosis diagnosis and treatment | 18 | 87,5% | - |
| Develop greater technical skill (tuberculin skin test, BCG vaccine, etc.) | 21 | 70,0% | - |
| Develop greater skill for nursing consultations and home visits to patients with TB. | 23 | 95,8% | - |
| Develop greater administrative skills. | 13 | 54,1% | - |
| Encourage enthusiasm for the TB program | 15 | 62,5% | _ |
| Others | 10 | 41,6% | - |
| | | | |

Note: Results are basedon non-emptyrows and columns in each innermost subtable.

N-Numberofacademics.

(1) Pearson's chi-squaretest (Wilks' G²) for independence (p-value<0.05).

*SignificantValues; NS - Non-SignificantValues.

Interpretationofthetest:

H0: The frequenciesobservedoccur in the same proportion for the different groups.

H1: The observed frequencies differsignificantly for the different groups.

Decision:Sincethecomputed p-valueisless than the significance level of alpha = 0.05, the null hypothesis H0

shouldberejected and the alternative hypothesis H1 accepted.

Source: Research protocol, 2019.

The academics listed the Potentialities and Fragilities regarding the application of the OSCE skills test, as can be seen in Tables 2 and 3.

| Table 2: OSC | <i>CE potential</i> | in acad | emics' o | opinion. |
|--------------|---------------------|---------|----------|----------|
|--------------|---------------------|---------|----------|----------|

| | Potentialities | | |
|-------|--|--|--|
| 1. | Perceptionofstrengthsandweaknessesduring a consultation | | |
| 2. | Improve anamnesisandphysicalexamination | | |
| 3. | Needtotrain more throughsimulationmethods | | |
| 4. | Self-perceptionofbehaviorstowardsthepatient | | |
| 5. | Goodevaluationmethodology | | |
| 6. | Improve knowledge | | |
| 7. | Betteracademicpreparation for professional life | | |
| 8. | Returnofexperienceslivedduringgraduation | | |
| 9. | Improve theperception of behaviors as future professionals | | |
| 10. | Examwellpreparedandorganized | | |
| 11. | Importanceofactivemethodology for studentstoexercisetheoreticalknowledge | | |
| 12. | Rememberthetheoreticalcontent | | |
| 13. | Reflectonthenurse'sbehaviortowardsthepatient | | |
| 14. | Enrichingandproductiveexperience | | |
| 15. | EncouragementtofurtherstudytheNationalTuberculosisControlProgramandprotocols | | |
| 16. | Reinforcetechnicalandscientificknowledgeonthetopic | | |
| 17. | Simulationmethodisextremelyvaluable | | |
| 18. | Stimulatesclinicalreasoning | | |
| 19. | Perceptionofweaknesses in care | | |
| 20. | The methodcan make up for thelackofdemands in thefieldsofpractice | | |
| 21. | Improve the approach tothepatient | | |
| 22. | Exerciseknowledgebeforegoingtopractice in theinternshipfield | | |
| 23. | Momentofreflectionabouttheknowledgeandbehavior in the face of TB | | |
| 24. | Self assessment and improving student performance | | |
| 25. | Rethinktheconceptsandtechniques for nursingconsultations | | |
| 26. | Observationofthefaultscommitted | | |
| 27. | Perceptionoftheimportanceofnursing in TB control | | |
| 28. | The weakness of TB teaching was observed | | |
| 29. | Needtotrain more throughsimulationmethods | | |
| 30. | Individualswellpreparedtosimulate reality | | |
| Sourc | Source: Research protocol 2019 | | |
| | Table 3: OSCE fragilities in goodenies' enjuion | | |
| | Fragilities | | |

- 1. Short time toperformtasks
- 2. Questionsduringtheexam
- 3. Nervousnessduringexamination
- 4. Better OSCE consultationorganization
- 5. Fragmentationofthestagesofthenursingconsultation
- 6. Lackofpreviousexperiencewiththe OSCE method

- 7. Difficulties in running the simulation
- 8. The waythepatientisapproached
- 9. The divisionintostationsconfused the nursing consultation process

Source: Research protocol, 2019.

The academics described in 3 words their perception of the OSCE method and of the debriefing moment, in which the most evident words were: knowledge (6); learning (5); reflection (3); trust (3); empowerment (3); necessary (3). From these terms, the word cloud was built, in which the most written words are in evidence, as can be seen in Figure 1.



Fig.1: Word cloud that represents the students' perception of the OSCE method. **Source:** Research protocol, 2019.

During the performance of the OSCE exam, the evaluating professors made important notes to be observed during the debriefing moment, such as the need to further investigate the symptoms of TB; difficulties in performing the physical examination; nervousness during the test, evidenced by the student's attempt to interact with the examiner, which is not allowed during the test; some academics did not read the exam results that were on the table; at Station 5 there was little emphasis on the importance of not abandoning treatment; doubts as to where the patient should be referred; some academics identified TB, but did not identify it in the exam, which

was multidrug-resistant; some academics wrongly cited treatment time.

This study shows that it is necessary to reflect on the structuring of the current nursing curriculum, especially regarding practical training and the acquisition of all necessary skills throughout the course. Academics must effectively and intensively train these skills (manuals, clinical reasoning and conduct) in real patients, real situations and real scenarios, and which also include hospitals, urgency and emergency units and ambulatories.

There must be a balance in the distribution of workload and in the focus of practical learning among all sectors of nursing. It is through mandatory internships in all practice sectors that students will have the opportunity to apply their acquired knowledge and develop the necessary skills and competence for the exercise of the profession (PEREIRA, 2017).

However, possibly, these academics are not fully and adequately inserted into their practice scenarios throughout their undergraduate studies, or else they are not the main "actors" in these scenarios. Thus, they do not gain autonomy, they do not acquire security for decision making and, above all, they do not develop the capacity for clinical reasoning, since they are unable to apply the knowledge they have learned (PEREIRA, 2017).

As for teaching TB, it highlighted the need to incorporate new teaching methods, new forms of assessment, as well as new practice scenarios, in order to diversify the students' experiences and contemplate their expectations regarding the nursing course and in accordance with the competencies and skills required for the professional nurse in the management of care for TB patients.

Added to this is the fact that the OSCE does not evaluate the student in real conditions, especially checking "show how you do it" and not "do it" itself. Arguably, direct and practical observation in real patients provides a more realistic and integrated view of clinical skills, but the lack of standardization in this form of assessment gives it low reproducibility and reliability to be used in scientific research (ZIMMERMANN, 2019).

Another limitation of the OSCE is the restricted time at each station. The fact that there is a fixed time for the completion of tasks creates anxiety and impairment in the execution of tasks. On the other hand, the conduct of conduct in real care often requires speed and agility, and therefore the student must also be evaluated under pressure and demand for speed in his actions (ZIMMERMANN, 2019).

Despite these limitations, the OSCE is a validated tool and has been used in much of the current research that aims to assess health skills and competencies. The limitation of this study lies in the small number of subjects in the sample (ZIMMERMANN, 2019). However, the results were relevant, and the data suggest further studies on a larger scale, to better assess and certify the results.

After being submitted to the skills test, the students had the opportunity to express their opinions and feelings, since it was the first time that they were experiencing the OSCE method. The evaluation by the academics was positive in the sense that a realistic simulation method was used that seeks to portray reality as much as possible, and in case of errors it does not cause harm to the patient. This type of method allows the student to train and acquire greater ability to act with greater confidence towards patients in the real scenario.

IV. CONCLUSION

Much more than looking for explanations of the facts, during the moment of feedback, ideas were shared, which throughout the research made it possible to think about the teaching-learning process and the strengthening of the processes that permeate the training of nurses.

The objectives proposed for this study were achieved and reinforced the thesis that adequate knowledge, attitudes and practices are fundamental elements in qualitative health education.

From this study, it was possible to verify the expectations of nursing students regarding the teaching of TB diagnosis, as well as to know the strengths and weaknesses regarding the OSCE exam, bringing to light its benefits regarding learning needs and expectations for being a method still widespread in nursing courses. The results enabled a joint reflection between teachers and students about teaching-learning practices, as well as the need to innovate the form of assessment.

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ATTACHMENT

INSTRUMENT FOR DATA COLLECTION

EVALUATION INSTRUMENT AFTER EXAMINATION OF CLINICAL SKILLS

Identificationcode: D_____

1- Considering the simulations cenariore produced during the research, discuss the strengths and weaknesses, which, in your opinion, can be high lighted from the experiences in the simulation.

2- Describe in 3 word syour perception of the moment of feedback (debriefing)?

3- Do you think that the developed scenario contributed to the practice of nursing in the face of TB diagnosis?

() YES () NO () IN PART

4- Do you think it is necessary that Nursing Courses should modify the preparation of academics in relation to tuberculosis?

YES () NO ()

5- If you answered YES, check the recommended changes:

() emphasize teaching about tuberculosis in thebasic disciplines (bacteriology, immunology, epidemiology, etc.).

() strengthen teaching on tuberculos is diagnosis and treatment.

() develop greater technical skill (tuberculinsk in test, BCG vaccine, etc.).

() develop greater skill for nursing consultations and home visits to patients with TB.

() develop greater administrative skills.

() encourage enthusiasm for the tuberculos is program.

() other – whichone?

Reduction of turbidity and Escherichia coli ATCC 25922 in wastewater of dairy industry after treatment with Moringa oleifera LAM

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Abstract— Several liquid wastes are generated daily in the agribusiness sector. In small dairy industry for example, the main concern is the volume of treated water used for less noble purposes within the company and the difficulty in wastewater treatment before disposal in receiving water bodies. Thus, this study aimed to evaluate the reduction of turbidity and Escherichia coli in synthetic agribusiness wastewater after treatment with Moringa seed extracts for reuse purposes and/or disposal. The extracts at a concentration of 20 mg L⁻¹, 40 mg L⁻¹, 60 mg L⁻¹ and 80 mg L⁻¹ were applied in wastewater made with reconstituted whole milk. Turbidity analysis and counts of contamination bioindicators were performed in the three repetitions. The extract of lower concentration proved to be undesirable for this treatment because it has increased the turbidity and not showed effectiveness against E. Coli to the treated samples. The results showed a turbidity reduction of 87.9% for effluents treated with 80 mg L-1 extract. The concentrations of 60 mg L⁻¹ and 80 mg L⁻¹, in a real situation, would be appropriate for the treatment of effluents with turbidity < 240 NTU, for later release on Class II and III water bodies. Similar to the turbidity test, after T_{IV}-MO80mg L-1 treatment decreased the population density of E. coli to, approximately, 2.2 x 10² UFC 100 mL⁻¹. The routine work using cleaner production, combined with the treatment of wastewater from natural coagulant, tend to minimize the negative impacts of such waste on the environment.

Keywords—dairy, moringa oleifera, plant extract, wastewater.

I. INTRODUCTION

A great part of Brazilian dairy companies are small and have difficulties in managing and treating their wastewater. Thus, while the activities of the dairy industry represent an important economic source [1], they have become a significant source of pollution of water resources from effluents generated in their production processes, equipment cleaning and environments [2].

The effluents generated by agribusiness, due to its characteristics, when released untreated into receiving water bodies, tend to change certain parameters such as Biochemical Oxygen Demand - BOD, dissolved oxygen, hydrogen potential, temperature and turbidity.

NEC Resolution 430 of 2011 defines a number of parameters that must be observed for the discharge of effluents into receiving water bodies, without changing their quality class [3]. Whereas NEC Resolution 357 of

2005 define quality classes in the water bodies [4]. According to this resolution most of water bodies in Brazil are within 2 and 3 quality classes that allows turbidity value to have 100 nephelometric turbidity units – NTU, and the presence of coliforms depending on the purpose of the water, varying 1000 - 4000 coliform per100 milliliters.

Efficient wastewater treatment can become possible its reuse in less noble purposes that do not require drinking water, monitoring of turbidity [5] and fecal coliform [6]. To this purpose, chemical coagulants such as aluminum and iron salts and following by chlorine are commonly used. Although the efficiency gains trigger a number of harmful side-effects such as Alzheimer's disease and other neuropathologies [7]. Due to these significant toxic effects, the treatment of wastewater constitutes a public health problem [8].

In contrast, natural coagulants such as Moringa Oleifera are presented as a promising alternative to different effluent treatment in order to remove turbidity [9], [10], [11], [12], [13], [14], [15], [16], [17].

