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Editorial

Dear authors, reviewers, and readers

It has been a month since I was given the privilege to serve as the Chief Editor of the International Journal for Innovation Education and Research (IJIER). It is a great pleasure for me to shoulder this duty and to welcome you to ***THE VOL-8, ISSUE-1 of IJIER*** which is scheduled to be published on **31ˢᵗ January 2020***.*

International Journal for Innovation Education and Research (IJIER) is an open access, peer-reviewed and refereed multidisciplinary journal which is published by the International Educative Research Foundation and Publisher (IERFP). IJIER aims to promote academic interchange and attempts to sustain a closer cooperation among academics, researchers, policy makers and practitioners from a wide range of disciplines, which contribute to state of the art in science, education, and humanities. It provides a forum for the exchange of information in the fields mentioned above by welcoming original research papers, survey papers, and work-in-progress reports on promising developments, case studies, and best practice papers. The journal will continue to publish high-quality papers and will also ensure that the published papers achieve broad international credibility.

The Chief Editor, appointed by the Associate Editors and the Editorial Board, is in charge for every task for publication and other editorial issues related to the Journal. All submitted manuscripts are first screened by the editorial board. Those papers judged by the editors to be of insufficient general interest or otherwise inappropriate are rejected promptly without external review. Those papers that seem most likely to meet our editorial criteria are sent to experts for formal review, typically to one reviewer, but sometimes more if special advice is needed. The chief editor and the editors then make a decision based on the reviewers' advice.

We wish to encourage more contributions from the scientific community to ensure a continued success of the journal. We also welcome comments and suggestions that could improve the quality of the journal.

 I would like to express my gratitude to all members of the editorial board for their courageous attempt, to authors and readers who have supported the journal and to those who are going to be with us on our journey to the journal to the higher level.

Thanks,
Dr Eleni Griva
Ass. Professor of Applied Linguistics
Department of Primary Education
University of Western Macedonia- Greece
Email: chiefeditor@ijier.net

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Influence of Government Funding on Academic Achievement of Public Secondary Schools in Nyamaiya Division, Nyamira County, Kenya

Jane Nyanchama Nyakoe

P.O Box 509 – 40500, Nyamira, Kenya.

Phone numbers: +254712829687.

Email: nyakoejayne@gmail.com

ABSTRACT

Despite the critical objective of government funding in education, and guaranteeing that all school going children access quality education, recent literature indicates that a good number of them stay away from school. The purpose of this research was to examine the role of economic investments on academic achievement of public secondary schools in Nyamaiya Division, Nyamira County, Kenya. This research study was directed by the listed objective: to establish the influence of government funding on academic achievement of public secondary schools in Nyamaiya division, Nyamira County. The study employed the Human capital theory. The research employed a survey research design which adopted a mixed methodology since it had both quantitative and qualitative aspects. The research employed concurrent triangulation approach. The study targeted 18 principals, 153 class teachers, 3470 students and 1 education support officer. The sample size constituted of 4 principals, 30 class teachers, 347 students and one curriculum support officer a total of 382 respondents. Purposive sampling was used to sample principals and curriculum support officer while random sampling was used to sample class teachers and student. Questionnaires were used to obtain information from students and class teachers while interview guide were used on principals and curriculum support officer. Piloting was conducted in the neighboring Nyamira division on 10% of the sample size. Test-retest technique was used to test reliability. Qualitative data was analysed thematically along the objectives and quantitative data using Statistical Package of Social Sciences (SPSS 21). The quantitative findings of the study were presented using frequency tables, percentages and inferential statistics using correlation whereas qualitative findings were presented thematically and in narration forms. From the analysis, it was noted that; government and donor funds have enabled school infrastructures to be put in place together with some teaching and learning equipment. Agricultural and entrepreneurial activities have enabled parents to raise school fees and supplement on other learning equipments. Improved infrastructure, availability of teaching and learning materials impacts positively on learners' academic achievement. The study recommends the government to support public secondary schools fully.

Key Words: influence, government funding, academic achievement, public secondary schools.

1. INTRODUCTION

Formal schooling is a medium through which poverty will be done away with. Students from economically

challenged backgrounds cannot be able to escape from poverty in the future unless they are empowered with skills and knowledge that will give them a chance for training and entry to the job market. It is the duty of the administration to intervene by establishing stable channels to eliminate this problem.

At the world education forum held in Dakar, Senegal in 2000, leaders from 180 countries agreed that by 2015 all children of school going age must be enrolled in schools. The international commitment to provide every child in developing countries with good, free and compulsory education was set. UNESCO was entrusted with the overall responsibility of coordinating; they provided professional and technical support, while countries concerned worked to develop efficient and effective education plans for levels of education. To achieve these goals of education, donors have partnered with the countries that are most in need to assist in developing better education plans.

The need to promote secondary education in Sub-Saharan Africa (SSA) countries is growing in an upward trend (Alvarez, 2003; Mulkeen, 2005; World Bank, 2005). The Kenyan government has taken milestone steps to build its human capital, specifically targeting education. Kenya's efforts towards education lead to the development of the FPE Program, which has necessitated the provision of free tuition in secondary education. At secondary level there has been an upward trend for the GER and NER have recorded 16.4 and 14.3 percentage point between 2009 and 2014 (MOE Basic Education Statistical Booklet, 2004). Despite these increments, regional and gender disparities still exist at secondary level of education. The main contribution of these disparities being the cost of education and the value parents from disadvantaged backgrounds attach to education. In collaboration with the private sector, Kenya has to outsource for more funds to assist public secondary schools enhance enrolment and retain learners in school (Vision 2030).

According to Sarah Cameron (UNICEF), only a few countries have succeeded to develop into middle level economies without the many of its people of their having access to secondary education. Karega (2008) noted that, after the start of FSE the MOE recognized the fact that fee payment was responsible for the low transition rate to secondary schools. Although there has been a steady increase in reported transition rate from primary to secondary education, the actual progression is low (MOE Task Force, 2014).

 Kilonzo (2007) noted that, 92.5% of the parents advocated for free of charge primary education. These are the same parents whose children transit to secondary schools after completing their primary education. Thus, the chance of such parents investing in their children's secondary education is minimal. It is the wish of every parent that government meets the cost of secondary education fully, but this expectation is not realistic. The government subsidizes education by meeting the cost of tuition, repairs, travel and transport, administrative, electricity and water bills, activity fees and non-teaching staff salaries.

Free Secondary Education (FSE) funds are entrusted to the hands of the BOMs as spelled out in the Basic Education Act (2013), The BOMs are given authority to allocate and spend funds received from the MOE according to the stipulated guidelines in order to achieve the desired goals. Therefore, it is presumed that BOMs and head teachers are knowledgeable on matters related to law, human resource management, supplies and procurement, contracting, accounting and project management.

Knight (1993) noted that, the main elements for efficient and effective financial management in schools were the economy and prudent use of resources. A random survey on the quality and level of BOMs in secondary schools reveals that, head teachers and board members face a serious task in school management (Kilonzo, 2007). This often leads to misappropriation and misuse of resources. In some instances, funds

received by schools from the government are treated as "their money" and therefore subject to misuse. Recent development by the MOE to take school managers through a financial management training by KEMI, is geared towards achieving efficient financial and resource management practices in order to assist realize the objectives of FSE. Because of the social, political and economic benefits associated with secondary education (World Bank2005), subsidized secondary education is seen as a potential approach to enable the poor access meangiful and quality education that results to improved academic achievement in schools.

Many studies have been done on investment in education in America, Europe, South Africa and Nigeria. For example, Paco Martorell (2015) carried out a study on investing in school; capital spending, facility conditions and students' achievement in US. Agabi (2012) carried out a study on Education as an investment; he noted that school facility spending represented one of the largest education investments. Despite the investment, he noted that facility improvements did not appear to translate into measurable improvements on student achievements.

A few studies have considered investment in education by families and economic investment of the stakeholders towards the improvement of education standards. Parents' and government contributions have a direct impact towards education achievements. In the local scene, there are few studies on investments in education. Various studies reviewed have looked into various aspects of investment in education. Getange (2013) studied financing of public day secondary school education and its implication on the quality of learning. Otiengo (2016) studied the influence of parental socio-economic status on students' academic performance in public schools. There is therefore inadequate documentation on the contribution of economic investments on academic achievement of learners in public secondary schools. This gap is what the current study wanted to fill.

2 OBJECTIVES OF THE STUDY

The research was guided by the following objective: to determine the influence of government funding on academic achievement of public secondary schools in Nyamaiya Division, Nyamira County, Kenya.

3. RESEARCH METHODOLOGY AND DESIGN

A research methodology is a theoretical and systematic examination of the techniques applied in the study. It generally outlines the methods to be used in the research and how a research task shall be undertaken. The study adopted a mixed methodology, since it had both qualitative and quantitative aspects. This methodology was appropriate because it allowed the investigator to gather information using quantitative standardized items or qualitative themes or both methods (Creswell, 2003).

The research employed a descriptive research design. This design allowed both Qualitative and quantitative data to be obtained roughly at the same time of research (Creswell, 2003). Qualitative data was analysed thematically along the objectives and quantitative data using Statistical Package of Social Sciences (SPSS 21). The design assisted the investigator to gather different but supportive data on the same topic (Morse, 1991).

4. ANALYSIS, PRESENTATION AND INTERPRETATION OF DATA

The study sought to establish the influence of government funding on academic achievement of public secondary schools. The students' responses were tabulated as shown below;

Table 1: Benefit of Government tuition, bursary and/or Sponsorship

Category	A		U		D	
	f	%	f	%	f	%
Received benefit from government tuition for secondary education, bursary and/or sponsorship	111	38.7	17	5.9	159	55.4
My academic performance has improved since the government started subsidizing secondary education	220	76.7	21	7.3	46	16.0

Table 6 gives summary of whether students have benefited from government in terms of tuition, bursary and/or sponsorship. The study established that one hundred and eleven representing38.7%have benefited, seven of them were undecided while one hundred and fifty-one out of two hundred and eighty-seven representing 55.4%have not benefited. In relation to improvement on academic performance due to government subsidy of secondary education, 220 out of 287 students representing 76.7% agreed, 21 of them were undecided while 46 students representing 16% disagreed. The findings of the study indicate that due to government funding of secondary education, academic performance has improved and this is attributed to increased transition, reduced absenteeism and improved access (MOE, 2014). These findings contradict the Constitution of Kenya 2010 and the Basic Education Act 2013 thatrecognize education as a fundamental human right and decree that it be free and compulsory. Basic education stretches from age 4 to 17 and covers 14 years of schooling in Kenya.

The study sought to know about the influence on government funding from teachers and their responses were summarized as shown

Table 2: Influence of government funding on academic achievement

Category	SD		D		U		A		SA	
	f	%	f	%	f	%	f	%	f	%
Have improved enrolment of students in your school	0	0	3	12	0	0	7	28	15	60
Government funds have enabled most school most schools Infrastructure to be established	3	12	4	6	0	0	13	52	5	20
The government should cater for school fees in order to enable all students to attend school programs	0	0	0	0	0	0	17	68	8	32

Findings from table 7 indicate that out of the twenty-five class teachers who participated in the study 60% (15) strongly agreed, 28% (7) agreed that government funding and sponsorship has im7roved enrolment and achievement in secondary schools while 12% (3) disagreed. This is in support to Kenya's efforts

towards FPE and FSE Program, which has necessitated the provision of free tuition in secondary education. About whether government funds have enabled most infrastructural facilities to be established, the study noted that 12% (3) strongly disagreed, 16% (4) disagreed, 52% (13) agreed, 20% (5) strongly agreed and none were undecided. The study also investigated whether the government should cater for school fees in order to enable all students to attend school programs. It was established that 68% (17) agreed, 32% (8) strongly agreed while none disagreed or remained undecided. The state of school facility and attendance directly impact on academic performance of learners and school in general.

The study interviewed principals on government funding and it sought to know whether the funds disbursed to secondary school have assisted improve students' enrolment, the four principal gave positive responses. Principal p1 noted that;

> *"Through government funding, students from poor and disadvantaged backgrounds have been able to access to secondary education. This is evident as the enrolment rate has improved especially in our day schools".*

The interview schedules indicated that the funds have enable most schools to establish some infrastructural facilities necessary for teaching and learning, others have used the funds to acquire teaching facilities and equipment. P3 and p4 indicated that improved in infrastructure has assisted in improving academic performance. P4 noted that;

> *"Government funding has increased retention, learners from economically challenged backgrounds have been given opportunity to regularly attend class and this has improved their academic performance".*

Despite the positive responses by the principals, they also noted that the government should address the issues of insufficient allocation, late disbursement and improper utilization of the funds by some BOMs. P4 indicated that;

> *"The allocation is not sufficient, disbursement is irregularly done causing inconveniences to the school management in planning and procurement of necessary resources and principals are not trained on financial management before appointment to the position".*

The principals' responses on government funding in secondary school education concur with the provisions of the Constitution of Kenya 2010 and the Basic Education Act 2013 recognize education as a fundamental human right and decree that it be free and compulsory and the Declaration of United Nations (1948) on Human Rights states that, "everyone has a right to education". This education should be ideally without charge, especially at primary school level. Quality education should be available while higher education should be accessible to all those who merit. Basic education is a fundamental right that all children of school going age are entitled.

The Curriculum Support Officer was also interviewed on the same and he noted that government funds have enabled most students from poor backgrounds to attend school. The same funds have enabled most schools to put up some teaching classrooms and laboratories for science subjects, at the same time the funds

have enabled schools to purchase teaching and learning equipment. Availability of adequate teaching and learning resources improve academic performance and achievement of learners and school in general.

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The study established that three fifth of the students who were interviewed have benefited from government bursary and sponsorship while two fifth have not benefited. The study established that attendance of the students has improved since four fifth of the students indicated that they are able to attend school regularly while only a fifth said they have not been able to attend school regularly. On whether government funds have improved enrolment of students in school, the findings of the study indicate that more than half of the students agreed, a quarter were undecided and another quarter disagreed. These results are in support to Kenya's efforts towards FPE and FSE Program, which has necessitated the provision of free tuition in secondary education. Since the government started offering free tuition secondary education, there has been an upward trend for the GER and NER have recorded 16.4 and 14.3 percentage point between 2009 and 2014 (MOE Basic Education Statistical Booklet, 2004). Out of the twenty-five class teachers who were interviewed, slightly more than half agreed that government funds have enabled most infrastructural facilities to be established while only a quarter disagreed.

The study interviewed principals on government funding and it found out that the funds have improved students' enrolment. The principals further indicated that the funds have enable most schools to establish some infrastructural facilities necessary for teaching and learning, others have used the funds to acquire teaching facilities and equipment. On the same principals noted that the allocation of the funds was not sufficient and the time of disbursement inconveniences the teaching programs and activities. Curriculum Support Officer was also interviewed on the same and he noted that government funds have enabled most students from poor backgrounds to attend school. The same funds have enabled most schools to put up some teaching classrooms and laboratories for science. The findings of this research on government funding in secondary school education concur with the provisions of the Constitution of Kenya 2010 and the Basic Education Act 2013 that recognize education as a fundamental human right and decree that it be free and compulsory. The findings of the study indicate that government funding of secondary education improves school attendance, access and facilitate acquisition of teaching and learning facilities. These aspects are key in determining the academic performance of learners in schools, thus the state of school facility and attendance directly impact on academic performance of learners and school in general.

The following specific conclusion was made based on the findings of this research: the study noted that government funds have enabled attendance of students in schools to improve. The same funds have enabled schools to put up basic infrastructural facilities as well as purchase teaching and learning facilities and equipment. These aspects are key contributors of improved academic achievement of learners and schools in general.

Based on the findings and conclusions of this study, the following recommendation was arrived at; the government to support secondary education in public school fully.

With the current trend in the world of work and in relations to this current study, the following researches are recommended for further study: a research to find out alternative sources of financing secondary school education.

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Moroccan Students' Writing Difficulties: Problems of Cohesion and Coherence Kenitra as a Case Study

Rachid Elkhayma

Abstract

This study aims at investigating and identifying cohesion and coherence problems that Moroccan 2nd year baccalaureate students encounter in written discourse. An overall number of thirty students from two fields of study (Math Sciences and Economics) participated in the study, producing a total number of thirty essays. Students' application of cohesion and coherence were studied and analyzed based on Halliday and Hasan's Cohesion in English (1976) and Oshima and Hogue's (2006) criteria for achieving coherence. Regarding the analysis of the corpus, it was discovered that students tend to use more reference ties, followed by lexical ties and conjunctions. Substitution and ellipsis linkers were scarcely used. Besides, the results clarify that Math Sciences Students outweigh their Economics counterparts in using and dealing with cohesion devices. As for coherence, the findings show slight differences between the two groups of upper high school students in adhering to coherence techniques. Finally, the study reveals that students lack important training in using and varying cohesion and coherence linkers.
Keywords: Writing, Coherence, Cohesion, second-year baccalaureate, Moroccan

1. Introduction

Researchers have long probed the difficulties that EFL learners usually encounter in writing. Some of the most commonly investigated areas of study in foreign language writing are cohesion and coherence. According to Halliday and Hasan (1976), cohesion involves different grammatical and lexical elements that combine various parts in written texts as well as between and among sentences. This suggests that cohesion creates syntactic and lexical relationships through different cohesive ties, such as the five cohesive categories devised by Halliday and Hasan (1976). As for coherence, it is broadly viewed as "the relationship that links ideas in a text to create meaning for readers" (Lee, 2002, as cited in Castro, 2004, p. 216). Coherence then is constructed as the meaningful interaction that exists between the ideas of a text and the reader (Castro, 2004).

There is a recurrent belief that EFL students face tremendous problems in writing, namely in cohesion and coherence. It is believed that when EFL learners write, they pay more attention to grammatical errors within sentences. They often think that they will come up with good pieces of writing if their texts are not syntactically deficient. Such an assumption has been proved wrong, for there is a lot of research (Carrell, 1982, Halliday & Hasan, 1976; Oshima & Hogue, 2006; Renkema, 2009; Taboada, 2004; Tanskanen, 2006) that has asserted the important contribution of cohesive and coherence linkers in the overall quality of students' compositions. That is to say, Cohesive and coherence devices bring sentences, ideas and paragraphs together meaningfully, as well as construct the overall unity of the text as a whole.

Additionally, students presumably think about cohesion and coherence as hazy concepts that are difficult to grasp. They also consider them a daunting mission to accomplish.

With the appearance of Halliday and Hasan's cohesion theory in 1976, understanding writing cohesion and coherence has witnessed a major breakthrough. They provided a framework that consisted of five types of cohesive devices for studying and evaluating cohesion and coherence: reference, lexical, conjunction, substitution, and ellipsis ties. These researchers assert that these ties can be utilized not only to examine cohesion, but also to determine the coherence and the general quality of writing. This view was later confronted by a lot of researchers such as Carrell (1982) and Brown & and Yule (1983).

2. Review of the literature

2.1. What is coherence?

Coherence is "the outcome of a dialogue between the text and its listener or reader." (Tanskanen, 2006). It reinforces the unity of discourse, be it at the sentence, the paragraph, or at the text level. It is, along with cohesion, a significant criterion that determines the quality of students' written texts. Without it, a written text cannot be properly a text (Hatch, 1992, as cited in Hang & Huong, 2012). This explains that coherence, through rhetorical devices, establishes order and unity in a given discourse.

In language education, coherence is traditionally identified as a challenge to students' composition. It is also seen as a permanent concern to language teachers, because, as reported in Lee (2002), coherence is not easy to teach and difficult to learn. For such a reason, coherence or texture, as Halliday and Hasan (1976) call it, has been dealt with by many researchers in order to come up with some recommendations on how best to teach and learn it.

In order to help students write a coherent text, there are several techniques that need to be followed to achieve a coherent discourse. They are derived from Oshima and Hogue (2006). The first one is to use consistent pronouns. They claim that pronouns should be connected to the same person and number in the text. The second technique concerns transition signals that are said to add a special meaning to the text; here are some of them:

a- In addition, similarly, moreover, etc.
b- For example, for instance, etc.
c- As a result, so, etc.
d- In contrast, however, on the other hand, etc.
e- In conclusion, to sum up, etc.

Another technique suggested by Oshima and Hogue (2006) is the repetition of specifically important nouns in the text. It is advisable in this vein to replace a pronoun by the repetition of a key noun, particularly when the meaning is vague or ambiguous. In addition to this, there is a fifth technique that "arranges sentences in some kind of logical order" (ibid., p. 34). It is illustrated by the use of chronological order (order by time), logical division of ideas, and comparison / contrast paragraph (the similarities and or differences between two or more items).With such techniques, coherence can substantially be achieved, but it needs to be correlated with cohesion ties in order to fully create cohesive and coherent texts.

2.2.   What is cohesion?

Halliday and Hasan's Cohesion in English is undoubtedly the primary reference for understanding cohesion. According to these researchers, cohesion or cohesive ties determine whether a set of sentences make a text. To them, a text is conceived of as "any passage, spoken or written, of whatever length, that does form a unified whole". This leads to the creation of 'texture', which entails that the texture of a text is established by the cohesive ties that the latter includes. In considering the following example *'Peter made a delicious meal. He cooks spaghetti'* it appears that, in these sentences, cohesion is achieved through the cohesive device that connects the presupposing item (the pronoun *he* in the second sentence) with the presupposed one (*Peter* in the first sentence) across the two sentences. This is a signification of how cohesive devices can form meaningful relationships between sentences and distinguish a text from a set of isolated sentences.

2.3.   The relationship between cohesion and coherence

Halliday and Hasan's (1976) cohesion theory states that cohesion is the basis for coherence in written texts. They claim, as mentioned in Tanskanen (2006), that grammatical and lexical devices become cohesive when they are interpreted through their relations to other elements in the text. Tanskanen illustrates that they have given more importance to explicit markers of cohesion while neglecting the underlying semantic relations in a text. This means that they ignore the role of coherence in building the meaning of texts.

They have been severely criticized for this by several researchers. They emphasize that cohesion alone cannot create unity in a text. In her influential article "Cohesion is not Coherence" (1982), Carrell says that cohesion is not the essence of coherence. She contends that a text can be coherent, but not necessarily cohesive. Following the example 'the picnic was ruined, no one remembered to bring the corkscrew', Carrell explains that coherence in this example is not achieved by cohesive elements of the 'picnic' and 'the corkscrew', but rather by the reader's 'schema' of picnic. This brings to light the schema theory that states that cohesive ties can be noticed only when coherence is accomplished in the text. Therefore, coherence is likely to be observed before cohesion, because we normally conceptualize and think about the coherence of texts, which is built around the common cultural knowledge of the writer and reader, before we consider texts' cohesive properties.

Morgan and Sellner (1980), as reported in Castro (2004), also criticized Halliday and Hasan for claiming that the coherence of content does not appear to make a text really coherent, and that for a text to be coherent there should be certain cohesive elements in it (Morgan and Sellner, 1980; as cited in Castro, 2004). They actually stress the significant role of content in texts, claiming that cohesion heavily involves content.

In addition to this, Tierney and Mosenthal (1983) investigated the relationship between coherence and Halliday and Hasan's cohesion. They studied students' utilization of cohesive ties in twelfth graders' written compositions, and they correlated them with coherence rates that were provided by instructors (Tierney and Mosenthal, 1983; as cited in Castro, 2004). The results demonstrated that content has important effects on "the options a writer has for using cohesive items" (Carrell, 1982, p. 484).

From their part, McClure and Steffensen (1980) explored the influence of cohesive links and background knowledge over students' reading of short texts. The students were given several passages in their own culture and in a foreign one. They were asked to read different passages and write about what they have recalled. After investigating the passages, McClure and Steffensen discovered that students were able to recall some cohesive links in their native culture more than in the foreign one. The outcome revealed that textual cohesion may be lost if students' background knowledge is far removed from that of the assumed text.

Widdowson (1978) (as cited in Tanskanen, 2006, p.28) believes that a text can be coherent even if it may not be cohesive. He says that when we engage in a discourse, we express a proposition, and, through this proposition, we perform an illocutionary act. According to Widdowson, the communicative value of a sentence depends on whether it carries a proposition, and this is what makes a cohesive discourse. And if the reader is unable to identify cohesive devices in a discourse, then he/she can resort to covert propositional links to make sense of the text. Widdowson provides an example to show that a text can be coherent although there may exist no cohesive connectors; let us consider this example:

A: That's the telephone.

B: I'm in the bath.

A. O.k.

The three utterances are not attached by any cohesive ties. If each utterance is signaled out individually, it just does not make any sense. However, 'that's the telephone' is taken to be a request to answer the phone, whereas 'I'm in the bath' is considered a replay that is meant to be an excuse for not answering the phone. Hence, the non-cohesive dialogue does indeed bear a communicative objective, which ultimately explains its unity.

In a similar regard, Brown and Yule (1983) emphasize the existence of coherence in order to come up with a meaningful text. They contend that 'meaning relations' are important in identifying texts; relying on cohesive elements is not the only option. They illustrate that when we read texts, we quickly conceptualize 'semantic relations'. So, cohesion only does not appear to be the only source for making sense of a discourse.

The relationship between coherence and cohesion reveals the diversity of opinions towards the importance of cohesion and coherence in written discourse. Both of them are key elements in the development and construction of readable sentences and texts. Cohesion, on the one hand, establishes grammatical and lexical links between written ideas. Coherence, on the other hand, creates semantic build-up within and among those connected ideas. No matter how disputable it may be, it can be deduced that each one complements the other. The most comprehensible written discourse is the one that is both cohesive and coherent. But we can say that cohesion and coherence are less dependent on one another in spoken dialogues, as previously argued by Widdowson (1978).

3. Methodology

The present study investigates the types of cohesion and coherence ties that Moroccan EFL students use in writing and the problems they encounter in dealing with them. To this end, Halliday and Hasan's

(1976) cohesion theory as well as Oshima and Hogue's (2006) set of coherence conventions will be adopted. This study is due to explore the following:

a- Cohesion and coherence errors in Moroccan High School students' written work.

b- The adequacy and inadequacy of cohesive ties they utilize.

c- The adequacy and inadequacy of coherence techniques they use.

d- The correlation between students' utilization of cohesive devices and the overall score they get in writing.

e- The correlation between the students' use of cohesive ties and the extent to which these ties lead to coherence in writing.

f- The differences between High School students in the application of cohesion and coherence in writing.

3.1.   Research method for analyzing data

The research method is basically quantitative; that is to say, it aims at gathering numerical data from writing tests, which will be administered to students as a measuring instrument. The collected data are expected to be about various elements of cohesion devices used by 30 individual second-year baccalaureate EFL learners. The 30 students under study will be assigned writing tests in which they are required to write an essay on two different topics. The tests will be corrected and marked by their classroom teachers, and then studied by the researcher.

3.2.   Participants

The participants are going to be 30 students in 2 high school classes. There are 15 students from each class, representing the actual number of students found in their corresponding classes. All of them are in the upper high school level, but from different fields of study: Math Sciences and Economics. These fields are randomly selected to be representatives of baccalaureate students from other fields in Kenitra city.

3.3.   Data collection

The data is collected from writing tests that are assigned to 2nd year baccalaureate students. The data obtained are 30 written texts from two classes. Students' writing results will be statistically analyzed to see if there is a correlation between the scores attained and the number of cohesive ties applied in compositions.

3.4.   Instruments for analyzing data

The data obtained from students' compositions will be analyzed based on two primary instruments: the researcher will resort to Halliday and Hasan's Cohesion in English to analyze and evaluate the learners' application of cohesive ties, while Oshima and Hogue's (2006) criteria for achieving coherence will be used to analyze and evaluate students' application of correct coherence devices.

The following are Halliday and Hasan's (1976) criteria for studying cohesion:

1) Reference ties: they provide references, such as personal pronouns, personal determiners, relative pronouns, etc.

2) Lexical ties: they involve repetition of lexical items.

3) Conjunctive ties: they link between sentences, paragraphs and ideas.

4) Substitution ties: they substitute an item by another.

5) Ellipsis ties: they involve omitting certain components from text.

And the following are Oshima and Hogue's (2006) conventions for achieving coherence that will be taken as a reference for studying coherence in students' writing:

1) Repetition of key nouns

2) Using consistent pronouns

3) Using transition signals

4) Arranging ideas in logical order

3.5. Data analysis

Based on the SPSS statistical package, the researcher is going to analyze the correlation between the students' utilization of cohesive ties and their writing scores, on the one hand, and between their use of cohesive ties and coherence scores on the other hand. Pearson correlation statistics will be adopted to study correlation between the target variables.

4. Results and discussion

4.1. Testing correlation between students' writing scores and the cohesive ties used

4.1.1. The group of Math Sciences

The analysis of the corpus in this group of students demonstrates that the number of cohesive ties applied by Math Science students does not match the given scores. There is an extensive discrepancy among individual students in terms of the quantity of ties used, as shown in the following:

Table 1: Number of cohesive ties and students' writing scores In Math Sciences

Number of Cohesive Ties

		Frequency	Percent
Valid	36	1	6,7
	38	1	6,7
	43	1	6,7
	48	2	13,3
	60	1	6,7
	67	1	6,7
	68	2	13,3
	71	1	6,7
	72	1	6,7
	84	1	6,7
	86	1	6,7
	90	1	6,7
	97	1	6,7
	Total	15	100

Writing Scores

		Frequency	Percent
Valid	5	8	53,3
	6	3	20
	7	4	26,7
	Total	15	100

However, the table does not include a considerable gap in the writing scores obtained by students even if there were too many differences in the amount of cohesive ties used.   Therefore, this can be illustrated by the minimum score, which is *5 out of 10*, while the maximum is no more than *7/10.*

In this regard, the correlation between the scores students received in the administered written tests and their utilization of cohesion ties was tested by Pearson correlation statistics in order to see whether the compositions that have more cohesive elements could get high scoring. The number of cohesive ties identified in each of the students' written texts was correlated with the respective grades given by their classroom teachers. The following table summarizes students' total number of ties and the scores they had for each composition.

After analyzing the correlation between the two variables above on the SPSS statistical package, the resulting correlation coefficient is r = 0, 185, which explains that there is a very weak correlation between the two variables; that is to say, a text that includes cohesive ties, regardless of their quantity, cannot necessarily get high scoring.

4.1.2.   The group of Economics

As the table below shows, the correlation between the two variables is weaker than expected. Although this group of students had more grammatical ties (more synonyms, antonyms and collocations), a lot of them failed to establish a logical relationship between the quantity of cohesive linkers they used and the grades they received in the written tests. There are a lot of cases where the application of cohesive linkers does not appear to go hand in hand with the writing score, as in this table:

Table 3: The number of cohesive ties and students' writing scores in Economics

	Frequency	Percent			Frequency	Percent
31	1	6,7	Valide 4	5	33,3
33	1	6,7	5	6	40
36	2	13,3	6	1	6,7
41	1	6,7	7	2	13,3
45	3	20	8	1	6,7
46	1	6,7	Total	15	100
47	1	6,7			
49	1	6,7			
52	1	6,7			
54	1	6,7			
64	1	6,7			
70	1	6,7			
Total	15	100			

The resulting correlation coefficient observed here (r = 0,420) confirms a weak correlation between the two variables. It can be deduced from such a result that the number of cohesive ties used in writing does not strongly affect writing scores.

Table 4: Correlating the number of cohesive ties and writing scores in Economics

		Number of ties	Writing Score
Number of ties	Pearson Correlation	1	,420
	N	15	15
Writng score	Pearson Correlation	,420	1
	N	15	15

4.2. **Testing correlation between students' number of cohesive ties and coherence scores   in the Math Sciences group**

Analyzing Pearson correlation between students' number of cohesive ties and their corresponding coherence scores show a negative correlation between the two variables (r = - 0, 272) as in this table:

Table 5: Correlation between the number of cohesive ties and coherence scores in Math Sciences

		Coherence Score	Number of Ties
Coherence Score	Pearson Correlation	1	-,272
	N	15	15
Numebr of Ties	Pearson Correlation	-,272	1
	N	15	15

Such a result, in fact, suggests that the coherence scores students have are not in harmony with the number of cohesive devices they used in their compositions. Many students had fewer linkers, but obtained a higher coherence grade (4 out of 4), while other compositions had 84 and 72 devices, and still received a minor grade, *3* out of *4*. So, it can be confirmed that the application of cohesive ties does not always contribute to coherence in writing.

4.3. Testing correlation between students' number of cohesive ties and coherence scores in Economics

The table below shows the number of cohesive ties that each student has in his / her essay and the score they received in coherence. Grading coherence follows Oshima and Hogue's four criteria for achieving coherence (repeating key nouns, using consistent pronouns, using transition signals, arranging ideas in logical order); so grading is limited to 4/4.

Table7: Number of cohesive ties and coherence scores in Economics

		Coherence Scores								
		1,00	1,90	2,00	2,15	2,75	3,15	3,75	4,00	Total
Number of	31,00	0	0	0	0	0	1	0	0	1
Ties	33,00	0	0	0	0	0	0	0	1	1
	36,00	0	0	1	0	0	0	1	0	2
	41,00	0	0	0	0	1	0	0	0	1
	45,00	1	0	0	1	0	0	0	1	3
	46,00	0	0	0	0	0	0	1	0	1
	47,00	0	0	0	0	0	0	0	1	1
	49,00	0	0	0	0	0	0	0	1	1
	52,00	0	0	0	0	0	0	0	1	1
	54,00	0	1	0	0	0	0	0	0	1
	64,00	0	0	0	0	0	0	0	1	1
	70,00	0	0	0	0	0	0	0	1	1
Total		1	1	1	1	1	1	2	7	15

The table demonstrates many differences between the two variables. In considering some examples, it can be noticed that one of the most coherent essays (*4/4*) used 33 cohesive ties only, whereas one of the least coherent (*1, 90*) had 54 cohesive devices. This implies that cohesion does not always lead to coherence, and that the number of ties that exist in compositions may have little to do with coherence. Consequently, the correlation between the two variables seems to be very weak (r= 0,213).

Yet, there are other students whose written texts were both cohesive and coherent, as in numbers 10, 11, and 12. However, the above results indicate that the use of cohesive ties in writing does not strongly affect coherence.

4.4. Cohesive ties used by students

4.4.1. Cohesive ties used by students of Math Sciences

The following analysis provides details and examples about the cohesive ties that are used by the Math Sciences group of students.

Table 9:   Number of cohesive ties used by Math Sciences

Cohesive Ties	Number of Ties	Percentage
Lexical	355	36,83%
Reference	439	45,54%
Conjunction	165	17,12%
Substitution	4	0,41%
Ellipsis	1	0,10%
Total	964	100%

The corpus in this field of study appears to have extensive cohesive elements. Reference ties are amongst the most common ties in students' essays, particularly personal pronouns that are highly recurrent: (220 pronouns). The number of relative pronouns is also very reasonable: (55 counts). Most of students are aware of how best to use relative pronouns. Let us consider this example:

"The first thing that I want you to know is that education is one of the most important things in our life because it gives us more information, *which* shows the right way." This example shows that personal and demonstrative reference ties (I, that, the, our,) are correctly used in the sentence.

What is special about this group is that a lot of students can use and correctly manipulate comparative adjectives and adverbs, as in the following examples:

"You know, your future won't be *better* if you don't complete your studies."

"You should know that you're going to suffer because you will have *more* problems."

These two examples demonstrate a carefully meaningful application of 'better' and 'more'. Nevertheless, they still find difficulty using such comparative references properly.

As for lexical cohesion, it was considerably present in this group's written texts. Most of the repeated words involve personal pronouns, personal determiners, demonstrative pronouns, and the conjunction 'and' (70 counts). The following is an example:

 "*I* was worried when *I* read *your* letter. *I*'m sorry for *your* father. *I* know *he* is dead   now and *you* have to work for *your* family."

"You're smart *and* you have just three years of hard work *and* then you will enjoy and relax."

In addition, one of the mostly repeated lexical items used by this group is the pronoun 'you'. In this way, students made their writing more personal and subjective, for they used fewer third person pronouns. Here are some examples:

"I know that you are going through a hard time in your school, and you are very exhausted"

"I know that you suffer due to the problems that you have, but you must take care of your future."

Indeed, this is not everything about lexical repetition. There are also other cases where students use the same word more than once, which obviously means that L1 conventions are transferred into their English, as in:

"I heard about your last *decision*, and I want to tell you that the *decision* is a mistake."

Actually, repetition is a recurrent issue in Moroccan students' composition. These students usually transfer their knowledge of Arabic into English writing; that is why there is an excessive use of repeated words and phrases in their written essays.

According to Hoey (1991), Lexical cohesion, which includes repetition, is the most widely used cohesive device. He said that "lexical cohesion becomes the dominant mode of creating texture." (Hoey, 1991; as cited in Tanskanen, 2006). He further explains his claim by comparing the frequency of repetition to reference, conjunction, substitution, and ellipsis. He also stresses that lexical cohesion is essential in establishing cohesion, because it reduces ambiguity between sentences.

What is important again in this group of Math Sciences is the presence of - albeit in a small number - synonyms and antonyms. This does not only represent the amount and diversity of their cohesive devices, but also their ability to play with words and avoid redundant repetition, as in this example:

"Motivation can come from seeing the *bad* situation of other poor children who don't have the chance to study or to have a *good* education."

As far as conjunctive cohesion is concerned, it comes in the third place. Math Sciences have a noticeably significant use of conjunctive ties, ranging from additive (83 counts), adversative (22 counts), to causal conjunctions: and, but, because, also, in addition, etc. Here are two instances:

"Education is one of the necessities of life. It has a lot of benefits, *as* it guaranties a good job*, and consequently* a better life."

"You should know that you're going to suffer, *because* you will have more problems *as* in our country if you don't have a good degree, you can't do anything and you can't have a good job. *Moreover*, I guess that you forgot your objective of becoming a doctor."

These two examples comprise several conjunctions: five additives such as 'consequently' and 'moreover', and one causal, 'because'. The student has managed, through those connectors, to create a logical connection between the sentences above. Yet, a number of other students still find problems with the additive 'and', which they overused. This is to say that they try to make a sequence and refer to previous clauses, as in:

"If you study hard, you can have a good job *and* you can help your family with your own money *and* you will learn the skills that you will need in your life."

Students belonging to Mathematical sciences have undoubtedly demonstrated practical skills in working with various cohesive devices. Their problems in cohesive ties are distinctively fewer than Economic students. So, according to Halliday and Hasan's (1976) taxonomy and Oshima and Hogue's (2006) coherence conventions, it might generally be concluded that this group has succeeded in building cohesion and coherence.

4.5. Students' problems in cohesion

a- They excessively use and misuse the conjunctive additive 'and'

In both classes, there are a lot of cases where students exaggerated and misused 'and'. Here are two instances from the data:

"You don't have any reason to give up studying, *and* you know your future better if you don't complete your study. Don't forget that your family counts on you, *and* 'she waiting' the end of the year to see the result of your *and* their effort."

"The death penalty is an order 'who' came from the judge and is actually said this 'order for a man or a woman who killed somebody and the death penalty is a different way and it so cruel."

The examples include situations where students transfer the application of 'and' from Arabic into English. In addition to this, instead of using other connectives, they kept repeating the coordinator 'and' over and over, making their sentences look awkward.

b- They overuse lexical reiteration

Reiteration is a constant issue in students' writings. In his study about cohesion and coherence in Arab EFL College students' writings, Khalil (1989) found that repetition of the same word is highly overused. The two groups under study have similarly produced the same problem, especially Economics students. A lot of their reiteration involves similar words, as in the following:

"The *death penalty* is something that many people do not have a clear decision on. Many people support *the death penalty*, while others wish for the *death penalty* to be abolished, and there are some that support the *death penalty*."

'Death penalty' is repeated above four times. Such a problem occurs as a result of students carrying over their L1 linguistic conventions into English. They negatively transfer repetition, which is one of the main features of Arabic rhetoric, into English writing.

c- Absence and misuse of references

The two classes have encountered problems of references, which in turn created non-cohesive and incoherent sentences and ideas. Most of the weaknesses in this area came from Math Sciences group. Some examples of wrong reference are given below:

"You study languages. *It*'s help you communicate."

"Don't forget that your family counts on you, and *she* waiting... ."

In the first example, instead of using the correct plural pronoun 'they' that refers to languages, the student wrongly used the third person singular 'it'. In the second example, it is the same thing happened. There were also examples where students did have the presupposing items, but with no presupposed ones:

"I hope you'll think about before you make a decision."

The student did not include the presupposed item 'it' that should normally follow the verb 'think about'; therefore it will look like this:

I hope you'll think about it before you make a decision.

4.6. The use of coherence by students
a- The group of Math Sciences

The class of respondents who apply coherence techniques better are Math Sciences students. Obviously, more than half of their written tests are in line with Oshima and Hogue's coherence elements. Most of the pronouns they used are consistent and they are appropriately used as referents, as in the following:

"I know you have a big problem with study, but every problem 'have' a solution, that's why you should think a lot before taking this bad decision."

Furthermore, many students in this group succeeded in smoothly moving from one idea to another through several transition signals, as shown in this example:

"The first thing you should know, without education you can't be successful in your life…. . Another thing you should never forget …."

The student here has two transitions: the 'first thing' and 'another thing'. He managed then to give meaning to his idea and establish transition between various sequences.

The following is an example of coherence in one of the students' essays:

"Well you told me that you wanted to drop out of school just to have a new life and leave all problems of school, but I'm sure you don't know the value of education as you're still an adolescent."

The student repeated the key pronoun *school*, used a consistent one *you*, used exact and adequate conjunctions, and found no difficulty moving from a sentence to another.

b- The group of Economics

In this class, the application of coherence techniques is relatively precarious and inconsistent. Many students were unable to properly use the coherence criteria suggested by Oshima and Hogue (2006). Their essays are less coherent. 7 essays out of 15 are less coherent, while *1* is totally incoherent. The number or type of cohesive ties used has nothing to do with the scores obtained. Despite the fact that their conjunctions outnumber those of Math Sciences in quantity and variety, they failed to get the expected results. So, this does not always lead to cohesion.

Indeed, the improper application of a number of conjunctions did not allow students to come up with effective transitions between ideas, as in this example:

 "The death penalty is firstly an order that came from the judge. And is actually said this order for a man or a woman who killed somebody. And the death penalty is indifferent ways and it is so cruel."

The above example shows that the incorrect use of the conjunction 'and' did not allow the student to meaningfully link between his ideas, therefore, he failed to arrange them in order.

Actually, there are several cases where students were unable to properly create logical connection between their sentences. Here is another example:

"This is the only way we didn't try before. For this reason, the totality of countries trying to stop death penalty in legislations. In my opinion, those who must be killed."

This student's set of sentences are completely disconnected. There is no relation between the first, the second, and the third sentence.

5.   Conclusion

The analysis of the data has clarified that Moroccan 2nd year baccalaureate students have significant imperfections in the use of cohesive ties and coherence techniques, as suggested by both Halliday & Hasan (1976) and Oshima & Hogue (2006) respectively. The analysis has also shown that the type and quantity of cohesive ties used by students do not strongly affect the scores they received in writing. In coherence, it was discovered that students' application of coherence linkers do not necessarily lead to cohesion.

As seen earlier, Math Science and Economics students used various cohesive devices, but obtained different writing scores. They primarily made use of lexical, reference, and conjunctive ties in their essays. In both groups, reference ties were the dominant type: 45 % in Math Sciences and 40 % in Economics

group. The second mostly used type were lexical devices: 36 % in Math Sciences and 29,74 % In Economics group. Conjunctions came in the third place with 17 % and 29, 31 % in Math Sciences and Economics group respectively. The least cohesive techniques used were substitution, whereas ellipsis ties were rarely encountered in students' essays.

Given the fact that students utilized such cohesive linkers, it might presumably be believed that they would get good scores in writing. However, that was not the case. There were a lot of examples where students used fewer cohesive devices than others, but scored higher. There were also examples where some students had many cohesive ties, but scored lower than others who had fewer ties. These results prove that the relationship between the use of cohesive devices and writing scores is not systematic; meaning that cohesive techniques cannot strongly affect writing scores.

Concerning coherence, the two groups (Math Sciences and Economics) made use of a number of coherence techniques, such as repeating key nouns, using consistent pronouns, using transition signals, and arranging ideas in a logical order. Following the application of these linkers, students received scores that were different from one to another. The students who properly had all these techniques obtained good coherence scores: 4/4. Such a correct use of coherence techniques was believed to correlate with the number of cohesive devices used in students' essays, but it was found out that coherent essays are not always cohesive. Many students had 4/4 as a coherence score, but their writings included fewer cohesive ties. Thus, it can be confirmed that cohesion does not always contribute to coherence.

From another perspective, Math Sciences students are considered high level classroom learners. This implies that they were able to use a wider variety of cohesive devices. They had more reference ties and a wider range of lexical ties. As for the second group, although most of them used more conjunctions, more synonyms and collocations, they did get good scores, because they had fewer lexical devices and a generally improper application of coherence techniques.