She has a protein with cationic property with high molecular mass [18], [19] that destabilizes negatively charged particles dispersed in the liquid medium, flocculating them, resulting in improving turbidity.

Regarding the inhibiting pathogens properties of Moringa Oleifera many studies have been done on different types of pathogens [20], [21], [22], [23], [24]. In this studies were evaluated the antibacterial properties in vitro tests with different ways of extraction, such as: aqueous, ethanol, methanol and chloroform extracts.

Natural coagulants have low biological risk because they are biodegradable and present a decrease in the volume of residual sludge [25]. In addition the reduction of the raw material in the environment reduces the availability of carbohydrates and protein to microorganisms that are likely to develop the dairy effluent [24] and consequently microbial growth.

In this context, this study aimed to evaluate the clotting action of Moringa oleifera Lam. extract in reducing Escherichia coli and turbidity in effluent from the dairy industry (SDE) to later disposal in water bodies and / or reuse.

II. METHODS

2.1 Preparation of synthetic wastewater

The preparation of the effluent consisted of a basic mix of reconstituted whole milk (LIR) of Itambé® (main components are shown in TABLE 1) and distilled water.

| Table 1: Cl | hemical comp | position ¹ of | whole | milk powder |
|-------------|--------------|--------------------------|-------|-------------|
| | insta | nt Itambé [®] . | | |

| Constituents | Amount (grams) ² |
|---------------|-----------------------------|
| Carbohydrates | 9.6 |
| Protein | 6.7 |
| Total Fat | 7.1 |
| Saturated Fat | 4.4 |

¹Constituents with the highest concentration; ²Amount corresponding to 26 grams of product.

The mix aimed to obtain a synthetic effluent turbidity of 240 NTU (nephelometric turbidity units), similar to dairy effluent. The synthetic effluent was homogenized for 30 minutes at room temperature using magnetic stirring. The turbidity of the effluent was measured by a turbidimeter Del Lab®; each sample was sterilized by moist heat for 15 minutes at 121 °C and after reaching ambient temperature the reading was taken.

2.2 Obtaining aqueous extract of Moringa oleifera Lam.

The pods of Moringa oleifera Lam. used to prepare the aqueous extract were obtained from a species cultivated in the city limits of Catalão - GO. These were placed in plastic bags and sent to the laboratory in Federal University of Goias - Regional Catalão.

The bark and pods were removed, the seeds were ground at room temperature in a household mixer for 5 minutes. Then 30 grams of the powder was weighed and 150 mL of distilled water was added to give a stock solution of 200 mg mL-1. Subsequently, the mixture was filtered on Melitta® paper (No. 103) and then filtered on membrane units consisting of cellulose ester (MEC) with 0.45 mm in porosity, and wrapped in sterile Boeco® bottle.

2.3 Standardization of inoculum

The overnight culture of Escherichia coli ATCC 25922 was standardized in similar turbidity to McFarland nephelometric scale tube 0.5 [27] and subsequently serially diluted to the standardized inoculum of 103 cells in final volume of 500 mL synthetic effluent. This cell concentration was used to simulate an effluent to be disposed of in Class 3 freshwater [3].

2.4 Coagulant action of Moringa oleifera Lam.(MO) extract

The synthetic effluent was treated with 4 different concentrations of Moringa Oleifera Lam extract. Thus, aliquots equivalent to 50 μ L, 100 μ L, 150 μ L and 200 μ L were pipettes in final volume of 500 mL of effluent, resulting in treatments with equal concentrations. at 20 mg L⁻¹, 40 mg L⁻¹, 60 mg L⁻¹ and 80 mg L⁻¹, respectively. The control group consisted of coagulant-free synthetic effluent.

Control groups underwent the same operation conditions for comparison to the treated samples (TABLE 2).

 Table 2: Tests with the aqueous extract of Moringa oleifera

 Lam.seeds.

| Group | Description |
|------------------------------|--|
| Control I - C _I | Becker presenting RWM |
| Control II - C_{II} | Becker presenting RWM + 1 mL <i>E.</i> <i>coli</i> ATCC 25922 |
| Treatment I - T _I | Becker presenting RWM + 1 mL <i>E. coli</i> ATCC 25922 + $MO_{20mg L}^{-1}$ |
| Treatment II - | Becker presenting RWM + 1 mL E. coli |
| T _{II} | $ATCC \ 25922 + MO_{40mg \ L}{}^{-1}$ |
|---------------------------|--|
| Treatment III - T_{III} | Becker presenting RWM + 1 mL <i>E. coli</i> ATCC 25922 + $MO_{60mg L}^{-1}$ |
| Treatment IV - T_{IV} | Becker presenting RWM + 1 mL <i>E. coli</i> ATCC 25922 + $MO_{80mg L}^{-1}$ |

RWM: Reconstituted whole milk; MO: Aqueous extract of *Moringa Oleifera* Lam.

The containers were previously marked on their external faces, to define two sampling levels (LI: lower referring to markings between 200 mL and 300 mL, LII: upper referring to markings between 300 mL and 400 mL). Each level was taken 100 ml of the sample which were duly packed in sterile bottles for further analysis.

2.4.1 Turbidity determination

The method used was the nephelometric. Thus, 20 mL of each SDE were transferred to specific containers of equipment that had been previously calibrated with standards (< 0.10 NTU, 10 NTU 100 NTU to 1000 NTU) before reading the samples that occurred in triplicate.

At the end of each reading, the container was washed with a brush, followed by decontamination with 70% alcohol, rinsed with distilled water and kept at rest until complete drying.

Comparisons between treatment and control groups were performed at the relative concentration.

2.4.2 Enumeration of Escherichia Coli ATTCC 25922

For the analysis, 1 ml of each sample was transferred into sterile plates followed by the addition of Eosin Methylene Blue Agar - EMB previously melted and cooled to 45 °C. After homogenization and solidification, the plates were incubated at 37 °C for 48 hours. Then the Colony Forming Units (CFU) and the results expressed CFU per 100 mL⁻¹ [28].

2.5 Data analysis

The averages for the parameters of fecal coliform and turbidity in triplicate were calculated. The results obtained for the contamination bioindicators were compared to the parameters applicable to non-potable water for reuse purposes [6] and receiving water body classes for effluents to be discarded [4]. For the turbidity analysis the mean scores were evaluated and analyzed for reuse purposes [5] and disposal [4].

III. RESULTS AND DISCUSSION

The results of the turbidity values and population density of E. coli ATCC 25922 in the synthetic effluent

were relatively promising after treatment with the aqueous extract of Moringa oleifera Lam. - MO.

In general the average scores for turbidity in "LI" were higher than those recorded in "LII" (TABLE 3).

Table 3: Turbidity results (NTU) obtained after stirring in iar test

| <i>J</i> | |
|----------|---|
| Level I | Level II |
| 312.22 | 274.66 |
| 265.89 | 263.78 |
| 502.00 | 491.78 |
| 358.44 | 364.59 |
| 94.28 | 68.16 |
| 49.59 | 33.23 |
| | Level I 312.22 265.89 502.00 358.44 94.28 49.59 |

In TABLE 3, we can see that the average values of turbidity in the control group "CI - RWM" were 312.22 NTU (LI) and 274.66 NTU (LII). After treatment "TI - MO $_{20mg L-1}$ ", there was an increase in turbidity for "LI" (502 NTU) and "LII" (492.77 NTU). Considering that the coagulant protein of Moringa Oleifera seeds neutralize the suspended particles coagulating the negatively charged colloids through subsequent flocculation and it is believed that the observed values "LI" are due to the deposition and / or presence of organic matter from the seeds of Moringa Oleifera in the sedimentation process during collection.

In TABLE 4 the variation of turbidity for the different levels and treatments is shown.

Table 4: Concentration relative (%) of change in turbidity after stirring in jar test and Moringa Oleifera Lam treatment at different concentrations.

| Group | Level I | Level II |
|-----------------|---------|----------|
| CII | 14.84 | 3.96 |
| T_{I} | -60.78 | -79.05 |
| T_{Π} | -14.80 | -32.74 |
| T_{III} | 69.80 | 75.18 |
| T _{IV} | 84.12 | 87.90 |

As can be observed in TABLE 4, the increase in turbidity was equal to 60.8% for "NI" and 79% for "NII". Similar to the "TI" the "TII" had the opposite of expected. There was an increase in "NI" (14.8%) and "NII" (32.7%).

Better reduction of turbidity from the "TIII" and "TIV", especially the latter ("NI": 84.10%; "NII": 87.9%) was observed. Both treatments were effective to remove organic matter in the synthetic effluent, leaving it appropriate to discharge into a water body, since the turbidity was less than 100 NTU [4]. The lowest average

score for turbidity was detected in level II after "TIV" (33.23 NTU). However, this concentration is not enough after the treatment of wastewater for reuse purposes, as parameters presented by [5]. In order to increase the reduction efficiency of turbidity can be used Moringa Oleifera seed extract associated with others natural or $\frac{2000}{100}$

chemical coagulants as tested [15], [16] for concrete wastewater.

In general, the largest reduction of population density of E. coli ATCC 25922 was observed in "NII" (Fig. 1).



Control Treatment

Fig.1: Escherichia coli ATCC 25922 (CFU 100 mL⁻¹) count in the samples after stirring jar test in synthetic wastewater and treatment with Moringa oleifera Lam at different concentrations.

Similar to turbidity tests after "TI " and "TII " reduction of Escherichia coli ATCC 25922 was not observed (Figure 1). In this study it likely the suspended organic matter arising from Moringa Oleifera seeds of 20 mg L⁻¹ extract was assimilated by the microorganism test, resulting in an increase in population [29] and [22] not observed significant bactericide effect in vitro test for doses around 20 mg L⁻¹. In this extract, an increase in average scores was observed on two levels ("NI" and "NII": 1.8 x 10³ UFC 100 mL⁻¹) compared to the "CII".

Several studies highlight the importance of Moringa Oleifera in inhibiting pathogens [30], [20], [31], [32], [33], [22], [23], [24], [34]. [23] and [34] observed that aquaous extract of Moringa oleifera exhibited a zone of inhibition against E. coli Whereas [33] observed that E. Coli tested against seed ethanol extract and found to be sensitive at 50 g L⁻¹. Although in this study the results did not differentiate from those obtained by [21] that verified the resistance in vitro of Escherichia coli ATCC 25922 to the action of Moringa Oleifera Lam. This situation can be explained since different strains have different resistances and although [33] have tested the same species they used different extract in a dosage more than six times our highest dosage. In addition it is important to highlight that the efficiency of any bactericide in a real situation of a wastewater treatment it is much smaller than in vitro situation. This happens because the particles presents in wastewater protect the microorganism from bactericide action.

The largest decreases were found for "TIII " and "TIV", especially the latter ("NI": 1.7×10^2 CFU 100 mL⁻¹; "NII": 2.2×10^2 CFU 100 mL⁻¹). Even with this reduction, in a real situation the highest concentration of extract was not adequate to ensure the absence of Escherichia coli ATCC 25922 in a hundred milliliters of effluent; therefore it would be inappropriate for reuse purposes [6].

Based on the results obtained relating to turbidity and the microbial bioindicator count, those treated effluent concentrations of 60 mg L^{-1} and 80 mg L^{-1} , in a real situation could be disposed of Class II and III receptor in the water bodies [4].

IV. CONCLUSIONS

With the results it was possible to conclude that:

- The concentration of aqueous extract of Moringa Oleifera lam. 20 mg $L^{\text{-1}}$ contributed to increase of the turbidity due to the accumulation of organic matter in the trials.

- The lowest average values of turbidity and microbial cell count occurred after application of aqueous extract of Moringa Oleifera lam. of 80 mg L^{-1} .

- none of the treatments was effective for adequacy of effluent for reuse purposes within the dairy industry, however it can be used in less noble activities in other sectors as water gardens and wash external areas.

- Concentrations of 60 mg L^{-1} and 80 mg L^{-1} demonstrated effectiveness in the adequacy of the effluent for disposal purposes in water bodies class 2 and 3.

- The aqueous extract of Moringa Oleifera lam. posses inhibitory effect against many types microorganism as the studies have shown, but against E. Coli specifically, even in vitro, the dosage is much higher than those tested in this work. So is imperative that new other tests with higher dosages be carry out in wastewater treatment.

- Adoption of strategies for cleaner production, combined with the treatment of wastewater from natural coagulant, can minimize the negative impacts of such waste in the environment.

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Mandibular Ameloblastic fibroma in a Pediatric Patient: Case Report

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Abstract— Ameloblastic fibroma is an unusual, benign, mixed, odontogenic tumor, usually asymptomatic, with prevalence in the first two decades of life, posterior region of the mandible. Because it is silent, it is usually discovered by routine imaging exams and requires a surgical approach for diagnosis and treatment, as they have characteristics similar to other tumors and cysts, in addition to having the potential to expand, reabsorbing bone and dental tissue. Treatment is widely discussed between a conservative and radical approach, and the choice must be made based on a thorough analysis of the lesion, as it may recur. Based on this, the present study aims to present a case with 2 years of follow-up of this rare pathology with enucleation and curettage of the region of the right mandibular angle and removal of tooth 47 germ from a 6-year-old child. Conservative treatment of ameloblastic fibroma in young patients presents itself as an effective option, since it has several advantages such as reduced morbidity and favors rehabilitation in an aesthetic and functional way.

Keywords— Odontogenic tumors; Fibroma; Surgery.

I. INTRODUCTION

Ameloblastic fibroma is classified as a true mixed tumor, involving neoplastic characteristics in epithelial and mesenchymal tissue^{1,2}. It is a rare, benign and slowgrowing pathology responsible for approximately 2.5% of odontogenic tumors³. Epidemiology shows that this tumor occurs in the first two decades of life, in addition to having preference for the areas of lower molars and premolars and posterior region of the mandible^{2,3,4}.

Clinically, minor lesions are asymptomatic, however, in situations of large extensions, the gnathium bones may present an increase in volume^{1,2,4}. When considering radiographic examinations, ameloblastic fibroma presents itself as a well-circumscribed multilocular or unilocular radiolucent area and delimited by a sclerotic border, and is generally associated with unerupted dental elements²⁻⁵.

Ameloblastic fibroma shares histological, radiographic and clinical aspects that are compatible with other tumors, such as ameloblastoma, odontoma, fibroodontoma and ameloblastic that could be identified as diagnostic hypotheses and represent a challenge for diagnosis and therapeutic management^{1,4}.

The treatment of Ameloblastic Fibroma can vary from conservative to radical depending on the extent and aggressiveness of the lesion. Based on the importance of understanding the peculiarities surrounding the therapeutic processes of the aforementioned pathology, the present study aims to report a case of Ameloblastic Fibroma in the body and mandibular angle in a 6-year-old patient.

CASE REPORT

Pediatric female patient, 06 years old, was referred to the specialist in oral maxillofacial surgery accompanied by the person in charge who reported radiographic changes identified by the orthodontist through an initial panoramic radiography for orthodontic treatment.

Imaging examination revealed a circumscribed unilocular radiolucent lesion delimited by a radiopaque halo extending through the region of the right mandibular angle and associated with the distal element 46 and the 47 element not erupted near the basal cortex (Figure 1).



Fig.1:Initial radiograph showing an extensive radiolucent lesion in the region of the right mandibular angle.

Anamnesis found ASA I patient without systemic compromises that could interfere with surgical treatment. In extraoral analysis, there was no facial asymmetry and swelling, while intraoral clinical examination was also within the normal range, with no expansion of the cortical or edema, and normal mucosa color, in addition to not responding with painful symptoms to semiotechnical maneuvers.

In view of the imaging and clinical findings, the presumptive diagnostic hypothesis of dentigerous cyst was potentially considered. After prior consent from the treatment plan, complementary exams and absence of systemic conditions, the surgical procedure was performed.

The patient was submitted to general anesthesia and the lesion was removed by enucleation via intraoral, and an incision was made over the alveolar ridge distal to the first molar. There was already a bone window and it was enlarged for better visualization and removal of the lesion.

The sample sent to the laboratory for anatomopathological analysis consisted of multiple

gelatinous fragments with a diameter of 4.7x3.7x0.4cm together with the dental fragment. Histological analysis revealed biphasic cell proliferation and epithelial component with blocks of odontogenic epithelium composed of basaloid and elongated cells, taking the form of small blocks and cords, with peripheral palisade permeating the loose and hypocellular mesenchymal tissue. Mesenchymal cells showed elongated nuclei without atypia, in addition to the absence of mitotic and necrotic figures. The loose connective tissue showed mild fibrosis with a slight mononuclear infiltrate and dental structures adjacent to the lesion. In this sense, the characteristics investigated confirmed the diagnosis of ameloblastic fibroma.

The case was continued and the control radiography 3 months after surgery revealed diffuse radiopacity in the operated area (Figure 2). The next visit was scheduled at an interval of 3 more months, presenting an imaging aspect with greater radiopacity than the previous one (Figure 3).



Fig.2: Panoramic radiograph 3 months after the enucleation and curettage of the lesion.



Fig.3: Panoramic radiograph 6 months after the enucleation and curettage of the lesion.

The patient returned to the office 1 year and 3 months after surgery and the panoramic radiography showed a radiopaque area suggestive of good bone formation (Figure 4). Finally, the imaging examination

corresponding to 27 months after the surgery showed bone formation with no suggestion of recurrence of the lesion (Figure 5).



Fig.4: Panoramic radiograph 1 year and 3 months after the enucleation and curettage of the lesion.



Fig.5: Panoramic radiograph 2 years and 3 months after enucleation and curettage of the lesion.

II. DISCUSSION

Ameloblastic fibroma (AF) was initially described by Kruse in 1892, later classified as benign neoplasia by Thoma and Goldman in 1946 and years later, in 1992 it was inserted in mixed neoplasms by the World Health Organization.^{6,7}

It is a true neoplasm with odontogenic origin, which is considered rare because it encompasses percentages of 1.5% to 4.5% of all tumors.⁶⁻⁹ It has a higher incidence in the first two decades of life, with some authors measuring that approximately 75% of cases are diagnosed at this stage⁶⁻⁹.

Some research indicates that there is a strong predilection for the male gender, with a proportion of 2 cases in men to one case in women. ^{1,6,7,10} Such avidity goes against other studies that deny that there is a prevalence in genders⁵. Still from an epidemiological perspective, studies indicate the mandible as the most common site, being affected in 80% of cases and in 75% involving an unerupted dental element. ^{6,7,8} Thus, the characteristics related to the report presented are observed, as it involves a 6-year-old child with a lesion in the posterior region of the mandible.

The AF is variable in relation to the radiographic aspect, the authors justify unilocular radiolucency for smaller lesions, which in most cases are asymptomatic.^{4,6} Therefore, the multilocular characteristic is associated with larger lesions that generally present painful symptoms and clinical signs, as swelling and facial asymmetry.^{4,6} Furthermore, authors add that the multilocular aspect is the most common, representing 75% of the lesions, which can cause root resorption and cortical perforation.^{7,10}

The differential diagnosis of AF includes other odontogenic cysts and tumors, such as dentinous cyst, keratocyst, ameloblastoma, myxoma. Although they have overlapping characteristics, it is essential to perform a biopsy to obtain the correct diagnosis.^{6,11} For this, histopathological analysis is essential, and the AF report comes from microscopic characteristics with epithelial and neoplastic connective components, in addition to the fact that the tissue epithelial is similar to the embryonic dental lamina with the shape of islands or strands of odontogenic epithelium with cell layers in the form of cubes or small nests with scarce cytoplasm, while the largest ones have similarities with reticular tissue⁷.

Treatment is widely debated, and some of the literature indicates that it should be chosen according to the size of the lesion. Thus, some authors indicate a conservative approach with enucleation and curettage of the adjacent bone for minor injuries and radical procedure with marginal or segmental resection for large injuries^{6,9}, while others argue that radical treatment should be reserved for cases of recurrence.1 Finally, it is essential that the monitoring is done effectively, as it is pointed out that the AF recurrence rate can reach 45%.⁶

III. CONCLUSION

Conservative treatment of AF in young patients presents itself as an effective option, since it has several advantages such as reduced morbidity and favors rehabilitation in an aesthetic and functional way.

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Base Shear Reduction Techniques: A Review

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Abstract— Now India comes under densely populated countries and the land shortage is the common concern in large cities now a days. To decrease this problem, buildings taller in height is the only option available since it provides more suitability in less space. In this study, various papers allied to this topic are intensively reviewed in which an enormous work is done in this field earlier. To make these buildings inexpensive, harmless and suitable it is really important to add new ideas and expertise. One of them is the base shear reduction of the entire structure. By using optimum size of the beam at the top floors of the building the base shear can be easily reduced under earthquake. By the help of this study, various papers are reviewed in which an enormous work has been done associated to this topic. With the help of this literature survey, we came to know the conclusive outcome which forms the research objectives of our further technical study.

Keywords—Base Shear Reduction, Beam Concrete Grade, Dual System, Dimension Change, Shear wall

I. INTRODUCTION

The trend now follows all the financial customs to make cost operative constructions. It only comes with the economic point of view to the stability of the structures which is again a tough task and it loses the above economic trend, since it requires heavy sections. The main criteria in this is that, it needs extra cost to make the structure earthquake free and also needs some additional stiffness resisting members for the same. The basic need of the modern tall structures is shear wall since it not only protects the same from seismic disasters but also stabilizes the tall structures. The heavy R.C.C. additional components that increase the complete weight of the structure on the other hand, it also increases with its base shear.

II. SHEAR WALL

A structural component added to the multistoried building structure made up of stiff R. C. C. wall, is an additional member used to resist lateral effects on it. This R.C.C. vertical wall starts from foundation base to the top of the building. Ordinary RC structural walls and Ductile RC structural walls are classified by the Indian standardization. As per IS 13920, one doesn't meet the special detailing requirements for ductile behavior is considered as the former one meet the special detailing requirements for ductile behavior is considered as the later.

III. CRITERIA OF BASE SHEAR REDUCTION

The theory by which base shear of the complete structure can be reduced by lessening the size of members or curtailing the size of the members of the multistoried building. Base shear reduction is important factor in the multistorey buildings under seismic loading. Anything that comes under reduction criteria will reduces the self-weight of the structure.



Fig. 1: Structure with Dual Structure Configuration and Base Shear Reduction Techniques



Fig. 2: Structure with shear Wall at Core



Fig. 3: 3D Sectional View of Structure with basic Base Shear Reduction Techniques

IV. REVIEW OF LITERATURE

The main focus on how to deal with lateral forces and counteract with special lateral load resisting elements. Their research work consists of usage of shear wall core type building with wall outrigger, wall belt and truss belt system. They have set the objectives of the study with the determination of different types of output parameters for the comparison and obtain the best case of the multistorey building under seismic loading. Total 7 cases have selected and abbreviated as S1 to S7. Various figures show the different cases easily and can be predicted as well. After the result analysis of various truss belt and wall belt systems, conclusions have been drawn. Last they have proved that wall belt system was proved to be more effective than truss belt system since the coverage area of the stability system is more i.e. Case S4 (Archit Dangi et. al.).

Researchers concentrated on the different ways to make the multistoried building more stable to resist the lateral loading. The special highlight in their research work was to increase the lateral load handling capacity in tall structures. For this, they found an optimum shear wall belt at different heights in 25 storied multistoried building using software approach. Plan of the structure selected was 825 square meter. In introduction part, they have elaborated the current scenario and the implementations of the lateral load handling capacity add on to the building along with its optimization criterion. They firstly proposed various objectives and output parameters such as maximum displacement in all three directions, storey drift, base shear and the applied load case that creates maximum drift. Various input parameters were shown in the methodology and structural modeling section with a view to counteract the seismic forces. Total 16 cases have selected in their research work and abbreviated as CASE A to CASE B14 respectively. After the comparison of the obtained result analysis, they proved the shear wall strip belt was placed optimum at floor 12 with a height of 47.58 m respectively (Neeraj Patel et. al.).

The main attention to relate to the opening area effect of the shear wall in tall structures. Authors in this work clearly proved the ability to resist the lateral forces can be done by shear wall member only. But due to efficiency, the shear wall could be used in such a manner that the area used by the wall was to be minimum throughout the entire height of the building. The work presented by the authors was a technical approach. For that, they first described the current scenario of the land used as per urban infrastructure point of view. They have considered total 5 structure models and abbreviated as SA, SB, SC, SD, and SE respectively. For analyzing the shear wall that was used at corners and the percentage area coverage of shear wall also was the major part of their study. Clearly, the shear wall deduction area was described in the table provided as per abbreviation. After comparison of the various results, it was clearly shown that whenever the shear wall used at corners, only 20% wall deduction criteria will be accepted and beyond this criteria, the structure will ultimately loose its stiffness (Prafoolla Thakre et. al.).