In this study, Math Sciences students utilized a considerable number of lexical ties. They could effectively manipulate various lexical items and avoid repetition. In the other group, the situation is, to some extent, different. The added value they have is the percentage of conjunctions they employed that is apparently higher in number and type; that is to say, they varied their use of conjunctions.

Besides, the analysis of the corpus has shown that both classes face considerable cohesion problems. Both of them used a lot of reiteration and repetition of similar words, had various wrong references, repeated 'and 'quite substantially, and misused several conjunctions.

Regarding the application of coherence devices, the study discovered that Math Science students' essays were more coherent than their counterparts'. Their coherent texts outnumber those of Economic students. The former made fewer mistakes in linking between sentences and paragraphs. Their ideas were more arranged in logical order than their counterparts. Yet, the differences between the two groups in achieving coherence were very slight. Economic students have also produced well coherent essays, in which they managed to follow the criteria of coherence achievement set by Oshima and Hogue.

It should be acknowledged that there are plenty of key elements that contributed to the imbalanced scores of the two groups under analysis, such as grammatical incompetence, lack of vocabulary, and lack of training in and understanding of cohesive and coherence skills. It should also be emphasized that the application of cohesive ties, regardless of their type and quantity, does not always help students come up

with coherent essays. In addition, the use of cohesive ties in writing does not, again, guarantee high wiring scores.

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The impact of metal hydride material activation to storage percentage of hydrogen in this material

Ľubica Bednárová[1], Tomáš Brestovič[1], Natália Jasminská[1], Marián Lázár[1], Romana Dobáková[1], Lukáš Tóth[1]

[1]Department of Power Engineerng, Technical University of Košice, Vysokoškolská 4, 040 01

Email: lubica.bednarova@tuke.sk

Abstract

Currently, a lot of focus is dedicated to metal hydride alloy and options of their utilization. Mankind must solve energy problems due to constant population growth and use of non-renewable energy sources. The World resources of oil are limited and therefore the mankind must start utilizing the alternative energy sources for example hydrogen. Its known that the hydrogen can be stored by metal hydride alloys what it represents the safety way of storage with absence high pressure and temperature. The process by produce of the alloy with good absorption properties the research does not end. Some alloy absorbs the hydrogen after they produce immediately, however a lot of them need the activation for improvement or starting absorption process. Process of activation is very important for achieving the maximum capacity at moderate temperature.

Keywords: Metal hydride, hydrogen storage, hydrogen activation

1. Introduction

In recent years, many new trends have emerged in metal hydrides with the introduction of new, unconventional production methods, surface treatments, and the discovery of new hydride phases. Their excellent properties are the result of combined engineering a lot of factors: the alloy composition, surface properties, microstructure, grain size etc. In development of nanocrystal hydride is not just the aim improvement of operating characteristics of existing hydrides but too, it is important the create the new generation of materials, those the properties will be proposed and controlled so that it meet the specific requirements of different applications.

2. Activation of alloy

We start with the problem about hydrogen diffusion into intermetallic areas of alloy. For better hydrogen diffusion it should evolve the special microstructure of material. In the case of nanocrystalic material provides a very small grain size enormously increased grain boundaries in the material. Although grain boundaries can act as hydrogen beds with very small amounts of hydrogen, due to the higher hydrogen content, the diffusion coefficient of hydrogen in nanocrystalline Pd has been shown to be higher than that of single crystalline palladium. Hydrogenation begins by filling easily accessible sites at the disordered (or

amorphous) grain boundaries. This leads to easier access of hydrogen atoms to nano-grains by avoiding long-range hydrogen diffusion through the already formed hydride phase, which is one of the most difficult phases of absorption. The second factor that can significantly improve hydrogen absorption is the surface to volume ratio. The large surface to volume ratio of the powders obtained by spherical grinding increases the accessibility of the hydrogen penetration material. In addition, ball milling creates a specific surface condition, with special surface defects and imperfections. All of this supports the hydrogen uptake reported in various documents. Nanocrystalline spherical grinding materials appear to have an ideal microstructure for hydrogen absorption. The microstructure of the Mg_2Ni spherical ground powder is shown in Fig. 1. Powder (20-50 μm) consists of very small grains (20-30 nm) which are randomly oriented in powder particles. As expected, the hydrogen uptake of the nanocrystalline material significantly exceeds the absorption rates for a conventional alloy [1-3].
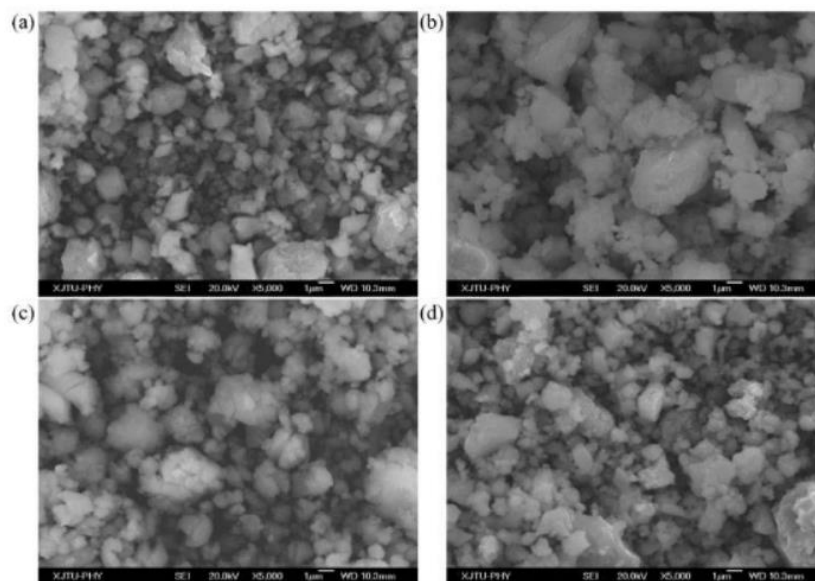
Figure 1. (SEM) of Mg2Ni powder prepared by different milling methods [1]

The rate of absorption can be improved even more radically when other kinetic constraints are reduced. Hydrogen dissociation is one of the critical factors of hydrogen absorption. For example, pure Mg surfaces do not have the ability to adsorb and dissociate hydrogen molecules to allow atomic diffusion within the metal. However, magnesium oxides can help dissociate the hydrogen molecules, but on the other hand the oxide layer significantly slows down the overall absorption rate. The oxide layer almost completely reduces the dissociative chemisorption of hydrogen. Therefore, a likely mechanism of activation is that the oxide layers are divided to expose clean metal surfaces, so that the overall absorption rate is increased [4, 5].

3. Activation to remove oxidation layer

V Most materials are highly reactive and easily form surface oxides and hydroxides that prevent hydrogen uptake. Typically, metal hydrides require activation, which typically involves a slow and complicated high temperature and high hydrogen annealing process.

Hydrogenation, i. formation of metal hydrides by hydrogen absorption is determined by both

thermodynamics and reaction kinetics. The following describes the basic mechanisms that govern these two aspects and also show possible ways of using them to improve the properties of metal hydrides. The following alloy activation process with composition $Zr_{0.5}Ti_{0.5}Fe_{1.2}Ni_{0.4}V_{0.4}$ is according to E.D. Koultoukis. For the activation process, all samples were placed in the sample holder at room temperature and under ambient atmosphere. To ensure the best degassing procedure, the samples were kept under vacuum at 350 ° C for two hours. However, this type of alloys requires high-energy activation to react effectively with hydrogen. Therefore, six to eight activation cycles were performed using the following procedure: as soon as the sample temperature reached 350 ° C after the previous degassing step, a pressure of 40 bar hydrogen gas was applied to the sample holder. Then the temperature was lowered to approximately 2 ° C - 5 ° C and the sample was allowed to absorb hydrogen until equilibrium was reached. The temperature was then raised once more to 350 [deg.] C. until the equilibrium was reached again. This procedure is repeated 6 to 8 times, each time the hydrogen pressure is applied to the sample holder. Fig. 2 shows an experimental procedure for such high energy activation for alloy-2. The hydrogen gas used in the present work is a purity of 99.999% [3,4].
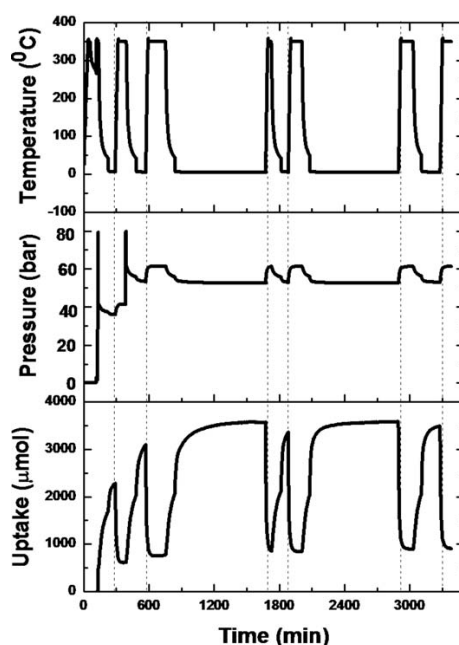
Figure 2. Alloy activation procedures [4]

ion can change dramatically using catalysts. The correct catalyst allows rapid and efficient dissociation of the hydrogen molecules. The efficiency of a catalyst is determined by its ability to "flood" the metal surface with hydrogen atoms to such an extent that the kinetic barrier of the oxide layer is reduced. As a result, activation becomes unnecessary and powders readily absorb hydrogen in the ready state, even after exposure to air [5].

The kinetic factors of hydrogen desorption are analogous to absorption and require similar considerations. The rate of desorption can be limited by diffusion of hydrogen in the material and recombination to hydrogen molecules on the surface. Thus, an increase in desorption can be achieved by methods similar to those used in absorption.

The above processes can be successfully applied to various hydrides, providing in any case an exceptional

improvement in hydrogen sorption, as shown for example for LaNi₅ in Fig. 3.
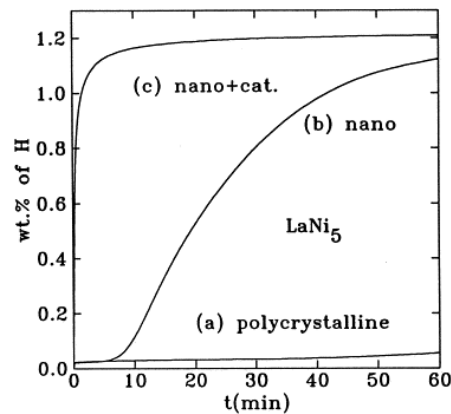
Figure 3. Hydrogen uptake rate LaNi₅: polycrystalline (a), nanocrystalline (b) and nanocrystalline with catalyst (c); without activation, temperature 40 ° C, pressure 15 bar [6]

The same is true for magnesium-containing light alloys, which combine two important advantages: high hydrogen capacity and low cost. Examples of the efficiency of light nanocrystalline alloys are shown in Fig. 4 and Fig. 5.
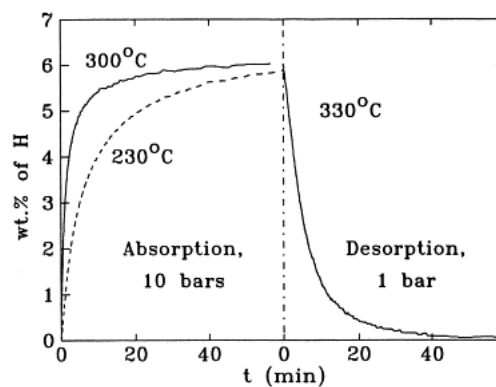
Figure 4. Absorption and desorption for nanocrystalline Mg-based alloy [7]
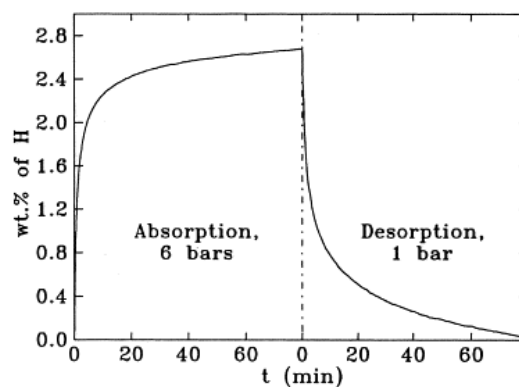
Figure 5. Absorption and desorption for a nanocrystalline light alloy at 235 °C.

Fig. 6 shows the absorption of a light alloy at low temperature. In all cases, nanocrystalline powders were exposed to air between production and hydrogenation and showed no pyrophoric tendency. After exposure to air (in some cases of the order of weeks), kinetic hydrogenation curves were measured without prior activation or treatment of hydrogen and found to be unchanged. Finally, nanocrystalline powders do not

disintegrate after absorption / desorption [8].
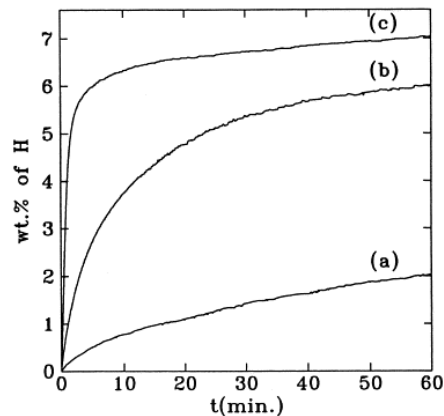
Figure 6. Low temperature absorption of light nanocrystalline alloy: 110 ° C (a), 170 ° C (b), 190 ° C, (c) (20 bar) [5]

4. Activation to change the phase structure of the alloy matrix

The activation properties of hydrogen storage alloys are generally determined by two main factors: the oxide layer on the surface and the phase structure of the alloy matrix. In the initial stage of activation, hydrogen atoms must penetrate the oxide film on the alloy surface and are absorbed by the volume of the alloy.

Activation of the phase structure of the alloy matrix is accomplished by sequentially hydrating and dehydrating the metal several times in a pulsed manner until the desired degree of activation is achieved. The metal is pulsed by alternately subjecting the metal to a hydrating and dehydrating force. The pulsation cycle is then repeated several times until the metal is activated to the desired degree. For the purpose of pulsating cycle activation, the hydridation and dehydration forces may be applied in any order, i. a dehydration force followed by a hydration force or vice versa.

The extent to which the metal is activated depends on the duration of the individual pulses in the pulse cycle, the switching times between pulses and the number of such pulses. In this regard, it is preferred that the metal in each pulsating cycle is hydrated to a significant extent, i. j. at least about one-tenth of one percent of its total capacity, but no more than about ten percent of its total capacity. To achieve this, the time of each hydration force pulse and the dehydration force pulse in each cycle will vary from metal to metal, but is typically about 10 to about 1000 seconds. From the processing point of view, it is advantageous if the hydration pulse time is the same as the dehydration pulse time [8].

Figure 7 shows experimental isotherms measured at 298 K in a low hydrogen concentration region (H / M <1.5) during the activation procedure. It is known from the literature that during the first hydration cycles decrepitations occur: precipitation of the hydride phase creates internal defects, which in turn induce crushing of the sample into a fine powder. From Figure 7 it is evident that the equilibrium absorption pressure decreases with increasing number of hydration / dehydration cycles (whole isotherms up to H / M6 not shown). The question is to find out whether or not there is any relationship between thermodynamic states and sorption kinetics. If so, what is the reaction step (surface chemisorption of bulk hydrogen transport by diffusion) that is most affected by this development. To answer this question, experimental impedance diagrams must be measured during activation (Fig. 7) [9-11].
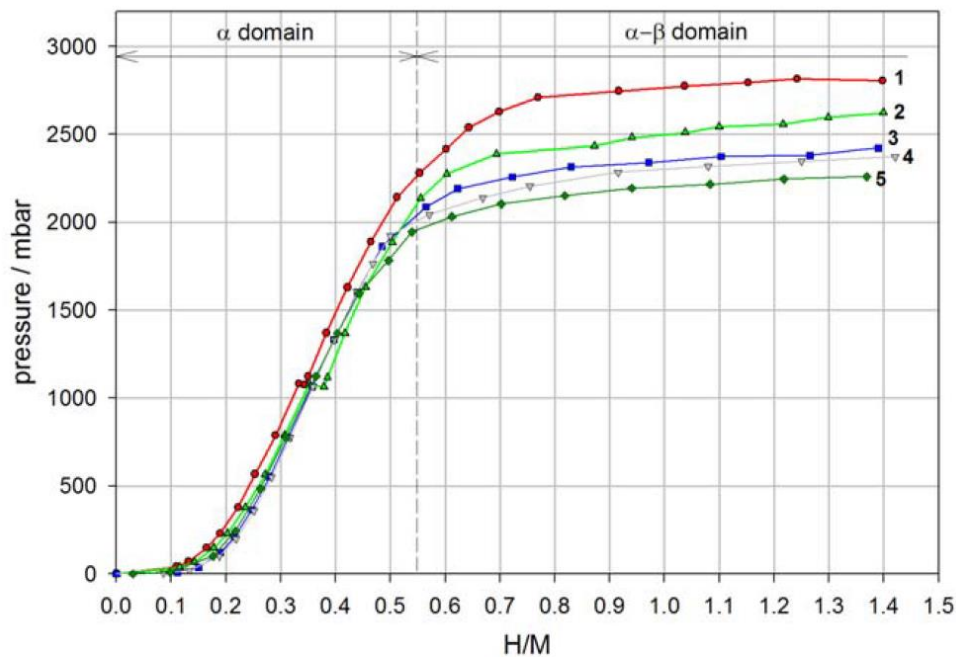
Figure 7. isotherms of the LaNi$_5$-H$_2$ (g) system measured at 298 K in a low hydrogen concentration region for 5 consecutive absorption cycles [9]

5. Conclusion

However, the thermodynamic and kinetic properties of most of these systems are complicated by hysteresis, and for practical applications it is necessary to develop activation procedures to optimize sorption capacities and kinetics. The thermodynamic and kinetic characterization of metal hydride systems is complicated by the presence of important hysteresis: the equilibrium pressure during absorption is significantly higher than the equilibrium pressure during desorption, indicating that irreversible transformations are occurring. For an unactivated sample of LaNi5 powder, the difference between the two equilibrium pressures is significantly greater (about 1400 mbar at 298 K). During the first hydration cycles, the equilibrium absorption pressure decreases and the difference can be reduced to approx. 400 mbar for 10 cycles. This process is known as decrepitation: the precipitation of the hydride phase produces significantly high internal stresses and tensions, which in turn crush metal samples. In the literature for activated samples, average particle diameters of several microns were reported.

The development of new materials for hydrogen storage requires overcoming many thermodynamic and kinetic constraints. In a new generation of modern materials, proper engineering of alloy composition, surface properties, microstructure, grain size, etc., we can design and control material properties according to the requirements of a particular application. A number of metastable phases and microstructures offer tremendous possibilities for modifying the p-c-T characteristics for better performance [7].

6. Acknowledgement

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Possibilities of utilization of waste heat of synthesis gas

Lukáš Tóth[1], Tomáš Brestovič[1], Natália Jasminská[1], Marián Lázár[1], Romana Dobáková[1], Ľubica Bednárová[1]

[1]Department of Power Engineerng, Technical University of Košice, Vysokoškolská 4, 040 01
Email: lubica.bednarova@tuke.sk

Abstract

The paper discusses possibilities of energetic utilization of waste heat from synthesis gas, which worsens possibilities of its further utilization. In this case, it is the recovery of synthesis gas with a high proportion of hydrogen produced by the thermal recovery of municipal waste by means of a plasma reactor. High temperatures deteriorate its recovery potential by separating hydrogen from the gas mixture and its subsequent use in fuel cells. Hydrogen separation takes place in the plant using metal hydride materials.
Keywords: synthesis gas; waste heat; plasma reactor; hydrogen;

1. Introduction

In view of the increasing need to improve the efficiency and energy use of all materials, to reduce the environmental burden and reduce the carbon footprint, there is a need to use all kinds of energy released during processing and to discharge it inefficiently into the environment. Due to the increasing amount of waste produced, there is also a need for efficient recovery, recycling and other recovery options.

Since it is not possible to carry out 100% recycling of municipal waste with current technology, it is necessary to improve its recovery. Landfill or incineration of municipal waste generates hazardous gases that cause soil pollution, acid rain and promote global warming.

Plasma reactors may represent a significant change in waste treatment. They can relatively cleanly dispose of most hazardous wastes, with the resulting product being synthesis gas and slag. During the gasification process, complex carbon chains decompose into primarily simple hydrocarbons, carbon monoxide, carbon dioxide and hydrogen. Nitrogen, argon and other gases are also present in the gas, either entering the system either in the material being processed or in the air that serves as the oxidant.

2. Amount of waste heat of the investigated gas

Synthesis gas produced by RDF waste was obtained for the experiment and was obtained by separating the combustible components from municipal waste. The treatment of the waste in a plasma reactor resulted in synthesis gas having the composition of Tab. 1.

Table 1. Proportion of individual components of synthesis gas [1]

COMPONENT	PERCENTAGE (%)	SPECIFIC HEAT CAPACITY c_p (kJ·kg^{-1}·K^{-1})	DENSITY ρ (kg·m^{-3})
CH_4	0.26	2.17	0.676

H_2	50.9	14.05	0.0899
O_2	0.03	0.91	1.429
N_2	4.25	1.04	1.234
CO_2	1.1	0.83	1.951
CO	43.5	1.09	1.234

Processing was carried out on a 10 kVA plasma reactor. Feeding of waste into the reactor is effected by means of a spiral feeder, the rate of feed being regulated by changing the speed. The decomposition of the waste to the basic elements is carried out by means of an electric arc of 1300° C.

Figure 1. Plasma reactor.

In order to determine the amount of heat to be removed from the gas, it is necessary to determine the operating conditions such as inlet and outlet temperature, the heat capacity c_p of the gas mixture and the gas flow through the exchanger. The operating conditions necessary to determine the amount of heat to be removed from the gas mixture are shown in Tab. 2. The gas outlet temperature is selected based on the requirement for further processing of the synthesis gas.

Table 2. Boundary conditions [1]

Inlet temperature t_1 (°C)	750
Outlet temperature t_2 (°C)	300
Amount of waste delivered Q_m (kg·min^{-1})	0.12
Amount of gas produced Q_V (m^3·kg^{-1})	1.803

The calculation of the heat (Q) of the individual components of the synthesis gas is performed only around because of the continuously varying proportion of the individual components, which is significantly dependent on the type of waste treated and even if the same proportion of individual components is

maintained, the individual components are uneven.

$$Q = c_p \cdot m \cdot (t_1 - t_2) \quad \text{(W)} \tag{1}$$

Where c_p is specific heat capacity; m – mass; t_1 - inlet temperature; t_2 - outlet temperature.

The total amount of heat to be removed from the synthesis gas can be determined by Equation (1). To determine the amount of heat it is necessary to determine the mass of the gas passing through the device. From Tab. 2 it is possible to determine the gas flow in $m^3 \cdot min^{-1}$. Gas flow rate $Q_{Vs} = 0.21636$ $m^3 \cdot min^{-1}$. In Tab. 3, the heat values that must be removed from the individual components of the synthesis gas and subsequently the total value are determined.

Table 3. Heat quantity [1]

Component	The proportion of individual ingredients in syngas Q_{Vs} ($m^3 \cdot min^{-1}$)	The proportion of individual ingredients in syngas Q_{ms} ($kg \cdot min^{-1}$)	Q (W)
CH_4	0.000563	0.000380	6.2
H_2	0.110127	0.009900	1043
O_2	0.000065	0.000093	0.63
N_2	0.009195	0.011347	88.5
CO_2	0.002380	0.004643	29
CO	0.094117	0.116140	949
		together	2116

3. Possibilities of heat removal from synthesis gas

In most cases, the gas is cooled either by the using cooling water which is injected into the gas to purify it from solid contaminants, or in heat exchangers where the water is heated for further technological use. Another possibility is to dissipate heat into the surrounding environment by means of an exchanger.

Injection of water into the system is not suitable for our use because of the excessive increase in moisture in the gas, which would lead to significant and rapid corrosion in the subsequent separation of hydrogen through the metal hydride materials, causing damage to the equipment. In this case, it is possible to use a small amount of water spraying to remove the solid contaminants, merely to stick the particles into larger agglomerates and then remove them in a cyclone trap.

Since the device in question is intended to operate independently and independently of the environment, the dissipation of heat through the exchanger would only lead to its transfer to the environment, which would in no way improve the overall energy efficiency of the device. On the contrary, it would be necessary to cool the device if it is placed in a closed complex due to the overheating of individual, especially electronic components.

The use of stirlig engines for converting the thermal energy contained in the gas into mechanical and then by means of an electricity generator, which could to some extent be used to meet the energy needs of other parts of the plant, thus increasing energy efficiency, seems to be an interesting option.

Referring to Fig. 1, it can be determined that, for a given device, the efficiency of a stirling engine to dissipate thermal energy from syngas is at a level of 20%, since the remaining heat is discharged to the cooler used for heating metal hydride alloys to allow better desorption of hydrogen. According to the graph, it can be determined that the efficiency of stirling engines will increase proportionally with increasing power, so it would be advisable to increase the production and possibly the temperature of the gas coming out of the reactor so that the efficiency of stirling engines could increase.
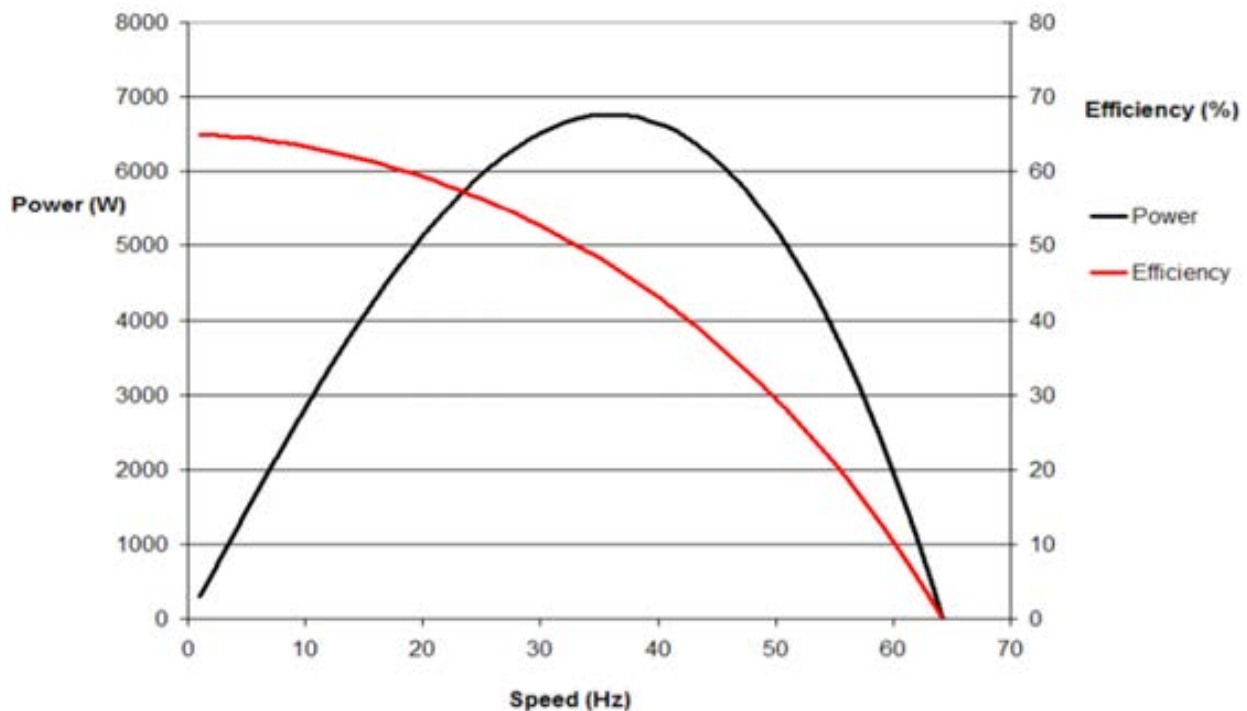
Figure 2. Dependence of efficiency on power and speed [5].

After removing 20% of the thermal energy by means of stirling motors, approximately 1700 W remains for heating the heat transfer medium. This energy can then be reduced to about 700-800 W in a further heat exchanger using another series of stirling motors, which is a sufficient level for heating the metal-hydroxide containers. By utilizing the cascade arrangement of stirling engines, it is possible to significantly reduce the temperature of the synthesis gas, whereby part of the energy is converted to mechanical and subsequently to electrical, thereby increasing the overall efficiency of the device.

3. Conclusion

Due to the use of the first set of stirling engines in a cascaded configuration, it is possible to obtain approximately 425W of mechanical energy from the synthesis gas in our case, which will then be used to generate electricity in the generator. The use of waste heat to generate electricity increases the efficiency of the plant and reduces the total operating costs of its operation.

4. Acknowledgement

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Effect of Environmental Performance and Environmental Costs on Financial Performance with CSR *Disclosure* as Intervening Variables

Cindy Pratama Derila, Einde Evana, **Fajar Gustiawaty Dewi**.

Faculty of Economics and Business, University of Lampung, Gedong Meneng, Bandar Lampung, Indonesia

Abstract

This research is a conceptual paper that aims to determine the effect of researchers will examine the effect of Environmental Performance and Environmental Costs on Financial Performance with CSR as an Intervening variable on mining companies listed on the Exchange Indonesian Securities and participated in the 2015-2018 PROPER. This research is expected to be used as a material consideration in making policies concerning environmental performance and as a tool to measure financial performance for the progress of the company. In addition to being taken into consideration, researchers hope that this research can be used to help in making investment decisions in the company as an evaluation material.
Keywords: environmental performance, environmental costs, *CSR* and financial performance.

Introduction

One way to assess the performance of a company is by looking at the company's financial performance. The achievement of the company's activities is illustrated by the profits generated. This is in agreement with Pujiasih (2013), namely the ability of a company to generate profits is the main thing in evaluating the company's financial performance. The use of earnings as a parameter in measuring financial performance is based on the fact that profits are needed by the company for the survival of the company (Jayati, 2012). The ever-increasing rate of profit reaching maximum profit is a good indicator of a company's financial performance. Wijadjaja (1996) said that companies with good financial performance will be able to continue to live and survive. Companies with poor performance will experience shaking and will die slowly. Therefore, companies are competing to create a perfect financial performance. The company's financial performance can be measured from periodic financial statements that provide an overview of the company's financial position (Sudaryanto, 2011). The principle of profit maximization in achieving good financial performance now has an impact that is not necessarily good for the community. The impact of the company's activities is the emergence of environmental damage, global warming, damage to the ecosystem, increased waste increases both air and soil pollution. According to McWilliams and Siegel (2001) in Fitriani (2013), *corporate sustainability* will be guaranteed if the company pays attention to social and environmental dimensions. Corporate responsibility is not only on the *single bottom line*, the *corporate value* reflected in financial aspects, but must be *triple bottom lines,* namely financial, social and environmental aspects. Financial condition is not enough to guarantee the value of the company grow sustainably *(sustainable),* but also must pay attention to social and environmental dimensions to avoid

resistance from the local community (Untung, 2008). Also, the community is now aware of the social impact of companies that want to achieve maximum profit, so the community demands that companies pay attention to and overcome the social impacts caused (Rahmawati, 2012). This is by the Government Regulation of the Republic of Indonesia Number 47 of 2012 concerning the Social and Environmental Responsibility of Limited Liability Companies. This social responsibility is often called *Corporate Social Responsibility. CSR* according to Susanto (2009) is as a corporate responsibility both inward-directed to shareholders and friends in the form of profitability and company progress, as well as outward responsibilities associated as taxpayers and employment providers, increasing the welfare and competence of the community and preserve the environment for future generations. Thus, the company can benefit not only its business but also benefit other parties. Companies need to do *CSR Disclosure* in their annual report. So that it can increase attractiveness *stakeholder* and consumer loyalty will continue to increase. *CSR Disclosure* contains all activities related to the company's social and environment. This can be used as a promotional event for the company so that environmental performance, environmental costs, and the company's financial performance are viewed well by *stakeholders*. This is believed to give an *image of* good the company and the impact on selling increasing and can guarantee the sustainability *(Sustainability)* company.

Issues

One important aspect of social performance as a reflection of social responsibility is the company's environmental performance. Environmental Performance is a mechanism for companies to voluntarily integrate environmental concerns into their operations and interactions with *stakeholders*, which exceeds organizational responsibility in the legal field. Minister of the Environment, Siti Nurbaya said that the level of company compliance with the environment in 2016-2017 reached 92%, up 7% from last year's achievement. From that assessment, 19 companies received gold ratings, 150 companies ranked green, 1,486 ratings in blue, 130 ratings in red and 1 company ranked in black (bisnis.com). This indicates that 130 companies have not yet carried out environmental management in accordance with the requirements, in addition, there is also 1 company that intentionally or neglected to carry out operations that cause environmental damage, so that regulations are still needed, improvement of human resources and improvement of facilities environmental management to support companies that are still in the red and black ranks to be better in managing the environment. The efforts of the regulatory authorities to preserve and develop harmonious, harmonious and balanced environmental capabilities have been carried out by stipulating Law of the Republic of Indonesia Number 32 2009 concerning Environmental Protection and Management (UUPPLH) is a systematic and integrated effort undertaken to preserve environmental functions and prevent environmental pollution and/or damage which includes pollution, utilization, control e, supervision, and law enforcement. The government through the Ministry of Environment has even established a program called PROPER as a form of environmental compliance for companies in Indonesia. This is done in terms of assessing the company's environmental performance and spurring so that the company is getting better at trying to care for the environment. Good response to the PROPER program as an assessment of the company's environmental performance continues to increase (www.mnlh.go.id)

Literature Review

Legitimacy Theory

the theory is a theory that assumes that companies are constantly trying to ensure that the operations they run are under the rules and existing social norms (Deegan, 2004). *Legitimacy theory* is essentially a system-oriented theory, in this case, an organization or company is seen as one component of a larger social environment. The legitimacy theory states that organizations operate based on a value system that is commensurate with the value system owned by the community (Zaenuddin, 2007). Legitimacy theory is a strategic factor for companies to develop the company going forward. It can be used as a vehicle to construct a corporate strategy, especially about efforts to position themselves in the midst of increasingly advanced community environments. Thus, legitimacy is a potential benefit or resource for a company to survive *(going concern).* This definition implies that legitimacy is a company management system oriented towards alignment with the community (society), the Government, individuals, and community groups.

Stakeholder Theory

theory *stakeholder* states that the company has a social responsibility that requires them to consider the interests of all parties affected by their actions. This theory emphasizes to consider the interests, needs, and influence of parties related to company policies and operations, especially in corporate decision making. The company needs to maintain legitimacy *stakeholders* and put it within the framework of policy and decision making so that it can support the achievement of company goals, namely business and guarantee *going concern* Adam's(in Hadi, 2011).

Financial Performance

Understanding financial performance is a picture of the achievement of the implementation/program/ policy in realizing the goals, objectives, mission, and vision of an organization (Bastian, 2006). According to Fahmi, (2012) financial performance is an analysis tool that is carried out to see the extent to which the company has implemented the rules of financial implementation properly and correctly, such as by making a financial report that has met the standards in SAK (Financial Accounting Standards) or GAAP *(General Accepted Accounting Principle).*

Environmental Performance Environmental

Performance is the company's performance in creating a good environment *green* (Suratno, 2008). In Indonesia, the application of corporate environmental performance is facilitated by the existence of a Company Work Rating Rating Program in Environmental Management (PROPER). PROPER is an instrument used by the Ministry of Environment to assess and rank company compliance in carrying out its environmental performance. The awareness of the company that determines good environmental performance is a manifestation of the company's accountability to the community and the environment.

Environmental Costs Environmental

Costs are costs incurred by companies related to environmental damage caused and protection carried out (Susenohaji, 2003). *The environmental cost* is the cost of *corporate social responsibility disclosure activities.* The environmental costs to companies can be seen in the allocation of funds for environmental development programs. According to Shohilin, 2004 environmental costs are costs incurred due to the presence or possibility of poor environmental quality.

Effect of Environmental Performance on Financial Performance

Disclosure of environmental performance is very important for companies to demonstrate their existence and participation in handling environmental problems. The company needs to show its existence and participation in handling environmental problems as a form of morally responsible corporate responsibility to the environment in which the company operates by the stated legislation theory. Djuitaningsih and Ristiawati (2011), stated that environmental performance has a positive and significant effect on financial performance because companies with good environmental performance will also get a good response from *stakeholders* and have an impact on increasing corporate income in the long run. Adhima (2011) also states the same thing that *Environmental performance disclosure* has a positive influence on a company's financial performance.

Ha$_1$: Environmental Performance positive effect   on Financial Performance.

Effect of Environmental Costs on Financial Performance

These environmental costs can be seen through the allocation of environmental development program funds in the company's financial statements and annual reports (Camelia, 2016). According to the research of Al Sharairi (2005), environmental costs have a positive effect on competitive advantage because the environmental costs incurred by companies can increase the company's reputation that has a positive effect on competitive advantage. This study is in line with Septiadi (2016) who found that environmental costs have a positive and significant effect on the company's financial performance.

Ha$_2$: Environmental costs have a positive effect on financial performance.

The influence of *CSR Disclosure* on Financial Performance

Angela (2015) revealed that by implementing CSR, the company's image will the better so that the loyalty of consumers and *stakeholders is* higher. As consumer and loyalty increase *stakeholders* for a long time, company sales will improve, and ultimately with the implementation of CSR, it is expected that the level of profitability of the company will also increase (Satyo, 2005 in Rahmawati, 2012). According to Suryani's research (2012), Rahmawati (2012)), and Octavia (2014) showed that the influence of CSR Disclosure on financial performance was stated to be significant

Ha$_3$: *CSR Disclosure* had a positive effect on Financial Performance.

Effect of Environmental Performance on Financial Performance with CSR Disclosure as an Intervening Variable.

Environmental performance is one of the indicators expressed in *Corporate Social Responsibility*. Therefore, if the environmental performance is good, the *Corporate Social Responsibility* of the company will be good too. *Good Corporate Social Responsibility* can be *good news* and add to the company's image so that investors or public trust can be increased in the company. In the end, the company can get additional capital and increase sales which result in increased *profits*. Thus, *Corporate Social Responsibility* can mediate the relationship between environmental performance and financial performance. Rakhiemah & Agustia (2009), Suryani (2012), Rahmawati (2012), and Pujiasih (2013) in their research stated that environmental performance and variables *CSR disclosure* together had a significant positive effect on financial performance.

Ha₄: Environmental Performance has a positive effect on Financial Performance with *CSR Disclosure*s an Intervening Variable

Effect of Environmental Costs on Financial Performance with *CSR Disclosure* as an Intervening Variable.

Companies that budget environmental costs show their seriousness in environmental management concerns. Whether it's the costs to prevent environmental pollution or the costs to overcome environmental pollution due to company production activities. In addition to showing the seriousness of the company in managing the environment, the company's budgeted environmental costs support the implementation of *Corporate Social Responsibility*. A high budget *environmental cost* is expected to support CSR, thus giving investors a good view of the *sustainability* company's(Tunggal & Fachrurrozie, 2014).

Ha₅: Environmental Costs have a positive effect on Financial Performance with *CSR Disclosure*s an Intervening Variable

Discussion

Company financial performance can be measured from periodic financial statements that provide an overview of the company's financial position (sudaryanto, 2011). Principle of profit maximization in achieving performance good finance now has an impact that is not necessarily good for the community. The impact of the company's activities is the emergence of environmental damage, global warming, damage to the ecosystem, increased waste increases both air and soil pollution. One factor that is consistently related to environmental performance and environmental costs to financial performance is *CSR Disclosure*. This is due to environmental performance and environmental costs are support for *CSR Disclosure.* If the environmental performance disclosed by the Ministry of Environment is good, then *CSR Disclosure* can be confirmed to be good. So this supports the relationship of environmental performance to financial performance.

Conclusion

This study is a conceptual study that discusses Environmental Performance and Environmental Costs of Financial Performance with CSR as an Intervening variable on mining companies listed on the Indonesia Stock Exchange and participating in the 2015-2018 PROPER. The results of this study are expected to be used as a material consideration in making policies regarding environmental performance and as a tool to measure financial performance for the progress of the company. Then with this research, it is expected that the company can pay attention to the environment and society around the company, so the focus of the company is not only profit-oriented. And for Investors, the results of the research can be used to assist in making investment decisions in the company as an evaluation material.

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The Influence of Tax Aggressiveness on Corporate Social Responsibility

Miryati Putri Rahayu

Faculty of Economics and Business, University of Lampung, Gedong Meneng, Bandar Lampung, Indonesia

ABSTRACT

The objective of this research was to analyze the effect of the tax aggressiveness on the corporate social responsibility of the mining companies listed on Indonesia Stock Exchange in the period of 2013 - 2015. The independent variable used in this research was the tax aggressiveness measured by the effective tax rate (ETR); while, the dependent variable used in this research was the corporate social responsibility (CSR). This research used three control variables (return on assets, leverage, and company size). The sampling technique used in this research was a purposive sampling technique so that the sample of this research was all mining companies (27 companies) which had published the annual financial reports in the period of 2013 – 2015. The sample was collected through 81 observations. Data analysis technique used in this research was a multiple linear regression using SPSS version 20. The result of this research showed that (1) the tax aggressiveness and the company size had an effect on the CSR; while, the return on asset (ROA) and leverage had no effect on the CSR.
Keywords: Corporate Social Responsibility, Tax Aggressiveness, ROA, Leverage, Size

Introduction

Disclosure of Corporate Social Responsibility is an obligation for every company regulated in the Law of the Republic of Indonesia No. 40 of 2007 article 74 paragraph 1 concerning "companies which carry out their business activities in the fields and / or relating to natural resources are required to carry out social and environmental responsibilities" and paragraph 3 concerning "companies which do not carry out the obligations referred to in paragraph (1) are subject to sanctions in accordance with the laws and regulations ". In addition to the above law, there is another Investment Law no. 25 of 2007 article 15 (b) states that every investor is obliged to carry out corporate social responsibility and in article 34 it is also stated that companies which do not fulfill the obligations set out in article 15 will be subject to sanctions. The company's activities are basically inseparable from social contracts with the community. Therefore the majority of companies in various parts of the world carry out corporate social responsibility or CSR as a form of caring for the community. Corporate Social Responsibility is defined as a serious effort by business entities to minimize negative impacts and maximize the positive impact of company operations for all stakeholders in the economic, social and environmental sphere to achieve sustainable development goals. This statement is also in accordance with the concept of a triple bottom line (Elkington, 1997) which uses "3P", namely *Profit, People*, and *Planet* where the company will succeed if not only pay attention to profits, but pay attention to people's welfare and care for the environment (Wibisono, 2007) .

Riset Issue

Data below is a breakdown of the percentage of CSR disclosures in mining companies in 2010 - 2015,shown in table 1.1 as follow:

Table 1.1

Percentage of CSR Disclosures for the 2009-2013Period

Year	Mining Companies Listed on the Indonesia Stock Exchange	Mining Companies Listed on the Stock Exchange Indonesia that Reveals CSR	% Mining Companies Listed on the Indonesia Stock Exchange which Reveals CSR
2009	23	13	56.25%
2010	29	22	75.86%
2011	31	29	93.54%
2012	37	33	89.18%
2013	39	35	89.74%

Source: www.idx.co.id, the data is reprocessed.

From table 1.1 above shows that the CSR report has not been optimally utilized, it is very likely due to the low awareness of the company in expressing social and environmental problems that occur. The low level of corporate awareness to disclose environmental and social problems is due to the present time that social disclosure is a form of voluntary disclosure, so the perception arises that it does not become a problem if a company does not do social disclosure.

Literature Review

Legitimacy Theory

Community legitimacy is a strategic factor for companies in order to develop the company going forward. That, can be used as a vehicle to construct a company's strategy, especially related to efforts to position themselves in the midst of an increasingly advanced community environment (Hadi, 2011).

Stakeholder Theory

Company not merely responsible to the owners *(shareholders)* as has happened so far, but has shifted to a wider extent, namely in the social domain *(stakeholders),* hereinafter referred to as social responsibility *(Social responsibility).* This phenomenon occurs, due to demands from the community due to *negative externalities* that arise and social inequality that occurs (Hadi 2011: 93).

Corporate Social Responsibility (CSR)

General definition according to the World Business Council in Sustainable Development, corporate social responsibility is the commitment of companies to behave ethically and contribute to sustainable economic

development by improving the quality of life of employees and their families, local communities and the wider community. With CSR the company is expected to increase attention to the environment, workplace conditions, public company relations, corporate social investment, and a good public image of the company, improve corporate financial performance and access to capital. In its activities each company will interact with its social environment.

Tax Aggressiveness

Hlaing (2012) defines tax aggressiveness as the tax planning activity of all companies involved in efforts to reduce effective tax rates. (in Balakrishnan, et.al. 2011) argues that tax aggressiveness is a more specific activity, which includes transactions whose main purpose is to reduce corporate tax obligations.