To deal with the issue of architectural point of view, researchers in this work reveals that floating column criteria can be implemented in a multistoried building. The main aim in their work suggested that there should be criteria of the column elimination so that the structure should maintain its stability and its overall stiffness should also be maintained. On other hand, locations of the floating column have also played an important role in this regard and the same maintained and proved in their work. They have done various reviews of the different approaches related to the same theme. After literature surveying, the have given the conclusions with the outline of their proposed work i.e. technical approach. In conclusive part, they suggested that optimization work on the floating column should be there as per building stories. Since from their work it has been cleared that floating column criteria should be provided as per optimum height of the structure (Gaurav Pandey et. al.).

This work addresses the possibilities of different grades of concrete in wall belt system comprises of dual structural system. The authors have done the parametric approach to prove their work. In introduction part, they simply described the importance of wall belt supported system. When this system combined with the dual structural system, it increases the stability of overall building. They have taken the G+18 storey building with various cases comprises of with and without shear wall belt. As per the objectives of their study, they needed some optimum parametric criteria's to fulfill the needs and prove their research work. They have considered the displacement, base shear, bending moment, shear forces axial forces and torsional values to compare all the cases and find the efficient one. They have abbreviated different cases as Case B0 to Case B9, such that total 10 Cases compared among each other under different parametric heads. For that, M25, M30 and M35 Grade of concrete have selected with 140 mm, 160 mm and 180 mm thickness of the wall belt. All the structures were supposed to be rested over medium soil at seismic zone III having importance factor maintained at 1.2. After comparing the results under various parametric heads, the conclusions have drawn. Their research suggested that Building Case B7 seems to be optimum after comparison among 10 various cases and should be recommend whenever this type of construction have done (Durgesh Kumar Upadhyay et. al.).

To overcome with the problem of increasing the compressive strength and flexural properties of the concrete, researchers come to grips with the usage of fly ash and the glass powder. They have made an experimental investigation using the replacement criteria of fly ash and glass powder with cement in a particular percentage to enhance the properties of concrete. In introductory part, they have clearly described the recent trend in their times that the construction industries needs the change. After that, they have shown the importance of the waste material can be used as a partial replacement to the costly raw material used in concrete that is cement. For experimental approach, they have taken the basic materials like cement (OPC), sand, natural coarse aggregate and the waste materials such as fly ash and glass powder for making the mixes. They have made total 7 mixes with the combination of different percentages of addition and replacement. The comparative results have drawn after the same. The results of compressive strength test are performed for 7 days, 14 days and 28 days of curing respectively. The same criteria were performed for flexural strength test too. After the comparison of analytical results under each heads, conclusions have drawn suggested that 25 % fly ash in combination of 0% glass powder in replacement of cement proved to the efficient combination. The abbreviation of the same effective case was Mix second i.e. (M-2) respectively (Sachin Sironiya et. al)

Management in this work is to emphasize the usage of the complete arrangement of telecommunication towers over a multistoried building. Since, we have not previously known if there will be telecommunication tower should be placed over roof top with the complete arrangement of the fixtures. The additional load if applied in future was going to be a disaster to a multistoried building when it will be in the influence of the seismic loading was the main idea of their research. This knowledge was provided in their introductory part. For the same topic, they decided the objectives comprises of different output parameters such as the comparison of shear in beam, bending moments in beam members, torsional moments and dynamic parameters. These output parameters have supposed to be compared for both the translational directions of the horizontal axis respectively. In structural configuration head, several input parameters have decided as the structure have situated in seismic zone IV. Total 5 cases have selected such that the roof was supposed to have different tower positions. The positions was abbreviated as P1 to P5 and the cases in which it was considered, abbreviated as CASE A to CASE E respectively. The

results were also represented as graphically as different graphs for each of the parametric head. The outcomes were shown in conclusions head, proved that there was an efficient case for each parametric head (Suyash Malviya et. al.).

V. CONCLUSIONS AND OUTLINE OF THE PROPOSED WORK

On analyzing above literatures and after the analysis of the complete theme, I found that no one have discussed this new way to lessening the weight of the structure, no one has ever done this ne0w thing, no one have ever gave the importance of base shear reduction in context to earthquake criteria. Reduction in the size of beams at top floors and the various cases discussed yet on the multistoried building structure. Here we come at conclusion drawn by literature reviews that the position for reducing the sizes of the members at top floors, ultimately under the earthquake effects, reduced the base shear of the structure.

The conclusive outcomes drawn from the study are enlisted below:

- 1. Conduction of the study for both the directions would be necessary for lateral effect calculation.
- 2. Different parameters of analysis should be checked and validate as per Indian Standards along within the limits.
- 3. Soil type should also be checked as per Indian Standardization IS 1893-2016.
- 4. Seismic zonal analysis should be check to analyze the data for different seismic zones in dual structural configurations.
- 5. It is always necessary to check the lateral effects in the form of displacements.

The main focus is to check the dual system with different grades of concrete that has going to be a major study for upcoming proposed work.

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Evaluation of antimicrobial activity of *Copaifera sp.*

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Abstract—The oil-resin of Copaifera sp. it is excreted from copaibeira, an endemic plant in Brazil. Its main medicinal properties are: anti-inflammatory activity, healing and antibacterial action. Its therapeutic potential occurs due to its chemical constituents sesquiterpenes and diterpenes, which are: β -karyophylene, α -copaene and copalic acid. The present work evaluates the activity of Copaifera sp. against the strains of Staphylococcus aureus, Pseudomonas aeruginosa and Escherichia coli. The technique used was the dilution in broth in Agar Müeller Hinton medium, in concentrations 0.5%, 2.5%, 5.0%, 7.5% and 10.0%, aiming to analyze the oil inhibiting power in the bacterial growth. A comparison with conventional antimicrobials, aminoglycosides (gentamicin), β lactams / cephalosporins (cephalothin), phenicols (chloramphenicol) and tetracyclines, was also performed. The preliminary antibacterial results were considered satisfactory against the Staphylococcus aureus strain, completely inhibiting its growth, whereas on the strains of Pseudomonas aeruginosa and Escherichia coli, the inhibition was considered weak to moderate.

Keywords — Oil-resin, Antibacterial, Copaifera sp., Agar Müeller Hinton.

I. INTRODUCTION

Popular medicine is the basis of the knowledge acquired in relation to medicinal plants, known for centuries and practiced worldwide, being in some populations the only resource available in the treatment of diseases. Despite their chemical complexity, plant-based drugs are widely used in modern medicine, based on therapeutic experiences gathered over the years (Maciel, Pinto, Veiga Junior, Grynberg, &Echevarria, 2002).

Brazil has a very rich flora, although, there is a lack of studies that prove the pharmacological action of these drugs. However, popular knowledge has been helping research regarding pharmacological actions, such as copaiba oil and its anti-inflammatory and healing properties, which can be found in numerous places, such as fairs and pharmacies for natural products (Packer & Luz, 2007).

From the perspective of ethnopharmacology, the use of some plant inputs, with specific pharmacological actions, such as anti-inflammatory, analgesic, antimicrobial, among others, is crucial to indicate the path in the production of new plant-based drugs (Scudeller, Rosa, & Barbosa, 2007). Plants belonging to the Copaifera genus are popularly known as copaíba, pau-d'óleo and copaibeira (Plowden, 2004) represented by many species, more than 72 in the world and approximately 16 endemic in Brazil, as reported by VeigaJúnior and Pinto (2002).

Pharmacologically evaluating copaiba oil, it was found that its use is well used, since in vitro and in vivo studies demonstrate anti-inflammatory, healing, trypanosomicidal, antitumor and antiedematogenic activities produced by the oil-resin (Soares et al., 2003), other research demonstrates its role as an antimicrobial (Cotoras& Mendoza, 2004; Santos et al., 2008), as well as an edema inhibiting agent (Francisco, 2005).

Recent researches has demonstrated the composition of copaiba oils, which invariably contains sesquiterpenes and diterpenes. The sesquiterpenes β -karyophylene, α -copaene and copalic acid (diterpene), are undoubtedly the main compounds of the oil-resin. The authors also state that in studies with different species and from different regions of Brazil, they all have this acid in common, therefore being considered a biomarker (Veiga Junior & Pinto, 2005; Soares et al., 2003). Pereira et al. (2008), quantifies the portion of karyophylene oxide that varies from 33, 72% to 38, 98% and reaffirms it as a major compound of *Copaiferalangsdorffii* oil-resin. In addition, Maciel et al. (2002), reports that diterpenes have been proven to be responsible for most therapeutic properties.

Attention to antimicrobial substances has been promoting the search for plant extracts capable of providing efficient action against certain agents. Several studies report on this action, demonstrating effectiveness against sensitive and resistant microorganisms, emphasizing the potential of plants in drug therapy (Nascimento, Locateli, Freitas, & Silva, 2000). According to Cowan (1999), most of the drugs sold come from plant bases, however these resources are not commonly used for antibacterial therapy.

The worsening of bacterial resistance in recent years, mainly in relation to microorganisms isolated from patients with infection, has produced large-scale studies on the pharmacological actions of antimicrobials (Oliveira et al., 2006). It is known that bacterial resistance is frequent and quite confusing, bacteria of great importance such as: Streptococcus pneumoniae, Haemophylus influenzae, Campylobacter jejuni, Staphylococcus aureus, Mycobacterium tuberculosis, Escherichia coli, Enterococcus sp.,Shigella sp., Salmonella sp. and Vibrio cholerae, have strains resistant to the most advanced antibiotic therapy (Gurgel&Carvalho, 2008).

It is important to measure the problem of this resistance at a global level, since it inevitably accompanies the studies that deal with the discovery of new drugs (Moellering, 2000). Currently, several types of combinations are being used in order to establish new therapeutic responses, relating antimicrobials to plant extracts (Yunes, Perosa, &Cechinel, 2001; Novais et al., 2003; Filoche, Soma, &Sissons, 2005; Oliveira et al., 2006; Rosato, Vitali, De Laurentis, Armenise, &Milillo, 2007; Shahverdi, Abdolpour, Monsef-Esfahani, &Farson, 2007). Therefore, this study is important to add knowledge to the literature for medicinal plants in the Amazon, specifically to determine the antimicrobial activity performed by the oil-resin of *Copaiferasp* and to observe the concentrations necessary to inhibit microbial growth.

II. MATERIALS AND METHODS

The experiments were developed locally in the multianalysis laboratory of a private college in the city of Belém-PA. To collect the material to be used, manual extraction of copaíba oil-resin was performed, obtained in the region of Cametá, in western ofPará, was carried out, transported in an amber bottle and stored at room temperature until the development of the experiments.

In order to carry out the tests and later evaluate the inhibitory activity of copaiba oil, the following microbial standard strains were used: *Escherichia coli* - ATCC 8739; *Pseudomonas aeruginosa* - ATCC 9027; and, *Staphylococcus aureus* - ATCC 25,923.

The profile of susceptibility to copaiba oil was initially tested using the dilution technique of vegetable oil in a melting medium, as described by Nonato, Lameira and Oliveira (2009). This method is based on the cultivation of bacteria in a synthetic culture medium Agar Müeller Hinton; the raising was carried out from 1 mm discs of the bacteria, obtained from the CefarDiagnóstica culture collection, which guarantees a basic microbiological profile.

Then, the Agar Müeller Hinton culture medium was dissolved in distilled water and autoclaved at 121 ° C for 15 minutes. Copaiba oil-resin in concentrations of 0.5%; 2.5%; 5.0%; 7.5% and 10.0% were added to the previously sterilized Agar Müeller Hinton culture medium. Then, it was homogenized to be discarded in sterile Petri dishes

(90x15mm), awaiting polymerization and subsequent inoculation of the bacterial discs.

The experiments were carried out in triplicate and the control was carried out with the culture medium in two phases, the positive with the value of the concentration established in its standard solvent, distilled water and the negative with the culture medium plus the determined concentration of copaiba oil-resin. In parallel, plates of Agar Müeller Hinton were sown with Gram negative bacteria: Pseudomonas aeruginosa and Escherichia coli, and Gram positive: Staphylococcus aureus, after which the gentamicin antimicrobial disks 10mcg, cephalothin 30mcg, chloramphenicol 30mcg 30mcg and tetrin, and chloramphenicol 30mg from the company LABORCLIN (Produtos para Laboratório LTDA), in order to provide parameters of efficiency or not of the plant product under analysis.

The data analysis was performed using a software for statistical calculations, called SISVAR (Program of statistical analysis and design of experiments), developed by *Table.1: Microbiological inhibition of copaiba oil-resin*

in a concentration of 0.5%

| Concentration | Bacteria | Halo- cm (mean) | Significance level |
|---------------|--------------|-----------------------|-----------------------|
| 0,5% | P.aeruginosa | 6,76cm | a ₃ |
| | S. aureus | 0,78cm | a 1 |
| | E. coli | 3,45cm | a ₂ |

Source: authorship

The result of the 2.5% concentration was satisfactory and equally significant for all strains tested (Table 2).

Table.2: Microbiological inhibition of copaiba oil-resin at a concentration of 2.5%

| Concentration | Bacteria | Halo- cm (mean) | Significance level |
|---------------|--------------|-----------------------|-----------------------|
| 2,5% | P.aeruginosa | 3,81cm | a_1 |
| | S. aureus | 3,57cm | a 1 |
| | E. coli | 3,27cm | a_1 |

Source: authorship

the Federal University of Lavras (UFLA), designed to perform analysis of variance preferably for balanced data. The studies were made from Analysis of Variance (ANAVA), with multiple comparisons between the means of the experiment, through the Tukey Test, considered rigorous since it is based on the minimum significant difference (DMS).

III. RESULTS

The present study evaluated the antimicrobial action of *Copaifera sp.* oil-resin in different concentrations: 0.5%, 2.5%, 5.0%, 7.5% and 10.0%, against standard gram negative strains of *Pseudomonas aeruginosa* ATCC 9027, *Escherichia coli* ATCC 8739 and gram positive *Staphylococcus aureus* ATCC 25,923. The evaluation of the concentration at 0.5% between the strains found significant values for the gram positive bacterium *Staphylococcus aureus* with the average of its growth halo \leq 0.78 cm (Table 1).

In the 5.0% concentration, only the growth halo formed by the *Staphylococcus aureus*was considered highly significant (Table 3).

Table.3: Microbiological inhibition of oil-resin from copaiba oil-resin at a concentration of 5%

| Concentration | Bacteria | Halo- cm | Significance level |
|---------------|--------------|-------------|-----------------------|
| | | (mean) | |
| 5,0% | P.aeruginosa | 4,34cm | a_2 |
| | S.aureus | 0,27cm | a 1 |
| | E.coli | 3,4cm | a ₂ |

Source: authorship

When the 7.5% copaiba oil concentration was evaluated, the significance was observed at different levels of the three strains evaluated, however the values of the growth halo for the microorganisms were considered significant, judging the values already found in the lower concentrations and mainly the action of oil on gram negative bacteria *Escherichia coli* and *Pseudomonas aeruginosa* (Table 4).

Table.4: Microbiological inhibition of copaiba oil-resin at a concentration of 7.5%.

| Concentration | Bacteria | Halo- cm (mean) | Significance level |
|---------------|--------------|-----------------------|-----------------------|
| 7,5% | P.aeruginosa | 3,46cm | a_2 |

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|-----------------------------------|--------|------------|--|
| S.aureus | 0,30cm | a 1 | |
| E.coli | 2,5cm | a2 | |

 a_2

Source: authorship

The 10.0% concentration was found to be highly significant for only one of the strains used, gram positive Staphylococcus aureus (Table 5).

Table.5: Microbiological inhibition of copaiba oil-resin at 10.0% concentration

| Concentration | Bacteria | Halo- | Significance |
|---------------|--------------|--------|----------------|
| | | cm | level |
| | | (mean) | |
| 10,0% | P.aeruginosa | 3,73cm | a ₃ |
| | S.aureus | 0,00cm | a 1 |
| | E.coli | 2,76cm | a ₂ |

Source: authorship

When this bacterium was evaluated against the antimicrobials: gentamicin and chloramphenicol, the response obtained was that Staphylococcus aureus - ATCC 25.923 produced a 13 mm halo, characterized as an intermediate performance for the evaluated antimicrobials, as established by the NCCLS (Clinical and Laboratory Standards Institute / NCCLS, 2005). The results found for the Staphylococcus aureus strain characterize the oil-resin of Copaifera sp. as an excellent antimicrobial, since at 10.0% concentration, it was able to totally inhibit the growth of the tested bacteria.

Table 6 demonstrates the performance of the gram positive bacterium Staphylococcus aureus, against the copaiba oilresin, in all concentrations performed, allowing to assess the progression of microbial inhibition and to compare with the other tests, shown in tables 7 and 8.

| Table.6: Performance of gram positive bacteria |
|--|
| Staphylococcus aureus |

| Concentration | Bacteria | Halo-cm (mean) |
|---------------|--------------------------|-------------------|
| 0,5% | | 0,78cm |
| 2,5% | | 3,57cm |
| 5,0% | Staphylococcus aureus | 0,27cm |
| 7,5% | | 0,30cm |
| 10,0% | | 0,00cm |
| Control | | 9,00cm |

Source: authorship

| Concentration | Bacteria | Halo-cm (mean) |
|---------------|---------------------------|-------------------|
| 0,5% | | 6,70cm |
| 2,5% | | 3,81cm |
| 5,0% | Pseudomonas aeruginosa | 4,34cm |
| 7,5% | | 3,46cm |
| 10,0% | | 3,46cm |
| Control | | 9,00cm |

Table.7: Performance of gram negative bacteria

Source: authorship

Table.8: Performance of the gram negative bacteria Escherichia coli against the oil-resin of Copaíba

| Concentration | Bacteria | Halo-cm |
|---------------|------------------|---------|
| 0,5% | | 3,45cm |
| 2,5% | | 3,27cm |
| 5,0% | Escherichia coli | 3,45cm |
| 7,5% | | 2,50cm |
| 10,0% | | 2,76cm |
| Control | | 9,00cm |

Source: authorship

To facilitate the understanding of the study carried out, as well as to demonstrate the main results obtained, follow figures 1, 2 and 3, which show the inhibitions that occurred in the tests with the studied bacteria and the copaiba oil:



Fig.1: Photo showing the inhibition of gram positive bacteria Staphylococcus aureus in Agar Müeller Hinton culture medium with 7.5% copaiba oil. Source: authorship

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Fig.2: Photo showing the inhibition of Gram negative bacteria Pseudomonas aeruginosa in Agar Müeller Hinton culture medium with 0.5% copaiba oil. Source: authorship



Fig.5: Photo showing the inhibition of gram negative bacteria Escherichia coli in Agar Müeller Hinton culture medium with 7.5% copaiba oil. Source: authorship

IV. DISCUSSION

It was observed that for copaíba oil-resin, in general, the antimicrobial action cannot be determined only by chemical constituents, a previous evaluation of the bacterium is important, so that the results obtained proved different inhibitory actions against the tested strains.

There are numerous studies that demonstrate the antibacterial action of copaiba oil in vitro as when it was tested on bacteria that form dental plaque, with excellent inhibitory results (Gilbert, Alves, & Ferreira, 2002; Simões et al., 2007). An in vitro study that evaluated the antimicrobial activity of Copaifera officinalis oil-resin on Streptococcus microorganisms: oral pyogenes, Streptococcus salivarius, Streptococcus mutans, Enterococcus faecalis, was effective among all tested strains (Pieri, Mussi, & Moreira, 2009), confirming the results obtained in this research, where Gram positive bacteria of the Staphylococcus aureus strain were inhibited by copaiba oil.

Santos et al. (2008), demonstrated the action of oil as an antimicrobial agent for several Gram positive bacteria, including methicillin-resistant Staphylococcus aureus (MRSA), these events corroborate the results obtained in this work, where the Gram positive strain Staphylococcus aureus was the most significant among all tested strains, since the inhibition occurred completely by copaíba oil in 10.0% concentration.

It could also be associated with the results found those described by Mendonça and Onofre (2009), which differ in methodology and in the specification of the species of copaíba oil, similar results were obtained, where all the bacteria evaluated were inhibited by the copaíba oil-resin, and in the present study, the best performance of the bacterium Escherichia coli occurred in the concentration at 7.5%, with an inhibition halo of \pm 2.5cm, whereas in the



Fig.3: Photo showing the inhibition of Gram negative bacteria Pseudomonas aeruginosa in Agar Müeller Hinton culture medium with 7.5% copaiba oil. Source: authorship



Fig.4: Photo showing the inhibition of Gram negative bacteria Escherichia coli in Agar Müeller Hinton culture medium with 0.5% copaiba oil. Source: authorship

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work previously mentioned, Escherichia coli showed prominence with minimum inhibitory concentration of 1.56%, both showing susceptibility to copaiba oil-resin.

Analyzing the results obtained in this study and comparing those achieved by Bloise (2003), where Copaiferaspp oils were used, and different methodologies, equivalent answers were obtained, where the strains of Pseudomonas aeruginosa, Escherichia coli and Staphylococcus aureus, showed sensitivity to copaiba oil. Biavatti, Dossin, Deschamps and Lima (2006), also tested the activity of Copaiferamultijuga oil, the most satisfactory results happened for Streptococcus mutans, for Staphylococcus aureus and Escherichia coli the results were considered significant, in agreement with the results found in our research.

Nascimento et al. (2007), reports that in order to compare the results obtained in the studies with those available in the literature, several factors must be analyzed, such as the technique used, the plant material, the culture medium, the innocuous density and the diluent used, the variability of materials and techniques makes comparison difficult, making it impossible to reproduce new works.

Santos et al. (2008), evaluated the in vitro antibacterial action of oil-resin from several copaiba species on Gram positive and Gram negative bacteria, the antibacterial activity occurred only on Gram positive bacteria, Pacheco, Barata and Duarte (2006), also demonstrated inactivity of copaiba oil on Gram negative strains, results that are opposed to those found in this work, where the inhibitory bacterial response occurred for all strains tested, with the halves being more satisfactory for Pseudomonas aeruginosa and Escherichia coli, which occurred in the concentration at 7, 5%, respectively \pm 3.46 cm and \pm 2.5 cm, for the Gram positive strain Staphylococcus aureus, the most significant concentration was 10.0%, where copaiba oil was able to completely inhibit bacterial growth.

França and Kuster (2009), reports that the difference in susceptibility may be due to the structure of the external cell membrane of Gram negative bacteria, and not only due to the biological activity of the tested products. Santos et al. (2008), further suggests, that the susceptibility of the bacteria occurs by the rupture of the cell wall and release of the cytoplasmic content caused by the oil, which was observed through a detailed assessment of the morphology and structure of the cell wall of Gram positive bacteria.

In vivo studies were carried out with the intention of validating the oil's antimicrobial action, as described by Martins and Silva (2010), where the activity of Copaifera sp. pure in topical application of infected wound, producing reduction of local edema and cessation of

purulent secretion resulting from the infectious process. Masson (2011), carried out in vitro and in vivo studies with *Copaiferalangsdorffii* oil-resin where he presented an antimicrobial response to gram positive microorganisms, demonstrated by the topical application in cream to 10.0% of copaiba oil in the infected ulcer model, producing reduction of the superficial microbial load and even of the deep tissue.

These data found in the literature strengthen the benefits of this work, which when evaluating different concentrations of *Copaifera sp.* against the pathogen *Staphylococcus aureus*, exhibited an efficient antimicrobial potential. In vivo tests guarantee credibility to the clinical use of copaiba oil (Gilbert, Alves, & Ferreira, 2002; Tincusi et al., 2002). Gonçalves, Alves Filho and Menezes (2005), in a diffusion test in Agar, tested the extract of the bark of Copaiba (*Copaifera officinalis*) on the strain of *Streptococcus pyogenes*, and the inhibition did not happen, suggesting that only the oil-resin of copaíba has constituents capable of inhibiting microbiological growth.

V. CONCLUSION

Through the results obtained, it is concluded that the oilresin of Copaifera sp., When evaluated in the concentration at 10.0%, presented a total inhibitory activity of the gram positive strain Staphylococcus aureus. Regarding the activity on the gram negative strains of Pseudomonas aeruginosa and Escherichia coli, the oil performed an inhibitory action, considered moderate, being possible to use it as a parameter to determine the use or not of the product. This fact is justified by the great diversity of chemical constituents in vegetable raw materials.