Return On Assets (ROA)

Return On Assets according to (On Cash 2012: 201(ROA) is a ratio that shows the results (*returns*) on the amount of assets used in the company. In addition, ROA provides a better measure of company profitability because it shows the effectiveness of management in using assets to earn revenue.

Leverage

Leverage is the amount of debt used to finance / buy company assets. Companies that have debts greater than equity are said to be companies with a high degree of leverage (Fakhrudin, 2008: 109).

Size

size of the company shows the size of the wealth (assets) owned by a company. Measurement company aims to quantitatively distinguish between large companies (large firm) with small companies (small firm) the size of a company that could affect management's ability to operate the company with a variety of conditions faced situaisi (Kris, 2013).

Tax Aggressiveness and Corporate Social Responsibility

Actions to minimize the tax burden or tax aggressiveness among large companies often occur, especially in Indonesia. The company feels burdened by the many burdens borne, for example the case that is currently happening is the company is trying to reduce the burden of corporate CSR by minimizing its tax burden. These actions are basically not in line with community expectations and have a negative impact on society because it affects the ability of the government to provide public goods (Lanis and Richardson, 2013). Based on the description above and the absence of direction consistency clear about the relationship aggressiveness taxes on CSR, then the hypothesis is:

H$_1$:Aggressiveness Tax effect on CSR (Corporate Social Responsibility)

Conclusion

This study aims to determine the effect of aggressiveness taxes on Corporate Social Responsibility (CSR) in mining companies in Indonesia in 2013-2015. Determination of sampling with a purposive

sampling method in mining. 27 companies were taken as samples for 3 years of observation. Thus the number of samples used in this study were 81 samples. Based on the results of hypothesis testing using testing tools in the form of SPSS for windows version 20 and the data used in this study are data in the form of financial statements of mining companies published through the Indonesia Stock Exchange website namely www.idx.co.id and ICMD (Indonesian Capital Market Directory) 2013-2015. Based on the results of research and discussion concluded as follows:

1. Tax Aggressiveness affects corporate social responsibility (CSR) in mining companies in Indonesia.
2. Return on assets (ROA) and leverage have no effect on corporate social responsibility (CSR) in mining companies in Indonesia.
3. Size affects corporate social responsibility (CSR) in mining companies in Indonesia.
4. This study uses one independent variable, namely Tax Aggressiveness and three control variables namely, Return On Assets (ROA), Company Size and Leverage.
5. The population in this study uses one type of company, namely
   Mining Companies that are listed on the Indonesia Stock Exchange.
6. This study uses time series data for three years of annual financial reporting namely,.
   2013-2015.

Based on the results of the study as well as matters related to the limitations of the study, there are a number of things that must be considered, namely: 1). The independent variable Tax aggressiveness in this study is expected to be reused in subsequent studies, because this study shows the influence of these variables on Corporate Social Responsibility (CSR); 2). Return on Asset (ROA) and Leverage control variables are expected to be reused in future studies because it does not rule out the possibility for ROA variables to have an influence on Corporate Social Responsibility (CSR); 3). Variable Control The size of the company (Size) in the study is expected to be used again in subsequent studies, because this study shows the influence of Corporate Social Responsibility (CSR); 4). For further researchers, because the variables used in this study are still small, it is hoped that in subsequent studies, it can consider other factors not examined in this study that affect corporate social responsibility (CSR) so that the research model becomes better; 5). In the next research it is expected to use the population of all companies listed on the Indonesia Stock Exchange or use companies other than mining companies so that the research results obtained are better than previous studies; 6). It is expected that further researchers to extend the study period so that the results and obtained better and research results will be consistent with previous studies.

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Analysis of the Effects of Environmental Performance and Disclosures

Corporate Sustainability Reporting on *Earning Response Coefficient*

Sudaryati, Susi Sarumpaet, Fajar Gustiawaty D

Faculty of Economic and Business, University of Lampung, Gedong Meneng, Bandar Lampung, Indonesia

Abstract

This study aims to determine whether disclosure of sustainability reporting by the company and also environmental performance affects the earnings response coefficient. The development of a business that is getting faster and wider makes the level of competition between companies higher. This development is followed by the uncontrolled exploitation of natural and human resources. To be able to compete in complex business conditions, companies must be able to do sustainability actions that can be presented through sustainability reports. It also needs to be supported also by a more focused environmental management, where environmental aspects become one of the variables in the ranking of environmental performance issued by the Ministry of Environment through PROPER. The purpose of this study was to determine the effect of disclosure sustainability report and environmental performance on the earnings response coefficient which is proxied by the cumulative abnormal return value. The number of samples in this study was 63 companies from three years of the 2016-2018 observation period. Hypothesis testing is done by using multiple linear regression analysis techniques and paired sample tests.
Keyword: Environmental Performance, Sustainability Reporting, Earning Response Coefficient

Introduction

Green economic paradigm is a manifestation of the concept of sustainable development*(sustainable development*) which aims to abandon economic practices that are only concerned with short-term profits and have a negative impact on the environment, to become economic practices that are environmentally friendly and can meet the needs of the present generation without having to sacrifice the ability of future generations.

In Indonesia, the Indonesian Accounting Association (IAI) has set up an environmental accounting disclosure standard in Financial Accounting Standard Statements (PSAK) No.32 (forestry accounting) and No.33 (mining and general accounting), where companies are required to report items its environment in the financial statements. Continuous reports *(sustainability report)* increasingly become a trend and the need for companies to inform the economic, social and environmental at the same time to all stakeholders (stakeholders) of the company (Chariri, 2009). *The sustainability report* is one of the ways companies do to emphasize to stakeholders related to risk management and company performance information (Ballou et al, 2006)

The regulations governing environmental management, namely Law Number 32 of 2009 which reads "the company that carries out its business activities in the field and or relating to natural resources are required to carry out social and environmental responsibility ". This regulation is supported by Law No. 40 of 2007 Article 66 concerning all social and environmental responsibilities that must be reported by the company in the annual report.

RISET ISSUE

Still many cases of earnings management carried out by companies (in Indonesia such as the case of Telkom, Lippo, Garuda Indonesia and others), so that investors or the market can consider other reports besides the financial statements.

Continuous reports *(sustainability report)* and the company's position in the PROPER will provide a new discourse for investors and reduce the use of information i profits are also likely biased information (Kurniawan & Nugrahanti, 2012).

One measurement that can measure the reaction of investors to the information accounting profit is the earnings response coefficient *(earning response coefficient)* which is the correlation between *unexpected earnings* with *abnormal returns* stock, *earnings response coefficient is* defined as a measure of the level of *abnormal returns* in response to the component *unexpected earnings* (Scott, 2015).

Earning Response Coefficient reflects the level of market participant's confidence in earnings quality announced by the company and represents a perspective of earnings quality based on market performance. If the strong market reaction to earnings information will be reflected in the high *earning response coefficient* which shows the high quality of the company's earnings, and vice versa (Sayekti and Wondabio, 2007). The strong market reaction to earnings information is reflected by the high coefficient of(*earnings response earnings response coefficient*), if reported earnings have a response(*power power of response)* then shows the reported earnings of quality.

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Literature Review

Signaling Theory

The signal theory states how a company should give signals to users of financial statements. This signal is in the form of information about what has been done by management to realize the owner's wishes. The signal can be in the form of promotions or other information stating that the company is better than other companies (Ludigdo et al, 1999).

StakeholderTheory

Theory *stakeholder* states that the company is not the only entity that operates for its own sake, but to be able to provide benefits to *stakeholders.*its *The stakeholders* referred to here are shareholders, creditors, consumers, suppliers, the government, the community and other parties who participate in the process of achieving company goals. Thus the existence of a company is strongly influenced by the support given by the company's stakeholders (Chariri and Ghozali, 2007).

Legitimacy Theory

According to Dowling and Pfeffer (1975), legitimacy is important for organizations, boundaries emphasized by social norms and values and the reaction to these limits encourages the importance of analyzing organizational behavior with regard to the environment.

Ghozali and Chariri (2007) state that the things that underlie the theory To continue to gain legitimacy, the organization of the company must communicate the activity by making social and environmental disclosure in a sustainability report (*sustainability reporting).*

Effect of *Corporate Sustainability Reporting* on ERC

Disclosuresdisclosure is *Corporate sustainability* expected to reduce the *earnings response coefficient*. The results of Jones, Frost & Van Der Laan (2007) stated that the disclosure of *corporate sustainability reporting* in the company's annual report has a negative effect on the *earnings response coefficient,* which in this case is indicated by the value of *the abnormal return.* It is expected that investors consider the disclosure of the information *corporate sustainability report* that is disclosed in the company's annual report so that in decision making investors are not solely based on profit information. Disclosure of *corporate sustainability reporting* information is expected to provide additional information to investors other than those already included in accounting income.

H1. Disclosure of *Corporate Sustainability Reporting* has a negative effect on the Earnings Response Coefficient.

Effect of Environmental Performance on Earnings Response Coefficient

The environmental performance will also be achieved at a high level if the company proactively carries out various environmental management measures in a controlled manner. Good environmental performance is a form of corporate concern for the environment (*planet).* Environmental performance is the company's performance in creating a good environment (Suratno *et.al.,*2007).

H2. Disclosure of Environmental Performance has a negative effect on ERC.

Discussion

Today's business world requires companies to balance the achievement of economic performance (*profit*), social performance (*people*), and environmental performance (*planet)* or so-called *triple-bottom-line performance* (Elkington, 1998). *Triple bottom line performance* shows that besides paying attention to financial performance, companies also need to pay attention to social and environmental responsibility (Pradipta and Purwaningsih, 2011).

Continuous reports *(sustainability report)* and the company's position in the PROPER will provide a new discourse for investors and reduce the use of the information I profits are also likely biased information (Kurniawan & Nugrahanti, 2012).

Conclusion

This study contributes to accounting research related to factors that influence *earning response coefficient.* One measurement that can measure the reaction of investors to the information accounting profit is the earnings response coefficient*(earning response coefficient)* which is the correlation between *unexpected earnings* with *abnormal returns* stock, *earnings response coefficient is* defined as a measure of the level of *abnormal returns* in response to the component *unexpected earnings* (Scott, 2015).

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CEO TENURE AND EARNING MANAGEMENT

(Empirical Study on Manufacturing Companies Listed on the Indonesian Stock Exchange)

Komala Sari

Faculty of Economic and Business, University of Lampung, Gedong Meneng, Bandar Lampung, Indonesia

Abstract

The action raises earnings management accounting reporting scandal in the business world. Research on management of profit made by the CEO at the beginning of the year working period and at the end of his tenure is comprehensive regarding the CEO incentive to undertake earnings management. Several previous studies have focused on the accrual-based earnings management techniques. But in this study earnings management is also measured by the real earnings management to get more comprehensive results. This study predicts that the CEO in the early years of operation will increase the earnings management earnings (income-increasing) which can be explained by the theory of career concerns.

Keywords: Accrual earnings management, real earnings management, the CEO of the early, late CEO, career concern theory

Introduction

The company is said to have a good performance when generating large profits and stock prices are high (Adiasih and Kusuma, 2011). When the CEO of serving stakeholders expect the company's performance is increasing from year to year, it sort of is what drives the main director to present the company's financial statements as possible. Scott (2000) states in general management compensation awarded based on two measurements of the management performance corporate profits and stock prices. Based on these two measurements is the case then the era of the relationship between compensation Executif Chief Officer (CEO) and earnings management. Research on management of profit made by the CEO at the beginning of the year working period and at the end of his tenure is comprehensive regarding the CEO incentive to undertake earnings management. Davidson et al. (2007) and Kalyta (2009) found that CEO at the end of his tenure will perform earnings management increase profits when retiring CEO was based on the company's performance. Several previous studies have focused on the accrual-based earnings management techniques. But in this study earnings management is also measured by the real earnings management to get more comprehensive results.

Right Issue

Earnings management actions cause scandal in business accounting reporting, including Enron, Merck, World Com and other companies in the United States (Cornett, et al. 2006). The same thing happened in Indonesia, namely earnings management conducted by PT Garuda Indonesia Tbk (GIAA) to the financial statements in 2018. In those statements, PT Garuda Indonesia (Persero) Tbk posted net income of USD809,85 thousand or equivalent Rp11,33 billion (assuming an exchange rate of Rp14,000 per US dollar). This figure rose sharply compared to 2017 a loss USD216,5 million. However, these financial statements polemical, because two commissioners Garuda Indonesia namely Tanjung and Dony Chairal Oskaria (currently not served), consider the financial statements of 2018 Garuda Indonesia is not in accordance with Statement of Financial Accounting Standards (SFAS). Financial statement manipulation case also happened in PT Kimia Farma Tbk. Based on the results of Bapepam (Capital Market Supervisory Agency, 2002), obtained evidence that there are misstatements in the financial statements of PT Kimia Farma Tbk, Former directors of PT Kimia Farma Tbk. has proved to have violated in the case of suspected inflation (mark-up) net profit in the financial statements of the state-owned company for the financial year 2001. The same case also happened in PT. Indofarma Tbk. Based on the results of inspection by Bapepam to PT. Indofarma Tbk. (Capital Market Supervisory Agency, 2004). Previous research predicts that the new CEO would do to lower earnings management earnings (income-decreasing), which can be explained by the big bath theory (Murphy and Zimmerman 1993; Wells 2002; Adiasih and Kusuma 2011; Bornemann et al. 2015). However, this study predicts that the CEO in the early years of operation will increase the earnings management earnings (income-increasing) which can be explained by the theory of career concerns. To test whether the CEO at the beginning of his tenure will perform earnings management that increase profitability, the study did not consider the transition to avoid lowering the earnings management earnings (taking a bath). Thus, this study contributes to closing the gap in the research literature.

Literature Review

Agency Theory

Conflicts of interest between agent and principal in achieving the prosperity that pleases called agency problem (agency problem). The agency problem may occur due to the asymmetry of information between owners and managers. This information asymmetry occurs when managers have the company's internal information that is relatively more and get relative information faster than external parties, such as investors and creditors. These conditions provide an opportunity for managers to use the information learned to manipulate financial reporting in an effort to maximize their own welfare (Richardson, 1998). As a rational man, the agent put his interests (without taking into account the interests of the principal), for example, by manipulation of the income statement.

Career Concern

Managerial labor market may trigger the CEO to perform their best performance since the labor market performance of the company's managerial using renew belief in the ability of the CEO and to determine the salary opportunities in the future (Gibbons and Murphy 1992). Because of concerns over his career, the

new CEO served as likely to make a profit to secure a management position (Bornemann et al. 2015) and to revise the perception of market participants on the ability of the CEO (Holmstrom 1999).

Earning Management

Earnings management financial statements prepared for the purpose of providing information on the company's financial position, performance and changes in financial position that is useful to financial statement users in making economic decisions (IAS, 2009). Based on this statement can be described that the financial report is a communication tool that is used as a liaison between the parties that have an interest in the company. The financial statements as well as a tool for managers to take responsibility for the management of the resources entrusted to them (Adiasih and Kusuma, 2011).

Discretionary Accrual

Discretionary accrual is a way to decrease or increase the earnings reporting difficult to detect through the manipulation of accounting policies relating to accruals, such as raising the cost of amortization or depreciation, recorded a great obligation to the price cuts, and record inventory obsolete. While accrual itself are all events that are operational in a year that does not affect the cash flow. In other words, the difference between the total accrual of income to cash flows from operating activities of the company. Total accruals are divided into two parts, namely the accrual that is naturally present in the financial statements referred to non-discretionary accruals and accrual is part of the data manipulation is called discretionary accrual accounting.

Earnings Management Through Real Activities

According to Roychowdhury (2006) earnings management is generally done in two ways: accrual earnings management and real earnings management. Several previous studies have focused on the accrual-based earnings management techniques. However, empirical evidence suggests that there is a shift in the way in which the management to manage earnings. Cohen and Zarowin (2008) states that the manager has shifted away from accrual earnings management leading to earnings management through real activities after the period of the Sarbanes Oxley Act (SOX).

Work Period (Tenure) Chief Executive Officer (CEO)

tenure CEOs are intended in this research is the life of the Chief Executive Officer (CEO). CEO tenure in Indonesia itself based on the policy of each company. As CEO or president of the company on average 3-5 years, if there is no one thing that causes premature CEO dismissed as an example: the CEO of poor performance led to CEO was dismissed early by the company. This study tries to analyze the presence or absence of earnings management beginning or the end of the tenure of CEO tenure CEO.

Effect of CEO Tenure in Early Years Of Work Period Accrual and Real Earnings Management

CEO Early Years and Profit Management Ent CEO in the early years of operation will try harder to show the best performance because of concerns about his career. Reputation CEO essence is the assessment of the

ability of market participants and CEO, but it is not easy to directly measure the ability of the CEO. Therefore, the length of the CEO office is one measure of the ability of the CEO (Milbourn, 2003).

H1: CEO would be more aggressive use of earnings management by discretionary accrual proxy that increase profitability in the early years of operation than in the coming years tenure.

H2: CEO would be more aggressive use proxies of earnings management with abnormal discretionary expenses that increase profitability in the early years of operation than in the coming years tenure.

Effect of CEO at Year-End Work Period Accrual Of Earnings Management and Real

CEOs are nearing the end of retirement will try to increase profit in order to increase the compensation, pension funds (Kalyta 2009; Davidson et al. 2007). The lower the risk will be borne by the CEOs nearing retirement may be detected using aggressive earnings management (Zhang 2009). Furthermore, Reitenga and Tearney (2003) found that CEOs earning management that increase profitability at the approach end of retirement in order to increase the probability served as a board of directors when the CEO retired. Based on the foregoing, the hypothesis is:

H3: CEO at the end of his tenure will be more aggressive use of earnings management by discretionary accrual proxy to increase profits.

H4: CEO at the end of his tenure will be more aggressive use proxies of earnings management with abnormal discretionary expenses to increase profit.

Discussion

Ali and Zhang (2015) argued that the CEO will have more incentive to manage earnings that increase profitability (income-increasing) in the early years of operation of the in coming years tenure. Research on management of profit made by the CEO at the beginning of the year working period and at the end of his tenure is comprehensive regarding the CEO incentive to undertake earnings management. Davidson et al. (2007) and Kalyta (2009) found that CEO at the end of his tenure will perform earnings management increase profits when retiring CEO was based on the company's performance. Several previous studies have focused on the accrual-based earnings management techniques. But in this study earnings management is also measured by the real earnings management to get more comprehensive results.

Conclution

Previous research predicts that the new CEO would do to lower earnings management earnings (income-decreasing), which can be explained by the big bath theory (Murphy and Zimmerman 1993; Wells 2002; Adiasih and Kusuma 2011; Bornemann et al. 2015). However, this study predicts that the CEO in the early years of operation will increase the earnings management earnings (income-increasing) which can be explained by the theory of career concerns. To test whether the CEO at the beginning of his tenure will perform earnings management that increase profitability, the study did not consider the transition to avoid lowering the earnings management earnings (taking a bath). Thus, this study contributes to closing the gap in the research literature.

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Advantages of 3D-CT Based Conformal Radiotherapy Treatment Planning Over 2D Conventional Tera Six Planning for Cervical Cancer Treatment at Ocean Road Cancer Institute

Khamis Amour

The state University of Zanzibar

Tanzania

Dr. Khamza Maunda

Ocean Road Cancer Institute

Tanzania

Dr. Mohamed Mazunga

University of Dar es Salaam

Tanzania

Dr. Peane Maleka

Department of Subatomic Physics, iTHEMBA LAB

Tanzania

Professor Peter Msaki

University of Dar es Salaam

Tanzania

ABSTRACT

Although External Beam Radiation Therapy (EBRT) is essential tool for the radiation therapy of cervical cancer; only one cancer institute in Tanzania performs 3-Dimensional Conformal Radiation Therapy (3DCRT) Computed Tomography (CT)-based planning. To identify benefits and advantages of 3D-CRT over 2D- conventional radiation therapy (2D-CRT), dosimetric parameters for tumor targets and organs at risk (OARs) were compared between these modalities for 23 cervical cancer patients. 11 cervical cancer patients were CT scanned after proper positioning and immobilization and transferred to Eclipse Treatment Planning System (TPS) for dose planning. The remaining 12 curative intent patients were planned using 2D-CRT system and treatment times were calculated for each patient. From the CT based planning, the minimum dose (D $_{min}$), maximum dose (D $_{max}$) and mean dose (D $_{mean}$) to Planning Target Volume (PTV) and organs at risk (OAR), were compared for each plan. On average, the optimized maximum doses for bladder, rectum, femoral heads, PTV and Gross Tumor Volume (GTV) were 46.56 Gy, 42.65 Gy, 28.76 Gy, 48.56 Gy and 48.53 Gy. For 2D-concentional planning, the dose rate was 75.75

cGy/min and the average treatment time was 1.6075 minutes. This study confirms that 3D CT-based planning is a good choice in the treatment protocol for carcinoma cervix as it delivered a highly homogeneous and conformal plan with superior dose coverage to PTV and better OARs sparing.

Keywords: 3D-Conformal radiation planning, cervical cancer, organ at risk, conventional simulator, planned target volume, ocean road

1. Introduction

The aim of radiotherapy is to eradicate cancerous cells while sparing normal tissues using ionizing radiation to a dose that is likely to cause complete destruction of the tumor. Eradication of tumour volume requires errors in the treatment protocol ranging from dose planning to dose delivery to be minimized[1] . This requirement is important because these errors lowers accuracy of the dose delivered to the tumour volume, which is intimately related to eradicate of tumour cells. They also undermine the ability of the treatment protocol to offer the desired protect of organ at risk (OARs) [2,3] . ICRU [4] Reports No. 50 and 62 define and describe procedures that can be used in dose planning to minimize errors in dose delivery to achieve the recommended limits of dose uniformity of +7% and –5%.

Minimization of these errors as described above is particularly important for treatment of cancer types with high curability (like cervical cancer) when detected and treated early[5]. Dose planning for this cancer type must therefore be optimized to deliverer accurate dose to the cervix while minimizing dose delivered to bladder and rectum which are sensitive organ in dose proximity to the tumour volume [6]. The ability to implement the ICRU procedures to achieve the recommended dose uniformity is dependent on irradiation modality. In particular, modern systems based on 3D-conformal planning and delivery are able to reduce the irradiated volume of normal tissue, and, therefore, offer the opportunity to deliver higher tumor doses with acceptable complication rates compared with conventional RT[7]. The aim of this work therefore is to use this uniformity index to assess the advantages of 3D-CT based conformal radiotherapy over 2D conventional radiotherapy planning at Ocean Road Cancer Institute (ORCI).

2. Materials and Methods

2.1 Patient selection

A cohort of 23 patients, diagnosed with carcinoma cervix was enrolled in this prospective observational study. Eleven patients were included in 3D CT-based plans with 15 MV, and 12 patients were included in 2D conventional plans using Tera six simulator.

2.2 Radiotherapy Techniques for Treatment Planning

Before treatment planning, a physical examination and medical history reviews were conducted for all patients included in this study. There were two simulators used for acquiring images used in treatment planning systems. These include 2D simulation by Tera six simulator and 3D-CRT simulation using 3D-CT based simulator.

2.3 2D Conventional Treatment Simulation

2.3.1 Acquisition of patient data in 2D Conventional planning

Each cervical cancer patient of the 12 was placed on the treatment couch of Tera six simulator in supine position to determine patient dimensions for dose calculation. The image obtained from this simulator was used to determine the location of the isocenter and reference point. The source to axis distance (SAD) as well as depths of interest was also obtained during this process. The identifiable reference points were then used to determine patient's treatment position and to identify the target volumes and OARs. A landmark using bony markers was used to match positions in the treatment plan with positions on the patient (Figure 1b). After proper determination of the beam geometry, patient contours were taken at a plane of interest to be used for treatment planning. In order to relate the position of the beam geometry to the patient, the wire was placed on the patient cervix on a transverse plane parallel to the isocentre plane (Fig.1a).
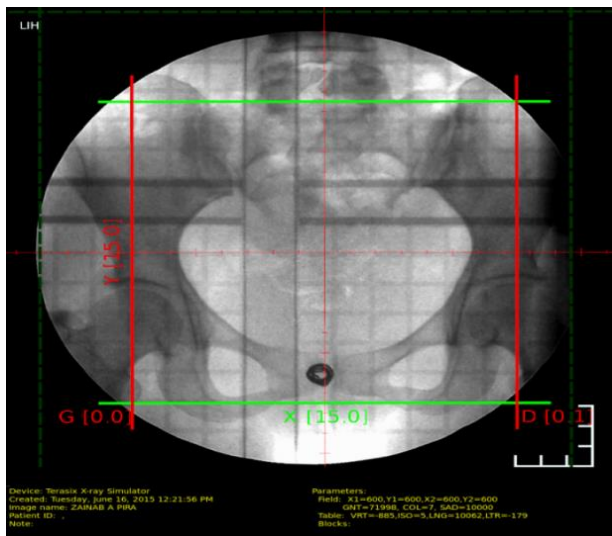
1
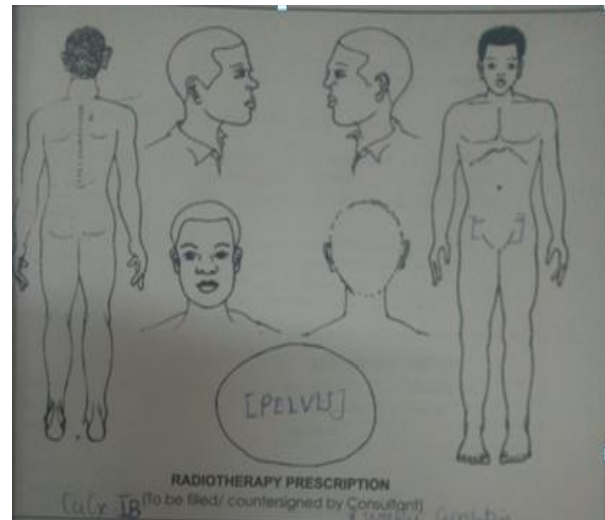
(a)   1 (b)

Fig 1(a): Typical simulator radiograph of cervical cancer patient obtained from 2D conventional Tera six simulator with field size 15 cm by 15 cm. **Fig 1 (b):** Radiotherapy prescription paper used in in 2D conventional dose planning for tumour allocation.

2.3.2 Treatment Time Calculation for Conventional Cobalt-60 Units

Treatment time calculations for this unit were carried out with the machine output (dose rate) of 75.59 cGy min^{-1} and the treatment timer setting in minutes replaced the monitor setting in MUs as used in 3DCRT planning. The irradiation time (T) to deliver prescribed dose for each patient was calculated using equation:

$$T = \frac{D_p}{Dr \times S_f \times pdd} \qquad (1)$$

where D_p and D_r represent prescribed dose and dose rate respectively, while S_f is total scatter factor and *pdd* is the percentage depth dose obtained from BJR supplement 25. The depth of a patient which is used to obtain *pdd* were calculated by taking patients' separation (*d*) divided by two, i.e. $d = \frac{s}{2}$.

(2)

2.3.3 3D Conformal Treatment Simulation

In this treatment planning, 11 cervical cancer patients underwent a computed tomography (CT) simulation on a (SIEMENS, Healthineer SOMATOME, USA) in a supine position with arms on the chest, using a 5

mm slice thickness. Prior to being scanned, the patients were marked with a reference isocentre, typically, a position near the centre of the proposed scan volume was then chosen. Markers were placed on the anterior and lateral aspects of the patient with the help of the room lasers to ensure proper alignment and the patient was tattooed to record the position of the markers to help with the subsequent patient set-up on the treatment machine. This reference isocentre position will be used as the origin for a reference coordinate system from which the actual treatment isocentre position can be determined through translational motions of the table. The treatment isocentre was identified on the patient through table motions and the use of a movable sagittal laser. Once the relevant treatment parameters have been obtained, the treatment beam geometry, the CT data including contours and the electron density information were transferred to the TPS for the calculation of the dose distribution. The images were sent to a Treatment Planning System (TPS) (Eclipse treatment planning system, Varian, Palo Alto CA, USA). All necessary beam data were entered into the Eclipse system, and medical physicists used this information to design the 3D-CRT beams used for treatment under specification from the radiation oncologist. The beam angles used were as follows: counterclockwise from 0° to 90°, 90° to 180° , 180° to 270° and from   270° to 360° with a collimator angle of 0° and a couch angle of 0°**.** The accelerator used for the cone-based Linac was 15- MV Varian Vital Beam photons. Fig. 2 show a CT imported image for treatment planning in Eclipse system.

Figure 2: An axial slice from planning CT of pelvis imported from Siemens CT simulator to Eclipse TPS

2.3.4 Target volume and organs at risk definition

Target volume (TV) and OAR's were delineated in axial CT slices by radiation oncologists as per the recommendations of International Commission on Radiation Units and Measurements Reports (ICRU) 50 and 62. The gross tumor volume (GTV) includes the cervix with visible tumor extension and the corpus uteri. Clinical target volume (CTV) was created by adding 5 mm margin to the GTV, and, included the external, internal and lymph nodes. The CTV was expanded uniformly with a safe margin of 5mm in all directions to produce a planning target volume (PTV).

2.3.5 Planning Objective and Target Volume in 3DCRT

Prescribed dose to PTV was 50 Gy in 25 fractions at 2 Gy per fraction. It was stipulated that not less than 95% volume of PTV should receive a dose less than the prescribed dose and that not exceeding 105% to

minimize the doses incident on the cervix. In order to ensure that the prescribed dose is actually absorbed in the CTV, the PTV was designed to select appropriate beam arrangements, taking into consideration the net effect of all possible geometrical variations. The PTVs were linked to the reference frame of the treatment machine and often described as the CTV plus a fixed or variable margin. Figure 3 shows the four-field treatment plan beams for a cervical cancer tumor as planed in Eclipse TPS at ORCI.
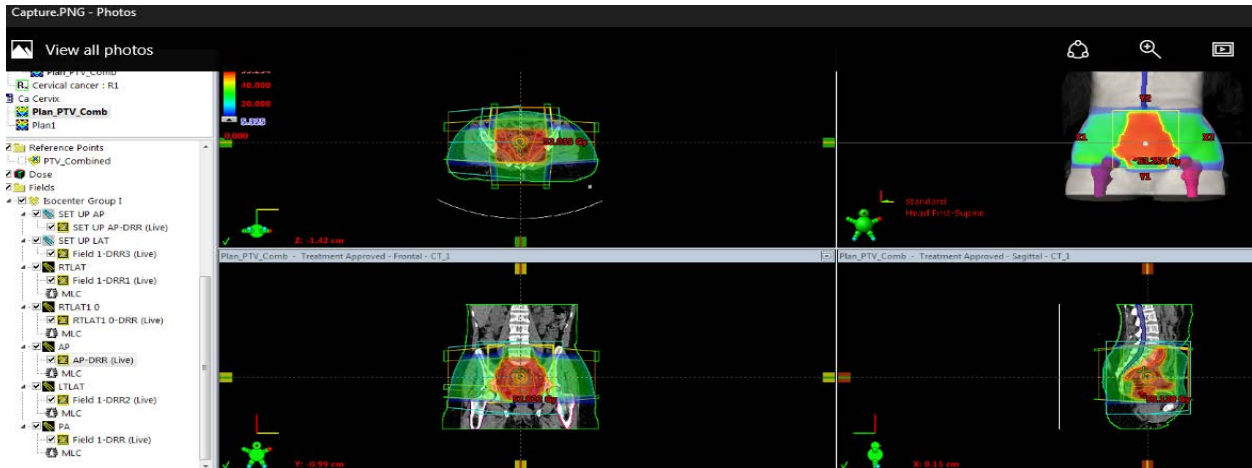
Figure 3:   A combination of anterior-posterior and tangential fields using four-field box technique produce isodose lines for isocenter selection of a cervical cancer allows beams from any gantry angle to be centered on the tumor.

3. Results

3.1   Treatment Time in 2D Conventional Planning

The treatment times obtained after calculation using equation (1) are presented in table 1.The patient with greater depth (12 cm) had a relatively higher treatment time while that of smaller depth (7 cm) had a lower treatment time among all patients.

Table 1: Treatment time for cervical cancer patient underwent 2D conventional planning

Field size (cm ^{2})	Patient depth (cm)	Scatter factor (S_f)	Dose rate (cGy/min)	Tissue air ratio (TAR)	Treatment time (min)
15×18	7	1.033	75.95	0.892	1.43
15×15	7.5	1.028	75.95	0.86	1.48
15×17	8.5	1.031	75.95	0.836	1.53
15×18	9	1.033	75.95	0.821	1.55
15×15	9	1.028	75.95	0.813	1.58
15×17	9	1.031	75.95	0.818	1.56
15×16	9.5	1.03	75.95	0.799	1.60
15×16	9.5	1.03	75.95	0.782	1.63
15×17	10	1.031	75.95	0.785	1.63
15×16	10.5	1.03	75.95	0.763	1.68
15×18	11.5	1.031	75.95	0.735	1.73

| 15×18 | 12 | 1.033 | 75.95 | 0.675 | 1.89 |

3.2 Dose statistics in 3D-CRT planning

In contrast to the other tools, the plan evaluation tool described here do not show the spatial distribution of dose superimposed on CT slices or on anatomy that has been outlined based on CT slices, instead, they provide quantitative information on the volume of the target or critical structure and on the dose received by that volume. From the matrix of doses to each volume element within an organ, key statistics were obtained included mean volume, minimum dose to the volume, maximum dose, and mean dose (Table 2).

Table 2: Dose-volume Statistics for 3DCRT (4-field) treatment technique

Structure	Volume (cc)	Min Dose (cGy)	Max Dose (cGy)	Mean dose (cGy)
PTV	494.5	20.949	48.586	45
CTV	365	33.702	48.529	45.5
Rectum	61.7	9.412	46.65	34.36
Bladder	205.8	25.988	46.65	34.37
L. femoral head	172.3	0.378	28.763	5.44
R. femoral head	183.5	0.384	31.03	4.578

3.3 Dose Volume Histogram in 3DCRT planning

To create a direct DVH, the computer sums the number of voxels with an average dose within a given range and plots the resulting volume as a function of dose. An example of a direct DVH for a target obtained in this study is shown in Figure 4. The ideal DVH for a target volume would be a single volume indicating that 100% of the volume receives the prescribed dose. For a critical structure, the DVH may contain several peaks, indicating that different parts of the organ receive different doses. In Fig. 4, a typical DVH for a PTV, CTV, bladder, rectum, left and right femoral heads and spinal cord are well displayed.
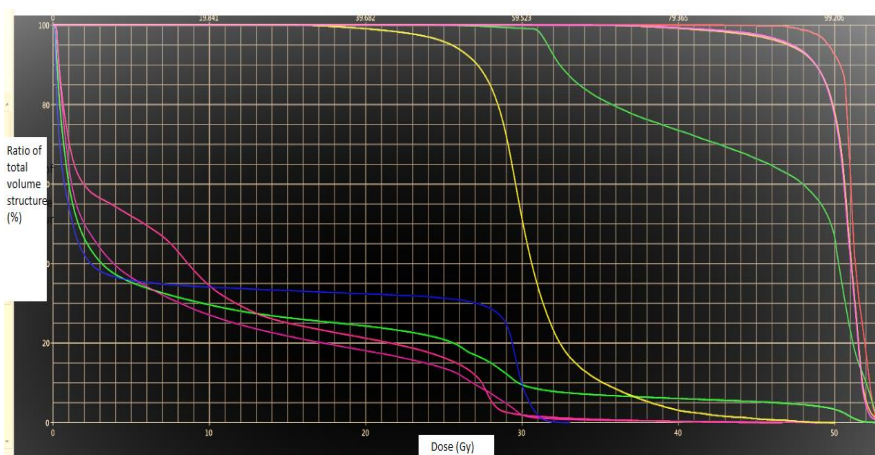
Figure 4: A dose-volume histogram expressed in terms of percentage of the structure volume of PTV, GTV and OARS for 15 MV 3D CT-based planning

3.4 Optimization of the Dose Distribution in 3DCRT plans

The 3DCRT plan creates beams in the Eclipse TPS using the automatically defined beam apertures set at the automatically located isocentre. The system then automatically calculates the dose delivered by each beam using 15 MV photons. (i.e. each beam contributed the same dose to the calculation point). The maximum dose, defined by the hottest points of tissue, was evaluated and the dosimetric metrics used for evaluating target coverage and OARs dose were extracted from the dose-volume histograms (figure 4). In this optimization, bladder, rectum, femoral heads, PTV and GTV received maximum doses of 46.56 Gy, 42.65 Gy, 28.76 Gy, 48.56 Gy and 48.53 Gy.

3.5 Healthy Tissues Sparing and OARs in Eclipse TPS

Conformal radiotherapy is now accepted as best practice for treatment of various cancer types, having the advantages of sparing normal tissue and providing the opportunity for dose escalation. Figure 5 shows head first-supine of cervical cancer patient planning with some of the MLCs closed to block unnecessary doses to OARs.
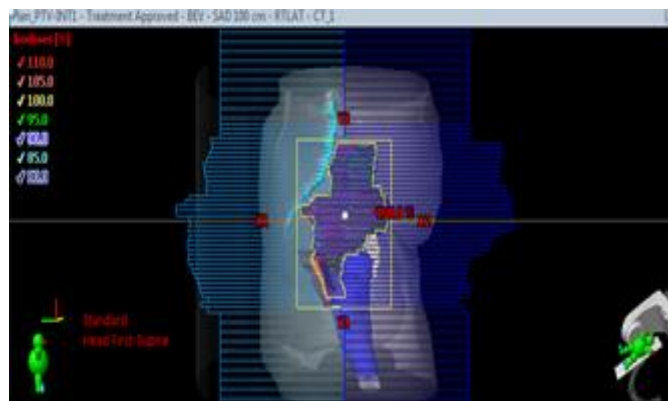
Figure 5: CT scan images showing radiotherapy planning showing MCL closing for sparing OARs and healthy tissues.

This TPS allows to fine tune treatment plans and can explore the possibilities between optimal organs at risk sparing and target coverage easily and efficiently without having to change current process. This 3DCRT planning is essential to visualize the coverage of the target volume and the avoidance of OARs in the highly complex treatment plans.

4 Discussions

Treatment field of whole pelvis for cervical cancer has long been defined by bony pelvic structure in the treatment of cervical cancer. For decades, patients with this cancer type had traditional radiography based treatment plans where a fluoroscopic imaging system may also be included and would be used from a remote console to view the patient's anatomy and to modify beam placement. However, this technique didn't allow the radiation oncologist and medical physicists to know exact dose to OARs or to the PTVs above and below the tolerance. Without using individual patient's CTV, this technique does not provide a customized treatment planning for each patient and may result in nodal-CTV coverage. Several results have

been reported by other investigators supporting the used of image guided and 3D treatment planning algorithm for external beam radiation therapy of cervical cancer[8,9] . Pendlebury *et.al*. [10] and Bonin et *al*. [11] respectively, reported inadequate coverage of the external iliac lymph nodes using standard irradiation fields in 45% and 62% of patients.   Finlay [12] showed that 34 patients (79.1%) had inadequate coverage and inadequate margin when bony landmarks were used to set the field boundaries. Most of the previous studies have indicated that, for complex target volumes in cervical cancer, 2D conventional planning may be less favorable dosimetrically than a 3DCRT[13]. The proposed beam configurations and split-field technique for treating cervical cancer with 3D-CRT is robust against simulated setup using conventional simulation because significant dosimetric gain was observed, whereby a reduction of dose in the low to intermediate dose region was achieved for the bladder, rectum and femoral heads. This study clearly demonstrated that satisfactory dose distribution in PTVs and OARs is achieved using 3D-CRT technique, and hence, the risk of destruction to healthy tissues is decreased. Review of several papers also suggested that no secondary cancer is developed in patients treated with 15 MV 3D-CRT as a result of treatment with radiation therapy while in 2D conventional technique there is high probability of recurrence of cancer [12-15].

4.1 3D CT- based versus 2D Conventional Simulations

In comparing the two methods of simulation, studies have shown that the target volumes and field sizes are smaller for CT-based than conventional simulation in cervical cancer with the associated reduction in irradiation of normal tissue [16]. One of the perceived advantages of CT-based simulation is the improved coverage of the GTV and the avoidance of OARs as a result of better visualization of soft tissue structures on a CT scan compared with a simulator image, particularly if shielded by bone. The increased soft tissue contrast in combination with the axial anatomical information available from CT scans provides the ability to localize very precisely the target volumes and OARs. The CT simulation segment allows for accurate identification and delineation of these structures directly on to the CT data set. This planning system, allows the user to define treatment fields with respect to the target volume and critical structure location easily. In contrast, 2D conventional simulation requires knowledge of tumor position with respect to the visible landmarks on the diagnostic quality simulator radiographs in which oncologist might over estimates malignant doses and underestimates OARs doses[16]. Since these radiographs provide limited soft tissue contrast, the user is restricted to setting field limits with respect to either the bony landmarks evident on the radiographs or anatomical structures visible with the aid of contrast agents such as barium. Another important factor is that time required for patient to stay in conventional simulator is quite longer until the end of simulation process has taken place. While in CT- based simulation, the patient only stays the minimum time necessary to acquire the CT data set. It is also remains unclear how much dose received to OARs using 2D conventional Tera six simulation treatments planning if you compare with 3DCRT which use CT simulation. CT simulation allows dose statistics which helps in providing qualitative information on the volume of target and OARs on the amount of dose received by each volume. From this matrix of dose to each volume element within an organ key statistics include minimum dose to the volume, maximum dose and mean dose as received by at least 95% of the volume, it hereby is recommended to avoid using 2D conventional simulation in treatment planning.

4.2 The future study

The GTVs is an oncological concept which varies according to the imaging technique used. However, many imaging techniques are now available which give an indication of the functional state of the tissues from cancer patient. This information can potentially be used in addition to CT-based planning at ORCI to improve the treatment of cervical cancer. Hence a prospective study will be conducted to assess EBRT techniques including beam flatness, tumor coverage and conformity indices at ORCI in order to determine the radiation the clinical benefits that will minimize and provides better cancer treatment in this center.

5 Conclusions

From this study, it can be concluded that the application of 3D-CRT planning of pelvic radiation is highly recommended in radiotherapy centers equipped with CT simulators and 3D TPSs to decrease uncertainties in the radiation planning process. The use of Tera six simulator for patients to be treated using Cobalt-60 techniques should be limited or avoided for curative intent patients due to its uncompromised tumor coverage to PTVs.

6 Acknowledgments

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Implications of Cash Flows and Investment Opportunity for Investment Decisions in Fixed Assets on Financially Constrained Companies

Citra Veronisa

Faculty of Economics and Business, University of Lampung, Gedong Meneng, Bandar Lampung, Indonesia

Abstract

This research is a conceptual paper that aims to determine the effect of cash flow and investment opportunity for investment decisions in fixed assets on financially constrained companies. This type of research is explanatory research with companies in the property and real estate sectors listed on the Indonesia Stock Exchange in 2016-2018 as a population.This research will be conducted to predict how much the level of investment decisions is influenced by cash flow and investment opportunities with financial constraints as intervening variables. Based on previous research, shows differences in research results, so the authors aim to see the results of research on companies in Indonesia with different conditions and measurement variables.

Keywords: cash flow, financial constraint, investment decisions, investment opportunity.

Introduction

One important decision for every manager is an investment decision because this decision will determine how effectively the company manages investor funds. Through the right investment decisions can increase the value of the company. Companies must be able to take the right investment decisions with a high level of profit in certain risks. High profits with risks that can be managed, is expected to increase the value of the company. The investment decision is the company's decision to allocate funds owned by the company to finance its investment with the aim of producing the highest level of profit with a certain level of risk. In financial management, there are two sources of funds that can be used in investments. The first one is an internal source, both from retained earnings and cash. The second source of funds is an external source of liabilities and shares. However, the selection of sources of funds needs serious consideration because each source has capital costs that need to be considered. Thus, the selection of sources of funds becomes an important decision for a manager.

Capital costs represent costs incurred for funds obtained to obtain company capital, both internal capital and external capital. The difference between the costs obtained from internal and external sources of capital raises problems, where the greater cost of external capital makes it difficult for companies to access external funding sources or what is called financial constraints (Fazzari et al, 1988). Despite having lower capital costs, internal funding sources are usually more limited than external sources. So, to finance their investment, managers always combine it with funds from external sources.

The existence of information asymmetry in external funding (debt) will lead to the cost of accessing external capital funding more expensive than internal funding, so that financial constraint companies have less access to external funding. Information asymmetry is a situation where managers have access to information on company prospects that are not owned by outsiders. Information asymmetry perspective to maximize the value of the company in the desired way. Asymmetry of information causes the risk of information getting higher, the high risk of information will have an impact on the high capital costs incurred by the company.