In view of the significant impact of the problems involved in the bacterial resistance process, copaiba oil-resin as an antimicrobial agent becomes a valuable adjunct for further studies, aiming to measure the true microbiological potential of the oil, its mechanism of action and its toxicity, ensuring its use. In addition, the results obtained show a significant contribution to the characterization of the antimicrobial activity of copaiba oil-resin, widely used in popular medicine.

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Microcephaly: Clinical and Sociodemographic Profile of Affected Children in the Municipality of Cacoal, Rondônia, Brazil

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Abstract— Microcephaly is a congenital malformation, which will impair brain development. It can occur due to genetic complications, classified as primary with genetic character and secondary non-genetic as; alcohol, drugs, radiation exposure and one of the most common is transmission of the zika virus that is transmitted by the aedesaegypti bug. The objective of this study was to analyze the clinical and sociodemographic profile of children notified with microcephaly in the city of Cacoal-RO. This is a descriptive, cross-sectional, qualitative study. The study was carried out with children affected with microcephaly registered in SINAN, the data collection was carried out by applying a semi-structured questionnaire prepared by the researchers. The data were collected through a questionnaire with 15 questions, the data collection was structured in 4 phases. The data obtained correspond to 3 children with microcephaly, with a predominance of females 3 (100%) aged between 2 to 4 years (66.7%). The parents' age group prevailed 18 to 29 years (66.7%), it was observed that the predominant family income was 1 to 2 minimum wages. In relation to cranial perimeter, 2 (66, 7%) was adequate for age, with 1 (33.3%) being below the expected for age, in relation to weight 2 (66.7%) was underweight for age followed by 1 (33, 3%) adequate. Children are monitored in health services, care is provided in specialized units. It was concluded that in view of the results obtained, knowledge of the family and social context in which the child is inserted is essential for planning care.

Keywords— Microcephaly, children, Nursing care.

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I. INTRODUCTION

Microcephaly is a congenital malformation that does not fully develop the newborn's brain, in which to consider a child with microcephaly the cephalic perimeter is less than two or more standard deviations in relation to sex, age or gestation time, the child with microcephaly due to this malformation there will be a delay in development and growth, thus affecting even simpler things like sitting, crawling, grabbing, among others (BRASIL, 2015).

In Brazil, between October 2015 and January 2016, there were approximately 4,783 notifications of microcephaly cases, in which of these notified cases, 3,174 (76.7%) are still under investigation. Among the total of notified cases (4,783), in 2015 there were 3,174 notified cases (66.4%), in January 2016, 1,599 cases were reported (33.4). In the total number of cases, 1113 (23.2%) would have already been investigated and classified, among those cases that were investigated and classified 404 cases would have been confirmed for microcephaly or some alteration in the central nervous system (SALGE, 2016).

Up to December 2016, 10,867 cases of microcephaly were reported, according to definitions in the surveillance protocol, out of the number of reported cases 3,183 (29.3%) continued to be investigated, and 7,684 (70, 7%) with 2,366 cases confirmed, out of the total number of notified 582 (5.3%) cases evolved to fetal or neonatal death (BRASIL, 2016).

In the period between 2000 and 2014 the number of live births with microcephaly were 2,464 with an average of 164 per year, in 2015 there was an increase of nine times more than the average number of cases per year, which was 1,608 cases in the year. year 2015. (MARINHO, 2016).

Among the causes characterized as secondary we have the Zika Virus, which is transmitted by the mosquito vector Aedesaegypti, the same vector that transmits Dengue and Chikugunya. In Brazil, the Zika virus is the most associated cause of microcephaly to date, the first cases being notified by the Ministry of Health (MS) in October 2014 in the state of Rio Grande do Norte, however there was only confirmation of the first cases of microcephaly a from the year 2015 (OLIVEIRA *et al., 2016*).

Within the diagnosis of microcephaly, there are some methods that make it possible to achieve the desired results, they are nonspecific: they are tests with a complementary character within the search for the identification of the disease, methods that can identify variations in many laboratory tests, among which are: protein C reactive, gamma glutamyltransferase, markers of inflammatory activity, leukopenia, among others. The diagnosis of specific character, on the other hand, directs the investigation for the Zika virus through the detection of viral RNA from clinical specimens (BRASIL, 2016).

Another important method in the diagnosis of microcephaly is the morphological examination of the skull, where its purpose is to measure the circumference or cranial perimeter, which will allow a comparison with the curves considered normal by the Ministry of Health (MS), thus lower results those considered normal, (31.9 cm for males and 31.5 cm for females), will be diagnosed positive for microcephaly (VITORINO, 2017).

There is no specific treatment for a child with microcephaly, however there are actions that help in the development of this child. This monitoring is carried out by several specialists, depending on the complication caused by microcephaly, the assistance that is recommended by the Unified Health System has the objective of neurophysicomotor rehabilitation of these children who were affected by microcephaly (BRASIL, 2015).

In Brazil, in 2015 there was a high rate of microcephaly cases, so the Ministry of Health developed protocols for guidelines, clinical, epidemiological investigations and case definitions for microcephaly. To avoid an increase in the number of cases, possible causes and preventable precautions should be identified in order to minimize the amount of microcephaly reports, promoting actions such as guidance for pregnant women on the risk factors that can be acquired during pregnancy, such as Zika Virus, syphilis, alcohol, radiation exposure, among others that can evolve to microcephaly (BRASIL, 2015).

The importance of knowing the demographic profile of these children notified with microcephaly is justified by not having studies related to the topic in the state of Rondônia because it is a clientele that needs specialized care to not further compromise their development, which is already normally impaired, thus avoiding neurological, physical, motor and social damage. The relevance of tracing the quality of care provided at health units will contribute to other studies in the future, taking into account that nurses have a contribution to the development of children with microcephaly, together with other professionals with the aim of reducing the sequelae that are caused by microcephaly.

The general objective of the study was to analyze the clinical and socio-demographic profile of the children notified with microcephaly in the municipality of Cacoal-RO, the specific objectives were: To identify the sociodemographic and clinical characteristics of the children affected by microcephaly, to evaluate growth and development through the notes in the child's handbook through standardized graphics on the handbook; describe the childcare provided to the child in primary health care by evaluating the variables (medical consultations, nursing consultations, immunization, vitamin A supplementation), verify the knowledge of professional nurses regarding the monitoring of children with microcephaly through the guide on early stimulation in Primary Care.

II. MATERIALS AND METHODS

A descriptive, qualitative and quantitative field research was carried out in order to enable the assessment of trends in health status and to compare variables between individuals, to provide a basis for planning, providing and evaluating health services, to identify problems to be studied through analytical methods and suggest areas of interest for investigation, transversal, because this study analyzed the state of the individuals contained therein in relation to the presence or absence of exposure, cause and disease in a single moment (ESTRELA, 2005). According to Gil (2008), the method of descriptive research has as its primary purpose the descriptions of the characteristics of a given population or phenomenon or establishment of variable relationships.

Qualitative, as this method seeks to explain reality in terms of concepts, behaviors, perceptions and assessments of the people object of the study (DEMO, 2000). Quantitative, as it seeks objective explanations for the phenomena thus leading to an emphasis on the numerical data that are the basis of this research method, which will be carried out in units in the Municipality of Cacoal-RO.

Data collection was carried out in 4 stages using a questionnaire containing 15 (fifteen) multiple choice questions and open questions adapted from the work of Cruz. Silva and Santos (2017)in "Clinical. sociodemographic and functional profile of infants with microcephaly treated in the occupational therapy sector of a center specialized in rehabilitation." In the first stage, a questionnaire was applied containing variables related to the characterization of the sociodemographic profile, such as: origin (rural or urban) age group of the child and parents, family income, educational level of parents, school situation of the child. In the second stage, the child's guardians were asked to answer questions related to the child's clinical conditions (sex, gestational age at birth, type of delivery, complications at birth, birth weight, cranialperimeter at birth, exams performed at birth, the cause of microcephaly). The third stage was asked to parents about the care of the child in the health unit, evaluating the following variables (consultation with a doctor in the health unit, nursing consultation, vaccination status, growth and development assessment, supplementation of vitamin A). In the fourth stage, the knowledge of the nursing professionals on the monitoring of children with microcephaly was evaluated through protocols standardized by the Ministry of Health, carried out some training in handling children with microcephaly and what are the main difficulties in caring for children with microcephaly.

Data collection took place in the months of June and September 2018, in the morning and/or evening periods.

The growth variable was measured by weight, body length and cranialperimeter using the Z score as a reference standard. This score is a terminology used to represent the variability of a given parameter between individuals and represents the distance, in the form of deviation- standard that the values of that parameter can assume in the population in relation to the average value.

After the project was approved, the researchers scheduled a meeting with the nurses responsible for each family health team, explaining the purpose of the study and later with the community health agents to locate the addresses of the respective children. In the first moment, the number of children with microcephaly was surveyed by the nurse of each health team. At this moment, the nurse was invited to participate in the research by answering the questionnaire of the fourth stage regarding the knowledge of the nurse about the care of children with microcephaly. After collecting these data, a visit to the child's home was scheduled through the CHA (Community Health Agent) to collect data with the parents or guardians. The researchers informed the parents of the children that the purpose of the interview is to collect data on the situation of children with microcephaly in the municipality and that at any time the parents would be free to interrupt the researchers to clarify doubts about the research and the condition itself of child.

The research was carried out after the project was approved by the Ethics and Research Committee of the Faculty of Biomedical Sciences of Cacoal - FACIMED; as well as the authorization of the primary care coordinator, manager, nurse who work at the BHU and those responsible for the children, ensuring the ethical rigor of research involving human beings. The study did not pose any risk to children, as it preserved any and all personal data from any of the samples. The project was initially considered by the Ethics and Research Committee (CEP) and approved according to 2,330,647. The data were inserted in the Word 2007 and Excel programs, were analyzed and tabulated, in which they are exposed in the work in the form of a table by means of descriptive statistics.

III. PRESENTATION AND DISCUSSION OF RESULTS

In this study, the population was initially constituted according to SINAN data. There would be 6 children between the age group of 0 to 6 years with a diagnosis of microcephaly. However, it was possible to collect data from only 3 children, because at the time of collection, 3 children could not be interviewed for the following reasons: 1 child was in the state of São Paulo undergoing treatment, one moved to Rolim de Moura and another had not confirmed the diagnosis of microcephaly.

Participants in the study were responsible for registered children living in the municipality of Cacoal-RO diagnosed with microcephaly. According to the table below, the predominant gender was female with 3 (100%), of the sample obtained 3 (100%) lived with father and mother, in relation to age group, a greater number of children can be

observed at the age of 2 to 4 years 2 (66.7%), in a smaller number are children aged 7 to 12 months 1 (33.3%), with relation to the age group of the parents, the prevalence was 18 to 29 years 2 (66, 7%) in a lower percentage are those aged 30 to 45 years 1 (33.3%), with regard to family income, there was a dominant income of 1 to 2 minimum wages 3 (100%), lastly the parents' schooling observed a higher number in relation to parents with incomplete high school 3 (49.9%), respectively incomplete elementary school 1 (16.7%), (See Table 1)

Regarding the characterization of children, Table 1 explains a distribution with 3 (100%) female children, the lowest age found was seven months and the highest age was 4 years.

Low family income was one of the aspects found that corresponds to other studies, being one of the main difficulties reported by parents, since low income makes it difficult in the care that children with microcephaly need in their daily lives, such care as transportation to specialized centers (physiotherapy), differentiated food and medication. (FREITAS, 2018).

| Variables | Nº | % |
|------------------------------|----|--------|
| Sex | | |
| Feminine | 3 | 100% |
| Who do you live with | | |
| Father and mother | 3 | 100% |
| Child Age Range | | |
| 7to 12 months | 1 | 33,3% |
| 2to 4 years | 2 | 66,7% |
| Parents' Age Group | | |
| 18 to 29 years | 4 | 66,7% |
| 30 to 45 years | 2 | 33,33% |
| Family income | | |
| 1st to 2nd minimum wage | 3 | 100% |
| Parents' Education | | |
| Incomplete Elementary School | 1 | 16,6% |
| Complete primary education | 1 | 16,6% |
| Incomplete high school | 3 | 49,99% |
| Others | 1 | 16,6% |

 Table 1- Characterization of the sociodemographic profile of families and children affected with microcephaly registered at SINAN in the municipality of Cacoal-RO 2018.

SOURCE: Silva, Sampaio, Viana. 2018

According to the data found, most parents had low education and low income, this shows how socioeconomic conditions are associated with knowledge about risk factors in relation to pregnancy and the complications that the mother and baby may suffer during the period pregnancy, this can also hamper access to health services. (ABREU *et al., 2016*).

The age range found in the study was 18 to 45 years, there was a difference for other studies in the maximum value in the age of the parents that was 59, however in relation to the minimum value in the age of the parents the results corroborate with other studies, this finding shows how fundamental is the knowledge of the family and social context in which the child is inserted, since the low age of the parents can compromise pregnancy and the baby's development due to several conditions, such as restricted

access to health services, vulnerability social, the mother's difficulty in understanding the baby's real needs and inadequate family and social support (ABREU *et al.*, 2016).

The table below shows the clinical conditions of the children, where it demonstrated that 2 (66.7%) the cranialperimeter was expected to grow for age and 1 (33.3%) below the expected for age, in relation to the height observed Although 3 (100%) of the children were of adequate height for their age, it was found that 2 (66.7%) were underweight for their age and 1 (33.3%) was underweight for their age, in relation to the BMI it was noted that 3 (100%) were suitable for their age, the cranialperimeter at birth of the children, observed that 2 (66.7%) CP less than 30 cm and 1 (33.3%) were born with CP greater than 31.5 cm.

 Table 2. Anthropometric assessment of children with microcephaly registered at SINAN, in the municipality of Cacoal-RO

 2018.

| Variables | N° | % |
|-------------------------|----|-------|
| Cranial Perímeter | | |
| Below expected for age | 1 | 33,3% |
| Expected growth for age | 2 | 66,7% |
| Stature | | |
| Suitable for age | 3 | 100% |
| Weight | | |
| Low weight for age | 2 | 66,7% |
| Suitable weight for age | 1 | 33,3% |
| IMC | | |
| Suitable weight for age | 3 | 100% |

SOURCE: Silva, Sampaio, Viana. 2018

In this study, there was a predominance in the number of children born with CP less than 30 cm, in which in another study reported exactly the opposite, where a greater number (52%) of children were born with CP greater than 30 cm. (CRUZ *et al., 2016).* However, it was observed that this finding corroborated with another result found, where there is a greater number of children with microcephaly with a perimeter smaller than 30 cm at birth. (VITORINO, 2017).

Regarding anthropometric measurements, length and cranialperimeter, weight, there was a difference. This finding validates the understanding that children with microcephaly when compared to children not diagnosed with microcephaly present different characteristics in anthropometric conditions and associated with this, it was observed that there was no adequate weight gain for the age group, where the development of the perimeter headache was also affected, falling below the standard values recommended by the Ministry of Health.

It was observed that there was a predominance of children who were underweight for their age, 2 (66.7%), and 1 (33.3%) with an appropriate weight for their age, this result corroborated with a study by Junior *et al.*, 2017; in relation to height, there was a divergence, because the result found was that 3 (100%) of the children were of adequate height for their age, different from the study by Junior *et al.*, 2017; in which a large part of the children were of an inadequate height for their age.

The table below shows through the questionnaire applied to parents, that 3 (100%) of the children interviewed went through and go through medical consultations regularly, regarding nursing consultations, 2 (66.7%) of the interviewees said they had passed and were passing through regularly consulted nursing consultations, and 1 (33.3%) reported that they did not and do not undergo regular nursing consultations, regarding the vaccination situation, it was possible to observe through the child's vaccine record that 3 (100 %) of the interviewees had age-appropriate vaccines, with regard to the assessment of growth and development, 3 (100%) of the interviewed

parents reported that their children have undergone and are undergoing evaluation at the specialized centers they attend, with regard to regards supplementation with vitamin A, 1 (33,3%) reported that the child received the supplementation, and 2 (66.7%) said they did not receive it.

 Table 3. Characterization of care in the health units of children with microcephaly registered at SINAN, in the municipality of Cacoal-RO 2018.

| Variables | No. | % |
|---|-----|--------|
| Child has had or goes through a Medical Consultation regularly | | |
| Yes | 3 | 100% |
| The child has gone through or goes through a Nursing Consultation | | |
| Yes | 2 | 66,66% |
| Not | 1 | 33,33% |
| Vaccination status is complete for age Yes | 3 | 100% |
| Growth and development assessment is carried out. | | |
| Yes | 3 | 100% |
| Received vitamin A supplementation | | |
| Yes | 1 | 33,33% |
| Not | 2 | 66,66% |

SOURCE: Silva, Sampaio, Viana. 2018

The study showed that 2 (66.7%) of the children went through nursing consultations and 1 (33.3%) did not, of these only 1 (33.3%) maintained regular consultations until the date of the study, this finding shows that nursing care must seek integrality, in order to guarantee the assistance of the needs they present. This result leads us to the duty of the nurse to seek the resolution of the problems faced by the family through referrals to reference services and laboratory support, services that are usually combined in large urban centers. There is no doubt, in relation to the important role of the nurse with the child with microcephaly, lacking, to provide comprehensive and quality care, to improve and enrich their necessary technical knowledge about the disease, treatment and care that will guide a good prognosis in the progress of patients with the disease. (VEIGAet al., 2017)

An efficient nursing assistance is able to reduce the impacts caused to parents and family, by seeking care provided to children with microcephaly, helping a better progress of family resourcefulness, improving the quality of life of both the child and his family. Nursing professionals should seek help from strategic means of emotional support, making use of information and communication, such as therapeutic activities, thus collaborating with the strengthening of the family bond.

It is important that the professional promotes a bond of trust with the parents, which will allow moments of listening and welcoming that will favor the divided and organized structuring of child care. The team carries with it the duty to provide training to the family in the prevention of possible sequelae from microcephaly, creating technical care interventions, as well as performing direct and objective observations of children introduced into the family dynamics, cooperating as a source of support and affective of support them, reducing the obstacles caused by the disease. (FREITAS, 2018)

In the 4th stage, the study aimed to describe the knowledge of the professional nurse when monitoring the child with microcephaly. The results of this study identified that most children 2 (66.7%) are in uncovered areas, without followup with a professional nurse, only 1 (33.7%) regularly follow up with this professional, this result leads us to the fact that most children are not monitored by this professional, thus emphasizing the need for this service, since the nurse is one of the main professionals in monitoring the child's growth and development, as he has his work focused on techniques that enable a adequate assistance for physical, motor and cognitive development. (VICTORINO, 2017)

IV. CONCLUSION

The results of this study lead us to conclude that sociodemographic factors can negatively influence the search for care for children with microcephaly, since they directly imply the means necessary for good assistance, where low education guides the lack of knowledge about the real needs of the child and the low income provides difficulties in the search for quality care in face of these needs. It was also observed that the results of this study are in line with the findings of other studies, so we hope that this study will stimulate the desire for new investigations on this subject, and that they can collaborate with the due importance and awareness necessary for health teams.+

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Knowledge and Attitude about Complementary and Alternative Medicine: Perceptions of Brazilian Health care Students

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Abstract— Objective: This study aimed to analyze the knowledge and attitude about Complementary and Integrative Health of Brazilian students of the health area. Methods: The cross-sectional study was conducted in the period from February to December 2012, with 163 students from two universities of different regions of Brazil. The Health Promotion in University Evaluation Instrument (IAPSU) was used to collect data about Complementary and Integrative Health. Results: With regard to the knowledge of the students about the concept of CIH, 47.2% of the students, being 52% of the northeast students and 43.3% of the southeast students, claimed to understand this concept, with no statistical significance when comparing the institutions (p>0.05). When asked if they knew the 20 different practices listed in the questionnaire, there was greater knowledge about acupuncture (87.1%), followed by medicinal herbs (82.8%), massage (80.9%), meditation (80.9%) and diets (80.3%). The practices most widely used by the students, however, were massage (38%), relaxation (36.8%), herbs (33.7%), diets (29.4%) and homeopathy (27.6%). Conclusion: It was concluded that the knowledge and use of CIH practices by students of different health courses in two Brazilian universities was limited and that the most known of these were acupuncture, herbal remedies, massage, meditation and diets, with, however, massage, relaxation, medicinal herbs, diets and homeopathy being more used.

Keywords— Health Education; Health Promotion; Integrative Medicine; University.

I. INTRODUCTION

In 2006, responding to the call of "World Health Organization Traditional Medicine strategy 2002-2005" [1,2], based on the progress of countries and current new challenges in the field of Complementary and Alternative Medicine (CAM), the Brazilian government created the National Policy on Integrative and Complementary Practices (NPICP) as part of the Brazilian National Health System (SUS) [3]. The main goal was to introduce CAM into all public healthcare services in Brazil, as well as into the undergraduate curricula of the health professions. However, CAM has been introduced very slowly into the care and even more slowly into the training of health professionals.

With the creation of the National Policy on Integrative and Complementary Practices, the Brazilian government extended the concept of CAM by placing emphasis on the perspective of the plurality of actors and actions in the health field with the adoption of the concept of integrality and practices, related to all health professionals, replacing medicine associated with a profession [3]. In 2014 similar expansion was carried out by the US government when changing the name of the National Center for Complementary and Alternative Medicine to the National Center for Complementary and Integrative Health (NCCIH). Due the similarity of the nomenclatures and perspectives adopted by the NPICP and the NCCIH throughout the article Complementary and Integrative Health (CIH) will be used [4].

Brazil is a country of continental dimensions marked by important socio-territorial inequalities, cultural diversity and very complex demographic dynamics, so that the local and regional contexts influence the development of public policies [5, 6]. Thus, although there are national standards for the health services, such as the NPICP in the SUS, and for undergraduate education of different professions in the health area, with National Curriculum Guidelines for undergraduate courses, it is clear that the concepts of CIH are not fully disseminated in the care and educational practices [7-9].

However, reduced academic teaching experiences of CIH has been registered, which results in resistance of health professionals to include these practices in the healthcare [10-16].

This study aimed to analyze the knowledge and attitude about Complementary and Integrative Health of Brazilian students of the health area. In the following sections the methodological procedures for collecting and analyzing the data are presented, the results of the knowledge and use of CIH in both institutions, as well as the implications of the study findings for the expansion of CIH in the care and education of the health field.

II. METHODS

The cross-sectional study was conducted in the period from February to December 2012. The study population was composed of students from two Brazilian universities, one (NU) in the northeast region, located in the state of Ceará, with this institution being private and having approximately 30,000 undergraduate and graduate students. The other university (SU) is located in the southeast region, in the state of São Paulo, this one being public, with approximately 35,000 undergraduate and graduate students.

The sample calculation was based on two analyzes. In the first, the total sample of students who were enrolled in the second year of undergraduate courses in medicine, nursing, pharmacy and speech therapy in 2012 was calculated. This universe of students enrolled in the two institutions was 637 students. The second analysis was based on an estimated age of 19 years at the time of data collection. Considering that the student finishes high school aged 17/18 years and that healthcare courses have the most competitive entrance examination, the likelihood of these students being in the age range of the survey would be around 50%, taking into account a β of 0.2. Therefore, the study population was estimated at 319 students and the sample was 163, corresponding to 51%.

Failure to provide any information for the instrument proposed in the study was used as an exclusion criterion. The Health Promotion in University Evaluation Instrument (IAPSU) was used for data collection, composed of identification items and 41 questions divided into five domains: physical activity (9 questions), diet (6 questions), environmental factors (5 questions), psychosocial factors/consumption of alcohol and drugs (18 questions) and CIH (3 questions). The present study only considered the questions related to CIH [17].

The data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 17.0. To analyze the homogeneity of the sample the Kolmogorov-Smirnov normality test was performed. In the descriptive analysis mean, standard deviation and percentage were used. The comparison of the results between the groups was performed using student's t-test for independent samples, with the chi-squared test used to assess the association of the categorical variables. P values <0.05 were considered statistically significant.