According to Prasetyantoko (2007), investment decisions consider the availability of cash flow as a source of internal funding. Corporate investment decisions made are influenced by the company's ability to provide cash that can meet the short and long term needs of the company. According to Fazzari et al. (1988) and Hidayat (2010), in their research stated that internal funding through cash flow is influential positive about investment decisions at financially companies constrained. However, this contradicts the research of Prasetyantoko (2006) which found that cash flow has a negative influence on investment decisions in the period before the crisis, and the effect was not significant after the crisis. Different results are found in the study of Lindananty (2004), which states that liquidity does not affect the investment decisions of fixed assets in financially constrained companies.

In addition, investment decisions are also influenced by investment opportunities in financially constrained companies, because the higher investment opportunities in company managers will take up these investment opportunities in order to maximize the welfare of shareholders. Myers (1977) states that investment opportunities are a combination of assets owned and investment choices in the future. According to Chung and Charoenwong (1991) that the essence of growth for a company is the existence of investment opportunities that generate profits.

Based on Hidayat's research (2010), it shows that investment opportunities have a positive effect on investment decisions, while according to Prasetyantoko (2006), shows that investment opportunities negatively affect investment decisions in the period before and after the crisis. Different results are also shown in the research of Hyun and Park (1999) and Lindananty (2004), which shows that investment opportunities do not affect investment in financially constrained companies.

Literature Review

Agency Theory

Agency theory is a principle used to explain and solve problems in the relationship between business people and their business agents. Agency theory explains the working relationship between parties that give authority (principals), namely investors and those who receive authority (agencies), namely company managers. According to Anthony and Govindarajan (2005), agency theory explains the contractual relationship between the principal and agent. Agency theory assumes that each individual in the organization (principal and agent) has different interests, giving rise to a conflict of interest between the two. Agency theory shows that in a company there is a contractual relationship between the holder of the resource. The agency relationship occurs when one or more individuals (principals) employ one or more

other individuals (agents) to perform certain services and then carry out a delegation of decision-making authority to the agent.

Pecking Order Theory

Pecking order theory claims that companies choose funds in sequence, first the company will use internal funding, followed by debt securities, and finally issue shares in the market. They prefer internal funding over external financing and new equity. After company managers assign greater priority to internal funding sources than to external ones, Donaldson outlines the hierarchy for funding sources. This theoretical trend was formally developed by Myers, which shows that a company's capital structure is the result of decisions that follow a sequence of preferences when seeking funding. Myers and Majluf explained that asymmetric information between managers and investors produces problems, because investors have less information that directs managers to the most appropriate source of funding for company objectives (signaling).

Financial Constraint

According to Farre-Mensa and Ljungqvist (2013) and Silva and Carreira (2012), financial constraints can be a measure of a company's financial condition or company's balance sheet conditions, such as cash flow, leverage, and company size. In this case, the greater the level of financial constraint of a company, the weaker the company's financial condition. Also, corporate investment is usually regarded as a company's fixed assets, such as property, factories, equipment, and depreciation (Bhaduri, 2005; Rungsomboon, 2005; Soumaya, 2012). Regarding corporate investment theory, companies that are financially constrained are considered to have weaker balance sheet conditions and therefore higher external funding costs, compared to those with lower financial constraints. This is because companies that are more financially limited will have relatively low liquidity and capital and higher default risk. As a result, the more financial constraints the company has, the lower the company's investment, because the company will have greater difficulty in investing and finding external funding sources (Agca & Mozumdar, 2008; Butzen, Fuss, & Vermeulen, 2001; Gilchrist & Himmelberg, 1995; Rungsomboon, 2005).

Investment decision

Investment decisions relating to decisions made by investors or top-level management with respect to the amount of funds to be used in investment opportunities. Simply put, choosing the type of asset in which the funds will be invested by the company is called an investment decision. These assets are divided into two categories, namely long-term assets and short-term assets. Investment decisions in short-term assets are very important for organizations because short-term survival is needed for long-term success. Through working capital management, a company tries to maintain a trade-off between profitability and liquidity. If the company has inadequate working capital, i.e. less funds are invested in short-term assets, then the company may not be able to pay off current liabilities and can lead to bankruptcy. Or if the company has more current assets than needed, it can have an adverse effect on the company's profitability. Thus, companies must have the optimal working capital needed for the smooth functioning of daily operations. In theory, efficient investment decisions are related to investments in projects that have a positive net present value and which provide maximum returns for the company and, therefore, for shareholders

(Biddle, Hilary, & Verdi, 2009). According to Richardson (2006), the level of investment can be estimated with growth in sales, debt, cash resources, size, profitability, and company maturity. Thus, an efficient investment decision is related to the allocation of financial resources to be applied in the project (assets), taking into account the risk and the return of ratio.

Cash flow

According to the Statement of Financial Accounting Standards (IAI, 2012), the definition of a statement of cash flows is the inflows and outflows of cash or cash equivalents. Cash equivalents (cash equivalent) can be defined as investments that are liquid, short-term and that can quickly be turned into cash in a certain amount without facing the risk of significant value changes.

Information about a company's cash flow is useful for users of financial statements as a basis for assessing the company's ability to generate cash and cash equivalents and assessing the company's need to use the cash flow. The purpose of cash flow information is to provide historical information about changes in cash and cash equivalents of a company through cash flow statements that classify cash flows based on operating, investing, and financing activities during an accounting period.

Investment Opportunities

According to Smith and Watts (1992), investment opportunity sets are the result of choices for making investments in the future. The investment opportunity set shows the company's ability to benefit from growth prospects. The growth prospect is a wish desired by management, investors, and creditors. The prospect of a company that grows for investors is a profitable thing, because the investment is expected to provide a high return. Growing companies will be responded to by the market and growth opportunities can be seen in investment opportunities that are proxied by various combinations of investment opportunity set values.

Norpratiwi (2007) stated that in general the investment opportunity set describes the extent of investment opportunities or opportunities for a company, but highly depends on the choice of expenditure for the interests of the company in the future. Thus the investment opportunity set is an investment opportunity or investment opportunity owned by the company and has an influence on the perspective of managers, owners, creditors and investors on the ability of profitability and the company's growth prospects. In addition, investment opportunity sets are not observable, so it is necessary to choose a proxy that can be associated with other variables in the company.

Investment choices are an opportunity to develop, but often companies cannot always implement all investment opportunities in the future. Companies that cannot use all of these investment opportunities will experience higher expenses than the value of lost opportunities. The investment opportunity value is the present value of the choices to make an investment company in the future.

In general, IOS illustrates the extent of investment opportunities or opportunities for a company, but very much depends on the company's expenditure choices for future interests. From various studies on IOS, it can be proven that IOS is used as a basis for classifying companies as a company that is growing and not growing.

Effect of cash flows on investment decisions

According to Fazzari et. al. (1988) cash flow is a source of internal funding for companies. With the financing hierarchy in which the cost to obtain external funds is higher than the cost of internal funds, the company uses internal funding sources in advance to finance its investment. Companies that experience financially constrained tend to rely on cash flow to fund the company's investment. The greater a company's cash, the company has a high opportunity to fund its investment. Cash flow is the availability of companies in funding the company's activities in the short and long term.

Ha$_1$: Cash flows positive effect on investment decisions

Effect of investment opportunities on investment decisions

According to Smith and Watts (1992) investment opportunities are a component of a company's value that results from choices for making investments in the future. That means the investment opportunity is equal to the company's value which is reflected in the company's stock price. The higher the stock price, the easier it will be for companies to attract investors to buy shares of the company, so that it will have an impact on increasing company capital where the additional capital can be used by companies to invest.

Ha$_2$: Investment opportunities effect on investment decisions

Discussion

Investment is an important decision for the company. The right investment decision can increase the value of the company. The type of source of funds used by the company in financing its investment comes from external funding sources in the form of debt and issuance of new shares, as well as internal funding sources, namely using retained earnings or utilizing company cash flow. The difference between the costs of accessing external funding is higher than internal funding, companies are often faced by financial constraints, where a company has difficulty in accessing external sources of company funds.

Companies that experience financially constrained tend to rely on cash flow to fund the company's investment. The greater a company's cash, the company has a high opportunity to fund its investment. Cash flow is the availability of companies in funding the company's activities in the short and long term. Cash flow is measured by the ratio of operating cash flow to capital stock (net fixed assets) at the beginning of the period (Chau et al., 2008).

Investment decisions are also influenced by investment opportunities. Companies that experience financially constrained, because the higher the investment opportunity in the company manager will take these investment opportunities to maximize the welfare of shareholders. Investment opportunities in this study are measured by the market to book ratio (Cleary, 2005). Market to book ratio is obtained from market value divided by book value of equity (total equity). Market value is the multiplication of the number of shares outstanding with the closing price of a year-end stock.

Conclusion

This study is a conceptual study that discusses Cash Flows and Investment Opportunity for Investment Decisions in Fixed Assets on Financially Constrained Companies. The results of this study are expected to provide an overview in investment decisions in companies experiencing financial constraints, so as to make policies in investing in the company's fixed assets. The investment decision is the company's decision to allocate funds owned by the company to finance its investment with the aim of producing the highest level of profit with a certain level of risk.

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Personal Characteristics of Physicians Influencing A Faster Adoption of Innovations: A Study Based on Diffusion of Innovations Attributes

Cesar Rago, Paola Zucchi
UNIFESP, Brazil

Abstract

This article comprises the results of a survey with 221 physicians located at Santa Casa de Misericórdia de Santos – SCMS, in the state of São Paulo, Brazil, regarding the use of Electronic Medical Record, based on their perception of Diffusion of Innovations attributes, defined by Everett Rogers. The method was based on a questionnaire specially developed for this study based on the literature review. The results show that younger and newer physicians have greater perception of those attributes, what leads them to a faster adoption of Electronic Medical Record. The research also identified that gender and amount of training do not influence the perception of attributes leading to adoption, but the familiarity with informatics, mandatory use, professional ties and academic preparation for the use of Electronic Medical Record are factors that influence its adoption. Although some findings are obvious, as with similar studies, others, such as: amount of training and professional ties can be useful in planning training programs conducted by IT staff prior to the implementation of innovations.

Keywords: Electronic Health Record, Diffusion of Innovations, Information Technology adoption, Sociological behavior, Physicians characteristics.

Introduction

Although physicians have been gradually adopting Electronic Medical Record – EMR, a survey done in 2015 in Brazil indicated that 36% of hospitals with up to 50 beds and 17% of hospitals with more than 50 beds still work only with paper-based records. (1)

Neumeier (2) reports that, despite the benefits gained with EMR, its adoption has been slow and highlights that there are many potential barriers to its implementation, with the most notable being the ones related to the change management.

This article aims to present the results obtained in a survey performed on the physicians working at Santa Casa de Misericordia de Santos - SCMS, in the state of São Paulo, Brazil, to gather their perception regarding the use of EMR, based on their personal and conjunctural characteristics correlated to the attributes of Diffusion of Innovations theory.

EMR is the innovation in this particular case, but the principles of this theory can be applied to Clinical Decision Support Systems, Artificial Intelligence, Internet of Things and any other systems or devices that can be recognized as innovations by health professionals.

Diffusion of Innovations

The Diffusion of Innovations theory was developed by Everett Rogers and explains that diffusion is the process in which an innovation is communicated through certain channels over time among members of a social system. It is a special type of communication, in which the messages are concerned with new ideas. (3)

This theory indicates the existence of four main elements for the diffusion of a new idea: the innovation itself, the communication channels, the time and the social system. Rogers defines innovation as an idea, practice or object that is perceived as new by an individual or other adoption unit. The adopters are the minimal study unit, generally they are individuals, but can also be professional categories, departments or companies. The communication channels are the means enabling the transference of information from one adoption unit to another. The time is the period between the appearance of the innovation and its eventual full adoption and the social system is the combination of internal and external influences which the adopting units may receive over the adoption process. (3)

Rogers points out also that the innovation adoption process goes through five stages: knowledge, persuasion, decision, implementation and confirmation. The stage denominated knowledge happens when an individual or other adoption unit learns of the innovation existence and gains some understanding of how it functions. Persuasion is the stage in which the individual forms a favorable or unfavorable attitude toward the innovation. The decision stage is the one in which it is defined the implementation or not of the innovation. The implementation is the stage of use properly, and the confirmation is the stage of evaluation of gains and losses over time related to the adopted innovation. (3)

The theory also highlights six attributes an innovation must have, that lead people to adopt new ideas and methods: relative advantage, compatibility, complexity, trialability, observability and flexibility or "reinvention". Each of these factors has the following definitions according to Rogers: (3)

- Relative advantage: the degree to which an innovation is perceived as better than its predecessor.
- Compatibility: the degree to which an innovation is perceived as consistent with existing values, needs and past experiences of the potential adopters.
- Complexity: the degree to which an innovation is perceived as difficult to understand and use.
- Trialability: the degree to which an innovation can be experienced before adoption.
- Observability: the degree to which the results of an innovation are visible by the organization.
- Reinvention (or Flexibility): the degree to which an innovation can be adapted before its definitive adoption.

These attributes are the focus of this study because, considering that, according to Rogers, the greater the perception of these attributes by the physician, the faster is the adoption of EMR.

Finally, Rogers classifies the adopters in five groups (Figure 1) according to the speed they adhere to the innovation: Innovators, Early Adopters, Early Majority, Late Majority and Laggards. (3)

Figure 1 - Adopters classification according to Diffusion of Innovations Theory (Rogers, 2003)

Objectives

This study aims to identify the perception of physicians at SCMS regarding to the six attributes of Diffusion of Innovations: Relative Advantage, Compatibility, Complexity, Trialability, Observability and Flexibility. SCMS was founded in 1543 and is the largest hospital in its metropolitan region. It receives patients from the nine cities that compose the region and also from adjoining cities; it has about 660 beds; more than 3,600 professionals and a clinical body of 480 medical doctors, being a reference in traumatology, cardiology, nephrology and ophthalmology. (4)

This hospital was chosen for this study due to its characteristics and its similarity with other healthcare facilities linked to the Brazilian Confederation of Santas Casas de Misericordia, Philanthropic Hospitals and Entities – CMB, which includes about 1,787 institutions with similar characteristics and which may benefit from the obtained results.

The Electronic Medical Record system was adopted in February, 2006 and its use became mandatory from August of the same year. Currently it is available for all the hospital departments, although not all the functionalities are fully in use.

Materials and Methods

This explanatory study aims to identify the correlations between the variables: age, gender, time from graduation, time working at the hospital, degree of familiarity with informatics, mandatory usage, professional ties, length of training, instructors involved and academic preparation, and the attributes of Diffusion of Innovations theory, by means of a quantitative approach, in order to discover if the perception of physicians using EMR towards these attributes, are influenced by the mentioned variables.

The 480 medical doctors included in the official listing of the SCMS clinical staff received a printed questionnaire and, among them, the ones who had an e-mail registered in the organization, received also an invitation to respond to the questionnaire, alternatively, on the Web. Banners were distributed to the places highly frequented by the physicians and, one month before the collection deadline, the Clinical Director sent out an official communiqué urging the physicians who still had not taken part, to participate on the final stage and fill the questionnaire. With these actions the response rate was 46% (221).

The questionnaire was elaborated with multiple-choice questions based on variables collected on the literature review. Divided in three parts, the first one serving to identify the respondent (4 questions), the second part was directed to the doctors who self-identified as users (18 questions) with the goal of characterize them and identify the facilitating and hindering factors perceived by these professionals in the use of the system, and the third part was directed to the ones who self-identified as non-users of the EMR (4 questions).

The questions of the second part were formulated affirmatively and graduated on the Likert scale in a numerical range from +2 (full agreement) to -2 (full disagreement).

After the 120 days of data collection period, the data went through a preparation that consisted on: 1. Complementation of information left blank; 2. Data entry and consistency check with the returned envelope count, and age and gender totals; 3. Preparation of data, due to requirements of the software used for analysis.

Once the data was prepared, the study advanced to the data analysis phase, considering first the identification of normal distributions for the definition of tests to be used. This first step was performed based on the Shapiro-Wilk normality test, which results ($p<0.05$), led to the use of non-parametric tests for the analysis of correlations between variables.

Therefore, Spearman Correlation tests were used to verify the relationships between quantitative variables, such as: age, time from graduation, time working at SCMS, degree of familiarity with informatics, length of training and the attributes of Diffusion of Innovations. The tests resulting in p-value < 0.05 indicated the existence of the correlation between variables and attributes. The Spearman "S" complemented the results indicating if the correlation is positive, that is, the higher the characteristic indicator for the doctor, the higher the perception of the attribute.

For the verification of correlation between quantitative and qualitative variables with two groups, to wit: gender (male or female), mandatory usage (voluntary or mandatory) and instructors (yes or not), the Mann-Whitney test was used and the groups median indicated which of them tends to each end of the Likert scale. Finally, the Kruskal-Wallis test was applied for the verification of relationships between the quantitative and qualitative variables with three or more groups, to wit: professional ties (residents, outsourced personnel and employees) and academic preparation (at least one class or lecture, one class along one semester, no classes and "I don't remember"). The result was also measured based on p-value < 0.05, indicating the existence of a difference between the groups and the tendency for each group was examined based on multiple comparisons of p-value.

Results

Among the 221 respondents, 169 (75.47%) was self-identified as EMR users and 52 (23.53%) as non-users. The physicians that made up the sample are, on average, 48 years old, have 22 years since graduation and have worked at SCMS for 19 years. The majority (76%) are hired as freelancers or outsourced personnel, began to use the system voluntarily as soon as it became available (76%), after a single training session (67.4%) headed for the most part by the internal IT team.

A noticeable piece of data is that 72.7% of the physician users reported not having received even one class or lecture about EMR in their graduate or postgraduate training, which is not surprising, since Meade *et al.* (2009) remind that most of the current crop of physicians graduated before the arrival of this kind of system and graduation courses usually take a relatively long time to adapt to the needs of the marketplace. (5)

It's important to highlight that, since the relative advantage attribute can be measured considering various aspects of the EMR usage, three requisites were considered for this item: ease of use of the system, time to fill in the treatment information form and quality of the patient care, all of them in comparison with paper records.

Analysis of Correlation between Physicians Characteristics and Diffusion of Innovations Attributes

It is important to remember that Rogers pointed out that the greater the perception of one or more attributes, the higher the speed of adoption, therefore, the table below (

Figure *2*) shows the attributes that can be considered more relevants to physicians adoption of EMR.

Figure 2 - Influence of physicians' characteristics on Diffusion of Innovations attributes perception

The correlation analysis between age and Diffusion of Innovations attributes identified that younger physicians have a higher perception of the relative advantage, low complexity, compatibility and experimentation attributes ($p<0.05$). Similarly, the ones with less time since graduation and less time working at SCMS perceive the factors low complexity, compatibility and experimentation in a more intense way than the more veteran ones and perceive the relative advantage factor in the same way, but only when comparing time to fill in the information and treatment quality ($p<0.01$).

Regarding gender, no correlation was identified to any of the Diffusion of Innovations component variables ($p>0.05$), meaning that doctors of both genders perceive the attributes in a similar way.

Analyzing the correlation between degree of familiarity with informatics and Diffusion of Innovations attributes, was observed that the most familiar users with informatics have a higher perception of relative advantage, on the aspects of time for filling in and perception of low complexity ($p<0.01$).

The question related to mandatory use indicated that the ones who started using the system voluntarily have a higher perception of relative advantage, compatibility, experimentation, observability and flexibility ($p<0.05$).

On the professional ties item was identified that residents, outsourced personnel and employees perceive in different ways the attribute relative advantage, related to the ease of use and treatment quality requisites, compatibility and flexibility ($p<0.05$). Comparing the averages for each kind of contract, it was observed that residents have a higher perception of these attributes than outsourced which, by turn, have a higher perception than employees.

The length of training variable also has not presented significant differences between the ones who received one, two, four or more training sessions related to the Diffusion of Innovations variable perceptions ($p>0.05$).

Regarding the item related to the responsible professionals for the training of the physicians, led to different perceptions: physicians trained   by the internal IT team presented higher perception of relative advantage (ease of use) and compatibility (average scores of the trained personnel higher than the average of the ones not trained by the internal team), doctors trained by fellow doctors presented lower perception of compatibility (average scores for the ones who received this training is lower than the average scores for the ones not trained by colleagues) and doctors trained by nurses presented higher perception of experimentation (average scores = 1.50).

When the academic preparation for using an EMR system variable was analyzed, it was observed that the physicians surveyed who received any information, in the form of class or lecture about electronic medical records, during graduation or post-graduation, perceived the attributes in a different way than the ones who didn't receive information during that period. Comparing the averages of the positions obtained on the Kruskal-Wallis test, it can be observed that those who had at least one class or lecture about the electronic records theme have a higher perception of relative advantage (ease of use and treatment quality) and observability than the ones who didn't have any information during their graduation or post-graduation

Discussion

In this survey, as previously mentioned, significant differences between genders were not observed, however, a study by Ma and Yuen (6), regarding the perception of ease of use and usefulness by professors of both genders reported that women are influenced by both attributes in a balanced way, while men are more strongly influenced by the usefulness attribute.

With a lesser degree of similarity to this study, since it was based on the Theory of Planned Behavior, different results were gathered in a survey by Morris, Venkatesh and Ackerman (7), in which the authors detected that the differences between men and women in the technology acceptance process accentuate with age.

Rogers (2003) highlighted the attributes relative advantage and compatibility as the most relevant for explaining the adoption rate of an innovation, and Perez and Zwicker (8), in a study using an adaptation of the Rogers model, made by Moore and Benbasat, concluded that these same attributes, as well as the result demonstrability (observability), contributed positively to the adoption of EMR in an universitary hospital in São Paulo, Brazil. The present study confirmed that, with the exception of the variable gender and length of training, all the others influence the perception of the relative advantage and compatibility.

Length of training, in particular, presented as little relevant for the perception of these attributes, which does not mean that training is unnecessary, but just that the number of sessions has little influence on the perception, corroborating therefore study performed by Morton and Wiedenbeck (9) who also used Diffusion of Innovations and TAM as a theoretical basis for their survey and detected the influence of the training variable on the perceptions of usefulness and ease of use is not statistically significant.

Also reporting low or no statistical significance in the correlation between training and perception of ease of use and usefulness, Gadd and Penrod (10), in a survey with doctors after six months from the implementation of an EMR system.

Another study performed in two hospitals, one in Brazil and the other in Spain, by Farias *et al* (11), detected that the higher the knowledge of informatics of the professional, the higher the chance for adaptation to the use of EMR. This result was confirmed by van der Meidjen *et al* (12), who identified the previous experience with informatics as a determining factor for the acceptance of an EMR system. In the present study, considering that the perception of the relative advantage and low complexity were more strongly observed by the users with higher degree of familiarity with informatics, it's possible to infer that these users tend more strongly to adhere to the use of this kind of system than the ones who do not have this perception.

Rogers observes also that the interpersonal communication channels are more effective when people in the same socio-economical and educational level exchange ideas about an innovation (3), although, in this survey it was observed that physicians trained by peers have a lower perception of compatibility of EMR with the work method of paper records.

Conclusions

Health institutions that had not yet implemented EMR, will certainly have no such difficulty as the first ones, but have to consider Diffusion of Innovations principles to ease its way. Those institutions where

EMR are fully implemented, have now another challenge: implementation of innovations resulting from the possibility of use of databases or technical features of this EMR, like clinical decision support system, data originated from wearables devices, suggestions from artificial intelligence systems and similars. Looking at these factors that mostly influence the perception of Diffusion of Innovations attributes and, consequently, can facilitate innovations adoption, there are some steps that can be followed by the IT Team in any organization that is in the process of EMR implementation:

1. Give a different treatment to physicians by age and time of working at organization;
2. Use those who have more familiarity with informatics as influencers, as well as those who voluntarily began to use EMR and, also, residents and outsourced personnel;
3. Integrate nurses to the IT team as trainers and, if possible, also physicians.

Also of note is the length of training, which results, evidenced the fact that it does not interfere on the physicians' perception towards any of the Diffusion of Innovations attributes, but it cannot be dismissed. Considering that the current study used as reference a single healthcare institution, its findings are limited to that institution. Nevertheless, since the beginning of the work it was known that other institutions are assembled in the Brazilian Confederation of Santas Casas de Misericordia, Philanthropic Hospitals and Entities, as well as other hospitals in Asian and Africa who still works with paper-based patient records and it is expected that the results obtained may serve as a reference for these entities, at the time of introducing electronic medical records.

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Successful Parenting in the Contemporary Era of Technology in Pakistan

Dr. Muhammad Ali Shaikh[1], Nadia Saeed[2], Zahid Hussain Sethto[3], Dr. Stephen John[4]

Abstract

Pakistan is one of the developing countries having low literacy rate in contemporary era of technology (Male: 72.5% and Female:51.8% but varies regionally), holding 180th position in the list of 221 big or small countries of the world. Media (social/electronic/print) has replaced parents, therefore, children learn and follow, as they find/listen/watch on it, parents have no more control over their children and consequently their teaching is no more effective. But in the present era of challenges/difficulties where parents find themselves hopeless/helpless, we find some parents have performed or are very successfully performing their duties. The objective of this research study was to discover the techniques used or parenting style followed by those successful parents. For the purpose, through snowball sampling procedure hundred (100) parents were selected. A questionnaire consisting close-ended questions was distributed among the participants and the purpose was to keep selected respondents on required track or provide them technical terms used in the world or to have fixed responses, while open-ended questions were posed to explore the techniques or parenting style adopted by them. The quantitative responses were analyzed using SPSS, while quantitative responses were sorted, labelled and quantified. The results show that parenting style or technique of using yardstick as per nature of a child is the reason behind successful parenting in the parent era.

Keywords: *Parenting, Contemporary Era, and Technology*

1. Introduction

The word 'parenting' is derived from a Latin verb *parere*, means 'to bring forth or produce. The role of parents in child development is commonly refer as socialization. A parent is someone who loves their child unconditionally. Baumrind (1991) introduced four (04) types of parents, after her other researchers added more i.e. authoritative, authoritarian, permissive, neglectful, overprotective, narcissistic, polarized, dependent, isolated and toxic.   According to autonomy model of inspiration, it is found that for teachers/parents it hard to inspire their students/kid and resultantly they become frustrated (Deci, E. and Ryan, R., 2009). When a child completes a job then parents/teachers need to appreciate the child because approval raise confidence while disapproval results in shame of lack of confidence (Deci, E. and Ryan, R., 2009). It has been observed that those parents who use reward to motivate their children, sometime their children also become habitual and they do nothing without that reward (Deci, E. and Ryan, R., 2009).

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[1] Professor, Department of Media and Communication Studies, Sindh Madressatul Islam University, Karachi
[2] Researcher, School of Foreign Languages, Central China Normal University, Wuhan, China
[3] Assistant Professor, Department of Teacher Education, Shah Latif University, Khairpur
[4] Associate Professor, Department of Education, Sindh Madressatul Islam University, Karachi, Pakistan.

Those parents and teachers who punish their children or students, their students' personality does not grow and they are having lack of confidence in their life (Hart, 2005). Gonzalez-DeHass et al. (2005) claimed that when parentages are convoluted in their kids' institutes, educational inspiration and attainment growth. Pupils' curiosity in education, capability, and thoughtfulness of a question zone, progresses and encourages pupil accomplishment. Gestwicki (1996) highlighted the detail that study shows the initial years are of greatest significance in location learning shapes for children and families. The standing of nurturing cannot be overstressed. Studies authorize the supposition that exact issues in the parent's style (particularly mothers) have significant and permanent influence on children's learning style, cognitive growth, and instructive accomplishments. (Gestwicki, 1996). The term "parental involvement" means the contribution of parents in steady, two-way, expressive communication connecting student theoretical knowledge and other school doings. Morin (2011) says that the finest slant for school accomplishment is to make certain that parents and teachers are employed collected as helpers. Occasionally, however, it can appear that there's a write line tired depressed the central of your child's life. Olsen (2010) showed that the optimistic possessions of parent participation on kids, relatives, and school when schools and parents endlessly upkeep and inspire the kids' education and growth (Eccles& Harold, 1993; Illinois State Board of Education, 1993).

1.1 Statement of the Problem

The growing challenges and complexities have affected the lives of people. They need to work very hard to deal with everyday situations successfully. These challenges have transformed the role of teachers on one hand and on the other hand the same have added to the responsibilities of parents. Now parents' responsibilities are not confined just to send their children to schools, rather they need to stay involved in their education processes. When parents remain busy in   the schooling of their kids along with teachers, kids will be able to show good academic performance. Unfortunately, in Pakistan parents are still unaware of this modern practice, therefore their efforts result in less and inadequate learning out comes. Hence, it is the high time to educate parents that without their vital role teachers cannot put the required potential in children, for better results they need to understand their responsibilities well.

1.2 Research Questions

    1.2.1   What are common issues of parents in the present era of technology?

    1.2.2   Which parenting style is more commonly adopted by successful parents?

2. Material and Methods

Both quantitative and qualitative approaches were implied to solve the issue. Universe of the study was those middle-class parents who have nurtured their children in such a way that children have scored high grades in their careers, and achieved their set targets, moreover they respect others and being respected by others. As it was difficult to find the required respondents therefore, snowball sampling procedure was adopted to select the sample. A questionnaire consisting sixteen (16) close-ended and four (04) open-ended questions was used to solve the query. Responses of close-ended questions were analyzed by using SPSS,

on the other hand open-ended by using NVivo. The results were illustrated in tables/graphs and were interpreted for better understanding of the readers.

3. Results

3.1 Gender

In the present research study hundred parents were approached by using snowball sampling procedure. In those parents, sixty-three (63) were females while thirty-seven were male participants.

Gender of the Participants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	37	37.0	37.0	37.0
	Female	63	63.0	63.0	100.0
	Total	100	100.0	100.0	

3.2 Participants Status

This purpose of first question was to understand the feelings of parents about their status in Pakistani society. The responses reveal that those parenting who were doing successful parenting in the era of technology, out of 100 parents, 59% and 9% parents feel that they belong to lower middle class or poor class respectively, but feel that they have played their part effectively in this era of technology, when majority of parents find themselves helpless and hopeless.

Where do you fix yourself?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Upper Class	6	6.0	6.0	6.0
	Middle Class	26	26.0	26.0	32.0
	Lower Middle Class	59	59.0	59.0	91.0
	Poor	9	9.0	9.0	100.0
	Total	100	100.0	100.0	

3.3 Accommodation

In Pakistan people belonging to lower middle or poor class mostly live in two (02) rooms house, they use one room as a drawing room while the other one as a bedroom. 45% and 48% respondents of the present research study were living in two (02) or three (030 rooms house respectively.

4.

How many rooms were you having?				
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Two	45	45.0	45.0	45.0
	Three	48	48.0	48.0	93.0
	Four	7	7.0	7.0	100.0
	Total	100	100.0	100.0	

3.4 Number of Children

In Pakistan especially lower middle or poor class people consider children blessings of Allah (God), therefore do not care about the number and they have strong belief that if Allah has bestowed them a child then Allah will fulfil all kind of needs of that child. As parents of present research study consider themselves lower middle or poor class people and consequently their responses depicted the same as expected that 62% parents were having more than three children. This number is alarming number in the present era.

<table>
<tr><th colspan="6">How many children do you have?</th></tr>
<tr><th></th><th></th><th>Frequency</th><th>Percent</th><th>Valid Percent</th><th>Cumulative Percent</th></tr>
<tr><td>Valid</td><td>Three</td><td>38</td><td>38.0</td><td>38.0</td><td>38.0</td></tr>
<tr><td></td><td>More than three</td><td>62</td><td>62.0</td><td>62.0</td><td>100.0</td></tr>
<tr><td></td><td>Total</td><td>100</td><td>100.0</td><td>100.0</td><td></td></tr>
</table>

3.5 Dealing Children

58% respondents disclosed that they provided guidelines to their children related to their study/future targets but at the same time they also used to monitor their children while 30% parents declared that they forced their children to do which they were thinking good for them.

<table>
<tr><th colspan="6">How were you dealing your children</th></tr>
<tr><th></th><th></th><th>Frequency</th><th>Percent</th><th>Valid Percent</th><th>Cumulative Percent</th></tr>
<tr><td>Valid</td><td>Letting them to do as per their wish</td><td>4</td><td>4.0</td><td>4.0</td><td>4.0</td></tr>
<tr><td></td><td>Just provided guidelines as per their wish</td><td>8</td><td>8.0</td><td>8.0</td><td>12.0</td></tr>
<tr><td></td><td>Provided guidelines as per their wish and monitored</td><td>58</td><td>58.0</td><td>58.0</td><td>70.0</td></tr>
<tr><td></td><td>Forced them to do as you wish</td><td>30</td><td>30.0</td><td>30.0</td><td>100.0</td></tr>
<tr><td></td><td>Total</td><td>100</td><td>100.0</td><td>100.0</td><td></td></tr>
</table>

3.6 Facilitating Children

In Pakistan it is a common perception that children go for extra coaching after school because teachers do not fulfill the requirements of the students, therefore most of the parents send their children to coaching centers or mostly children also wish to attend evening coaching classes because those students who take coaching classes score good marks in the examination. But the collected data reveals that 66% parents did not depend upon the school or coaching center, they guided or taught their children by themselves.

How were you facilitating your children in learning process?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Depended on School	13	13.0	13.0	13.0
	Provided coaching through evening coaching centers	21	21.0	21.0	34.0
	Guided by themselves	66	66.0	66.0	100.0
	Total	100	100.0	100.0	

3.7 Guiding Children at Home

It is common practice in Pakistani society that males use to work to fulfil the financial needs of the family while females are not allowed to work whether they educated or having professional qualification. The ladies are supposed to look after the household matters and are expected to perform a strong role in upbringing of the children. The collected in the present research study reveals that 72% mothers have played their role in success of the children or they have coached or guided their children at home or have provided controlled learning environment to their children at home.

Who used to guide the child at home?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mother	72	72.0	72.0	72.0
	Father	28	28.0	28.0	100.0
	Total	100	100.0	100.0	

3.8 Reason Behind the Success of Children

In response to this question, 52% parents chose the option 'His / Her Own Motivation' while 39% parents gave credit to the school environment behind the success of their child. 5% and 4% also appreciated their own as well as teachers' efforts respectively.

Whom do you consider behind the success of your child?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	His / Her Own Motivation	52	52.0	52.0	52.0
	Yours Efforts	5	5.0	5.0	57.0
	Efforts of the Teachers	4	4.0	4.0	61.0
	School Environment	39	39.0	39.0	100.0
	Total	100	100.0	100.0	

3.9 Time for Self-Study

In Pakistan students mostly used to stay in a school or college for six (06) hours and during these six (06) hours they have to attend 7 to 8 periods of 40-45 minutes for each subject (compulsory or optional/selected i.e. English, Urdu, Islamic Education, Pakistan Studies are compulsory subjects from lower to intermediate level, while at secondary or intermediate level students choose or take 3-4 optional subjects). At school/college they do not get time transfer the knowledge gained during class lecturers from short-term memory to long-term memory, therefore most of the educationists recommend that students need to use transitional time effectively (transitional time means from school to school again which are 16-18 hours). The data of the present research depict that 62% successful children use effectively more than four hours from the transitional time for their studies.

After school how many hours were your children spending for self-study?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Four	38	38.0	38.0	38.0
	More than Four	62	62.0	62.0	100.0
	Total	100	100.0	100.0	

3.10 Time Slot for Self-Study

At home students use different time slots for self-studies, the students in the present research study used 11 to 12 (44%) while 9 to 10 (34%).

Which time slot was mostly used by your child for study?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4 to 6	14	14.0	14.0	14.0
	7 to 8	8	8.0	8.0	22.0
	9 to 10	34	34.0	34.0	56.0
	11 to 12	44	44.0	44.0	100.0
	Total	100	100.0	100.0	

3.11 Mobile Used by Children

Now-a-days mobile phone has become the need of human beings but at the same time because of the facilities available in a mobile set has started spoiling time and character of the young generation. The responses parents of successful students reveal that they did not provide mobile to their children during their schooling

Did you provide mobile to your children at home?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	33	33.0	33.0	33.0
	No	67	67.0	67.0	100.0
	Total	100	100.0	100.0	

3.12 Reason(s) for Not Providing Mobile to Children

Those participants, who chose the option 'No' were further asked about the reason behind for not providing mobile phone to their children as it has become the necessity now-a-days. The participants used different phases/sentences/words for expressing the reason, i.e. thirty-two (32) parents said they were unable to provide, twenty-seven (27) time wastage, three (03) diverting children from right path, three (03) they were allowed to use their mobile, while two (02) of the participants also 'they do not need mobile at this stage of life.'

3.13 Computer Used by Children

Computer has become the need of everyone specially of students, 67% parents of successful students declared that they provided computer to their children while only 33% parents used the option 'No'.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	67	67.0	67.0	67.0
	No	33	33.0	33.0	100.0
	Total	100	100.0	100.0	

Did you provide computer to your children at home?

3.14 Internet Used by Children

Internet is a source of information; it is connecting the whole world because of internet the world is changed into a global village. 78% parents used the option 'somewhat' provided this facility to their children. While there was only one respondent who used the option 'No'.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	21	21.0	21.0	21.0
	No	1	1.0	1.0	22.0
	Somewhat	78	78.0	78.0	100.0
	Total	100	100.0	100.0	

Were you allowing your children to use internet?

3.15 Reason(s) for Not Allowing Children to Use Internet

As there was only one (01) who used the option 'No', when he was asked to write the reason for not allowing children he wrote, 'computer is spoiling young generation'.

3.16 Use of Social Media / You Tube by Children

Social media or You Tube is also a big source of information; it provides latest information to the audience but at the same it also has information which can spoil the young ones.   69% respondents disclosed that they allowed somewhat their children to watch social.

Did you allow your children to watch social media/You Tube?				
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	4	4.0	4.0	4.0
	No	27	27.0	27.0	31.0
	Some What	69	69.0	69.0	100.0
	Total	100	100.0	100.0	

3.17 Reason(s) for Not Allowing Children for Watching Social Media / You Tube

Those participants, who used the option 'No' they were further asked to write the reason behind not allowing your children to watch social media/ You Tube. Fifteen (15) said 'divert attention of the young people', nine (09) 'spoil young mind', while three (03) participants said, 'they do need at this stage of life'.

3.18 Excursion of Children

As it is recommended by number of researchers that school and parents need to take their children for outing somewhat when they get time. But in the present research study, 51% parents used to take their children for outing quarterly, 38% used the option twice a year, but 11% also said that they do this activity once a year.

What was your routine of taking your children for outing?				
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Once a Year	11	11.0	11.0	11.0
	Twice a Year	38	38.0	38.0	49.0
	Quarterly	51	51.0	51.0	100.0
	Total	100	100.0	100.0	

3.19 Reasons for Not Taking Children for Excursion

The participants were also asked to write about reason behind this routine of taking children for outing, once a year/twice a year/quarterly, the words chosen depicting the reasons were 'finance', 'non availability of such places', 'environment of such places', and shortage of time

3.20 Problems Faced while Nurturing Children

In the present era of technology when children are neither in control of school nor in the control of parents, 63% respondents chose the option of 'Teacher-Parents collaboration' was the biggest issue faced by them. While 21% and 16% parents also raised the issue of finance and parents-school communication.

What was your biggest issue, while nurturing your children?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Finance	21	21.0	21.0	21.0
	Parent-Teacher Collaboration	63	63.0	63.0	84.0
	Parents-School Communication	16	16.0	16.0	100.0
	Total	100	100.0	100.0	

5. Discussion

More females participated in this research study, as it was decided that data will be collected from those parents who consider, their children successful but they must be part of middle class. The participants expressed their feelings about the status and declared themselves the part of middle or lower middle class. They used to live in two to three rooms house, most of the participants were having more than three children and it could be difficult to accommodate big family in a small house. But participants were divided into two major groups as per their options chosen by them, a bit bigger (58%) were providing guidelines to their children as per their choice but another group of participants (30%) forced their children against their aptitude, which is not appreciated in the parents' world of modernization, but they consider that their children are successful. As most of participants belong to lower middle or poor class, then may be because of the financial issues they were not be able to provide home/coaching center tuition, therefore they provided guidelines to their children by themselves. When we critically analyze the data, we find that female participants have given credit of success to their husbands while male participants have credit to their wives. According to the participants the reason behind their children success is their own motivation or the school environment. Most of the successful students used to spent more than four hours for self-study in a day and study from 9 to 12 PM. The parents do not provide mobile to the children because they feel they don't need it or it's a source of wastage of time. Parents have provided them computer but do not allow them to use internet at home again they have opinion that it wastes the time of their children or also distract them from the right path, they also not allow their children to watch social media having the same logic behind. Because of financial issue they do not take their children on excursion. The biggest issue faced by them is lack of cooperation from the teachers.

6. Conclusions

Followings are the conclusion drawn from the present research study:
- Mother are playing effective role in the success of their children.
- Finance can be a barrier between a person and success.
- Separate accommodation is not essential for study, only will is needed.
- Parents monitoring is required for successful career of the children.
- Teacher cooperation and school environment can play an effective role in the success of students.

- There is no need of internet to students in Pakistani education system.
- Students should avoid watching social media YouTube or other sources till they are indulged in their studies

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Appendix A/B

Appendix-A

QUESTIONNAIRE

1. Gender?
   a. Male
   b. Female

2. Where do you fix yourself?
   a. Upper Class
   b. Middle Class
   c. Lower Middle Class
   d. Poor

3. How many rooms were you having?
   a. Two
   b. Three
   c. Four
   d. More than four

4. How many children do you have?
   a. One
   b. Two
   c. Three
   d. More than three

5. How were you dealing your children?
   a. letting them to do as they wish
   b. Just provided guidelines as per their wish
   c. Provided guidelines as per their wish and monitored
   d. Forced them to do as you wish

6. How were you facilitating your children in their learning process?
   a. Depended on school
   b. Provided coaching through evening coaching centres
   c. Hired individual tutor at home
   d. Guided by themselves

7. Who used to guide children at home?
   a. Father
   b. Mother

8. Whom do you consider behind the success of your child?
   a. His / Her own motivation
   b. Yours efforts
   c. Efforts of the teachers
   d. School environment

9. After school, how many hours were children spending for self-study?

      a. Two

      b. Three

      c. Four

      d. More than four

10. Which time slot was mostly used by your child for study?

      a. 4 to 6

      b. 7 to 8

      c. 9 to 10

      d. 11 to 12

11. Did you provide mobile to your children?

      a. Yes

      b. No

12. If not, what were the reasons? --------------------------------------

13. Did you provide computer to your children at home?

      a. Yes

      b. No

14. Were you allowing your children to use internet?

      a. Yes

      b. No

      c. Some what

15. If not, what were the reasons? --------------------------------------

16. Did you allow your children to watch social media?

      a. Yes

      b. No

17. If not, what were the reasons? --------------------------------------

18. What was your routine of taking your children for outing?

      a. Once a year

      b. Twice a year

      c. Quarterly

      d. Monthly

      e. Weekly

19. If not, what were the reasons behind this routine? --------------------------------------

20. What was your biggest issue while nurturing your children?

      a. Finance

      b. Parent-Teacher Collaboration

      c. Parent-School Communication

Patient with Sickle Cell Anemia: Reflection in The Light of Medical Anthropology

Aniandra Karol Gonçalves Sgarbi[1] (Corresponding author)

[1]Epidemiologic Studies. Graduate Program on Health and Development in West Central Region. Faculty of Medicine, Federal University of Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil. Telephone: +55 (67) 99945-1334. E-mail: ani_karol@yahoo.com.br

Maria Lúcia Ivo[1]; Indiana Ludwig[2]; Rodrigo Guimarães dos Santos Almeida[3]; Abílio Torres dos Santos Neto[1]; Délia Esmeire Paredes[1]; Kátia Gianlupi Lopes[1]; Grasiele Santana Amaral[2]; Gabrielle Caroline Firmo[2].

[2] Health Education. State University of Mato Grosso do Sul, Dourados, Mato Grosso do Sul, Brazil.

[3] Integrated Institute of Health, Federal University of Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil.

Abstract

This work aimed to approach Sickle Cell Anemia from the standpoint of medical anthropology, from the perspective of health, disease and culture, not only addressing the disease as a biological event, but also other socio-cultural aspects of the individual. This is a descriptive, theoretical-reflexive analysis-type study. Seeking to know the disease, its treatment and complications within the socio-cultural context are important to contribute to possible changes in the perspective with the individual regarding this morbidity. Having the field of public health in development, an approach beyond the technical molds for the treatment of diseases, a multidisciplinary approach is needed to meet the needs of the population, to provide patient-centered care for their social, psychological and cultural context.

Keywords: Sickle Cell Anemia; Medical Anthropology; Culture;

1. Introduction

Sickle Cell Disease has been considered a public health problem in Brazil due to its epidemiological importance in view of the high prevalence of cases [1]. The disease has its origin in Africa and was brought to the Americas as a result of the forced immigration of slaves. Due to miscegenation, this disease can be found in a large part of the Brazilian population, however, with a higher prevalence among blacks and mulattoes [2].

Defined as a set of different genotypes that are characterized by the presence of hemoglobin S (HBS), a variant alteration of normal hemoglobin (HBA), the alteration occurs by replacing the sixth amino acid of globe beta or glutamic acid by valine. Under low oxygen pressure, polymerization occurs, causing the normal shape of the RBCs to change to a scythe/middle moon shape, decreasing the life span of the RBCs [3]. This modification (HbS) causes molecules to organize into polymeric bundles when deoxygenated, giving the red blood cell an elongated and rigid form, called "scythe form" or "half-moon" [4].

There are two forms of sickle cell anemia, homozygous and symptomatic when the individual inherits the Hb S gene from his parents, he acquires the Hb SS genotype, the form of which is considered to be the most severe. In its heterozygosis and asymptomatic form, the patient presents the sickle cell trait, in which a copy of this gene is inherited from the parents, manifesting the genotype Hb AS [5]. If parents have sickle cell trait, there is a 25% probability of genetic manifestation in Hb SS and 50% in Hb AS [6].

It is important to highlight that the black population, the most affected ethnic group, is at the base of the social pyramid with the worst epidemiological, economic and educational indicators [7]. These factors contribute significantly to the poor life prognosis of people with sickle cell anemia [8]. For many years this disease was considered to be specific to black people, who came to suffer racism for the condition [9].

Although sickle cell anemia has treatment, it is a chronic disease that limits the patient to his/her daily life and makes him/her vulnerable and with biopsychosocial losses. It changes both your quality of life and that of your caregivers since it can prevent you from studying and/or working and even performing daily tasks and can generate suffering [10].

The socio-economic and educational situation, access to medical assistance and environmental conditions influence the worsening effects of the disease on the patient [11]. Researchers conducted a cohort study with patients with sickle cell anemia in the state of Minas Gerais and showed that social condition may worsen the disease and increase morbidity and mortality, which corroborates that the disease is also analyzed from political and social issues [12].

Therefore, this study aimed at reflecting on sickle cell anemia from the point of view of medical anthropology, in the perception of health, disease and culture.

2. Method

This is a descriptive, theoretical-reflexive analysis-type study. Inclusion criteria were: full articles, theses, dissertations, monographs, Course Conclusion Paper, book chapters available in the listed databases, in any language and with a five-year time frame. The exclusion criteria were: editorials, letters to the editor, abstracts, expert opinion, reviews.

Data were obtained from the Scopus, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Science Direct, National Library of Medicine National Institutes of Health (PubMed) and Web Of Science databases.

The indexed descriptors were used in the *Medical Subject Headings* - MeSH: "*Anemia, Sickle Cell*"; "*Hemoglobin S Disease*"; "*Sickle Cell Anemias*"; "*Sickle Cell Disorders*"; "*Sickle Cell Diseases*"; "*HbS Disease*"; "*Anthropology, Medical*"; "*Medical Anthropology*". There was a cross between them to ensure a broad search across all bases with Boolean operators OR and AND.

We found 221 articles, two of which were excluded for duplication. By applying the inclusion and exclusion criteria, 80 articles were selected. Also included in the sample by manual search, two theses and three dissertations on the subject. After reading the full text, and through eligibility, 23 primary studies were selected that addressed the topic.

3. Discussions

In order to treat sickle cell anemia under sociocultural and historical aspects, it is necessary to conceptualize

first sickle cell anemia in order to rescue its historical aspects and highlight the importance of anthropology in this area.

3.1 Sickle Cell Anemia: Evolutionary and Epidemiological Aspects

The studies of chronic diseases were approached qualitatively from the 20th century.   In this century, the investigation of chronic diseases had its development based on the significance and complexity of the illness experience as a socio-cultural phenomenon [13].

Among the first studies associated to sickle cell anemia in Brazil, it was that of the physician José Martins da Cruz Jobim, who in 1835 reported in his speech about the diseases that most afflicted the lower class of the population in the city of Rio de Janeiro. Jobim reported the association between opilation and anemia, defined as intertropical hypoemia, and the perception of greater resistance to intermittent fevers by slaves coming from Africa, which was then pointed out as the protective effect of Hb S against malaria [14].

However, it was only in 1910 that the first scientific article on sickle cell disease was published. Under the authorship of doctor James Bryan Herrick, the article entitled "*Peculiar elongated and sickle-shaped red blood corpuscles in a case of severe anemia*", published in the American magazine *Archives of Internal Medicine*, demonstrated the presence of "sickle-shaped red blood cells" in a young black student from the Antilles emigrated to Chicago with severe anemia, jaundice, and intense arthralgia. Given the discovery, for years sickle cell anemia was considered a racial marker [15].

In 1922, the term sickle cell anemia was first used by Vernon Mason, and in 1927 Hahn and Gillepsie found that red blood cell sickling was dependent on low oxygen tension [16].

The 1930s was a period in which the importance of sickle cell anemia was recognized in studies in Brazilian nosology, emerging studies that addressed its clinical and pathological forms [17].

In the following decade, the goal of many researchers, such as Ernani Martins da Silva, a scientist at the Oswaldo Cruz Institute, was to correlate the frequency of sickle red cells with Brazilian racial diversity, especially to identify the degree of miscegenation [18].

Sickle cell disease was discovered, however, its inheritance was only found by the study of physician José Accioly, in 1947 in Bahia, which characterized red blood cell sickling as a consequence of an autosomal dominant inheritance [19]. But it was in 1949 that James Van Gundia Neel proved it experimentally [20].

Also in 1949, Linus Pauling and colleagues identified HbS by electrophoresis techniques, separating hemoglobins from sickle and normal erythrocytes. With this study, they pioneered the account of what they called "molecular disease" [21].

In 1954, Anthony Clifford Allison, a South African geneticist and medical scientist, did a pioneering study on genetic resistance to malaria and linked the protective effect of Hb S to disease, that is, people with sickle cell characteristics would be resistant to malaria whose agent was the highly deadly Plasmodium falciparum, which reinforced the observations already made by José Martins da Cruz Jobim in 1835 [22].

Ingran, in 1956, used the fingerprint technique (two-dimensional electrophoresis associated with chromatography) to demonstrate that HbS synthesis was caused by the replacement of glutamic acid by valine at position 6 of the β-globin chain [16].

Already in 1978, Kan and Dozy demonstrated, through molecular biology, the difference in the sequence of nitrogenous bases in the gene encoding hemoglobin beta structural chain, initiating the study of sickle cell disease through molecular biology [23].

In West, Central and East Africa there are efforts to control communicable diseases, with neglect of non-communicable diseases, hereditary blood diseases such as sickle cell disease, a consequent increase in the number of cases. Recent global estimates suggest that more than 300,000 children affected by sickle cell disease are born annually, about two-thirds of them in Africa [24]. In western Kordofan, a state of Sudan, has shown that the allelic frequency of sickle cell disease at the site is one of the highest in the world and studies on it are virtually nonexistent [25]. Even with the high mortality rate due to the disease, this condition may be a reflection of inbreeding marriages and the heterozygous advantage against malaria [26]. Data from the National Screening Program (PNTN) of the Ministry of Health, show that in Brazil are born about 3,000 children / year with sickle cell disease and 200,000 with sickle cell trait. The incidence of people with sickle cell disease is 1: 1000, and the trait in Brazil is 1:35 of live births [27].

3.2 Health, disease and culture

From the 1990s, social representations about Health and Disease have been discussed in anthropological research, aiming to address health and disease under a historical approach [28].

Culture is a set of beliefs, knowledge, behaviors, rules and values common to the social group, which provides ways of thinking and acting on what is believed [29]. The disease is subjective, whose biological process is interceded by culture, that is, the conceptions that the person has about the disease and treatment, acting and thinking come from his previous knowledge [30].

Medical anthropology is concerned with the feelings patients have about the disease, that is, based on two classic distinctions: the disease that treats the disease of the biomedical viewpoint and illness which is the experience of getting sick. These two denominations seek to address the patient's illness upon his social construction, in addition to the specific traditional and technical treatment, sustained by health professionals [31, 32].

The correlation of biology and environment as disease-causing factors is beyond the reach of culture. The modern conception of culture, accepted by most anthropologists, is more comprehensive and complex. In medical anthropology it is believed that all research, being subjective and scientific, is deepened in the culture and experience of those who interpret the results [33].

In 1944, in the field of hematology, physician Fritz Ottensooser and physician-anthropologist Ettore Biocca ensured that studies with indigenous people on blood groups for racial classification were more successful than those used by anthropology (physical anthropology) [34]. Fritz Ottensooser performed a mathematical calculation to calculate racial mixture by the frequency of blood groups, and thus, in addition to defining the concentration of indigenous black and white blood that each person retained, also indicated the degree of purity of each race [35].

On September 11, 1946, the conference "Application of the sicklemia Test to Anthropology" was held under the command of researcher Ernani Martins da Silva, which was based on his 1945 study at the Oswaldo Cruz Institute, called the "Study on sicklemia Indexes" [36]. In his research, Ernani highlighted his findings on sickle cell anemia, pointing to it as a hereditary and racial disease, especially in countries

such as Brazil, with a large contingent of black and mestizo people [37]. For him, the early detection of the disease would serve as prophylaxis of sickle cell anemia, and by the sicklemia test, it would be possible to assume whether or not the newborn would develop the disease and transmit it to his heirs.

In the 1950s and 1960s, new paths of anthropology and sociology were already being sketched out with regard to racial issues. The relationship between disease and race started to attract the attention of doctors and scholars who were thinking about Brazilian ethnic and racial formation, arousing interest in studying sickle cell anemia from an anthropological, both biological and cultural point of view [18].

Peter Fly was the anthropologist most dedicated to the study of sickle cell anemia. This researcher raised questions that sickle cell anemia could not be associated to a race, even having its origin in Africa, as it happened in the United States, where anthropologists and doctors used the disease as a racial marker, differentiating whites from blacks [9]. For this scholar, as sickle cell anemia has spread throughout the world, the disease can no longer be characterized as exceptional of the black race, but can occur in any individual.

3.3 Diagnosis and treatment: preconception and discrimination

Lopes' research identified notable discrimination against opiate-type drugs, used by patients with sickle cell anemia in a Belgian crisis, and because of this, they are now seen as chemical and opioid-dependent [38]. The dependence on this type of analgesic can happen, even though it is very well dosed and administered, however, it is also interesting the psychological follow-up for these patients. Called opio-phobia, this prejudice about the use of these drugs exists because of the lack of knowledge of health professionals in dealing with painful processes caused by the disease, and thus hinders the correct follow-up for treatment and alienates patients from the health services [39].

During the research of Ciribassi and Patil, patients reported feelings of frustration, not only because professionals did not believe in their pain, but also because they doubted the treatment with the use of opioids to cure it. Sickle cell anemia requires self-care which makes patients aware of their needs, but the doctor-patient relationship suffers stigmatization, whose professional hesitates to believe that the patient needs analgesic and, due to the hierarchy condition, the patient's request is either denied or is granted with judgments, such as the "opioid addict [40].

Thus, patients who feel illegitimate within the biomedical system refuse to proceed or seek treatment, and with the absence of the patient in the health unit, he tends to practice self-medication and self-treatment and has consequences for his health [41].

Ciribassi and Patil showed in their study that patients with sickle cell disease are often accused of using the disease itself to manipulate health professionals, with the evocative use of language and metaphor, to convince them of the pain by making it true and making it visible. However, in the face of doubt about the patients' pain, blood tests (which make the disease visible to doctors) replace the real complaint, because medicine demands a more observable and qualified reality, which makes these patients invisible when they complain and such disbelief implies in the management of care [40].

Sickle cell anemia is considered a predominant disease among blacks, who in many cases are part of the poorest groups of society, live in peripheral regions and have less access to health and education [42]. Williams and Priest have highlighted racism as a fundamental and working health cause, especially when

it comes to institutional and cultural racism, which can affect through prejudice and racial discrimination and stigma. Racism may not be the only one present in social disparities, but its presence impacts on the health of the individual and may negatively accentuate other health risk factors [43].

Another major factor to be highlighted is the significance of the disease to patients. In a survey conducted by Araújo, people with sickle cell anemia were interviewed, who pointed out morbidity as a "punishment", when they considered themselves punished due to the feeling of exclusion for being black and poor [44].

We can see that the disease reflects negatively on the patient's work activities and quality of life. However, problems such as difficulties in dealing with sickle cell anaemia, poor housing, unemployment and/or bad pay could be reduced with appropriate social and psychotherapeutic follow-up, which should be made available to these patients. In Brazil, mortality from sickle cell anemia is also estimated to be high due to the lack of implementation of public policies aimed at its approach. Patients with sickle cell disease deserve attention by the health system and through social promotion in order to reflect on improving their quality of life and life expectancy [45].

For Thornburg, Ware and each culture sees sickle cell anemia differently, and each patient and family has their individual beliefs, and so it is up to the professional team to learn to identify them. Many communities consider sickle cell anemia to be a "spell" made by witches rather than a genetic problem [46]. Others consider it a curse of some enemy, a Divine punishment, that this is the will of God or reincarnation of someone who has had the disease [47]. This way of considering the disease helps patients to think about their condition and avoid blaming themselves, in order to help them play an active role in society in coexistence with the disease [48].

Patients with sickle cell disease live with health professionals, considering that most of them have a medical follow-up, so explanations about the disease are coming from medical terms. Therefore, it is recommended that professionals, in addition to discussing diagnoses, present the disease portrayed in the social world of those who experience it. Such an approach is necessary because the patient needs both his social and cultural background and the medical environment in order to understand the disease in a clearer way and closer to his reality [49].

In view of this, it is possible to point out that issues of prejudice and stigma discriminate people and are based on stereotypes that need to be considered within the historical and social context of the person with the disease, since both consider the difficulty of society in dealing with those with differences [50].

3.4 Sickle Cell Anemia in the biocultural approach

Health and disease under biocultural analysis have biological, social, environmental, ecological and cultural characteristics, which interfere with human behavior and generate reference models [28].

The research by Lima and collaborators on quality of life evaluated 20 patients with sickle cell anemia and 40 other participants without the disease. Those with the disease perceive their quality of life as poor, with emphasis on social and physical aspects. He also pointed out that people with the disease are historically assessed as disadvantaged by the population, due to their low socioeconomic situation, which also reflects their low education, as well as the limitations that the disease itself imposes [51].

Another study by Swanson, Grosse and Kulkarni from a literature review showed that the unemployment rate among adults with sickle cell anemia is high in several countries. The same study points to an

unemployment rate ranging from 38% to 50%, and among employees, about 17% of working days suffer abstinence due to pain crises [52].

Biological vulnerability is evidenced in the clinical consequences of the disease. Intense pain, successive infections, blood transfusions, frequent hospitalizations and the need for successive treatment exemplify the materialization of these adverse conditions. There is also social vulnerability, in which the injuries caused to the physical body can reflect on the individual's mental health and, consequently, on their social relationships [53].

In a study aimed at assessing the knowledge and practices of families involved in sickle cell disease in a city in Congo, it was found that more than half of parents do not feel guilty about their child's disease. Regarding the impact on their social lives, permanent stress was the most reported condition, followed by divorce (68%). As for living with the disease, about 32% view the situation normally, 22% see it as a nightmare and 18% see morbidity as bad luck or as a will of God (28%) [54].

A study conducted in Jamaica also assessed participants' knowledge about the disease. Most said that the white blood cells attacked their red blood cells, others described that the white blood cell "sucks" the red blood cell, or that the white blood cells "eat" the red blood cells, causing an imbalance between them. In addition, much of the information is reported to have been given by health professionals, or obtained from reading materials on sickle cell anemia. In this research, as a preventive strategy to strengthen the body, participants believe that enjoying a healthy diet with iron source foods decreases the depletion of red blood cells [55].

In the same research, the patients interviewed reported that at low temperatures and prolonged periods in the water, the blood "clogs", or gets blocked causing a painful crisis. To do this, they believe that keeping the body warm makes the blood flow, and that they should also avoid rain and cold. Although medicine does not attribute sickle pain to poor circulation, doctors believe that its intensity increases on cold days and in humid conditions [55].

Dhabangi and collaborators revealed in their research in Africa that even though sickle cell anemia is well known by the population, in some communities there is no specific name for the disease, being understood in the context as loss, lack or not "having" blood. Erroneously, some patients believe sickle cell anemia was the consequence of another condition, such as poor nutrition or malaria [56].

In addition, the interviewees were asked about the clinical picture of the disease. Some reported paleness of the palmar, conjunctiva and tongue, others reported jaundice, splenomegaly, shortness of breath and poor diet, while for others the disease was caused by bad spirits [56].

A study involving 81 male and female individuals, already screened for identification of sickle cell anemia, evaluated the impact of sickle cell tracking on the population in Paris. The patients' doubts and misinformation are mainly about what is the difference between trait and disease itself, the type of hemoglobin and blood groups and lastly the Mendelian transmission. Sickle cell anemia is loaded with erroneous and stigmatizing information, as referred by a patient who believes that relating to a person, both with sickle cell trait, would not generate an individual with the disease [57].

The lack of knowledge about the disease causes embarrassment due to its appearances, such as yellowish eyes, short stature and fragile appearance. Problems arising from difficulties related to the provision of financial support and sex life, cause depression in these patients [53].

Therefore, Canesqui's considerations can be reiterated "[...] to approach the socio-cultural dimension of long-term illnesses means looking at the subject living with a condition that accompanies him everywhere [...]"[31].

4. Conclusion

People with sickle cell anemia not only face a biological condition, but the disease is also part of their life, promoting various changes that impact their emotional and social state. They impact on the life of the sick person and the family, and are also a challenge for public programs and policies.

The suffering of patients with the disease is experienced as a result of situations such as late diagnosis, misinformation about the disease, dependence and difficulty in accessing health services, prejudice due to the use of medication, body changes, lack of employment, loss of freedom, depression, weakening of family and social bonds.

Living with sickle cell disease requires the ability to meet the challenges that the disease itself imposes. Seeking to know the disease, its treatment and complications within the socio-cultural context are important to help change the individual's perspectives on this morbidity. Understanding the disease and its changes is of great importance for the individual to understand his life history and obtain biological control of his body in the face of this chronic disease.

Health professionals should be prepared from initial training to deal with situations involving socio-cultural aspects and issues of vulnerability, since it is not only the biomedical and technical part that contribute to the improvement of the patient, but also consider the socioeconomic and biocultural context that this patient experiences. For often what makes treatment difficult is the stigmata he suffers, and the vulnerable conditions in which he finds himself.

Finally, medical anthropology, as a reflexive and critical area, should be a compulsory subject in undergraduate health courses, since many diseases are considered public health problems. Having the field of public health in development, an approach beyond the technical molds for the treatment of diseases, a multidisciplinary approach is needed to meet the needs of the population, to provide patient-centered care for their social, psychological and cultural context.

5. References

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Biomedical Mechatronic Dynamometer to Support the Evaluation of the Effects of Leprosy Through the Palmar Holding Strenght and the Tweezer Holding Strenght

Josivaldo Godoy da Silva [1,3] (Corresponding author)

[1]Engebio – Laboratory of Biomedical Engineering and Assistive Technologies. Faculty of Medicine, Federal University of Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil.

Telephone: +55 (67) 99577142

E-mail: josivaldog@gmail.com

Desirée Ferro Scapinelli [2], Josivaldo Godoy da Silva [1,3], Lailson Moura Fé [3], Iandara Schettert Silva [1,2]

[1]Faculty of Medicine, Federal University of Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil.

[2]Integrated Institute of Health, Federal University of Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil.

[3]Faculty of Engineering, Federal University of Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil.

Abstract

The hand can suffer the effects of several diseases among the most serious, leprosy stands out, which is considered infectious and can generate loss of muscle strength, atrophy, deformity and physical, mental and social disability. For the World Health Organization (WHO) and also doctors and physiotherapists, it is necessary to evaluate the diseases in an objective, reliable and early manner in order to propose appropriate treatment and follow their evolution. This research proposed a biomedical mechatronic dynamometer in order to support the evaluation of the effects of leprosy by means of palmar grip strength and grip strength of tweezers performed by hand. The experimental research was developed at the Federal University of Mato Grosso do Sul and consisted first of all in the survey of the demands of the health area in relation to the biomedical dynamometer being consulted the following databases: Medical Literature Analysis and Retrieval System Online (Medline); US National Library of Medicine National Institutes of Health (PUBMED) e Institute of Electrical and Electronic Engineers (IEEE). The mechatronic biomedical dynamometer consisted of three fundamental parts: mechanical structure, electronic signal conditioning circuitry and digital information processing. The mechanical structure was designed to withstand a strenght of up to 700 N, developed in brass because this metal has low cost, has less mass and also because it is easier to machine than steel. The oval shape of the structure contains two lateral and thin regions that measure 2 cm thick, 3 cm wide each and aim to concentrate mechanical stresses in order to sensitize the strain sensor consisting of the four linear strain gages, model N2A-XX-S5262P-350/E4 and nominal resistance of 350 Ω, from the company Micro-Measurements, which showed accuracy of 98%. The

mechanical structure also has a stainless-steel support that measures 1 cm thick and 3 cm wide located at the bottom and on which was glued a cushion to support the palm of the hand. This support can be replaced by other models that also contain a cushion that considers the presence of injuries or deformities in the hand. The mechanical structure also has a upper support that also measures 1 cm thick and 3 cm wide, to which four pressure sensors developed with rosette strain gages model N2K-XX-S5294R-350/DP/E4 with a nominal resistance of 350 Ω, from the company Micro-Measurements, were fixed and which showed an accuracy of 99.5%. The deformation sensor is stimulated by the application of palmar grip strenght while the pressure sensors are stimulated by the realization of index, middle, annular and minimum finger gripping strenght. In addition, these sensors are connected to Wheatstone Bridges whose feeds and also the responses are processed by five signal conditioning circuits developed with operational amplifiers LF 356, OPA 27 and OP27 GP of the company Burr-Brown, whose structure consists of voltage oscillator, amplifier, band pass filter, buffer and peak detector that generates DC voltage that feeds the data acquisition board. The answers on this board are sent to the Inspiron 15 3000 microcomputer from Dell, which has installed Labview software from National Instruments, which processes the information, stores, plotts the palmar grip strenght and pinch grip strenght graphs and can also send the information over the Internet. This research has the potential to obtain accurate information on the effects of leprosy in the hand that can support the evaluation, diagnosis of health professionals, follow up the evolution of the disease and the treatment adopted.

1. Introduction

The human hand is a prehensile organ that constitutes the most distal part of the upper limbs and can be used to perform various daily activities of interest such as manipulating objects with the application of strenght and interacting during communication with other people [1]. There are two postures that define the strenghts applied by the human hand, the hand grip strenght (HGF), which applies strenght to a given object so that the thumb is added and positioned to oppose the finger pulps and gripping strenght clamp (GFC) which occurs between the flexor surfaces of one or more fingers with the thumb in opposition, being performed when the need arises for a refined movement of touch [2], [3] and [4]. However, the hand may suffer the effects of several diseases, and among the most severe is leprosy considered infectious and contagious and being feared by disabilities generated in the physical, mental and social aspects [5]. This disease is considered chronic, but curable and is caused by Mycobacterium Leprae - a mandatory intracellular host bacillus (tropism by nerve cells, Schwann's sheath) that affects the peripheral nerves located in the face, feet and hands, generating an inflammatory process characterized by acute pain due to compression and imprisonment of the swollen nerve that leads to loss of sensitivity in the distribution path of the affected nerve, atrophy and decrease in muscle strength may cause deformities and functional disabilities [6], [7] and [8].

Hand paralysis in people with leprosy is related to five important changes from the motor point of view, among them: muscle weakness in the flexion of the metacarpophalangeal muscles; loss of the ability to abduct and add fingers; weakness in the extension of the proximal interphalangeal muscles; weakness in

the flexion and opposition of the 5th finger and the loss of the opposition of the thumb and consequently compromising the interaction of the affected person with the other people and with the environment [8] and [9].

In addition, since leprosy is a complex and highly severe neuropathy, it should be monitored by means of evaluation in order to verify its evolution in the nervous system. In addition to the inspection and tactile sensitivity examination by means of Semmes-Weinstein nylon filaments, a motor evaluation is performed respecting the degree of muscle strength that the individual can achieve, this test being extremely important to detect motor losses and obtain information from the health professional [8] and [9].

According to the World Health Organization (WHO), leprosy is a disease of sanitary interest due to its high level of disability that it generates, and control policies have been concerned with diagnosing it early in order to adequately treat the affected individuals. In addition, there is a need for physiotherapists and physicians to have early, objective and reliable information on the manual strenghts that can be related to their presence and consequently to the effects of various diseases, thus contributing to the adoption of procedures and the monitoring of the evolution of the situation [10] and [11].

Among objective methods that can be used to obtain information on the manual strenght produced by a person, the biomedical dynamometer (BD) stands out since its design considers the physical differences of the user, has adjustment between the supports for the hand, contemplates the anthropometric differences and is economically viable. However, in the specific case of this project, the proposed biomedical mechatronic dynamometer (BMD) also had to be able to generate information on the hand grip strenght (HGF) and gripping strenght clamp (GFC) simultaneously applied by the hand in order to relate to the effects of leprosy.

2. Materials and Methods

The research was developed at the Federal University of Mato Grosso do Sul - UFMS and consisted of a DBM that can generate objective and reliable information on the manual strenghts produced by a person affected by leprosy, in addition to considering the needs of health professionals, as commented, in order to have relevant information during the tests, as shown in Figure 1.

The mechanical structure (2) was projected to support strenght of up to 700 N, with the use of brass with the objective of facilitating machining, for being of low cost and possess mass inferior to the stainless steel that in general is used in other DBs. This aims to make the equipment economically accessible to medical clinics, hospitals and also to not cause muscle fatigue to the patient. In addition, this structure (2) has an oval shape and the largest diameter is 20 cm while the smallest diameter is 14 cm, with the objective of concentrating the mechanical tensions on the two thin sides that measure 2 cm of thickness, 3 cm wide and where four linear strain gages (SG) model N2A-XX-S5262P-350/E4 with a nominal resistance of 350 Ω, from the company Micro-Measurements, were glued together to form a single strain sensor (8), which has the purpose of measuring the intensity of HGF during the static or dynamic test.

Four pressure sensors (7) were developed using four N2K-XX-S5294R-350/DP/E4 rosette type SGs that have a nominal resistance of 350 Ω, from Micro-Measurements. Each pressure sensor (7) has the purpose

of measuring individually the intensity of GFC during the static or dynamic test when each finger applies strenght on its dome.

To allow the performance of GFC, the pressure sensors (7) were fixed on the stainless steel support (4) that measures 1 cm thick, 3 cm wide and 12 cm long. Tests involving people with leprosy will occur at a later stage because the conditions of protection are being created for the researchers involved and also for the laboratory in order to avoid contamination with the disease.

On the dynamometer presented was requested patent deposit n. BR 10 2019 005169 8 with the National Institute of Industrial Property (NIIP) in Brazil.
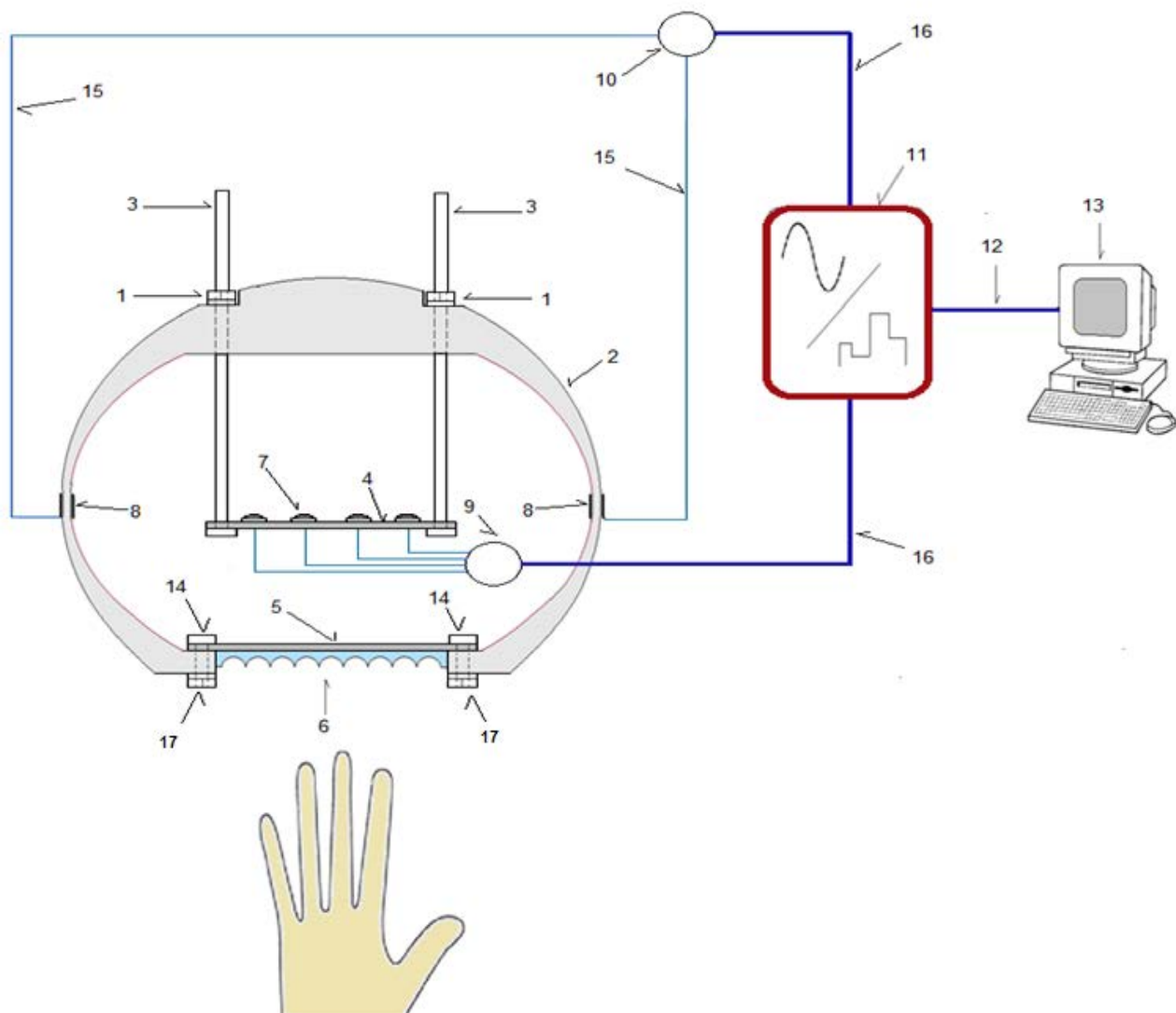
Figure 1. Mechatronic biomedical dynamometer.

Caption

1: Fixing nut.	**8:** Deformation sensor.
2: Mechanical structure.	**9:** Signal conditioning circuits.
3: Screw.	**10:** Signal conditioning circuits.
4: Pressure sensor support.	**11:** Data acquisition board.
5: Pillow holder.	**12:** Network cable.
6: Pillow.	**13:** Microcomputer.
7: Pressure sensor.	**14:** Screw.
	15: Cables from the deformation sensors.
	16: Cable.
	17: Nut.

The support of the support (4) of stainless steel in the desired position is accomplished by two screws (3) that cross the mechanical structure (2) and the height is adjusted adjusting two nuts (1). The cushion (6) for the palm of the hand (PH) is fixed to the support (5) of stainless steel that measures 1 cm of thickness, 3 cm of width and 14 cm of length and its ends are fixed to the mechanical structure (2) by means of two screws (14) fixed by two nuts (17) that allow the replacement of this set by another model that has cushion that considers the presence of deformities or lesions in the PH.

When the PH compresses the cushion (6) and the four fingers: index, middle, annular and minimum compress the domes of the pressure sensors (7), the HGF and also four individual GFC appear. Each pressure sensor (7) is connected to Wheatstone Bridge (WB) while all four strain sensors (8) are connected in a single WB as shown in Figure 2.
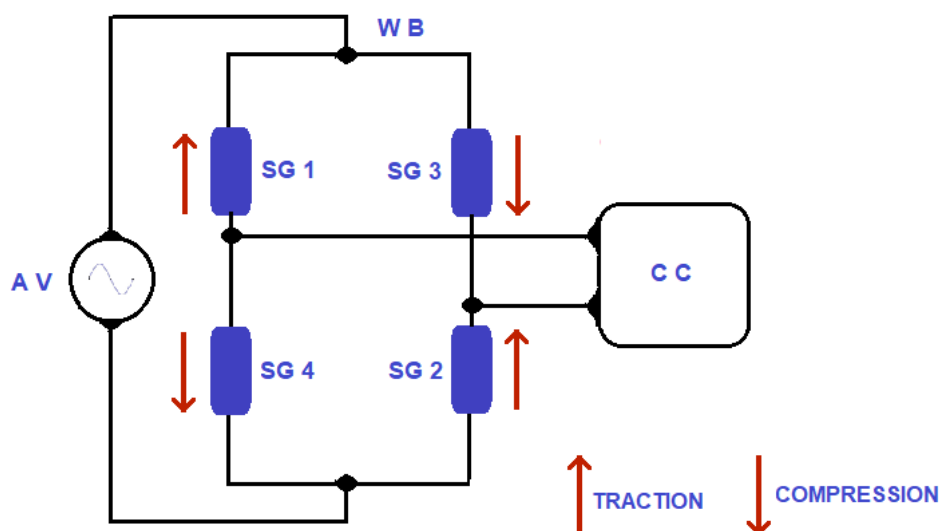
Figure 2. Wheatstone Bridge with strain gage.

Caption

SG 1 and SG 2: Strain gage 1 on the right side and strain gage 2 on the left side of the outer surfaces of the mechanical structure (2).

SG 3 and SG 4:   Strain gage 3 on the right side and strain gage 4 on the left side of the inner surfaces of the mechanical structure (2).

CC: Signal conditioning circuit.

AV: Power supply voltage.

The WBs are powered by the oscillators of the five signal conditioning circuits (DC) with 15 V peak sinusoidal voltage and 20 kHz frequency and when stimulated with static or dynamic HGF and GFC applications, they generate analog responses of voltage x time, which are modulated, amplified, filtered and transformed into DC voltage (direct current) by means of peak detectors. These CCs have identical configuration, being developed with operational amplifiers LF 356, OPA27 and OPA27GP of the company Burr-Brown.

Each response generated by CC is then scanned on the data acquisition board (11) and sent to Dell's Inspiron 15 3000 microcomputer via the network cable (12) to be processed and presented by National Instruments' Labview software. Figure 3 shows the layout of the signal conditioning circuit. Figure 3 shows the layout of the signal conditioning circuit.

Figure 3. Signal conditioning circuit.

The calibration of the strain sensor (8) was initially performed by gradually placing standardized masses of 10 kg, in the range of 0 to 70 kg, in a basket hung from the support (5). In the opposite direction, it was performed the gradual removal of the masses of 10 kg of the basket until returning to 0 and this process was repeated four times in which Figure 4 shows the response in Volts of the DBM.

The calibration of the pressure sensors (7) was initially performed by gradually placing standardized masses

of 10 kg, in the range of 0 to 70 kg, in a basket hung from the support (4). In the opposite direction, the removal of the masses of 10 kg was gradually performed until returning to 0 and this process was repeated four times for each of the four pressure sensors (7). However, as these sensors are identical and consequently their responses, Figure 5 shows the response in Volts of DBM for only one pressure sensor (7).

In Figure 6 shows a dynamic test with HGF and GFC application by hand. This test aimed to verify the response in Newton of the DBM.

3. Results and Discussion

In Figure 4 shows the linear behavior of the graphs when placing and later removing masses of 10 kg, showing an accuracy of   98%; however, in the interval between 20 kg and 60 kg, there was a small variation between the straight lines, caused by the stiffness of the glue used to fix the four SGs in brass.
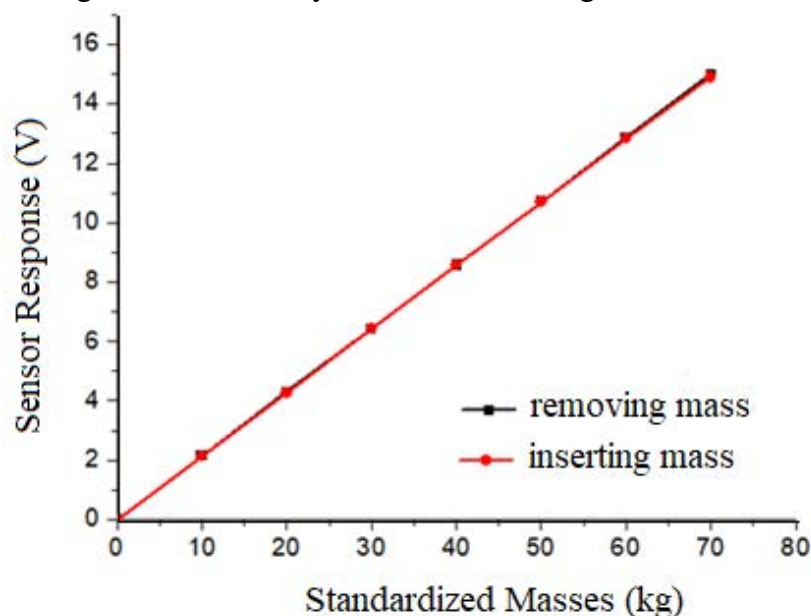
Figure 4. Calibration of the strain sensor.

In Figure 5 also shows the linear behavior of the graphs, when placing and later removing masses of 10 kg with an accuracy of 99.5%. It is understood that the result was caused by the adequate relaxation of the glue used to fix GSs in this second phase.
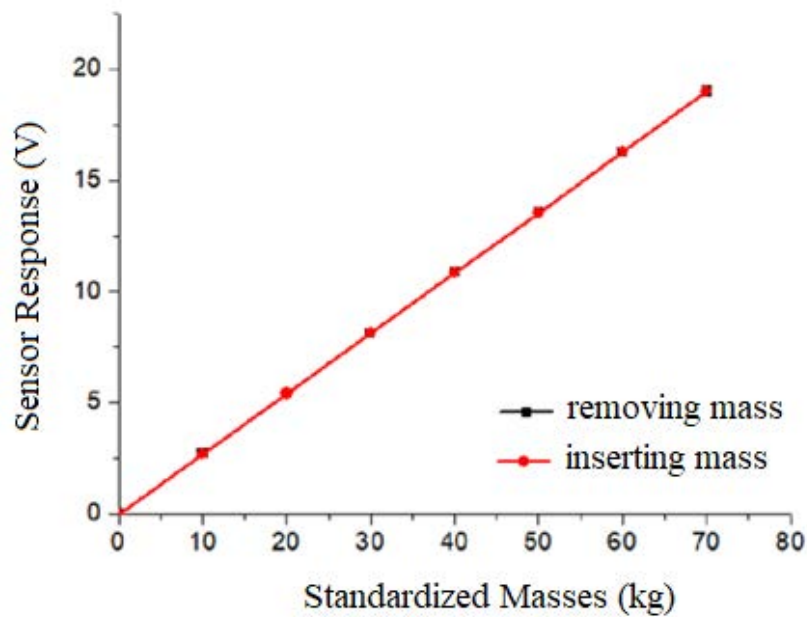
Figure 5. Pressure sensor calibration.

In Figure 6 shows a small difference in the amplitudes of the DBM responses due to the fact that the strain sensors (8) and the sum of the responses of the pressure sensors (7) have different sensitivities as presented in the previous calibration graphs. However, these sensors have reliable responses and high accuracy.
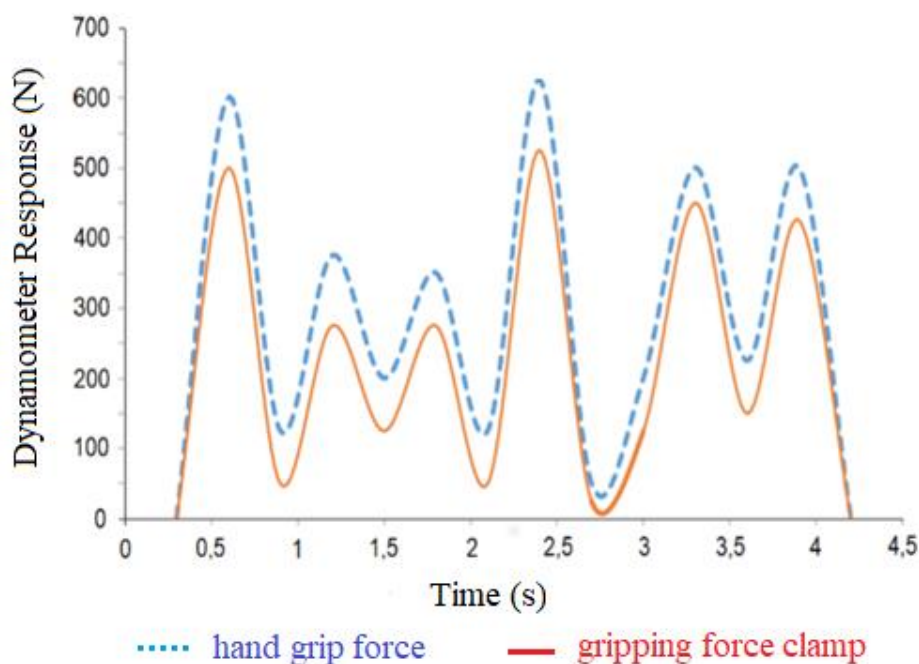
Figure 6. DBM dynamic response.

4. Conclusions

In this research, a biomedical mechatronic dynamometer was presented that has the potential to objectively and accurately measure both static and dynamic HGF and GFC, whose behaviors may be related to the effects of leprosy when they affect the hand. This device sought to contemplate the demands of the health

area such as ease to adjust the spacing between the rigid supports (4) and (5) in order to accommodate hands of different dimensions, replace the cushion (6) for the PH, considering the presence of lesions or deformities that cause difficulty in performing the tests.

Another relevant characteristic refers to the use of brass in the mechanical structure in order to facilitate machining, reduce its mass so as not to cause muscle fatigue in people with the disease and also reduce the cost of the equipment, to make it accessible to clinics and hospitals. In addition, the information processed by the microcomputer can be plotted, stored in a database or sent through an internet network to other places of interest in the health area.

For future developments it is suggested to develop the mechanical structure using polymer instead of metal because the polymer besides being an insulator has an even smaller mass.

Finally, this device will provide relevant information about the effects of leprosy on the hand, allowing the health professional to adopt appropriate treatment and to monitor its evolution over time. In addition, the equipment will have strong social appeal since the tests are easy to perform and non-invasive.

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Experimental Models in Rheumatoid Arthritis: A Systematic Review using the IRAMUTEQ software

Verônica Assalin Zorgetto-Pinheiro (veronica.azp@outlook.com)

MSc., PhD Fellow at Health and Development in West Central Region Graduate Program, Medical School (FAMED), Federal University of Mato Grosso do Sul (UFMS), Campo Grande-MS, Brazil.
ORCID: 0000-0001-8898-4216

Alexandre Meira de Vasconcelos

PhD, Adjunct Professor at Natural Resources Graduate Program, College of Engineering, Architecture and Urbanism and Geography (FAENG), Federal University of Mato Grosso do Sul (UFMS), Campo Grande-MS, Brazil.
ORCID: 0000-0003-0824-9495

Rafael Sanaiotte Pinheiro

PhD, Adjunct Professor at College of Engineering, Architecture and Urbanism and Geography (FAENG), Federal University of Mato Grosso do Sul (UFMS), Campo Grande-MS, Brazil.
ORCID: 0000-0001-9524-6131

Danielle Bogo

PhD, Adjunct Professor at Health and Development in West Central Region Graduate Program, Medical School (FAMED), Federal University of Mato Grosso do Sul (UFMS), Campo Grande-MS, Brazil.
ORCID: 0000-0003-0233-3047

Iandara Schettert Silva

PhD, Associate Professor at Health and Development in West Central Region Graduate Program, Medical School (FAMED), Federal University of Mato Grosso do Sul (UFMS), Campo Grande-MS, Brazil.
ORCID: 0000-0001-9431-098X

Abstract

Rheumatoid arthritis is an autoimmune and chronic pathological condition characterized by an inflammatory process of the joints It is a complex and multifactorial, involving genetic, epigenetic and environmental factors and the use of experimental models is required to better understand its pathology and for drug testing. The aim of this study was to perform a systematic literature review on experimental models in rheumatoid arthritis using IRAMUTEQ, a software that analysis, qualitatively and quantitatively, text fragments, as a methodological tool. After searching for articles published in the last five years on Scopus database and applying the exclusion criteria, we ended with 84 articles. The most commonly employed experimental models was the arthritis induction by inoculation of the Complete Freund's

Adjuvant (CFA), followed by the use of combined methodologies and the collagen-induced arthritis (CIA). The analyses of abstracts by the IRAMUTEQ software provided a classification according to their textual elements in four classes, which were grouped into three main themes: in vivo models (class 1), clinical practice and traditional medicine (classes 2 and 3) and in vitro models (class 4) and it was also possible to build a similarity tree of the terms present in the abstracts and a word cloud with the most cited terms. Thus, the use of the IRAMUTEQ software as a methodological tool has been satisfactory, since it was possible to identify the main experimental models used, keywords, pathological processes and molecules involved in the pathogenesis of rheumatoid arthritis free of the researchers' bias, in addition to being a tool for visual and intuitive results.