III. RESULTS

A total of 166 questionnaires were completed, with three excluded due to incomplete information, so that 163 students participated in the study, 73 (44.8%) of the NU and 90 (55.2%) of the SU. When comparing the sociodemographic variables: gender, age, marital status and family income, there were no significant differences, demonstrating the homogeneity of the sample (Table 1).

| | Total (n=163) | NU (n=73) | SU (n=90) | p-value |
|--------------------|---------------|--------------|---------------|---------|
| Age (years) | 18.2 ± 0.6 | 18.3 ± 0.6 | 18.2 ± 0.6 | 0.1 |
| Gender (M/F) | 32/131 | 11/62 | 21/69 | 0.1 |
| Marital Status | | | | |
| Single (n/%) | 163 (100%) | 73 (100%) | 90 (100%) | 1.0 |
| Family Income (MW) | 4.8 ± 2.1 | 4.2 ± 2 | 5.3 ± 2.2 | 0.08 |

Table 1: Sociodemographic aspects of the participants of a northeast and a southeast Brazilian university.

NU= Northeast University; SU= Southeast University; n= number of subjects; \pm = standard deviation; M = male; F = female; MW = minimum wage.

Regarding the knowledge of the students about the concept of CIH, 47.2% (n=77) of the students, being 52% (n=38) of the NU students and 43.3% (n=39) of the SU students, claimed to understand this concept, with no statistical significance in the comparison between institutions (p>0.05). However, when asked if they believed that CIH could promote health, 86.3% (n=63) of the NU students and 83.3% (n=75) of SU students said yes, which represents a higher percentage than those of both universities that claimed to know the concept. When asked if they knew the 20 different CIH practices listed in the questionnaire, there was greater knowledge of acupuncture (87.1%), followed by medicinal herbs (82.8%), massage (80.9%), meditation (80.9%), and diets (80.3%). The practices most widely used by the students, however, were massage (38%), relaxation (36.8%), herbs (33.7%), diet (29.4%), and homeopathy (27.6%) (Table 2).

| Table 2: Knowledge | and Use of | CIH of 163 | Brazilian | students. |
|--------------------|------------|------------|-----------|-----------|
| | | | | |

| Knowledge | | Attitudes |
|-----------------|------------|-----------|
| Variables | n (%) | n (%) |
| Acupuncture | 142 (87.1) | 14(8.5) |
| Aromatherapy | 92 (56.4) | 5 (3.0) |
| Crystals | 67 (41.1) | 6 (3.6) |
| Chromotherapy | 5 (3.0) | 5 (3,0) |
| Diets | 131 (80.3) | 48 (29.4) |
| Medicinal herbs | 135 (82.8) | 55 (33.7) |
| Floral remedies | 87 (53.3) | 22 (13.4) |
| Hydrotherapy | 96 (58.8) | 5 (3.0) |
| Homeopathy | 101 (61.9) | 45 (27.6) |
| Iridology | 13 (7.9) | 2 (1.3) |
| Lian Gong | 46 (28.2) | 16 (9.8) |
| Massage | 132 (80.9) | 62 (38) |
| Meditation | 132 (80.9) | 33 (20.2) |
| Moxibustion | 10 (6.1) | 3 (1.8) |
| Music Therapy | 101(61.9) | 12(7.3) |
| Orthomolecular | 48 (29.4) | 5 (3.0) |
| Chiropractic | 31 (19) | 1 (0.6) |
| Reflexology | 35 (21.4) | 3 (1.8) |

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|---|------------|------------|--|-------------------|
| | Reiki | 43 (26.3) | 15 (9.2) | |
| | Relaxation | 123 (75.4) | 60 (36.8) | |

n = number of individuals; % = percent.

There was greater knowledge of 16 practices by the SU students (p<0.05) (Table 3), with the best-known practice in both institutions being acupuncture, with 75.3% (n=55) of the NU students and 96.6% (n=87) of the SU students. Chromotherapy was the least known practice, with no NU student knowing about it and only 5.5% (n=5) of the SU knowing it.

| | NU (n=73) | SU (n=90) | |
|-----------------|-----------|-----------|----------|
| | n (%) | n (%) | p-value |
| Acupuncture | 55 (75.3) | 87 (96.6) | < 0.001* |
| Aromatherapy | 23 (31.5) | 69 (76.6) | < 0.001* |
| Crystals | 17 (23.3) | 50 (55.5) | < 0.001* |
| Chromotherapy | 0 (0) | 5 (5.5) | 0.04* |
| Diets | 54 (74.0) | 77 (85.5) | 0.01* |
| Medicinal herbs | 54 (74.0) | 81 (90.0) | 0.003* |
| Floral remedies | 25 (34.2) | 62 (68.8) | < 0.001* |
| Hydrotherapy | 41 (56.1) | 55 (61.1) | 0.5 |
| Homeopathy | 25 (34.2) | 76 (84.4) | < 0.001* |
| Iridology | 3 (4.1) | 10 (11.1) | 0.1 |
| Lian Gong | 3 (4.1) | 43 (47.7) | < 0.001* |
| Massage | 54 (74) | 78 (86.6) | 0.03* |
| Meditation | 52 (71.2) | 80 (88.8) | 0.001* |
| Moxibustion | 4 (5.5) | 6 (6.6) | 0.8 |
| Music Therapy | 28 (38.3) | 73 (81.1) | < 0.001* |
| Orthomolecular | 11 (15) | 37 (41.1) | < 0.001* |
| Chiropractic | 9 (12.3) | 22 (24.4) | 0.059 |
| Reflexology | 13 (17.8) | 22 (24.4) | 0.3 |
| Reiki | 11 (5.5) | 32 (35.5) | 0.005* |
| Relaxation | 48 (65.7) | 75 (83.3) | 0.005* |
| | | | |

Table 3: Comparison of knowledge of CIH among students of a northeast and a southeast Brazilian university.

NU= Northeast University; SU= Southeast University; n= number of subjects; $\pm =$ standard deviation; *= p<0.05; %= Percent.

Regarding the use of CIH practices by students was no statistically significant difference in the variables: chromotherapy, herbal medicine, floral remedies, homeopathy and lian gong, with greater use reported by the SU students (p<0.05) (Table 4).

| | NU (n=73) | SU (n=90) | n nalvo |
|-----------------|-----------|-----------|----------|
| | n (%) | n (%) | p-value |
| Acupuncture | 4 (5.5) | 10 (11.1) | 0.2 |
| Aromatherapy | 1 (1.3) | 4 (4.4) | 0.2 |
| Crystals | 3 (4.1) | 3 (3.3) | 0.7 |
| Chromotherapy | 0 (0) | 5 (5.5) | 0.04* |
| Diets | 25 (34.2) | 23 (25.5) | 0.2 |
| Medicinal herbs | 17 (23.2) | 38 (42.2) | 0.01* |
| Floral remedies | 2 (2.6) | 20 (22.2) | 0.001* |
| Hydrotherapy | 2 (2.6) | 3 (3.3) | 0.8 |
| Homeopathy | 6 (8.2) | 39 (43.3) | < 0.001* |
| Iridology | 0 (0) | 2 (2.2) | 0.2 |
| Lian Gong | 0 (0) | 16 (17.7) | < 0.001* |
| Massage | 30 (41.0) | 32 (35.5) | 0.2 |
| Meditation | 12 (16.4) | 21 (23.3) | 0.3 |
| Moxibustion | 1 (1.3) | 2 (2.2) | 0.7 |
| Music Therapy | 6 (8.2) | 6 (6.6) | 0.5 |
| Orthomolecular | 2 (2.6) | 3 (3.3) | 0.8 |
| Chiropractic | 1 (1.3) | 0 (0) | 0.2 |
| Reflexology | 0 (0) | 3 (3.3) | 0.1 |
| Reiki | 3 (4.1) | 12 (13.3) | 0.053 |
| Relaxation | 24 (32.8) | 36 (40) | 0.3 |

Table 4: Comparison of use of CIH among students of a northeast and a southeast Brazilian university.

NU= Northeast University; SU= Southeast University; n= number of subjects; $\pm =$ standard deviation; *= p<0.05; %= Percent.

IV. DISCUSSION

This study is relevant as it analyzed the university environment in Brazil in different local and regional contexts. Its limitations are focused on the fact that not all the undergraduate courses of the health area existing in the universities studied were included, as well as the lack of evaluation of the knowledge and attitudes of the students throughout the course and at the end of their education.

The comparison between the two regions is relevant considering the continental dimension of the country and the socio-economic and cultural differences. Some of the major urban and industrial centers, responsible for most of the national Gross Domestic Product, are found in southeast Brazil. The northeast of the country is characterized by greater vulnerability to climatic variations, lower levels of education, income and skills, with large areas poorly integrated into the national economy [18].

Regarding the CIH, many of the Northeast students said that they understood this concept, representing a greater percentage in relation to the southeast students, however, there was no statistical difference when comparing the results. When asked if they knew the 20 different practices listed in the questionnaire, there was greater knowledge of 16 of these by the SU students (p<0.05), contradicting the previous data and leading to a reflection regarding whether these students really understand the concept of CIH.

Over 80% of the students from the two universities considered CIH important to promote health, which represents more than those who claim to know them. This fact makes us believe that, despite not being able to describe each of the unconventional practices according to the scientific literature, the students perceived them as positive for the development of healthy individuals.

A study by Fontanella et al. [19] aimed to analyze the knowledge, access and acceptance related to CIH for female SUS users in southern Brazil and showed that the majority of the practices were not known by the community, although teas, spiritual healing and herbal medicine were therapies that the population knew and used. The article confirmed that the use of nonconventional therapies without the accompaniment of a health professional was common. Another study, with professionals of primary care teams of the SUS, showed incipient use of CIH by the professionals, while valorization of these practices by the population was perceived, especially those involving cultural tradition, such as the use of medicinal plants [20].

According to Azevedo and Pelicioni [21] and Barros et al. [11] the health area courses, in all of Brazil, have been unable to overcome the biomedical perspective and propose actions for teaching CIH. Also according to the authors, only some educational institutions offer disciplines in their curriculum that include the basic concepts of the various non-conventional health practices. Salles, Homo and Silva [22] analyzed the situation of the teaching of CIH in physical therapy, nursing and medical courses of Brazilian institutions, unlike those investigated through analysis of the curriculum, and showed that while the complementary and integrative practices are recognized by the federal councils of different professions, few institutions offer disciplines related to CIH and when offered they are in the form of non-compulsory subjects.

Local evidence produced by the present study and by other Brazilian researchers agrees with global records, such as that of the Institute of Medicine's Committee on the Use of Complementary and Alternative Medicine by the American Public [23-32].

A study performed with students of the first semester of a medical course in the United States found that 84% reported knowing what CIH is [33], similar to that observed in the present study. In Australia a similar study, with 800 medical students of the first, third and fifth year of the undergraduate course, highlighted low selfreported knowledge (56%) regarding CIH. In the same study the students reported that massage, meditation and acupuncture were the practices best known by them [34], also corroborating the results of this study in Brazil.

Otani and Barros [35] believe that the importance of vocational training for the spread of a new and comprehensive view of health, in the short term, may have higher costs due to changes in the organization of the health system and in the perceptions of professionals regarding the health-illness-care process. They also highlighted that in the medium and long term, the creation of integrated services will lead to reduced costs, disease prevention and health promotion. Complementary and Integrative Health practices can be useful resources in this process, especially as they establish the holistic perspective and individual empowerment, with impacts in the daily lives of individuals and communities [36].

Considering, however, the low level of use and knowledge of the practices associated with CIH by students and professionals of the health area courses, both in the different Brazilian regions and the different countries of the world, there is the need to construct specific plans directed toward its teaching [20, 23-32]. These plans can be critical to the health field for guiding the training of health professionals concerned with reducing the effects of medicalization [37,38] and pharmaceuticalization [39], with practices that seek to stimulate the natural mechanisms of care, with an emphasis on a welcoming and humanized listening, operated with an integrative view of the health-disease-care process.

V. CONCLUSION

It was concluded that the knowledge and use of CIH practices by students of different health courses in two Brazilian universities was limited. Furthermore, it was concluded that the complementary and integrative practices better known by the students were acupuncture, herbal remedies, massage, meditation and diet, with, however, massage, relaxation, medicinal herbs, diets and homeopathy being more used.

It was also evident that the SU students presented lower self-reported knowledge regarding the definition of CIH, although they knew more practices and made more use of these. The urgency is emphasized of the creation of a new view of the curriculum of undergraduate courses in the field of health and new studies with larger numbers of participants and more institutions, to increase local and global strategies to strengthen the implementation of CIH in the care and training in the health area.

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