Keywords: Rheumatoid arthritis; Experimental models; IRAMUTEQ; Content analysis

1. Introduction

Rheumatoid arthritis is an autoimmune and chronic pathological condition characterized by an inflammatory process of the joints and, with the evolution of the disease, bone and cartilage loss due to fibrovascular infiltration in the affected tissue being responsible for motor impairment if not controlled. Usually the synovitis is installed preferably in small joints (feet and hands), leading to incapacitation of carrier in simple tasks of daily life if not controlled.

The pathogenesis of rheumatoid arthritis is complex and multifactorial, involving genetic, epigenetic and environmental factors. Despite the drugs available present positive effects in disease control for most of the population, diseases of autoimmune nature continue to be a vast field of research to the elucidation of pathophysiology and search for alternative therapies for better control of the disease. Central aspect of the pathogenesis is the activation of macrophages by autoreactive T cells resulting in the production of pro-inflammatory cytokines such as tumor necrosis factor alpha (TNF-α) and interleukins 1, 6 and 17 [1], [2]. According to Caplazi et al. [3], therapeutic strategies and research has addressed the immunotherapies that targets the inflammatory cytokines and/or their receptors, the events that trigger the generation and recruitment of autoreactive T cells, the role of antigenic variants of autoreactive T cells against citrullinated antigens and the presence of citrullinated antobodies, which has been linked to the development and progression of autoimmune diseases [4].

Although also affects the joints as well as causes the symptoms of chronic inflammation, leading to cartilage and bone loss, osteoarthritis has big differences when compared to rheumatoid arthritis and cannot be studied and treated the same way. Both are inflammatory manifestations in the joints, but while osteoarthritis is induced by multifactorial mechanisms triggered basically by biomechanical stress in a particular joint, rheumatoid arthritis is triggered by a systemic autoimmune process that affects multiple joints at the same time to bilateral way and is characterized by a chronic inflammation that manifests itself in cycles of activity and remission. Due its autoimmune origin, the rheumatoid arthritis also carries with it some comorbidities, such as cardiovascular problems related to the formation of atherosclerotic plaques, higher risk of developing tumors and immune dysfunctions, increasing the risk of bacterial, viral and fungal infections [5], [6], [7].

Besides the difference regarding the pathogenesis, recent researches have shown epigenetic differences,

involving patterns of histone acetylation and methylation, expression patterns of serum inflammatory cytokines and matrix metalloproteases, different patterns of oral microbiota and distinct secretory activity in the joint and subcutaneous adipose tissue [6], [7], [8], [9], [10].

The IRAMUTEQ (Interface de R pour lês Analyses Multidimensionnelles de Textes et de Questionnaires), a textual content analysis software created by Frenchman Pierre Ratinaud, uses the Phyton language and makes use of statistical tools of the R software, which promotes an impartial and optimized analysis of textual content to address a given topic to be studied, in addition to providing you with the results in the form of dendrograms, similarity trees and word clouds [11].

The analysis is based on the concept of descendent hierarchical classification (DHC), which sorts the text segments on the basis of their respective vocabularies. This classification aims at obtaining classes of elementary context units (ECU) which includes the amount and average frequency of words in different texts. Therefore, within the same class, the ECU presents similar vocabulary to each other, and a different vocabulary if compared to the ECU from other generated classes It is also possible to be made a factorial correspondence analysis (FCA) from the DHC, which allows us to analyze the statistically most significant words of each generated class plotted on a cartesian plane [12].

It is scarce the amount of scientific articles that have made use of this methodology for research on systematization of a literature review, but we can highlight the work of Broc et al. [13], in which the qualitative analysis of the opinion of surgeons in order to find out the factors that influenced significantly the decision-making process of these professionals in the treatment of patients with colorectal tumors. After analysis, it was possible the separation of the factors influencing decision making in five different classes (factors related to the opinion/desire of the patient, prior knowledge of the surgeon, aspects of treatment, tumor aspects and organizational aspects) and it was observed that all the criteria for a decision, biomedical (tumor) or heuristics (experience of the surgeon), converged to a single central factor (age) in the analysis of similarity. That way, they could propose an explanatory model where it was possible to check how heuristic factors impacted on medical affairs (diagnosis, prognosis and treatment) and, consequently, in decision making.

Another aspect that can be addressed by using the software as a methodological tool is the identification of central lexical items and their peripheral system on similarity analysis. Thus, from the verification of the connectedness of the terms, it is possible to infer which co-occur in terms more often and, from this premise, make use of these terms as a guide for the preparation of revisions of a particular topic of interest. The more branched the similarity tree generated is, will be the broadest web of interrelations on a determining issue [14].

In the light of the stated above, our goal was to perform a systematic search of the literature on experimental models in rheumatoid arthritis using IRAMUTEQ software as a methodological tool.

2. Methodology

Articles published between 2014 and 2018 and indexed in Scopus platform using the directories "rheumat* arthritis" [AND] "experiment* model" were selected according to the following exclusion criteria: (a) review articles; (b) absence of abstract available; and (c) other pathological condition addressed.

For textual content analysis, we used the IRAMUTEQ software (Interface de R pour lês Analyses Multidimensionelles de Textes et de Questionnaires), which did the analysis of the articles' abstracts that were grouped into a single file in text format (.txt), called textual corpus. For each abstract, have been assigned the following identification directories: first author of the article and experimental model used. By being connected to the software platform of R, it was possible the analysis of multivariate and content as the frequency of words, factorial analysis of correspondence of word classes and the directories used, analysis of similarity and word cloud, enabling a qualitative and quantitative analysis of the abstracts.

3. Results and Discussion

The search for articles in Scopus platform that were involved in research about rheumatoid arthritis using experimental models resulted in a total of 112 articles published between 2014 and 2018. Among this total, 28 were excluded from subsequent analysis articles, where 19 of them were about other pathological conditions, 8 were reviews of literature and 1 did not contain abstract available, totaling 84 articles for review of abstracts through the software IRAMUTEQ (Figure 1).
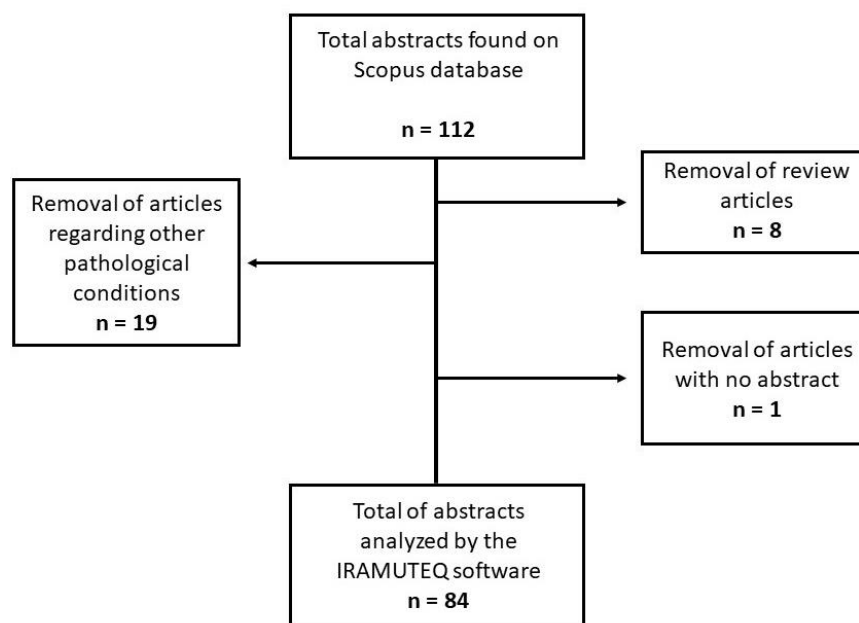
Figure 1. Flow diagram regarding the selection process of the articles on "rheumatoid arthritis" and "experimental models" searched on Scopus database and published between 2014 and 2018.

When it comes to the experimental models employed in the development of research in rheumatoid arthritis, the most commonly employed are the induction by inoculation of the Complete Freund's Adjuvant (CFA), accounting for 31% of the abstracts surveyed, followed by the collagen-induced arthritis (CIA), present in 18% of the abstracts surveyed. Most of the researches are also carried out using combined methodologies, i.e. more than one type of induction, named in our research as multiple methods (mult), accounting for 26% of the surveyed abstracts. (Figure 2).
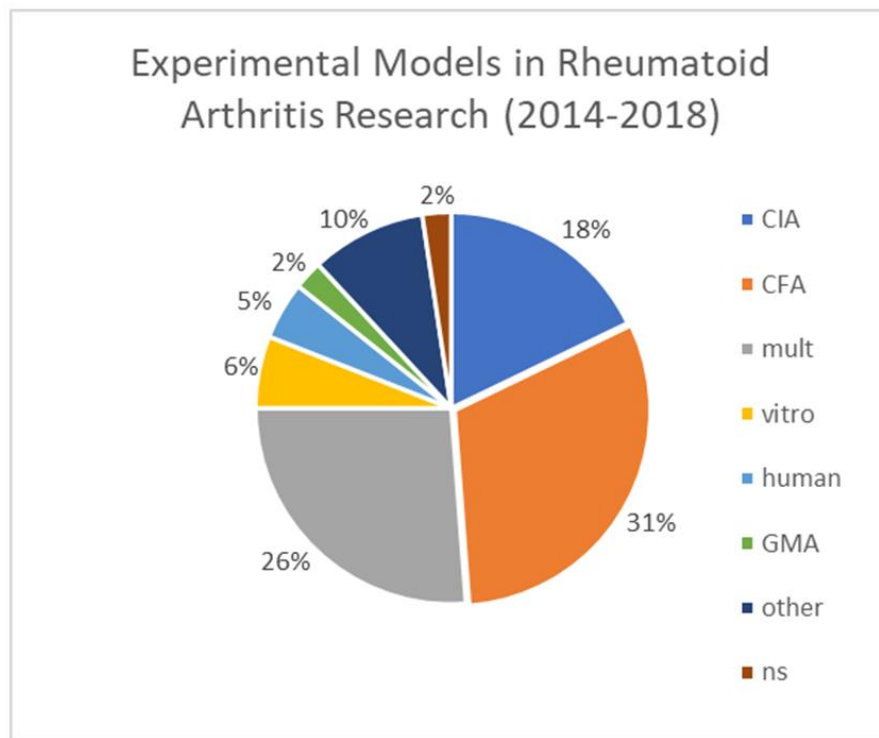
Figure 2. Frequency of the experimental models used on rheumatoid arthritis research in published abstracts on Scopus database between 2014 and 2018 (n=84).
CIA: Collagen-induced arthritis. CFA: Complete Freund's Adjuvant. Mult: multiple models Vitro: in vitro models. Human: use of patients' samples. GMA: Genetic modified animals. Other: other models. NS: Non-specified.

The textual content segmented and analyzed by DHC is represented in the form of a dendrogram, where we can observe the stratification of the textual elements in four distinct classes and, within each class, the terms with the highest occurrence (Figure 3). This representation allows us to infer the distance between textual content, being the class 1 more distinct and the classes 2 and 3 closer to each other. This proximity and even interrelationship can also be visually observed on the cartesian plane representation of the FCA (Figure 4).

Descending Hierarchical Classification – Experimental Models on Rheumatoid Arthritis Research

In Vivo Models

Clinical Practice and Traditional Medicine

In Vitro Models

(36.02%)
CLASS 1

Word	%	χ^2
rat	76.67	50.67
group	95.65	37.67
control	82.35	34.64
day	85.71	32.28
level	70.37	32.0
paw	87.5	29.38
compare	80.5	29.06
gastrocnemius	100.0	25.78
serum	93.75	24.11
IL1	93.33	22.22

(15, 16, 17, 18)

(32.75%)
CLASS 2

Word	%	χ^2
therapeutic	77.08	48.74
model	66.67	32.66
study	59.49	32.04
rheumatoid_arthritis	50.71	31.71
development	90.0	31.35
investigate	86.36	30.4
disease	65.31	26.91
potential	75.0	20.71
mechanism	76.19	19.0
experimental models	73.91	18.79

(19, 20, 21, 22)

(17.13%)
CLASS 3

Word	%	χ^2
anti_inflammatory	58.82	45.54
extract	100.0	39.5
property	78.57	38.6
agent	75.0	29.2
drug	75.0	29.2
previous	100.0	24.5
activity	44.74	22.57
report	70.0	20.2
anti_tnf	61.54	19.67
immunomodulatory	75.0	19.26
antioxidant	75.0	19.26

(23, 24, 25, 26)

(14.11%)
CLASS 4

Word	%	χ^2
cell	69.77	123.31
Treg	100.0	88.37
Th17	84.21	80.94
activate	91.67	61.44
Th17	87.5	36.3
macrophage	61.11	34.38
Tcell	100.0	30.83
STA21	85.71	30.16
FOXP3	85.71	30.16
IFN	66.67	28.21
suppress	50.0	24.77
polarization	83.33	24.1
enhance	63.64	22.91
monocyte	71.43	19.32

(27, 28, 29, 30)

Figure 3. Dendogram of the Descending Hierarchical Classification (DHC) with the percentage of Elementary Context Units (ECU) of each class.
Words with greater chi-square and abstracts classified in each class provided by the IRAMUTEQ software, 2019.

The representation of the FCA in a cartesian plane makes the separation of the classes intuitive and practical, so that we can visually identify the class 1 and class 4 more clearly separated from the other two remaining cl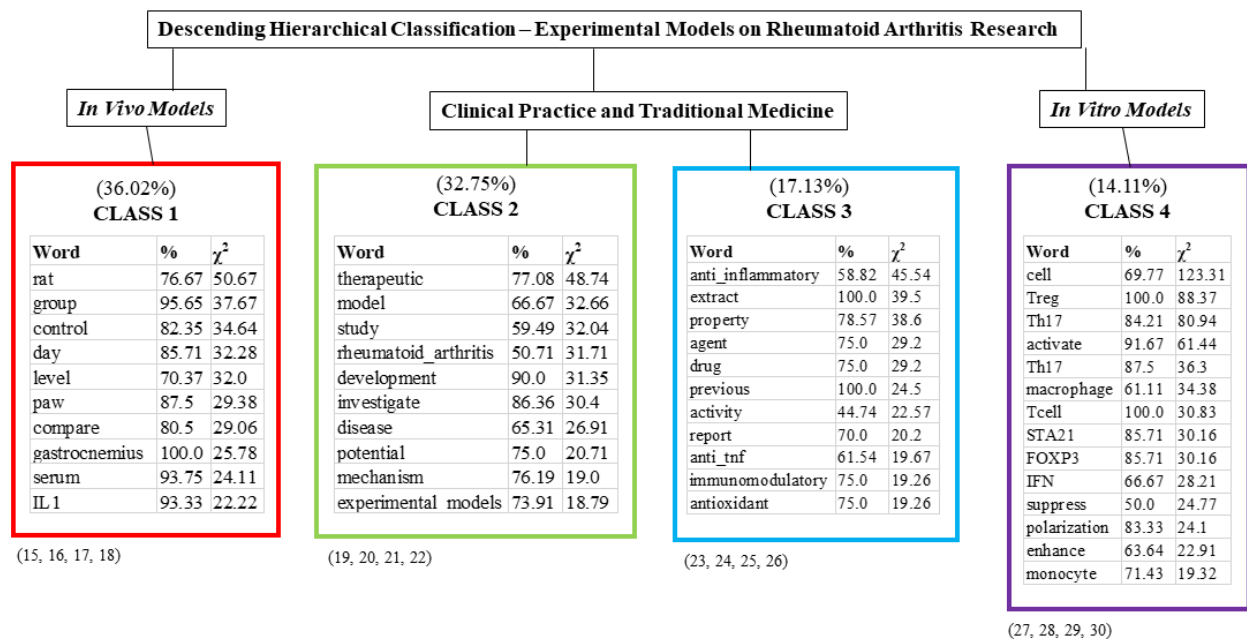asses, which are visually connected, and can be considered as a single class. In this representation you can also view the terms that have high frequency (greater qui square) within each class; most frequently terms are represented in major fonts and, less frequently, in smaller fonts (Figure 4a).

When interpreting the results from the DHC and FCA, it was able to name the main areas of study of the research topic. The class 1 stick with the terms relating to the use of model experiments in animals, such as: rat, group, control, day, level and paw. The classes 2 and 3, which may be grouped together due to the apparent overlap of their terms in the FCA, made use of terms referring to the epidemiological characteristics, clinical and observational data, the main ones being: therapeutic, model, study, potential, anti-inflammatory, extract, property, drug, among others. The class has 4 terms of Immunology and areas of cultivation of cells to investigate the modulation and control of serum levels of biomarkers such as interleukins and Cytokines and comparing the effect of therapeutic targets in the increase or decrease of these factors, correlating them. We can also observe the use of alternative models, in vitro techniques and genomic analysis, proteomics and biotechnology for the great quote of terms such as: cell, Treg (T regulator lymphocyte), Th17 and Th1 (T helper lymphocytes responsible for production of interleukins 1 and 17), macrophage, IFN (interferon), mesenchymal stem cells, polarization, production, proliferation, among others. Thus, it was possible the correlation of the themes of these generated classes (1-in vivo Models 2 and 3-extrapolation of experimental data for clinical practice and use of medicinal plants and 4-in vitro Models) with some of the abstracts researched and experimental models used (Figure 4b).
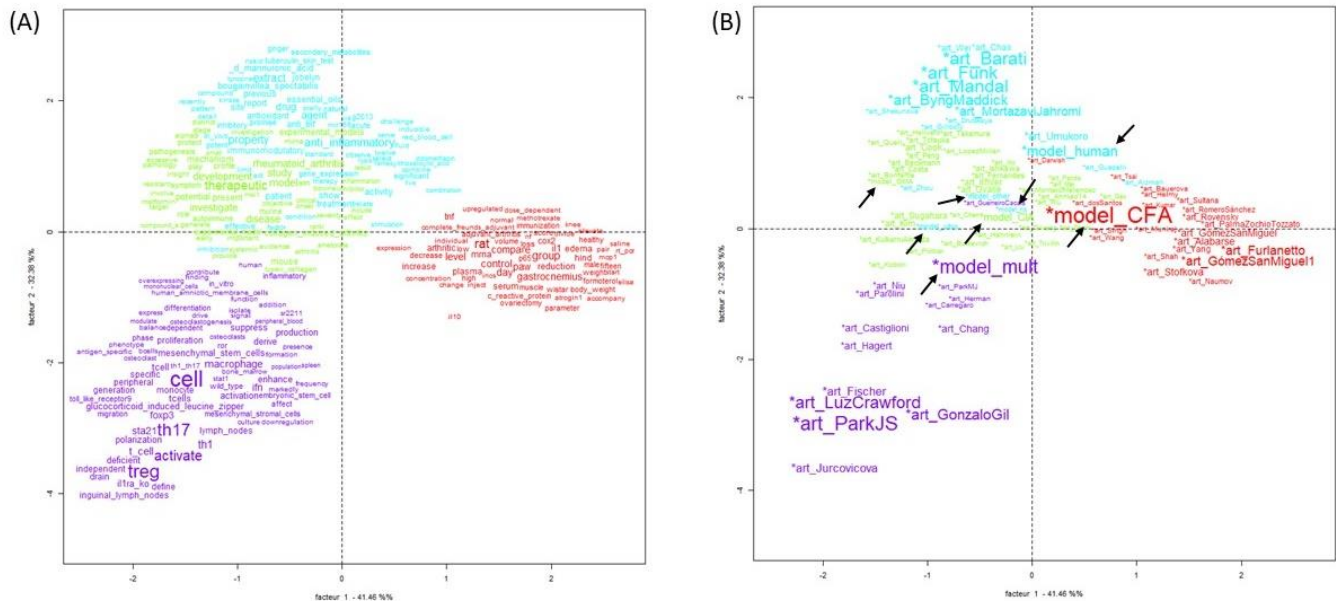
Figure 4. (A) Factorial representation generated from the DHC of the ECU provided by IRAMUTEQ software. (B) Factorial representation generated from the DHC of the directories attributed on the analyzed abstracts (n=84) provided by IRAMUTEQ software, 2019.
Circles: experimental model. CIA: Collagen-induced arthritis. CFA: Complete Freund's Adjuvant. Mult: multiple models Vitro: in vitro models. Human: use of patients' samples. GMA: Genetic modified animals. Other: other models. NS: Non-specified.

Despite the experimental models be sorted by the software as belonging to different classes and since they are more widely used to meet grouped around the center of the cartesian axis, not necessarily the articles classified in the same class of a particular experimental model, will present the use of this model. It is worth noting that the software makes the classification according to the textual corpus of each abstract, bringing articles to a particular experimental model due to language and terms employed.

The similarity analysis is based on graph theory and identifies the co-occurrence between words in a text segment, indicating the connectedness between words with greater frequency in the abstracts. The analysis result is obtained in a graphical format of a tree formed by the lexical items, the central topic of research, and peripheral items attached to it. The closer a lexical item to another, closer are in same text segment, and the more branched perform similarity tree, widest is the interrelation of the terms and the search object [12].

The similarity tree generated in our review of the literature does not have many branches, being almost linear, which demonstrates the robustness in the scientific method of investigation of rheumatoid arthritis by research groups from different places in the world. The software was able to identify the central theme of the research, rheumatoid arthritis, experimental models mostly used by researchers, induction by collagen type 2 and use of Freund's complete adjuvant (adjuvant arthritis), key issues in the pathogenesis as the terms joint, chronic, autoimmune, inflammatory, macrophage, TNF (Tumor Necrosis Factor), cytokines, and terms related to the scientific methodology to develop in vivo models, as the animals used,

rat and mouse, and the terms group and control. (Figure 5).
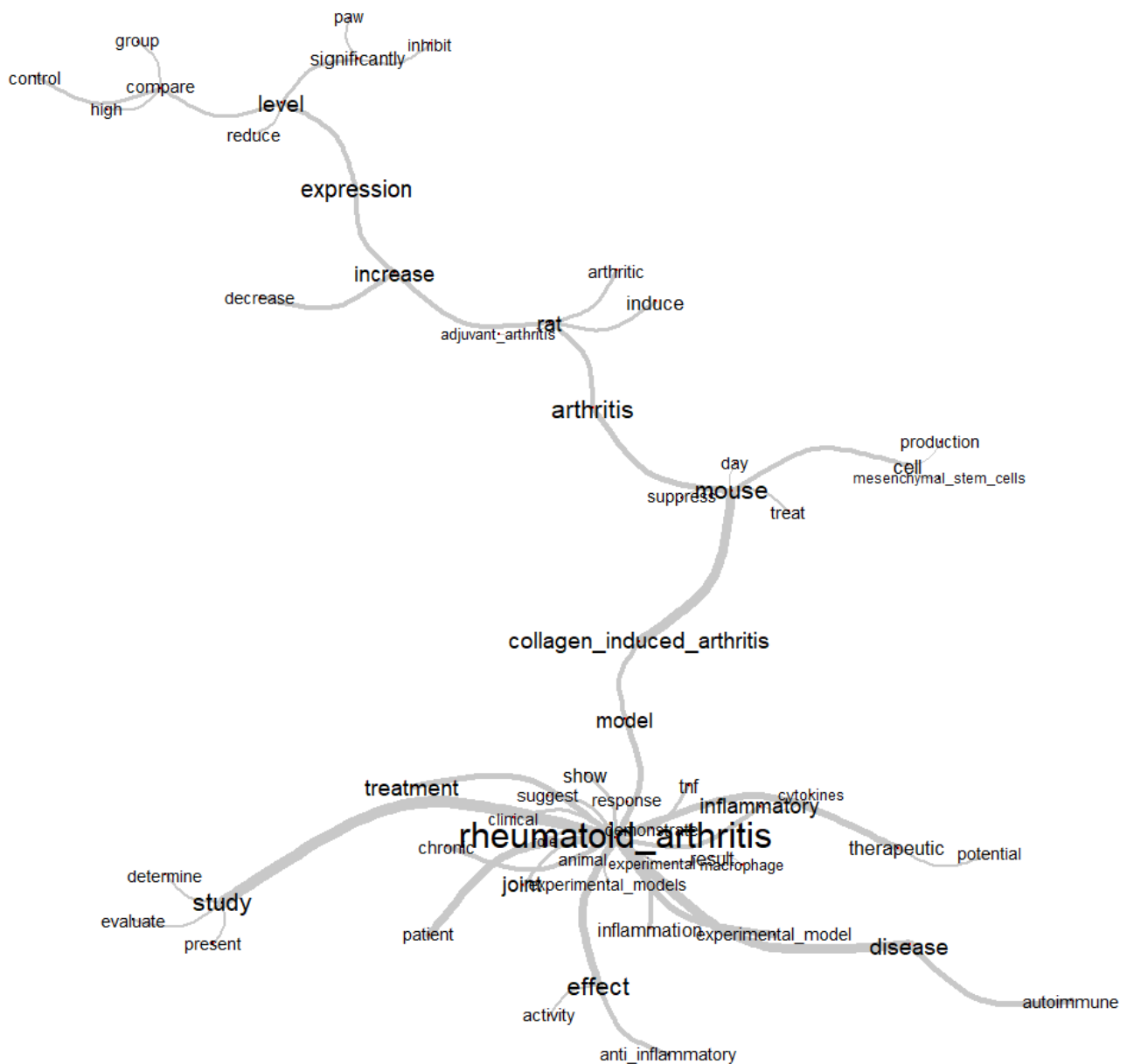
Figure 5. Similitude tree generated from the selected abstracts (n=84).
It expressess the proximity relation between the highest frequency terms in the same period of textual corpus (provided by IRAMUTEQ software, 2019)

We can observe that the words around the central theme, rheumatoid arthritis, are related with terms found in the early part of the abstracts (background), where it is described the etiology of the disease. Then, distancing from the central theme are the terms associated with the experimental model used and the methodology employed. And, finally, the developments of the research. That way, all the branches were isolated from the similarity tree with its central lexical items and its peripheral system and from the

verification of the connectedness between words, it was possible to identify the central theme of the research and its main developments (Table 1).

Table 1. Identification of the central theme, peripheral themes and their developments in the similitude tree generated from IRAMUTEQ software, 2019.

CENTRAL THEME	PERIPHERAL THEMES	DEVELOPMENTS	STEP OF THE STUDY
Rheumatoid Arthritis	Disease	Autoimmune	Background
	Effect	Activity	
		Anti-inflammatory	
	Joint	-	
	Patient	-	
	Macrophage	-	
	Inflammation	-	
	Cytokines	-	
	TNF (Tumor Necrosis Factor)	-	
	Experimental Model	-	
	Response	-	
	Study	Evaluate	Methodology
		Determine	
	Mouse	Collagen-induced Arthritis	
		Treat	
		Suppress	
	Cell	Production	
		Mesenchymal Stem Cells	
	Rat	Adjuvant Arthritis	
		Induce	
	Expression	Increase / Decrease	Results
	Level	Reduce	
		Significantly	
		Inhibit	
		Paw (edema)	
	Compare	Group	
		Control	

Also as part of the review of abstracts by IRAMUTEQ software, it was generated a wordcloud in which the terms with greater frequency are organized graphically, allowing rapid identification of keywords of a set of texts. The bigger the font and more centered on the cloud, the greater the frequency of the word (Figure 6).

In this way, we can identify around the topic of research, rheumatoid arthritis, the terms related to the main

experimental models used, collagen-induced arthritis, mouse, inflammatory, anti-inflammatory, experimental model, treatment, study, expression, therapeutic, autoimmune, joint, patient, targeted-molecules/compounds used in the researches among others with smaller co-occurrence between abstracts search (Figure 6).
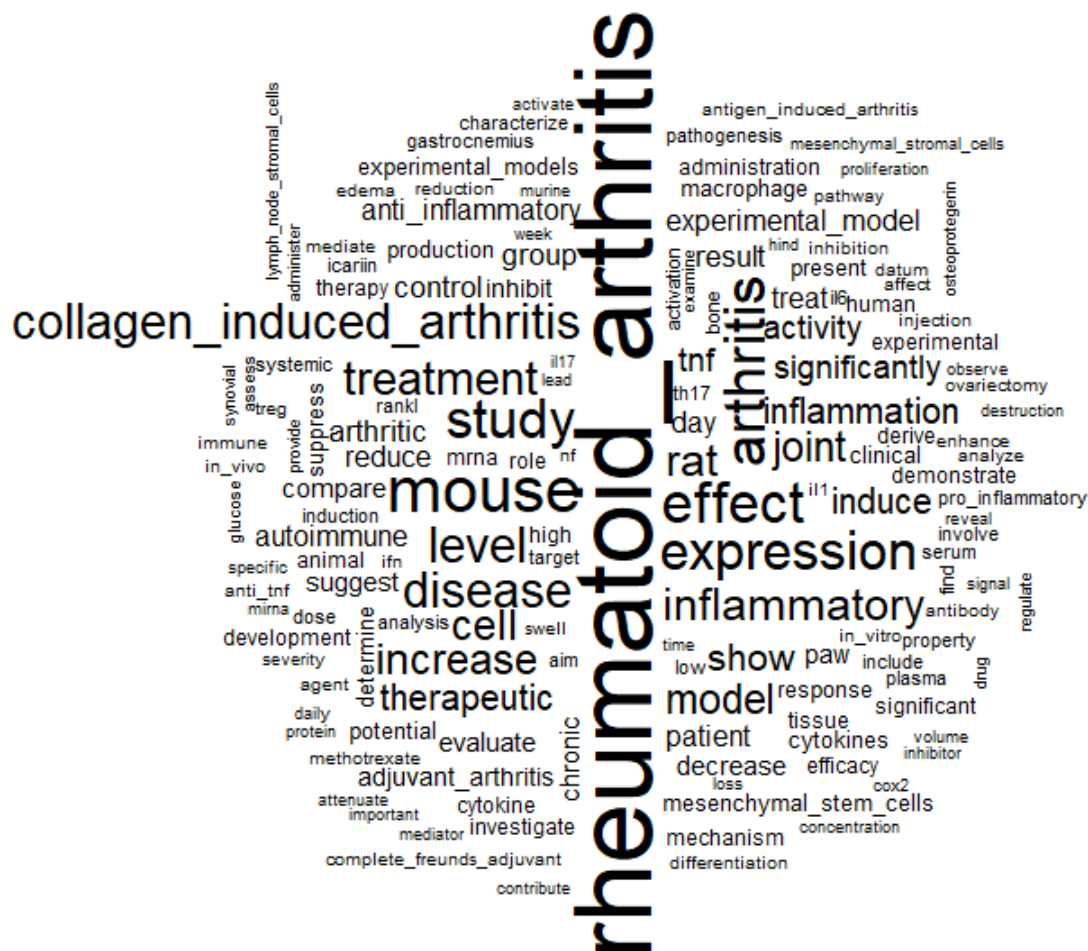
Figure 6. Word cloud generated from the terms' frequency in the selected abstracts (n=84). Bigger letters mean higher frequencies and smaller letters mean lower frequencies (provided by IRAMUTEQ software, 2019).

5. Conclusion

The experimental models most used in studies published in the last 5 years were the use of Freund's Complete Adjuvant (model of adjuvant arthritis) and the combined use of multiple models in the same study, followed by the collagen-induced arthritis model.

The abstracts were classified according to their textual elements in four classes by the IRAMUTEQ software, which were grouped into three main themes: in vivo models (class 1), clinical practice and traditional medicine (classes 2 and 3) and in vitro models (class 4).

The use of the IRAMUTEQ software as a methodological tool has been satisfactory, since it was possible to identify the main experimental models used, keywords, pathological processes and molecules involved in the pathogenesis of rheumatoid arthritis free of the researchers' bias, in addition to being a tool for visual

and intuitive results.

6. Acknowledgement

7. Competing Interests

The authors declare no competing interests.

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Impact of Gamification on Brain Activity and Learner Performance: An in Class Concurrent Measurement

Peace Mabeta [1]*, Priyesh Bipath[1], Murray Louw[2] , Jannie Hugo[2]

[1]Department of Physiology, [2]Department of Family Medicine, School of Medicine, Faculty of Health Sciences, University of Pretoria, Pretoria, South Africa

* Correspondence: peace.mabeta@up.ac.za; Tel.: (+27) 123192907; Fax: +27-012-321-16-79

Abstract

The optimal application of gamified methods in the teaching of Physiology requires research, as evidence on its impact is rudimentary. The purpose of this study was to determine the effects of gamification on learner attitudes, student performance scores, and brainwave activity in a Physiology learning environment. A cohort of 14 students from the first year Bachelor of Clinical Medical Practice program were randomly assigned to the gamified (G) and non-gamified (N-G) groups. The G group participated in a gamified activity, while the N-G group participated in a didactic teaching setting. The students were assessed on the same content. Electroencephalogram (EEG) recordings were measured using a MyndBand device during student participation in the assigned activities. Software algorithms computed attention and meditation brainwave signals that had been recorded during the testing sessions. The results of the study revealed higher performance scores in the G group when compared to the N-G group. Results also showed a higher median brainwave activity for attention signals in the G than in the N-G group. There was a positive correlation between median attention signals and performance scores. These preliminary findings on the use of gamification in a Physiology classroom setting indicate an improved cognitive outcome that is substantiated by the EEG brainwave attention signals.

Keywords: Gamification, EEG, brainwave activity, focused attention, meditative state, medical education, student performance

1. Introduction

Historically, the preclinical training of medical students has largely focused on didactic methods of teaching [1]. Developments in technology, as well as the challenge of increased learner-to-lecturer ratios, have necessitated the exploration of multiple learning media and approaches to enhance the learning experience. Furthermore, in complex multi-lingual and multi-cultural environments, creating an interactive classroom poses a challenge. Gamification, the application of gaming elements or mechanics to a non-gaming environment, has been employed in training programs in a variety of sectors and has the potential to alleviate the challenges posed by these complex-learning environments [2-4]. In the context of higher education, various studies have shown that gamification increases learner participation [5,6].

While gaming as a means of improving student motivation has been studied widely, observations have been mainly anecdotal. Most studies found that gamification increased motivation, but some other studies reported no improvement in motivation. [7-9] Furthermore, although gamified learning systems are increasingly being employed in higher education, evidence of their impact on student performance is still limited [10]. Additionally, there is a lack of Physiological data to show the effects of gamified systems on learner focus and concentration. Thus an investigation of the effect of gaming elements on brain activity may further enhance our understanding on the impact of gamification on student learning.

The physiology of memory and cognition are important facets in influencing student learning and academic performance [11-13]. A study monitoring brainwave patterns was previously employed to study brain activity by measuring parameters such as the attentive state [14]. The study showed that the attentive state is associated with learning effectiveness. [14] Generally, brainwaves are classified into various categories based on wave frequency; the theta waves (4-7.99 Hz), alpha waves (8-12,99 Hz), beta waves (13-29,99 Hz) and gamma waves (30-50,99 Hz) [15-17]. In particular, frequencies in the theta/alpha categories are associated with the meditative state, while beta frequencies are associated with the attentive state and focused mental activity [16,17]. Gamma waves are involved in simultaneous processing of information. The purpose of the current study was to investigate the effects of gamification on brainwave activity and whether the brainwave activity related to student performance in assessments and student perceptions of the learner experience.

2. Materials and Methods

2.1. Participants

The study involved a cohort of fourteen students from the Bachelor of Clinical Medical Practice (BCMP) who had enrolled for the first year Physiology module.

2.2. Gamification

The students were assigned randomly to two groups, the gamified (G) or non-gamified (N-G) groups, and the same Physiology course content was used for the two groups of students. Gaming elements in the form of the wheel of knowledge, a game adapted from the wheel of fortune, was employed in the gamified group, while no gaming activity was employed in the non-gamified group. In the latter group, didactic methods were used. In both groups, brain activity was measured while the students undertook the assigned activities. Students were assessed and gained points at the end of their activities. Students in the G group were also requested to provide input concerning their experience of the gaming activities.

2.3. Brain activity assessment

Each of the students in the two groups was fitted with an electroencephalogram (EEG) headset and brain wave activity was measured as they participated in the assigned activities. The MyndBand EEG headset (MyndPlay®, USA) was used for the EEG measurements.   The device headset measured raw EEG signals via two electrodes positioned on the forehead of each participant and a ground electrode earpiece. The raw EEG signals of 3 to 50Hz were recorded from which brainwave activity was computed with the NeuroView version 4 software (NeuroSky Inc., USA).

2.4. Statistical analysis

Comparison between the gamified and non-gamified groups were analyzed using the Student's T-test and the Mann-Whitney U Test at a significance of level of $p<0.05$. Analyses were performed using the SPSS (version 25, IBM) statistical software package.

3. Results and Discussion

The mean performance score for the N-G group was 16.9% while the mean performance score for the G group was 63.4% (Fig. 1). Nonetheless one student in the G group obtained a performance score that was in the similar range with scores attained by students in the N-G group. It is also important to note that in terms of formative assessment grades, the students were spread evenly between the two groups.

Thus, the differences in the average performance scores may be partly due to gamification. It is anticipated that an increase in sample size will give a better representation of the effect of gamification on student performance.
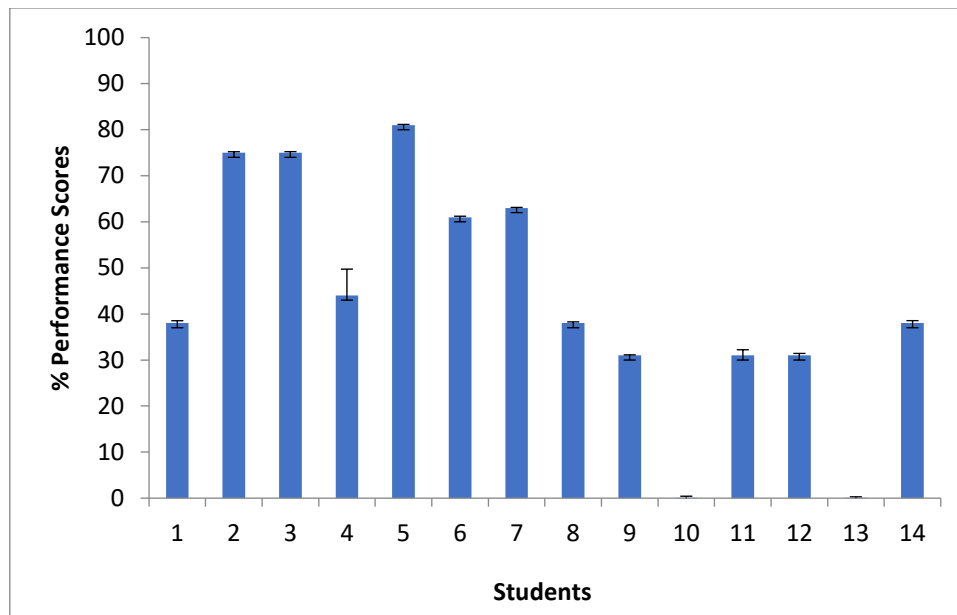
Figure 1.   Student performance on gaming (students 1-7) and non-gaming activities (students   8-14). Values are mean percentage scores ±SD.

A survey was conducted to determine participant experience with the gamification activities. In the first part of the survey, the students were asked to indicate whether the experience was positive, neutral or negative. All students except one indicated that they had a positive experience. One student indicated that his experience of gamification activities was neutral (Table 1). In the second part of the survey the students were asked to select phrases that describe their experience of the gamification exercise. Students in the gamified group indicated that they found gamification activities highly stimulating and that they were motivated to participate in learning activities (Table 1). In a recent study, Martin *et al.* (2018) observed an improvement in participation and team dynamics when game-based learning was employed [18]. In addition, the same study showed that students who participated in gamified activities were more aware of the level of their knowledge competence when compared with their peers [18].

Another study reported an improvement in intrinsic motivation, which is defined as participating in tasks due to the satisfaction derived from performing and completing activities rather than to attain high assessment marks [19]. Further, several other studies reported on the positive impact of gamification on the learner experience [20-22]. Taking the findings of the different studies as well as student feedback in the current study, it is plausible that gamified elements may have a role in encouraging motivation in the training of medical students [23]. Moreover, McCoy *et al.* (2016) reported on the potential benefits of gamified system in improving the training of medical students both at the pre-clinical and clinical levels [3]. However, according to some of these studies, there is a need for substantive evidence on the effects of incorporating gaming activities on learner performance [19-22].

Table 1. Gamified student's group perceptions of gaming activities

Participant no.	Experience	Student Comment
1	Positive	Great experience; Would prefer use of gamification in the teaching of Physiology
2	Positive	Enjoyed game; Would prefer use of gamification in learning
3	Positive	Enjoyed game; Would prefer use of gamification in the teaching of Physiology
4	Neutral	Made no difference; It would not make a difference if gamification was incorporated in the teaching Physiology
5	Positive	Enjoyed game; Would prefer use of gamification in the teaching of Physiology
6	Positive	Perfect experience; Would prefer the use of gamification in the teaching of Physiology
7	Positive	Best experience; Would prefer the use of gamification in the teaching of Physiology

In the present study, brain activity waves were measured to establish the impact of gamification on learner concentration. The algorithms generated Attention and Meditation brainwave values via a combination of frequencies from the Theta frequency (4-7.99Hz) which represents deep relaxation, to the Beta/Gamma frequencies (12 – 35Hz) which represent engaged, active to focused mind state. The average Attention and Meditation brainwave values were recorded per session for each participant and are indicated in Fig. 2.
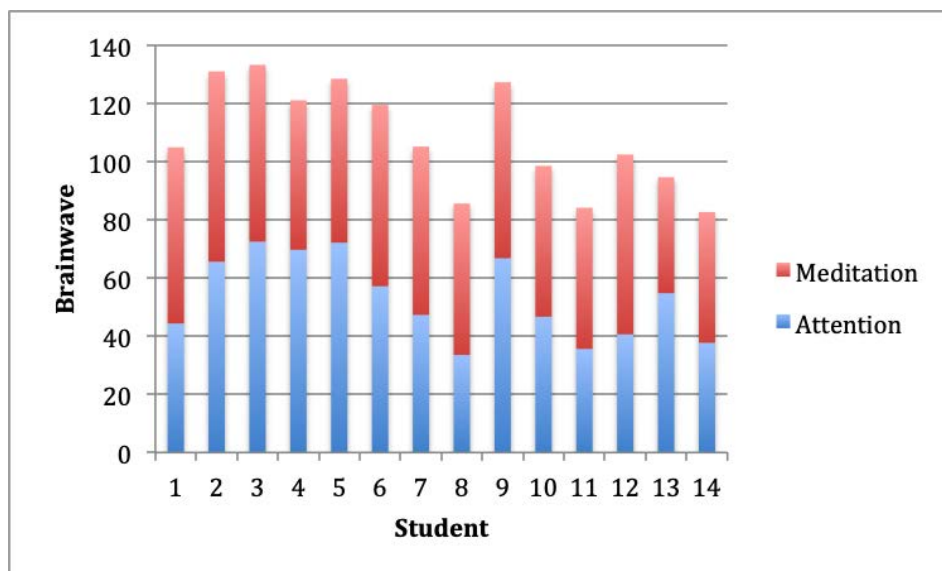

Figure 2. Brainwave activity measured in gamification (students 1-7) and non-gamification (students 8-14) groups.

The results showed that the mean Attention wave values were 45.14 ± 12.01 (mean wave frequency $\pm$ SD) in the N-G group. There was a significant increase ($p=0.024$) in the mean Attention wave values in the G group (61.29 ± 11.78). On the other hand, brainwaves that corresponded with the Meditative state averaged 59.26 ± 4.54 for the G group and 51.38 ± 7.90 for the N-G group ($p=0.053$). Furthermore, Attention wave values correlated positively with student performance scores (Spearman rho: 0.4089; $p<0.05$).

4. Conclusion

Our findings revealed an improvement in student performance when gamification was used, as evident from the higher average scores achieved by students in the G group. Furthermore, the improvement in performance scores correlated with increased attention. Contrary to our expectation, the meditation brainwave values were not lower in the gamification group. However, it must be noted that according to normal brainwave activity, an increase in the attention wave values does not necessarily imply a decrease in the meditative state. While there is limited empirical evidence on the impact of gamification on learner performance, our observations in this initial study suggest that the use of gamified elements in the teaching of Physiology may improve learner performance as well as attention. Further studies are underway using larger sample sizes to further investigate the impact of gaming activities singly and in combination with didactic approaches on formative assessment outcome.

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Conflicts of Interest

The authors declare no conflict of interest.

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Traditional Ecological knowledge of predicting rain for climate adapting in North Benin

Hermione Noumawudo ZOUNON[1], Nasser Mohamed BACO[1], Bienvenu Akowedaho DAGOUDO[2], Saddam Kadjogbé SAHAGUI[3]

[1]Laboratoire Société–Environnement (LaSEn), Department of Agricultural Economics and Rural Sociology, Faculty of Agronomy, University of Parakou

[2]Department of Agricultural Economics and Rural Sociology, Faculty of Agronomy, University of Parakou

[3]Department of Planning and Management of Natural Resources, Faculty of Agronomy, University of Parakou

Abstract

Traditional knowledge is base of decisions taking by local population affecting their livelihood. This traditional knowledge, focusing on practices and experiences highlighted the weather and climate information which is important for rain fed agriculture in Kandi commune. This research focuses on traditional knowledge of predicting rain through the climate indicators. It was carried in four districts 4 districts (Sam, Donwari, Kassakou and Sonsoro) of Kandi commune. Through 75 interviews (resource persons at least 40 years of experience) and 7 focus groups in the community, information was gathered about traditional climate and weather indicators and prediction tools. The snowball sampling technique was used to choose the respondents. Knowledge about climate indicator is exchanged, passed on from generation to generation and concerned plant species, animal species and astronomical elements. These climate indicators revealed onset of rain season, intensity of rain in full season and the end rain season. Multiple correspondence analyses with statistical software R Version 3.02 show three categories group. One shows the indicators such as wind, thunder, Cloud, Bird. The second group combines the factors transmit to member of family and acquire by initiation. The third group concerns bird indicator.

Keys words: rain season, traditional knowledge, climate indicator, predicts, Kandi.

Introduction

It is longtime the nature constitute a climate reservoir for predicting rain though indicators. It provides the provision of relevant, accessible and timely information to local population, especially those dependent on subsistence farming, which constitutes indigenous knowledge. Myriad studies (Parlee & Berkes 2006; Diawuo & Issifu 2015; Kafalew et al. 2015; Tugume et al. 2016) have shown the value of indigenous knowledge in the use, management and conservation of natural resources. Around the world, local peoples have developed environmental knowledge systems that have allowed them to continuously produce the food necessary for survival under different and varying conditions (Gliessman, 1999). Thus, populations in the African Sahel region have over the past years coped or adapted to extreme climatic events, especially

severe drought through their indigenous knowledge systems (Nyong et al., 2007). There has been a growing awareness that scientific knowledge alone is inadequate for solving the climate-crisis, and the knowledge of local and indigenous peoples is increasingly recognized as an important source of climate knowledge and adaptation strategies (Finucane, 2009; Nakashima et al., 2012). An increasing number of research and projects have focused on indigenous knowledge or traditional ecological knowledge and its relevance to our understanding of climate change and developing adaptation strategies. While most of this research focuses on the Arctic (Alexander et al. 2011; Cochran et al. 2013; Cruickshank 2005; Huntington et al. 2004; Ignatowski and Rosales 2013; Weatherhead et al. 2010) and the Pacific (Bridges and McClatchey 2009; Kelman et al. 2009; Lefale 2010), other regions are represented in Galloway McLean (2010), Green and Raygorodetsky (2010), Nakashima et al. (2012) and Salick and Ross (2009). Some of these studies demonstrate that local and indigenous knowledge can be corroborated by science (Adger et al. 2011; Alexander et al. 2011; Ignatowski and Rosales 2013), while others point out the limitations of such an exercise (Huntington et al. 2004; Weatherhead et al. 2010). This study focus on traditional knowledge of predicted rain for climate adapted. Traditional belief systems are often intricately intertwined with Traditional Ecological Knowledge (TEK) in which spirituality is rooted within the ancestral spirit-world and built from adaptive processes of trial and error of living with the land. Thus, TEK is a knowledge - practice - belief complex (Berkes and Folke 2002; Berkes, 2012) that has long been the organizing attractor around which the culture and practice of rural community life has persisted (von Heland and Folke 2014). TEK structures understanding of, and interaction with, the natural environment through establishment of formal constraints and norms of behaviour (Berkes and Folke 2002). According to the Intergovernmental Panel on Climate Change (IPCC), vulnerability is the degree to which a system is susceptible to, or unable to cope with adverse effects of climate change, including climate variability as a result of adaptive capacity (IPCC, 2001). Thus, vulnerability is determined by the degree of risk exposure, coping capacity and recovery potential (Blaikie et al., 1994). This brings to the fore the dual nature or structure of vulnerability, an external side and an internal side. The external side comprises the exposure to risks and shocks and the internal side, the capacity to anticipate, cope with, and recover from the damaging effect of the hazard (Bohle, 2001; Chambers, 2006; van Dillen, 2004). Thus, predicting rain is the capacity to anticipate the activities or the risks and shocks to cope. It has been constructed through detailed observations of the environment, such as the behavior of animals, changes in the morphology and the physiology of plants, patterns in the formation and properties of clouds, the appearance of the moon and other celestial bodies, and other meteorological phenomena that are useful to climate prediction (González, 2003; Avedaño, 2012). Berkes et al. (2000) indicate that traditional ecological knowledge is a key resource for adaptive capacity, not just in terms of knowledge content, but also through the process of knowledge generation and learning (Boillat and Berkes 2013). Of particular importance to adaptive capacity are TEK based practices that focus on managing change, building resilience and facilitating recovery following disturbance. Sillitoe underscores the importance of indigenous knowledge systems in research. He argues that indigenous knowledge is holistic and can facilitate interdisciplinary research towards accelerating development and addressing poverty in the Developing World (Sillitoe, 2004). Thus, this article focuses on ethnoecology and environmental anthropology in order to evaluate the traditional ecological knowledge or indigenous knowledge of local people in terms of rain prediction. Traditional ecological knowledge and

practices observed are described, analyzed and classified into groups through multiple correspondence analysis.

Methods

Study area

The commune of Kandi is located in department of Alibori, north-west of Benin. The population of Kandi was estimated 136 013 peoples (INSAE, 2015). It is located between 10°90' and11°35' Latitude North and 2°38' et 3°15' Longitude west. The area receives between 850 and 1150 mm of rainfall annually with mean annual temperatures ranging from 23 to 36 °C
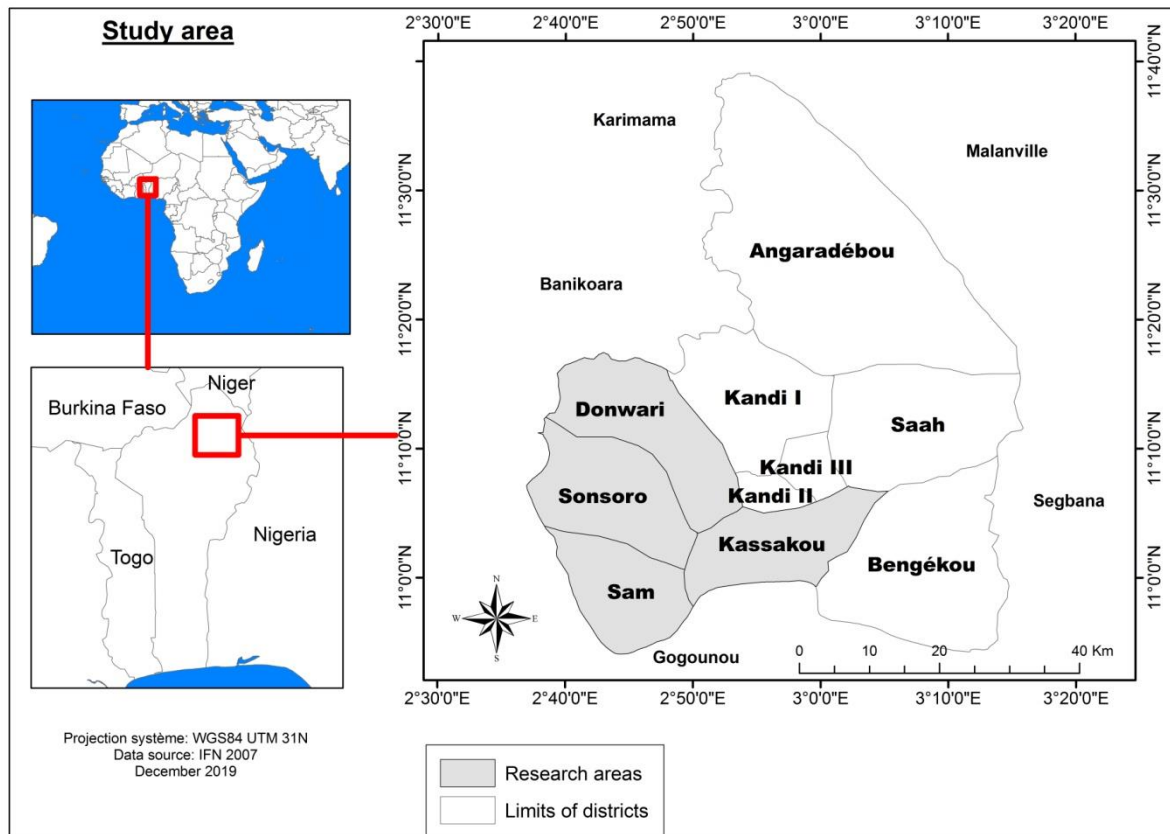
Figure 1: location of commune of Kandi, study area

Data collection and analysis

Looking to the nature of study, the qualitative approach, which is more appropriation in case of studying traditional knowledge systems and natural resources. Participatory Action Research (PAR) was applied in this research to establish a data set of traditional ecological knowledge on predicted rain for climate adapting in Kandi. PAR covers a series of participatory approaches to action-oriented research (Kindon et al., 2007). Focus group discussions and individual semi-structured interview were used to explore the traditional ecological knowledge of the local stakeholders about predicting rain. Focus group discussions are normally used to get in-depth qualitative information which cannot be obtained on a one-to-one basis (Makwara, 2020). Focus group discussions comprised 5 to 10 participants in order to have homogenous stakeholders group. Homogenous stakeholders group in this case was constituted: farmer and breeder,

traditional chief and hunter. 7 Focus group discussions were organized in 4 districts of commune (Sam, Donwari, Kassakou and Sonsoro).   In regard to individual semi-structured interview, 75 semi-structured interviews were conducted with an equal number of persons (Table 1).   The respondents of focus group discussions and individual semi-structured interview have ages ranging from 40 years and above and they were all selected on the basis that they have always stayed in the area, and are originally from the districts. The selection of interviewees followed the "snowball method", by which an informant or group of key informants lead to other individuals who possess information relevant to the study (Taylor and Bogdan, 1987; Fuentelsaz, 2004). Sample size was determined through "theoretical saturation", which prevents data repetition and ensures its representativeness (Glaser and Strauss, 1967).   The data collected emphasized traditional   ecological knowledge possessed by the participants: i) the identification of climatic indicators in the local environment; ii) acquisition and transmission rain predict knowledge; iii) the timing of events and indicators ; iv) the factors that influence local knowledge about the climate, and v) the relationship between all of the above. Qualitative data from interview transcripts and field notes were analyzed by way of soft R, which facilitates data storage and particularly the coding and construction of categories, leading to the identification of the aspects that are relevant to the informants. Through such analysis, it is possible to systematize and associated categories in Multiple Correspondence Analysis (MCA) are placed close together in a Euclidean space, leading indicators, or a combinations of points that have similar distributions (Das and Sun, 2015; Das and Sun, 2016). Notably, MCA produces two point indicators (i.e., individuals and categories), which are usually defined by two-dimensional graphs (Das and Sun, 2015).

Table 1: status of respondents and district

District	Focus group	Homogenous group	Participants to focus group	individual semi-structured interview
Sam	2	Farmer and breeder	8	25
		Traditional chief	6	
Donwari	2	Farmer and breeder	8	20
		Hunter	5	
Kassakou	1	Farmer and breeder	9	15
Sonsoro	2	Traditional chief	6	15
		Hunter	4	
Total	7		46	75

Multiple correspondence analysis models for traditional knowledge

Multiple Correspondence Analysis (MCA) is a powerful technique for analysis and graphical presentation of categorical data in large and complex datasets (Das and Sun, 2015; Greenacre, Blasius, 2006; Das and Sun, 2016). MCA graphical overviews, which are more conventional rather than log-liner models, simplify the expression of the relationships between variables without the necessity of any preconditions, thereby making interpretation easier (Das and Sun, 2016). Additionally, very small and very large sample sizes

significantly influence the performance of both count data and crash severity models (Ye and Lord, 2014). MCA also has the capability to look at multiple types of data and dimensions simultaneously, which is in contrast to running countless bivariate analysis (Kim and Yamashita, 2008). MCA is performed on indicator to predict rain matrix in which the set of categories of the variables: (1) wind, (2) cloud, (3) plant, (4) bird, (5) insect,   (6) thunder (7) transmit to children, (8) transmit to member of family, (9),acquire by initiation, (10) acquire by experience. In order to identify the key contributing factors, we used R Version 3.02 statistical software and the Facto Mine R package to analyze the dataset and plot the two-dimensional graphs. The MCA graphical representations help simplify the process of interpreting the relationships among variables

Results

Traditional knowledge to predict rain

The rain fed agriculture is the principle activity for population of study area. This activity was exerted by grand-parents that transmit generation to the next with knowledge of nature. Without technology, the nature provides the information about weather, season and climate through the signals. This signals guides agricultural activity in rainy season and out season decisions taking. They stem from observation of plants, animals and astronomical elements. This traditional ecological knowledge is relied on experience and embedded in cultural and traditional ritual. Each community has reference of this knowledge because it defined their identity and particularity. In Kandi commune, three groups have been distinguished owing to particular usage of particular usage of traditional ecological knowledge. There is a group of traditional chief who are traditional guarantors whose knowledge to predict rain is powerful. For hunter group, their activity is most links to wild life whose knowledge to predict rain constitutes a base and compass. In regard to group of farmer and breeder, traditional ecological knowledge is alone source to justify the practices in rain fed agriculture and predicting rain allows them to orient their agricultural activity. Through indicator of plants, animals and astronomical elements, these groups reveal to get early information on onset rainy season, end rainy season and rain weather in rainy season.

Indicators of onset rainy season in community of study

The data survey has led to meet three different groups: traditional chief, hunter and breeder and farmer. Each group inherited from past generations the indicators of onset rainy season. These indicators concerned plants, animals and astronomical elements. The indicators of onset rainy in five categories are: bird singing, wind direction, flowing plant, insect apparition and cloud form. Table shows the percentage of different groups of respondents with indicator of onset rainy season.

Table 2: indicators of onset rainy

Respondents	Indicator of onset rainy season	Percentage of responds
	Bird singing	100%
	Wind direction	100%
Traditional chief	Flowing plant	16,67%
	Insect apparition	16, 67%
	Cloud form	100%
	Bird singing	100%
	Wind direction	100%
Hunter	Flowing plant	100%
	Insect apparition	100%
	Cloud form	100%
	Bird singing	100%
	Wind direction	100%
Farmer and breeder	Flowing plant	100%
	Insect apparition	20%
	Cloud form	100%

A group of traditional chief knows bird singing, wind direction and cloud form like indicator of onset rainy season. Hunter group has knowledge about the five categories for like indicator of onset rainy season. Regardless a group of farmer and breeder, he doesn't know in majority (18, 75%) insect apparition like indicator of onset rainy season.

Indicators of the rainy season end

The end of rain season marks the end of rain fed agriculture activities. Thus, the local population has the signals of the rainy season end through plants, animals and astronomical elements in order to prepare their out season activities. Three categories of indicators are notice by the different group respondents: bird singing or apparition, wind direction and fruit maturity. Table shows the different groups of respondents with indicator of end rainy season.

Table 3: indicators of the rainy season end

Respondent group	Indicators of end rainy season	Percentage of responds
	Bird singing or apparition	100%
Traditional chief	Wind direction	25%
	Fruit maturity	100%
	Bird singing or apparition	100%
Hunter	Wind direction	100%
	Fruit maturity	100%
	Bird singing or apparition	100%
Farmer and breeder	Wind direction	100%
	Fruit maturity	100%

Indicators of rain weather in rainy season

After a rainy season has started, local population identifies weather of rain through observation of indicators like wind, cloud and thunder pop. These indicators are the astronomical elements that the grandparents had knowledge and transferred to next generation. Table follow shows the percentage of respondents know indicator of rain weather.

Table 4: indicators of rain weather in rainy season

Respondents	Indicator of rain	Percentage of responds
Traditional chief, Hunter and Farmer and breeder	Wind	100%
	Cloud	100%
	Thunder	100%

Inventory of traditional climate predictors

The observation of climate predictors is traditional knowledge inherited from past generations, and the large number and variety of indicators recognized by the people interviewed in the study attest to its relevance (See Tables 5).

Table 5: inventory of traditional climate predictors

Category	Species	Scientific name	Local name	Description
Vegetal climatic predictors	Shea	*Vitellaria paradoxa*	*Sombou*	When the fruit of this plant is very matured (April, mi-june), it is going to rain in two at three weeks
	Néré	*Parkia biglobosa*	*Donme*	When the fruit of this plant arrives to be matured (march-April), it is going to rain in one month
Animal climatic predictors	Swallow	*hirundo rustica*	*Tiancoli ou*	This animal appears in successive vague (April-May) to announce the onset of agricultural season.
	Sparrowhawk	*Accipiter spp*	*Coucou*	If you are singing on the trees in the morning (April-May), it is an indicator the onset of rain season
	Red billed Hornbill	*Tockus erythrorhynchus*	*Tiankro*	They move the east to west to indicate the onset for rain season (April-May)

				and move the north to south (October-September) for the end of rain season
	Black ant	*Formicidea sp.*	*Turu*	When black ants begin to appear (Mai and June), it is a sign of good quality of rain during agricultural work.
	Termite	*Macrotermes bellicosus*	*Tannan*	When termite begin to appear (Mai and June), it is a sign of good quality of rain during agricultural work
Astronomical predictors	Wind		*Wo*	When wind blows to east with intensity, it is going to rain in fourth day
	Thunder		*Goura N'gbanrabou*	When you hear the thunder pop at east in day, at night it is going to rain.

A total of 4 species of vegetal and animal were recorded, in addition to two astronomical events used as climate predictors (Table 4). Plants like Shea (*Vitellaria paradoxa*), Néré (*Parkia biglobosa*) are mentioned to predict rain through fruit maturity. Animal climatic predictors are Swallow (*hirundo rustica),* Sparrowhawk (*Accipiter spp*) and Red billed Hornbill (*Tockus erythrorhynchus*). Wind and thunder are astronomical elements that local population uses to predict weather of rain.

Traditional knowledge categorize with multiple correspondence analysis
In this paper, the MCA method is used to evaluate and simplify the structure of the associations between indicators to predict rain variables and present it graphically. The eigenvalue of each dimension, which is a value between 0 and 1, indicates the total variance between indicators to predict rain variables: wind, cloud, plant, bird, insect, thunder, transmit to children, transmit to member of family, acquire by initiation, acquire by p. We note that the first and second dimensions had higher eigenvalues (51.146%) compared to other dimensions, so a two-dimensional graph includes most of the information, as shown in Figure 2.

Table 6: eigenvalue and Percentages of Variance of the first five Dimensions

	Dim.1	Dim.2	Dim.3	Dim.4	Dim.5
Variance	0.121	0.112	0.091	0.069	0.063

| % of var | 26.614 | 24.532 | 19.913 | 15.160 | 13.780 |
| Cumulative % of var | 26.614 | 51.146 | 71.059 | 86.220 | 100.000 |

Figure 1 shows that many variables are placed near each other, thus making roughly the same contribution to all the variances. Additionally, the points close to the centroid of the map, for one dimension, contribute less to the eigenvalue of that particular dimension
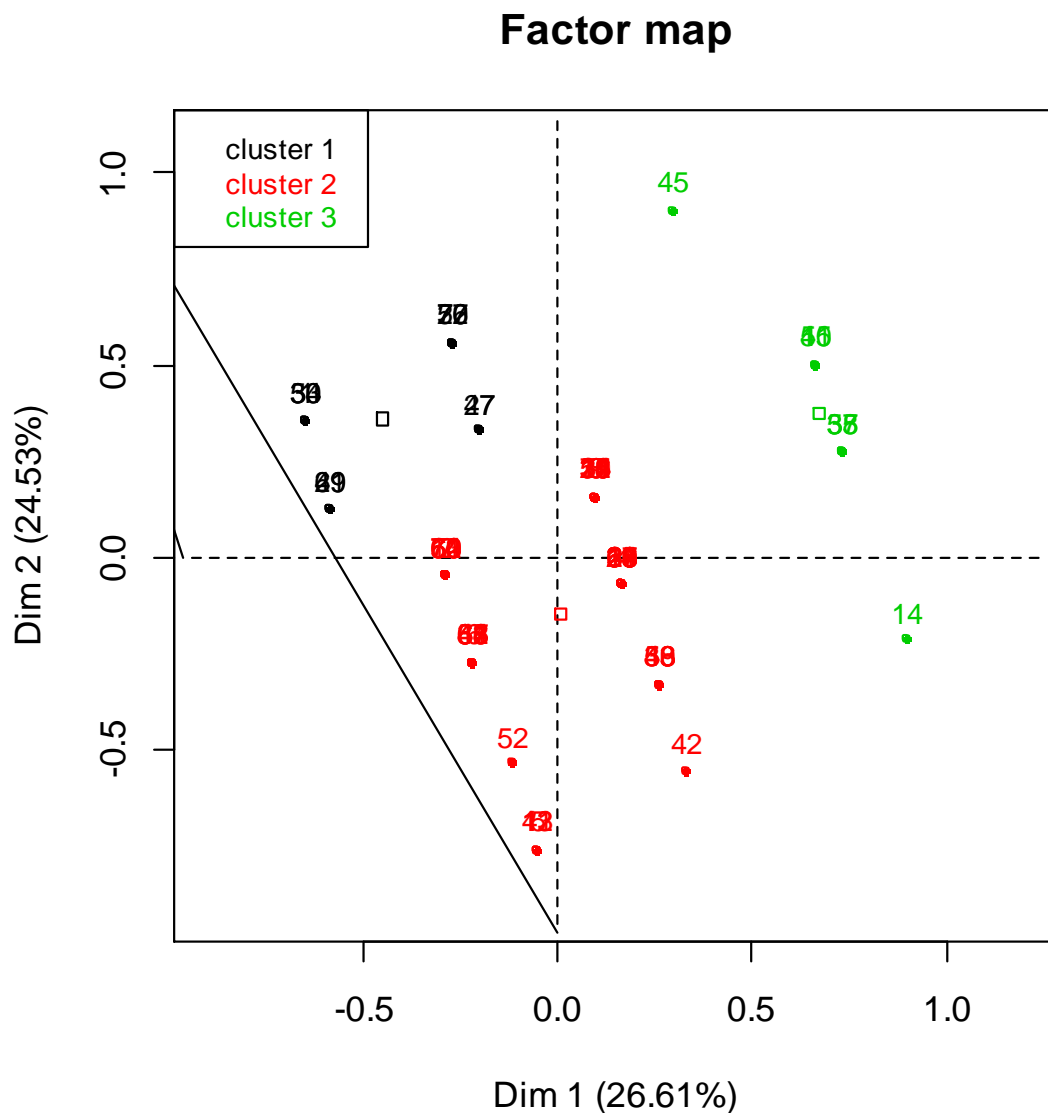
Figure 2:   MCA plot for the variable categories

Figure 2 illustrates a two-dimensional plot of the top 3 categories that contributed most to predict rain. According to this figure, several point clouds can be created based on the relative proximity of point combination.
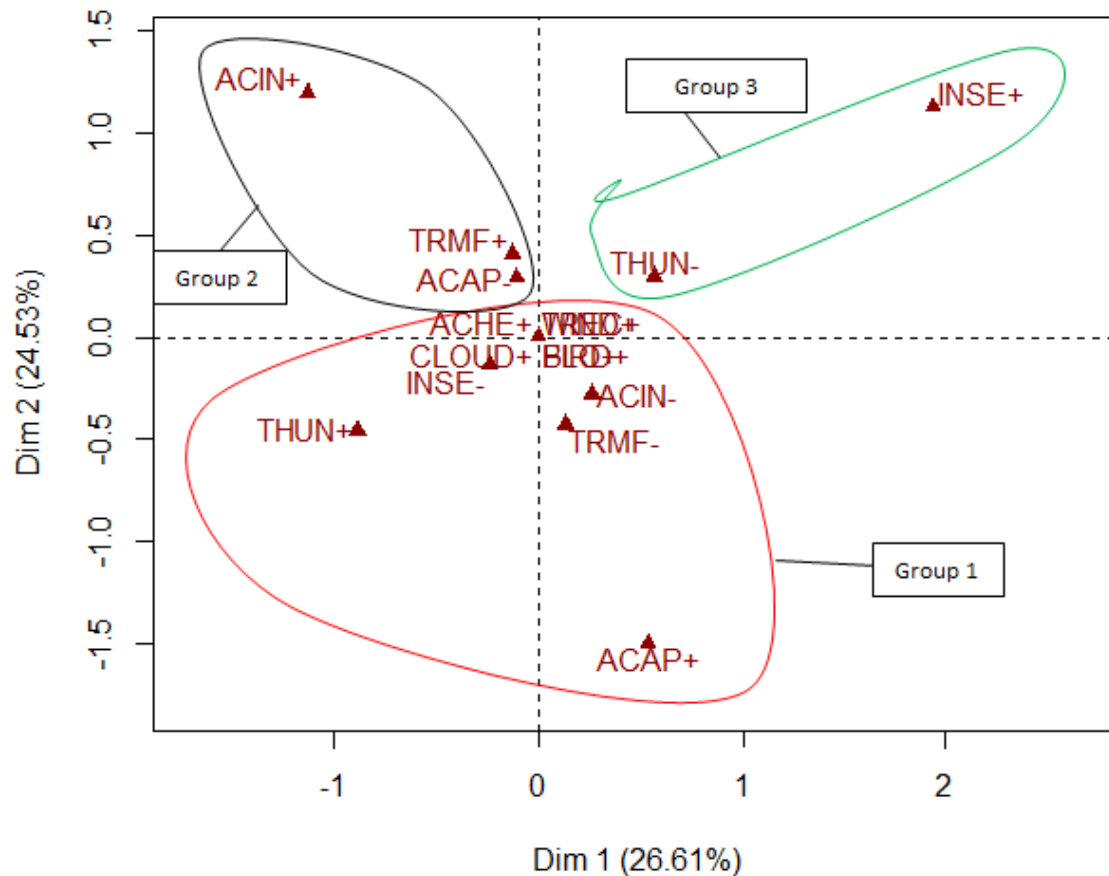
Figure 3: MCA plot for the variable categories.

Group1 combines indicators such as wind (WIND+), thunder (THUN+), Cloud (CLOUD+), Bird (BIRD+) and acquire by experience (ACHE+). This means that someone knows one of indicator to predict rain, knows the rest. This group demonstrates knowledge of indicators to predict rain (wind, thunder, bird) are acquired by experience. In another combination (Group 2), transmit to member of family (TRMF+) and acquire by initiation (ACIN+). This result appears to justify an initiation for member of family in order to acquire traditional knowledge to predict rain. According to group 3, it is formed indicators like insect (INSE+) to predict rain.

Discussion

The rain fed agriculture practices by local population of Kandi commune. Without forecast the weather technology, they compel to the signals of nature to forecast the weather for agricultural activity. It is local knowledge stem from observation and experience. Farmers mix a variety of local forecasting knowledge such as environmental observations and spiritual traditions (Roncoli et al., 2002). Like agricultural activity, this traditional knowledge is transmitted to next generation. According to Mapara (2009), Shoko (2012) and Van Fleet (2003), traditional knowledge is unique to a people through which they have survived on, accumulated through experiential learning within their environment and passed on from generation to generation). Traditional knowledge used in community of study pertained to indicators of plants, animals

and astronomical elements to predict rain. Traditional knowledge is collective in nature and regarded communal property and often transmitted to selected few people within the community through specific cultural and traditional information exchange mechanisms. It encompasses mental inventories of local biological resources, animal breeds, local plant, crop and tree species and belief systems that enhance the livelihood of the people, health and protect the environment (Hansen &Van Fleet, 2003). Result highlight that bird singing, wind direction, fruit maturity, insect apparition, cloud form and thunder constitute traditional knowledge or indigenous knowledge to predict rainy season and weather rain. In Turwi Basin, like in Makueni district in Kenya, communal farmers ordinarily depend on indigenous knowledge to predict the short-to-medium term weather conditions associated with the coming season just before the start of the farming season (Makwara, 2020). The results show that plants like Shea (*Vitellaria paradoxa*), Néré (*Parkia biglobosa*) are mentioned to predict onset and end rain season through fruit maturity. This finding is consistent with findings made by Risiro et al., (2012) in Chimanimani District who added baobab/muuyu (*adansonia digitata*) while Alvera (2013) added mushuma (*dyspros mespiliformis*) and nhunguru (*flacourtia indica*) in Mbire District among other weather indicator fruits trees. Modern scientific forecasts are usually issued for a period of one, three or six months and suggest the total amount of rainfall expected over that period, but not the distribution of rainfall within that period (Githungo et al., 2009). Wind and thunder are astronomical elements that local population uses to predict weather of rain. Therefore, it is revealed the three groups respondents that wind, thunder and rain could provoke through traditional ritual in full season. Climate predictions lead to a variety of strategies, including propitiatory rituals and changes in agronomic practices (Claverías, 1991). Culture is the medium through which people transform mundane material phenomena into significant symbols through which meaning and value is attached (Cosgrove and Jackson 1987), through which social order and norms are communicated, reproduced, experienced and explored (Williams 1982) and through which social groups develop distinct patterns of life (Jackson 1989). Traditional knowledge is relied on experience and embedded in cultural and traditional ritual. Highly place-specific and qualitative in nature, many studies have highlighted the importance of traditional knowledge and its associated ethics and worldviews in shaping culture and identity in addition to adapting to environmental change and crises (Folke 2004; Berkes 2012). Through indicator of plants, animals and astronomical elements, the respondents underscore to know onset rainy season, end rainy season and rain weather in rainy season. Several farm-level decisions hinge on the nature of rainfall variability or the prediction of climate variables for a specific year (Githungo et al., 2009). The most useful forecast information, according to the farmers, are the early warning on anticipated poor season, the commencement of the season and adequacy of anticipated rains (Phillips, 2001). Thus, group 2 combines the factors transmit to member of family and acquire by initiation through Multiple Correspondence Analysis (MCA). This is explained, the complexity of traditional climate knowledge. The concept of traditional climate knowledge has increasingly become topical and been embraced by academics and development practitioners as integral to addressing multiple livelihood challenges faced by rural communities in developing countries and as a basis for locally driven adaptation strategies that transcend the planning stage and can begin to be implemented (Mapfumo et al., 2015; Moonga & Chitambo, 2010; Saitabau, 2014).

Conclusion

This study reveals the indicators used by local population to predict the weather. These indicators are vegetal climatic predictors, animal climatic predictors and astronomical predictors. The group respondents (farmer and breeder, traditional chief and hunter) safeguard the traditional knowledge of identifying the indicators and interpreting the signals. This Traditional knowledge to predict rain includes the understanding of weather events and weather changes at different time scales. The ability to interpret weather events shapes the accumulated knowledge about the climate through generations may prove today a relevant tool for improving agricultural practices. Multiple correspondence analyses analysis gathered the indicators and three groups are distinguished. One shows the indicators such as wind, thunder, Cloud, Bird. According to the groups, these indicators were acquired by experience. The second combines the factors transmit to member of family and acquire by initiation. This group shows the glimpse of traditional knowledge transmission to member family was done by initiation. The third concern the insects.

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Cost-Effective Platform for Particulate Matter Rapid Monitoring

Luciano André Barbosa Da Silva, Otavio Andre Chase, Glauber Tadaiesky Marques,
José Felipe Souza de Almeida, Milena Marília Nogueira de Andrade

Federal Rural University of Amazonia (UFRA), Cyberspatial Institute (ICIBE)

Av. Presidente Tancredo Neves, 2501 – Montese, Belém-PA, 66077-830, Brazil

e-mail: lucianoandre45@gmail.com, otavio.chase@ufra.edu.br, glauber.marques@ufra.edu.br,
felipe.almeida@ufra.edu.br, milena.andrade@ufra.edu.br

Abstract

Particles in the air with volume ≤ 2.5 μm^3 have been classified as carcinogenic by the World Health Organization (WHO). Therefore, rapid monitoring systems are crucial to obtain information about particulate matter (PM) concentrations and make this information publicly available. Supported by WHO criteria, this text focuses on the development of a field-portable cost-effective platform for rapid monitoring, data acquisition of particulate matter (PM_{10} and $PM_{2.5}$) and measurements of environmental variables (relative air humidity and temperature) at the micrometeorological level, in addition to providing access via the Internet of Thing (IoT). The platform was tested, as well as validating its results when compared to those made available at the National Meteorology Institute-INMET (Instituto Nacional de Meteorologia). Based on this technology, tests and measurements have been performed in the local presence of the population and vehicle traffic, in order to identify the concentrations of PM in public places. Between the results obtained, the device recorded higher temperature and low humidity, at 12 noon, and the average hourly reached 175.3 $\mu g/m^3$ (PM_{10}) and 164.2 $\mu g/m^3$ ($PM_{2.5}$), which means a warning sign. This computational platform would be useful for cost-effective and rapid quantification of PM density, even in the field and resource-poor settings.

Keywords: Air-quality monitoring; Embedded system; Particulate matter.

1. Introduction

The air is an essential resource and indispensable for all living beings. With technological development, there was an increase in quantitative population in line with the increased demand for natural resources, attempting to satisfy human consumption [1]. This has generated tremendous pressure on the ecosystem, leading to unprecedented impacts worldwide. Among the varieties of other problems, air pollution has drawn attention due to the harmful effects on the environment and health-related to Particulate Matter (PM) [2]. PM can be defined as a mechanism for mixing solid and liquid particles of organic and inorganic substances in the atmosphere. PM is often referred to as aerosol, aero colloid or particles which include dust, ash, smoke, fog, pollen and marine sprays. In this respect, the most worrying pollutants for public health are PM, i.e., nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3) and carbon monoxide (CO) [3].

Particle air pollution is formed by solid and liquid particles dispersed in the air [4]. These PMs may

have adverse health effects over time, depending on particle size and concentration in the atmosphere. The smaller the particle, the higher the damage to human health, being associated with numerous diseases due to its small size [5]. These PM may originate from natural as well as anthropogenic sources and are classified according to their aerodynamic diameter. Particulate material with diameter $2.5\mu m < PM_{10} \leq 10$ µm is known as gross inhalable, usually barred in the upper respiratory tract. The other range of PM is breathable or thin inhalable, with aerodynamic diameter $PM_{2.5}$ ($0.1\mu m > PM \leq 2.5\mu m$). Air quality data are essential, considering human actions on the environment. This information contributes to the creation and development of policies for the control, use of natural resources and the improvement of current technologies to the reduction of atmospheric emissions [6].

Nowadays, there is various types of equipment involving the monitoring of environmental variables, but most of them are imported and have a high financial cost, which discourages their use in various applications. Thus, the development of low-cost technologies and open technologies are significant for conducting microscale studies and enabling the monitoring of environmental variables in locations not monitored by financially accessible sensors [7]. The use of wireless and integrated circuit sensors and microprocessors has stimulated the creation of smart sensor networks that operate remotely and autonomously, facilitating the collection of environmental data [8]. Therefore, this work aims to present the development of a pollutant monitoring platform to contribute to the expansion of solutions to air quality issues.

2. Background of the Study

The quantification of pollutants gives the level of air pollution in the atmosphere. Consequently, the choice of air quality parameters was established in the practical order, limited according to their importance and universality of pollutants as broader indicators of air quality (SO_2, NO_2, CO, O_3, PM). Some of these gases and particles were chosen as indicators because they are often linked with adverse effects on the environment and health [9].

Carbon monoxide (CO) is considered a pollutant that is present everywhere in the urban environment, is characterized by an odorless and colorless gas, formed mainly in the burning process, and one of its sources is in emissions from the combustion of engines. The importance of CO monitoring is essential because of its potential for harmfulness and abundance in the air [3]. The health-related effects of CO range from the subtlest effects such as behavioral swings to death. These damages are caused due to the high affinity of CO gas to hemoglobin, consequently causing a deficiency in oxygen transport to organs [10].

Nitrogen is one of the most abundant gases in the atmosphere. Associated with this, other elements are belonging to the nitrogen cycle, such as nitrogen oxides and human actions in industry, mainly in agriculture, which favors the increase of nitrogen compounds in the atmosphere, causing changes in the natural oxygen cycle. In urban centers, nitrogen dioxide (NO_2) is considered one of the primary pollutants; it is directly related to the production of ozone gas (O_3) and the formation of acid rain and directly influences the global climate [3]. The process of NO_2 emissions comes from both anthropic and natural sources. Natural sources emit the most NO_2 to the atmosphere, but direct emissions of this gas are relatively low. Nitric oxide, due to its rapid oxidation, is one of the main sources of NO_2 gas. Nitric oxide has as main

natural sources the edaphic microorganism activities. In urban centers, the main source is the burning of all types of fuels. The effects of nitrogen dioxide on human health may occur in respiratory and allergic problems and lung problems [11].

There are several natural sources of SO_2 emissions, such as volcanoes, marine aerosols, and organic decomposition and by anthropogenic sources such as the burning of fossil fuels from petroleum and coal, accounting for about 95% of air emissions. When in the atmosphere, it forms various reactions with other compounds, forming small sulfate particles contributing to the formation of secondary particulate material. Sulfur dioxide has high water solubility, the reaction of this gas in the presence of water vapor forms sulfuric acid (H_2SO_3) and in the presence of oxygen is rapidly oxidized to sulfuric acid, characterizing it as one of the acid rain precursors, as well as NO_2 [12]. Exposure to sulfur with a concentration of 0.19 particles per million (PPM) and an average of 24 hours of exposure with high particle concentrations is capable of causing irreversible effects on living beings. Sulfuric acid and sulfides affect sensory and respiratory functions, in some cases aggravating the crises of people with asthma problems. In vegetation, the presence of high concentrations of SO_2 directly affects the photosynthesis capacity [13].

Ozone gas is formed secondarily in the lower atmosphere from another NO_2 pollutant by photochemical reaction with oxygen and solar radiation. When formed in the troposphere (lower layer of the atmosphere), it is highly toxic. The effects of ozone in high concentrations cause eye irritation, headaches, nausea, among other effects related to the form and time of exposure to gas. Besides, ozone is harmful to plant metabolism [14]. The prevention of harmful effects on health goes by indicating the primary atmospheric contaminants and establishing minimum safe levels, promoting the protection of the human quality of life. From these levels, the air quality standards are established numerically [15].

The first interventions on air pollutant issues took place in the 1950s, in the United States, through the Air Pollution Control Act 1955, becoming a milestone in the world's environmental legislation. In 1963 a federal law entitled Clean Air Act created for air protection commissioned the United States Environmental Protection Agency (USEPA) to determine national air quality standards NAAQS - National Ambient Air Quality Standards. In 1970 the USEPA stood out for being a pioneer in monitoring air sampling, which was the basis for the Brazilian legislation. So, split its standards in primary and secondary. The first standards were created to promote the protection of public health, drawing attention to the most vulnerable population such as children, elderly, and sick respiratory. Secondary standards aimed at protection against damage to animals, crops and materials [16]. Table 1 presents these values.

Table 1 - Air Quality Standards adopted by the US Environmental Protection Agency.

POLLUTANT	DIAMETER	PRIMARY/SECONDARY	AVERAGE TIME	LEVEL µG/M³
PARTICULATE MATTER (PM)	$PM_{2,5}$	Primary	1 year	12
		Secondary	1 year	15
		Primary and secondary	24 hours	35
	PM_{10}	Primary and secondary	24 hours	150

Source: Adapted from USEPA.

Although WHO standards have global application, the setting of individual country standards should

be under their specificities, with each country having the autonomy to define its values according to its economic and technological circumstances. Table 2 shows the particulate matter concentration patterns [17].

Table 2 - WHO recommended global concentrations.

POLLUTANT	DIAMETER	AVERAGE TIME	LEVEL ($\mu G/M^3$)
PARTICULATE MATTER (PM)	$PM_{2,5}$	24 hours	25
		1 year	10
	PM_{10}	24 hours	50
		1 year	20

Source: WHO [17].

WHO [3] also includes provisional targets for pollutant concentration in addition to the general guideline. These provisional values correspond to intermediate concentrations, aiming to promote continuous compliance with the final recommendations. If these intermediate objectives are met, the risks related to PM can be considerably reduced [18]. Table 3 shows the values of interim targets with their benefits to be achieved.

Table 3. Intermediate Standard IS and Final Standard FS, annual average values.

PHASE	PM_{10} ($\mu G/M^3$)	$PM_{2.5}$ ($\mu G/M^3$)	INDICATED LEVELS
IS-1	70	35	15% higher risk of mortality compared to FS
IS-2	50	25	6% risk reduction in premature deaths compared to SI-1 (2% to 11%)
IS-3	30	15	Risk reduction by 6% mortality compared to SI-2 (2% to 11%)
FS	20	10	Low mortality

Source: WHO [17].

.Some PM are dark and large enough which can be seen with the naked eye, others are so small that they can only be detected by electron microscopy [19]. As an example of the intense dispersal of organic PM released into the atmosphere are the Amazon forest fires, which occurred due to the poor environmental management of the Brazilian government. Soot plumes from forest burning can be carried thousands of miles away from the outbreaks. As a result, last August 19, 2019, the country's largest city, Sao Paulo, received a plume of smoke and soot in gigantic proportions (Figure 1). This phenomenon what was called as "the day that became night" when São Paulo's skies, 3 pm afternoon suddenly turned black was close to 500 µg/m³ ($PM_{2.5}$) [20].

Figure 1. São Paulo on the day that became night.
Source: O GLOBO [26].

As an explanation, the interactions of aerosol particles with solar radiation directly affected the reflection and absorption properties of surface light. In addition to acting as a condensation nucleus, therefore delaying precipitation and providing the formation of soot-contaminated giant clouds [21]. This soot is known as Black Carbon, which has a high capacity to absorb radiation. These PMS are due to biomass combustion, which mainly emits $PM_{2.5}$ mode particles [22].

The thick plume of PM was detected by the CPTEC/INPE satellite responsible for monitoring the transport of pollutants emitted by burning in South America using the CATT-BRAMS model (Coupled Aerosol and Tracer Transport model to the Brazilian developments on the Regional Atmospheric Modeling System) [23]. Based on these monitoring results, it was possible to detect the river of smoke from thousands of kilometers, favored by the weather conditions (Figure 2).
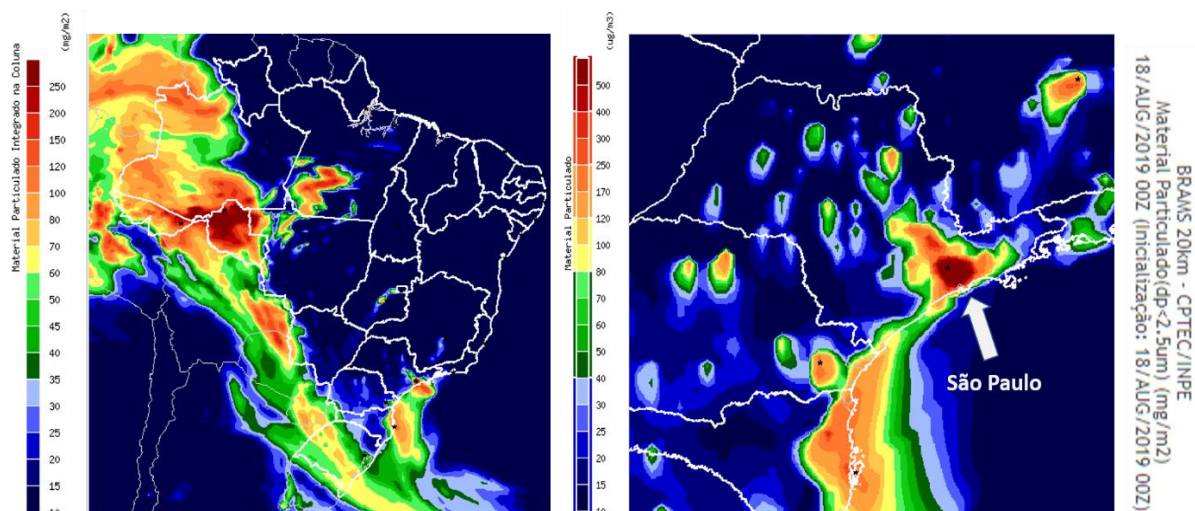

Figure 2. $PM_{2.5}$ particle plume detected by CETEC.
Source: CPTEC/INPE [23].

3. The Embedded Computing System

This text describes the specifications of the sensors used, including the auxiliary components of data processing and storage, as well as the procedures followed to perform the testbed. For this, five steps must be considered, namely: Assembly of the electronic circuit; Arrangement of sensors in the shelter; Programming and implementation of algorithms; Measurement and data collection (testbed). Likewise, this monitoring platform is intended for the acquisition and storage of PM, temperature and relative air humidity data at the micro-meteorological level, *in situ*. Next, tests were made at the bus stop, located in front of the Federal Rural University of Amazonia - UFRA.

The components used for mounting the platform were: ESP8266 NodeMCU Wifi Module, Shield SD card, Real-Time Clock RTC DS3231, Sensor SDS011, Sensor BME280. NodeMCU (Node Microcontroller Unit) is an IoT-based development coupled with an ESP8266 WiFi chip. This Wifi module, through its configuration, can provide embedded system IoT communication signals via the digital cloud. Therefore, an enabled user on the Internet network can remotely access information about quality conditions in the environment.

The embedded system has both hardware and development of free software. The ESP8866 chip attached to the embedded ships has all devices of a computer: CPU, RAM, Wifi, and even the Linux operating system. Besides these advantages, they are related to low cost and low power consumption. The NodeMcu project can be an add-on for the Arduino IDE that allows programming the ESP8266 using the Arduino IDE and its programming language, and therefore, to connect and control compatible sensors. Due to the small size, this work used a base that expands the connection capacity of the module pins, in order to facilitate the connection of the components. So, all components have been powered on and operated by NodeMcu.

The SD card module communicates with NodeMcu via the serial peripheral interface (SPI) communication protocol, which is a data protocol used by the microcontroller. NodeMcu connections with the Shield SD card were inserted into an 8 gigabyte FAT32 formatted memory card for storing the monitored data. This allows continuously to record the incoming data from the sensors, and when they are downloaded to a computer for processing and graphing.

The DS3231 Real Time Clock (RTC) or low-cost real-time clock is an electronic component capable of forthcoming information such as date and time. A lithium battery is attached to the component, ensuring data reliability even in the absence of external power supply. To record the time of data collection, this module was used to inform the date, time, and minutes of the data collection, creating an internal datalogger to storage data. Diffusion conditions can influence high concentrations of PM and this, in turn, is altered by climate variables that include humidity, temperature, wind and precipitation [24]. For this purpose, the BME-280 sensor was used to measure ambient temperature and relative humidity, which is ideal for applications in which the project requires reduced size dimensions and low power consumption. Furthermore, it can measure humidity in the range of 0 to 100% with an accuracy of 0.008%, atmospheric pressure from 0 to 1100hPa barometric range with an accuracy of $\pm1Pa$ and temperature in the range -40 to 85ºC with the fast response time.

The SDS011 sensor uses the laser diffraction principle, and this technique is widely used for particle

size evaluation. This sensor operates by light scattering which will be induced when particles pass through its detection area, generating fluctuations in light intensity. These fluctuations are transformed into electrical signals that will later be amplified and processed. This method facilitates data collection due to high sample throughput and instant response. The SDS011 sensor officially registers PM_{10} and $PM_{2.5}$ enabling to detect concentrations of 0 µg/m^3 to 999 µg/m^3. The manufacturer specifies that its relative maximum error is ±15%. Else then, its operating scheme begins with air entering through a circular opening that is channeled to a detection area where a beam of light strikes particles. Given this, light scattered is detected by a photoconductor. Therefore, the circuit was assembled and ready for running tests (Figure 3).
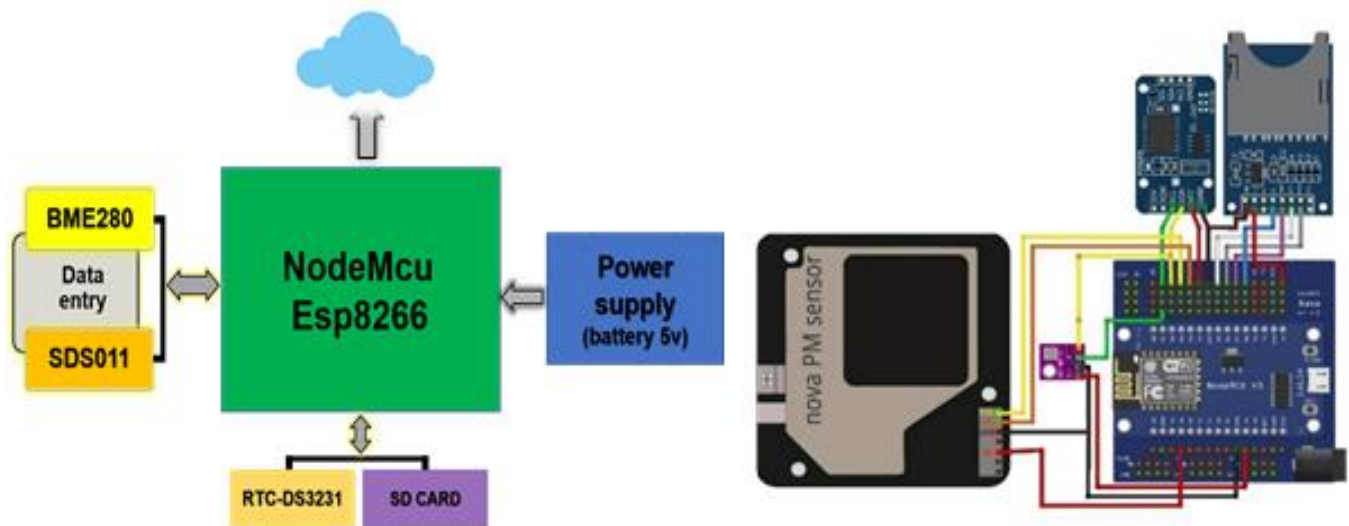
Figure 3. Block diagram.

From the prototyping of the circuit, a case was adapted to measure the arrangement of sensors and components. The arrangement of the sensors was made according to the manufacturer's recommendations. However, other components were organized according to the ease of connection of the components (Figure 4).
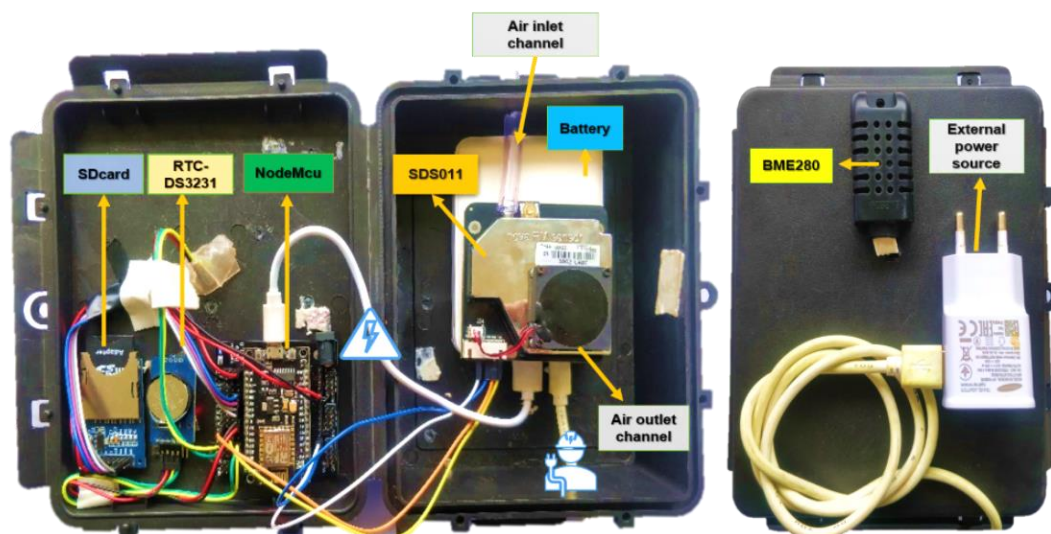
Figure 4. Platform prototype.

Finally, the chosen place to the experiment is in UFRA, located in Belém (state of Pará, northern Brazil), latitude 1°27'30.26"S and longitude 48°26'12.08"W, at an altitude of 15 m above sea level. It is noteworthy that Belém has an equatorial climate, the average annual rainfall of 2537 mm, and the average temperature is 26.4 °C [25]. The annual average high temperatures favor high convection and unstable air that provide the formation of convective clouds. Strong convection, instability and high humidity contribute to convective cloud formation, resulting in a high incidence of precipitation [25]. Subjected to these weather conditions, the platform was programmed to get and store data every 10 seconds, with a total of 6 collections per minute. As an experiment, the platform was coupled to the data collection point, about 1.20 m from the floor and remained collecting data for 11 hours, from 7 am to 6 pm due to crowding of passengers (Figure 5).
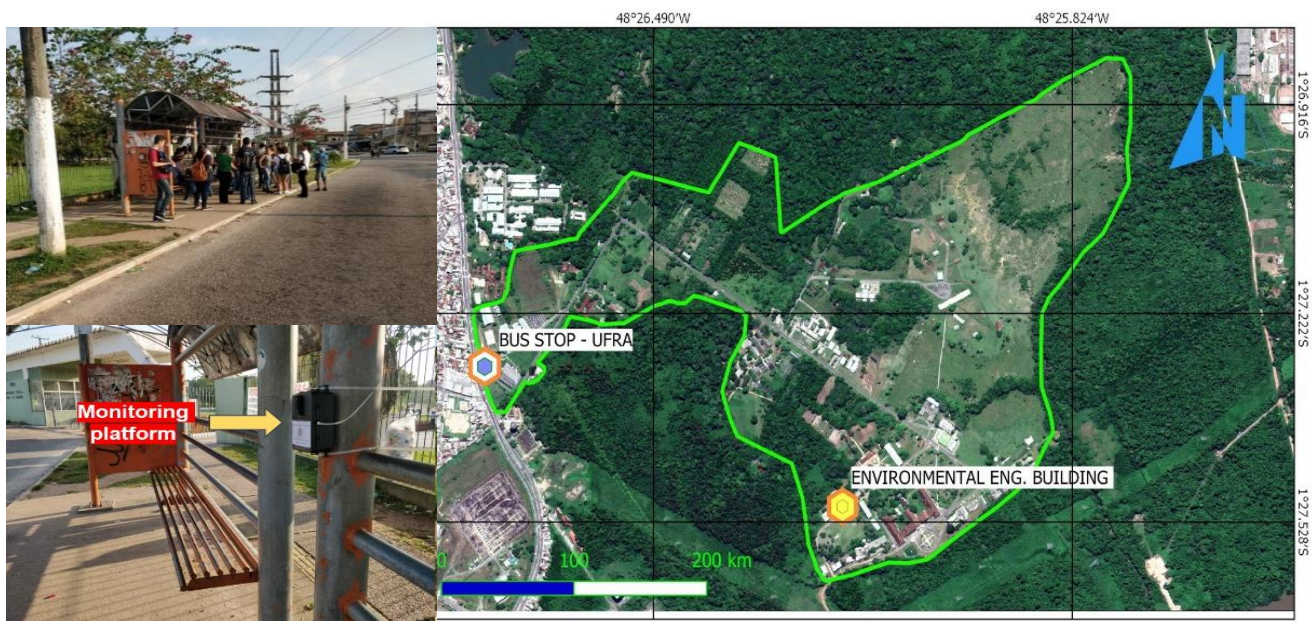
Figure 5. Image of the experiment and its respective location.

4. Results and Discussion

The testbed lasted approximately 11 hours (6:58 am to 6:02 pm), resulting in 3980 data collected. In the first 2 hours of monitoring, the concentration values for PM_{10} and $PM_{2.5}$ were 109.5 µg/m^3 and 37.2 µg/m^3, respectively, both measured at 7:10 am (Figure 6). The environment at 6:58 am when the measurements began presented gross concentrations of 39.8 µg/m^3 PM_{10} and 19.8 µg/m^3 $PM_{2.5}$. These variations indicate the beginning of a high flow due to the activities of passers-by and the constant traffic of public collectives, acting as a source of PM.
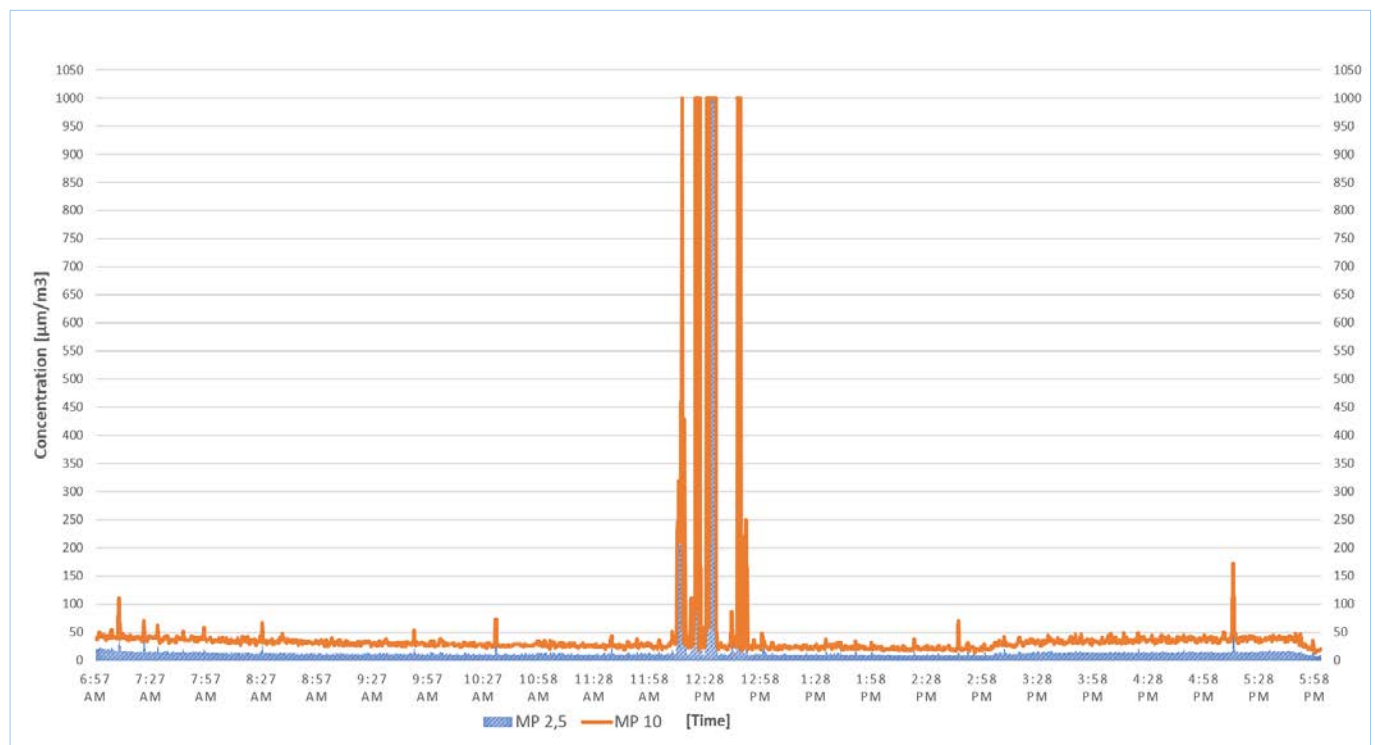
Figure 6**.** Particle volume (μm^3).

Average hourly concentrations decreased over time in the morning ranging from 40.7 µg/m^3 at 7 am to 26.5 µg/m^3 at 11 AM PM$_{10}$ and from 16.37 µg/m^3 at 7 am to 11.3 µg/m^3 at 11 am PM$_{2.5}$. Both results showed the same trend and this trend results from the attenuation of dust suspension and vehicle combustion. At 12 noon, PM concentrations increased abruptly reaching the maximum detection capacity of the SDS011 sensor (999.9 µg/m^3 PM$_{10}$ and PM$_{2.5}$). Nevertheless, these values are generally considered to be saturated values as they reach the upper limit of sensor detection. The average hourly for this event reached 175.3 µg/m^3 and 164.2 µg/m^3 for PM$_{10}$ and PM2.5, respectively. Therefore, the hypothesis of suddenly high values goes beyond vehicular traffic as a source of emission, but also the substantial permanence of people at the bus stop, which commonly prevents the circulation of wind, increasing the residence time of high concentrations of PM at noon This event was detected 46 times, distributed within 1 hour. These values coincide with the time of the highest inflow and outflow from UFRA. In the forthcoming process over the next 2 hours, so there was a decrease to 87% of average hourly, ranging from PM$_{10}$ (23.3 µg/m^3 to 21.68 µg/m^3) to PM$_{2.5}$ (10.58 µg/m^3 to 9.69 µg/m^3).

Throughout the entire experiment period, at 3 pm the values increased as the traffic increased, registering concentrations of 172.1µg/m^3 and 65.4 µg/m^3 at 5:14 pm to PM$_{10}$ and PM$_{2.5}$, respectively. The maximum and minimum temperature values monitored by the sensors were higher since the beginning of the measurements, with a minimum temperature of 29.08 °C and a maximum of 31.5 °C. While the INMET station had a minimum value of 24.6 °C and a maximum of 24.8 °C for the same time, only at 5 pm, the minimum sensor temperature was below that of INMET, as shown in Figure 7.
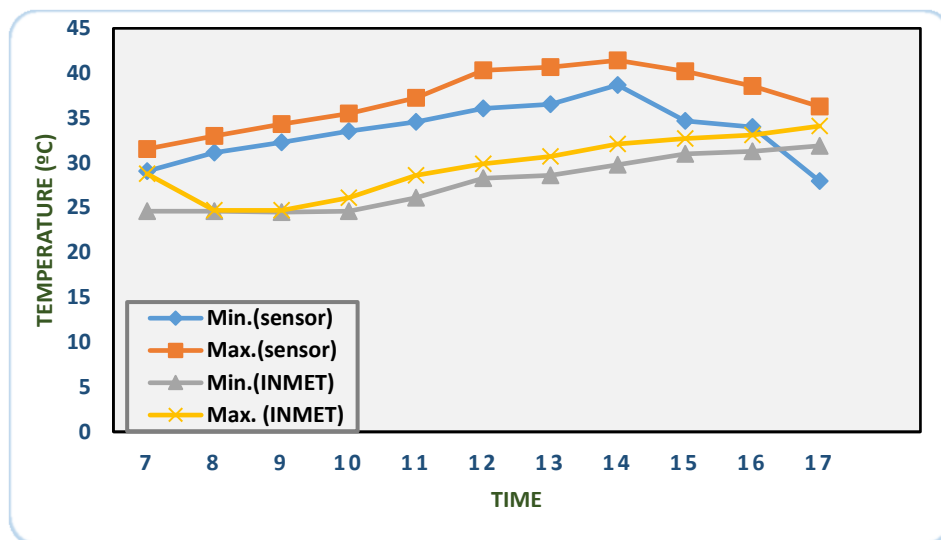
Figure 7. Comparison of temperature values between the Sensor and INMET station.

The difference between platform values and INMET station during monitoring is due to the sensitivity of the BME280 sensor to the effects of microclimate, because own the short distance from the paved surface and the sensor, contributing to the temperature rise at the bus stop. Under these circumstances, it should be observed that INMET stations do not have any obstacles or people within a 30 m radius, to avoid noise in the data. For instance, a different condition from the sensor which has been maintained at a bus stop. Therefore, the maximum and minimum relative air humidity data recorded in the embedded system were lower than the INMET stations, since the temperature detected at the bus stop was higher, influencing the disruption of water molecules present in the air, resulting in at an attenuated humidity (Figure 8).
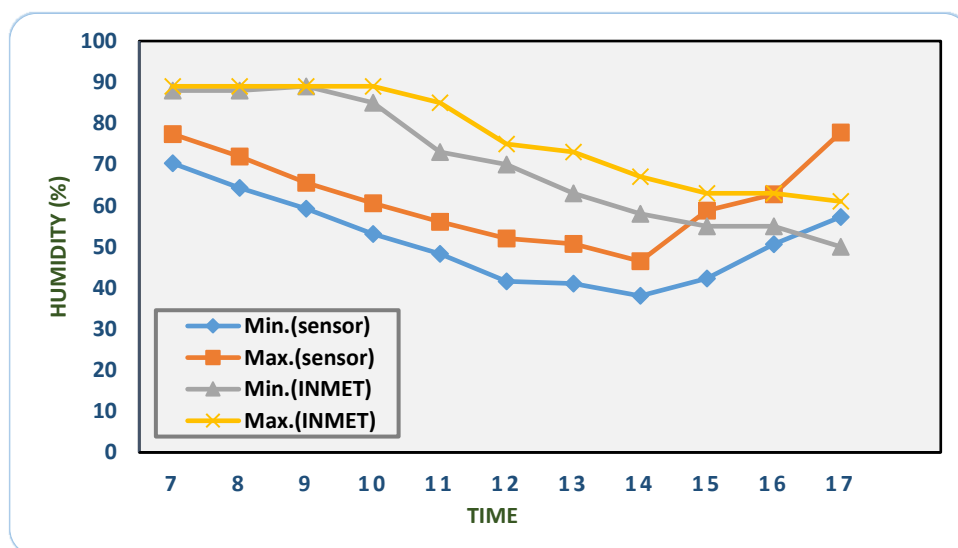
Figure 8. Comparison of relative air humidity values between the Sensor and the INMET station.

In the measurements made by the monitoring platform, the humidity value at 7 AM was 70.29% minimum and 77% maximum. The INMET station had a minimum humidity of 88% and a maximum of 89%. So only at 5 PM, the platform humidity was higher than the INMET station. The data obtained by the sensors are represented in microscale because it is of atmospheric conditions and events less than 1 kilometer and less than 1 hour. Table 4 shows measures of central tendency and standard deviation, as well

as maximum and minimum values resulting from all testbed measurements at the UFRA bus stop for PM, temperature and humidity.

Table 4. Key monitoring values.

Parameter	Average	Median	Minimum	Maximum
$PM_{2.5}$	26,24	12	7	999,9
PM_{10}	44,11	30,2	13,1	999,9
T (°C)	35,31	35,21	27,97	41,43
H (%)	56,77	56,25	38,04	81,85

Source: The Authors.

The average data represents the distribution center. Therefore, the average and the median, they measured the central tendency of the collected results and were directly affected by PM peaks, which represent atypical values called outliers. These results indicate the importance of using alternative solutions for monitoring air quality, temperature and humidity in urban environments. The variation along the PM, in the observed place, evidenced a relationship with the arrival and departure flow of people at 7 am, 12 am and 5 pm; consequently, there was also a higher flow of vehicles in the locality, which contributes significantly as a source of emission. Particles due to combustion and dust lifting.

5. Conclusions

This article has been presented a portable and cost-effective PM detecting, measurements of environmental variables (relative air humidity and temperature) at the micrometeorological level. In addition to access signal via IoT, the module containing an embedded computational system consists of a field-portable device weighing 600 g, which allows easy installation in places containing crowding of passengers and vehicle traffic in public environments. The proposed device can be used in urban or rural places that present natural or anthropogenic sources of PM, which may cause a health risk through inhalation. Furthermore, the test performance of the device was validated by measuring climatic variables, when compared results with those available, and a close correlation was shown. Considering the aspects of utilization to air sampling by the computer system, the results were in agreement with the verified situations. We hope that the contribution of this platform might be considered useful in order to a wide range of applications in air quality management and improvement of life in the most impoverished areas.

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GameMove: A proposal for evaluation of motor development in children mediated by digital games

Dra. Denise Berlese, Dra Débora Nice, Dr. João Batista Mossmann, Me. Guilherme Theisen Schneider, Me. Bernardo Benites

Summary

The purpose of the test is to present an active digital game with a set of sensors called "GameMove". In the first stage is the Game Development (GameMove). In the second stage will be presented proposal to use the game GameMove (digital). GameMove is constituted in a digital game in exergame format (active digital game), which, with a set of sensors, will capture movements, to assist in the evaluation of engine development. The Game proposes to generate data from each individual and can be used in the educational or health context, allowing professionals of Education Fitic can evaluate the Dinvolvement Motor (DM) of children and propose motor interventions. It will be up to the child to follow the game's motion instructions, in a fun and engagedway.

Key Words: Development motor; Crianças; Games digitais ativos

ABSTRACT

The purpose of the essay is to present an active digital game with a set of sensors called "GameMove". In the first stage, we present the game development (GameMove). In the second stage, a proposal of use of the game GameMove (digital) will be presented. The GameMove Game is a digital game in exergame format (active digital game), which, with a set of sensors, will capture movements to assist in the assessment of motor development. The Game aims to generate data from each individual and can be used in the educational or health context, allowing Physical Education professionals to evaluate Motor Development (MD) in children and propose motor interventions. It will be up to the child to follow the game's movement instructions in a fun and engaged way.

Keywords: Motor development; Children; Active digital games.

1. Introduction

Human development according to Papalia and Feldman (2013) among its numerous nuances includes physical growth and motor development. Nista-Piccolo and Moreira (2012) affirm that development does not always happen linearly, because it is not only processed by biological or genetic aspects, but also by the influence of the environment. That is, development takes place in cognitive, motor, affective and social dimensions, based on the construction formed by the relationships that the human being makes with the other and with the world.

Regarding the motor dimension, understood by motor development, it is understood that since conception, the human organism has a biological logic, an organization, a maturative and evolutionary

calendar, a door open to interaction and stimulation (ROSA NETO, 2002). There is special attention to the description and identification of developmental motor milestones in early childhood, when motor development (DM) presents observable behaviors of great social significance, since, through body movements the child interacts and acts dynamically in the physical and social environment (KREBS *et al.* , 2011; ABIKO *et al.* , 2012).

In this sense, motor development can be considered a sequential process, continuous and related to chronological age, by which the human being acquires an expressive amount of motor skills, which progress from simple and disorganized movements to the execution of highly organized and complex motor skills (SOARES et al, 2015).

For Gallahue, Ozmun and Goodway (2013) motor development is the continuous change of motor behavior throughout the life cycle, caused by the interaction between motor task requirements, individual biology and environment conditions. That is, it is a process of changes in an individual's level of functioning. Thus, the study of motor development has as a premise to describe and explain the changes that happen in motor behavior throughout life.

Regarding the evaluation of DM, it is understood that, through it, it is possible to monitor developmental changes, identify developmental delays and obtain clarification on instructive and interventionist strategies. Also, it is possible to trace the motor profile of Brazilian children, providing an adequate physical programming for the reality of each one (FERNANI *et al*., 2011).

A child with proper motor development tends to become a young and adult who learns better and has a better quality of life. This means that, by conquering good motor control, the child will be building the basics for their intellectual development, preventing them from having impairment of motor and cognitive abilities (ROSA NETO *et al.* , 2010).

Thus, evaluating children's DM becomes fundamental, as it makes it possible to identify proficiency in motor skills for sport and leisure, as well as the ability of children to make friends and engage in social groups, in the construction of feelings, autonomy, competence and motivation for achievement and for the search for challenges and achievements (LUBANS *et al.* , 2010).

According to Gallahue, Ozmun and Goodway (2013) basic motor skills are: balance, global and fine motricity. The overall motor ability is the one that involves in its manifestation the movement of large muscle groups promoters of trunk strength, arms and legs also including postural reactions such as balance of the head, sitting, standing, crawling and walking. After the child has mastered the movements linked to the large muscles, then the development of fine motor skills is developed. Fine motricity involves the coordination of small muscles and coordination between eyes and hands, such as buttoning shirts and drawing figures. These skills make it possible for children to have the greatest sense of responsibility and personal care (SILVEIRA *et al.* , 2014).

Thus, evaluating children's DM becomes fundamental, because it makes it possible to identify proficiency in motor skills for sport and leisure, as well as the ability of children to makefriends, engage in social groups, build feelings, autonomy, competence and motivation for achievement and to search for challenges and achievements (LUBANS *et al.* ,2010).

In this sense, motor skills are part of motor development (DM) and evaluating them becomes fundamental to explain children's development(NOBRE; FLAG; ZANELLA, 2015).

In recent decades it is evident that the motor possibilities in childhood present significant changes due to technological advances. Digital, computational games and video games are part of the children's routine. Raupp and Eichler (2012) point out that there is a vertiginous increase in the use of different forms of Information and Communication Technologies (ICT) by society in general, which inserts the different types of technological resources into everyday life quite often.

Considering this scenario, we noticed a *gap* in terms of solutions using digital technologies as a means of expanding the forms of evaluation of DM, as well as solutions that enable the evaluation of children's DM. Therefore, a gap in digital technologies that can meet the recreational playful universe of the child is identified and at the same time provide data to enable the diagnosis of DM by qualified professionals.

In this sense, the proposal arises to develop an active digital game to assist in the evaluation of the motor development of children from 03 to 10 years. The game, in exergame format (active digital game), along with a set of motion capture sensors, can be used in the educational or health context allowing qualified professionals to evaluate children's DM and provide *feedback*. This would incur a significant gain to develop motor intervention strategies collaborating, both with the elements of learning and health of the child.

So far it has not been evidenced in the scientific literaturethatis a protocol from Active Digital Games that evaluates the motor development of children with motion sensors. Nessthe perspective, it is aimed at developing research and an active digital game that implements a protocol to evaluate the motor development of children called "GameMove".

2. What is the relevance of Gamemove?

In Brazil, the main references of protocols for the evaluation of children's DM are[5]: EDM proposed by Rosa Neto (2002); LC-MABC-2 proposed by Henderson *et al.* (2007) and validated in Brazil by Ramalho *et al.* (2013); TGMD-2 proposed Ulrich (2000) and validated in Brazil by Valentini *et al.* (2008); McClenaghan and Gallahue (1985). The protocols mentioned present solutions with the use of concrete and analog material demonstrated the lack of tests using active digital games to assess motor development.

Studies that used the protocols referredto, show that the children investigated present lower motor development than expected for chronological age. Spessato *et al.* (2015), for example, investigating the motor development of 1,248 children aged 3 to 10 years from Porto Alegre pointed out the low performance for fine, global motricity skills and spatial organization in children investigated in this region of the country. In northeastern Brazil, Nobre *et al.* (2009), Nobre *et al.* (2012), Costa *et al.* (2015) and in the Southeast, Coelho *et al.* (2010) confirm the results found in the South. Thus, there is a tendency of children to have low motor proficiency in fundamental abilities in most ages and in both sexes, regardless of geographic context.

Costa *et al.* (2015) found high percentages of children with much lower motor development. Marramarco *et al.* (2012) also studied the motor development of gaucho children aged between 05 and 10 years and found that the vast majority presented performance between low and lower normal.

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[5] An example of protocol application can be seen at: http://www.motricidade.com.br/kit-edm.html

Based on the results presented in the studies mentioned above, itis questioned whether the protocols used for the evaluation of motor development meet the demand for a technological generation, or children effectively present such an expressive motor deficit.

If we consider that environmental and task stimuli have changed, create a protocol for the evaluation of DM that dialogues with the reality of children of the 21st century, it becomes extremely relevant. In this sense, digital technologies are now used as an important tool in anumber of segments, such as health, training and education. Thinking about education and health without technology becomes incoherent in the current scenario (BROLIO, 2017).

3. How will game GameMovebescarved ?

For the development of the game GameMove will be used the model proposed by (BABA; TSCHANG, 2001), which describes a development spiral with specifications of the steps required for product production, using prototyping, testing and evaluation of all tasks cyclically.

Thus, the development of the product, from conception to the application of the final product, will involve the Development Phases, namely: 1- Inspiration; 2- Concept; 3 - Project; 4 -Development; 5 - Test and Evaluation. Each Phase corresponds to a project milestone. In Phase 1 called Inspiration there will be the understanding of the product vision by the team, to support the fundamentals of the project and compose the contents that the game and set of sensors. Profile study of participants and technological support environment. Initial product design game and set of sensors.

In relation to Phase 2 or Concept, the game conceptions will be deepened with definition of the playful universe of the game (narrative), mechanics and content manipulation. The definition of requirements and information will be provided by the game and set of sensors.

In Phase 3 or Project will be developed the game project that will contemplate the layout, rules, gameplay elements, characters, narrative and the fictional universe that will involve the theme. Planning the interaction of children with the product. Visual prototype generation for information analysis and interaction. Design of the sensor set.

For Phase 4 will be developed the game and will contemplate, among other elements, the setting /fictional aspect, script, definition of rules and interface, production of visual and sound *assets, layo*ut,gameplay prototypes, content insertion, etc.

For Phase 5, intermediate tests of the Viable Minimum Product (MVP) of the product between team and validation of the proposed solution will be performed with a sample of the target audience.

The sample will be non-probabilistic will include 90 children in the age range from 03 to 10 years of age of both sexes, regularly enrolled in a school in the Valley of the Bell Region. The distribution of children will be performed by age group 1 (G1) will include 30 children aged 3 to 5 years; Group 2 (G2- 30 children) from 6 to 8 and Group 3 (G3- 30 children) from 8 to 10 years. In this sense will be contemplated the motor phase is foundedl; stages: initial, elementary and mature (3 to 7 years) and specialized; transient internship (7 to 10) according to Gallahue, Ozmun and Goodway (2013). The GameMove pilot test iscarried out in the educational context. All evaluations will be carried out after the signing of the Free and Informed Consent Form for Minors, according to the determinations of resolution 466, december 2012, of the

National Health Council. Participants will receive information regarding their right to participate, from warranties of anonymity. It is noteworthy that relationships already have prior authorization through institutional contracts for the development of research and testing of products in the format proposed by EDM and GameMove with the target audience. The project was approved by feevale University's research ethics committee with CAE number: 17201119.8.0000.5348.

The game will produce data from each individual and can be used in the educational or health context, allowing qualified Physical Education professionals to evaluate children's DM and propose motor interventions. Figure 1 presents a conceptual model of the proposed Game.

Figure 1- Proposed Game conceptual model
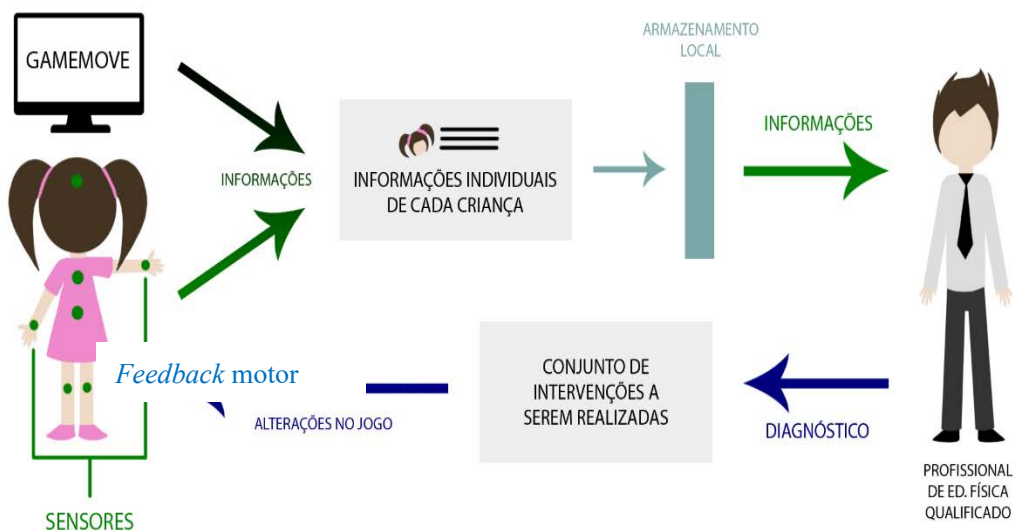
Source: Prepared by researchers

A set sensors will be positioned on children according to a manual that will be made available along with game GameMove. The game, in exergame format, will run via computer through an interface with a set of sensors and motion capture. In this sense, stabilizing, locomotor and manipulative movements that are linked to body perception, space and time will be evaluated, and are basic domain components for both motor learning and school training activities and quality of life.

It will be up to the child to follow the game's motion instructions, in a fun and engaging way. "GameMove" proposes to be a product accessible to the Brazilian reality, focusing on the educational and health market.

With each child's assessment, the data will be stored locally,in the game, for the realization of a diagnosis of DM by qualified physical education professionals. After the diagnosis, a proposal for motor intervention will be made available to teachers/professionals, such as school physical education planning, age-appropriate sports and recreational activities.

For application and validation of the game will be made available to the evaluator (physical education professional) a manual together with the game and a set of sensors, with the appropriate position

of each of them. Three kits with game + sensors are planned to be 1 for ages 03 to 05 years (G1); 1 for ages 06 to 08 years (G2) and 1 for ages 08 to 10 years (G3), enabling testing with up to 3 children simultaneously.

Data analysis will take hold from the information generated by the game and set of sensors that will be programmed to create engine development scores of those investigated according to chronological age and performance in the motor skills proposed in the game.

Necessary changes in the game will be developed taking as input the application performed and the data collected. At this stage, *feedback*will also beconsolidated, where professionals from the Physical Education course at Feevale University will be able to access and propose interventions related to children's DM.

4. How will GameMove be used?

In the educational sphere GameMove will be applied by physical education teachers trained to install the sensors in the muscle groups responsible for the specificity of the movement and later analyze the data and propose motor interventions.

For the health area GameMove, can be used in clinics and hospitals, expanding the field of action of PhsicEducationprofessionals, who will assist in the diagnosis and propose interventions in the motor development of children who present pathologies that compromise cognitive and motor development. Validation aims to evaluate the aspects of us,gameplay, and its potential, from the interaction subject-content - digital resource.

Currently, in Brazil, the evaluation of motor development of children is performed analogously. For this, an ADAPTATION EDM protocol proposed by Rosa Neto (2002) will be used. With this, it will be possible to evaluate and identify the motor profile of those investigated in the skills: fine motricity, global motricity and balance.

With the developmentofthe game GameMove, which constitutes an active digital game in exergame format,it is expected todevelop a digital solution for the evaluation of motor development. In this sense, it will be possible to evaluate the motor development of children through an interactive, playful, recreational active digital game with a narrative adherent to the profile of the child of the 21st century.

In general, the qualification of an individual in a given motor state would be based on the characterization of their performance skills, which would be representative of a minimum motor competence so that the individual can act according to the demands of the motor activities of daily, occupational, expressive, recreational and sports life. In addition to the diagnosis, valid criteria, such as scores, will be used to characterize DM according to chronological age.

As a vision of the future, from the information provided by the game and by the set of sensors, it will be possible to organize a network of physical education teachers/professionals in schools, clinics and hospitals that consume and generate information for interventions regarding the motor development of Brazilian children. From the data generated, longitudinal studies will be conducted dedicated to the description of developmental changes. The data may also support public policies in the area.

GameMove can also be used to diagnose DM of children with disabilities, as it will assign scores to DM according to chronological age and performance in motor skills.

5. Final considerations

By developing an active digital game it will be possible to incorporate it into programs for child development and training of health professionals and schools. It is also expected to strengthen the segment of development of digital games for health, especially with regard to issues related to child development, as well as develop *research know-how* in the education, digital games and health interfaces in the theme of child motor development in order to support the practices of teachers and physical education professionals.

With GameMove it will be possible to still understand, with the participation of the different subjects and in light of the results of this study, how digital games can help in the evaluation of child motor development considering the profile of Brazilian children. With this there will be the strengthening of the Creative Industry and technological solutions focused on Health Education actions, as well as the development and strengthening of a group of researchers involving digital technologies for this area.

The firstimpact l predicted on society from the application of GameMove is to enable an evaluation motor development in childhood rationing the ludicity and active digital play; bringing the possibilities of digital games beyond entertainment.

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Psychological Factors Related to Fibromyalgia Syndrome Phenomenon

Keila Junghans Rempel;[6]

Milena Menezes Mendonça[1];

Magda Bianca Cardoso[1];

Juliana Pinto Coelho[1];

Tirza Almeida da Silva[1];

Kenne Samara Andrade Martins[7];

Rômulo Chaves Pereira de Oliveira[8];

Daniel Cerdeira de Souza[3]

Érica da Silva Carvalho[2];

Sônia Maria Lemos[2];

Eduardo Jorge Sant'Ana Honorato[2]

Abstract

Fibromyalgia is a chronic rheumatic syndrome characterized mainly by diffuse musculoskeletal pain. Its diagnosis is clinical and the presence of 15 to 18 tender specific painful body sites (tender points), with no specific laboratory alterations. It is often associated with other symptoms such as constant fatigue, swelling, morning stiffness, difficulty in memorizing and concentrating, mood swings, anxiety, and depression, among others. This condition mainly affects women, bringing a considerable negative impact on carriers. Pain perception is the result of multiple factors: biological, social, and psychological. This study sought through qualitative research to recognize the psychosocial factors related to fibromyalgia, as well as identify the possible meanings to suffering, seeking to contribute to elucidate the psychogenic phenomena related to the pain of Fibromyalgia Syndrome. Finally, to analyze if patients who are undergoing psychotherapy follow-up benefit from the symptoms caused by chronic pain of fibromyalgia. The result is divided into three categories: Implications of the diagnosis in social relations, repercussions of the diagnosis on the interviewees' quality of life, and psycho-affective symptoms experienced by the interviewed fibromyalgia patients. According to the research, it was observed physical limitation, adding severe pain, memory impairment, concentration, excessive fatigue, resulting in psychic suffering characterized as guilt, frustration, depression, anxiety, and self-image affected. In this study, ten female patients with a mean age of 40.2 years were interviewed, of which 30% are undergoing psychological follow-up, which resulted in greater acceptance of their comorbidity and coping with it.

Keywords: Fibromyalgia-FM, Biopsychosocial Factors, Women

INTRODUCTION

Fibromyalgia is a rheumatic syndrome mostly diagnosed by clinical examination. The symptoms

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[6] Unip – Universidade Paulista
[7] UEA – Amazonas State University
[8] UFAM – Amazonas Federal University

of this clinical condition are painful and have implications for the quality of life of the individual with this syndrome. The Fibromyalgia Syndrome - FM is usually polymorphous, that is, subject to change of form. The symptom presented by patients with this syndrome is chronic pain, and patients have difficulty locating the pain and specifying whether the origin is muscle, bone, or joint. The amount of pain varies among patients and may be characterized by burning, stinging, weight (tiredness), or as a bruise. Also, according to this, the aggravation of symptoms may be related to cold, humidity, climate change, emotional tension, or physical exertion. (RUSSEL, apud PROVENZA, J.R. et. Al, 2004)

According to Martinez (cited in PROVENZA, JR et al, 2004), fibromyalgia significantly affects patients' quality of life due to the deterioration in functional capacity, sleep, sexuality, and professional life. Fibromyalgia patients should be given a global approach and not only regarding physical complaints. According to Junior (2012), fibromyalgia syndrome can affect patients of any age and mainly diagnosed in women. A study was conducted at the American College of Rheumatology that found a prevalence of 3.4% in women and 0.5% in men, especially in the 35-60 age group. Due to this significant information, we chose gender as a research factor and the age group, which is among the most afflicted by the disease. The individuals with fibromyalgia syndrome find their body as a source of suffering, frustration, and impotence in the face of pain. Knowing the origin and accepting body limitations can lead to better adaptation and possible improvement of pain.

Through informal conversations with physicians and patients in the community, there was an interest to investigate more about this pathology, as well as the possible causes and treatments to alleviate chronic pain caused by FM.

METHOD

A qualitative, descriptive/exploratory research, this research proposes to analyze the interaction through individual interviews through questions related to the biopsychosocial context involving patients with the syndrome and analysis of qualitative data. According to Bardin (2006), content analysis is a set of communication analysis techniques, which seeks to interpret the information contained in the interviews, which can be about the meanings or significant, is highlighted in this field, the importance of semantics for method development.

The research aimed to analyze a group of 10 women. The interviewees were indicated by a local hospital in Manaus, Amazon - Brazil. Inclusion Criteria: Women residing in Manaus, aged between 30 and 50 years, who have a final diagnosis, with at least one year of diagnosis. Exclusion Criterion: It is perceived as indicative of exclusion - being fit to the inclusion criteria and: being women with severe mental disorders (a definition that associates the duration of the problems, the degree of emotional distress, the level of disability that interferes interpersonal relationships and social skills and diagnosis). Women who have only suspected fibromyalgia syndrome; have another nationality that makes it impossible to speak or understand the Portuguese language.

We used the individual interviews as methodology; through these, we worked the theme, divided into two moments. In the first moment, we presented the Informed Consent form, informing the participants that the interviews and the collected information would be used exclusively for the research and that the

identity of the participants were going to be preserved. Later, in the second moment, we proceeded with the interview, addressing the themes of the biopsychosocial aspects of fibromyalgia, possible meanings to suffering, psychogenic factors related to FM pain. We also approached, through the interview, if they had psychotherapeutic follow-up.

This study was conducted through data collection and semi-structured interviews that, according to Cervo & Bervian (apud OLIVEIRA, 2011) is one of the main techniques, and can be performed through face-to-face conversations by the research team, following the method and ethics, in order to obtain the data information related to the proposed research. This content analysis consists of General reading of the collected material (interviews and audios); Coding for the formulation of analysis categories, using the theoretical framework and the indications brought by the general reading; Clipping of the material, in comparable units of record (words, sentences, paragraphs) and with the same semantic content; Establishment of categories that differ thematically in the registration units (passing from raw data to organized data). The formulation of these categories follows the principles of mutual exclusion (between categories), homogeneity (within categories), relevance in the transmitted message (non-distortion), fertility (for inferences) and objectivity (comprehension and clarity); grouping of registration units into common categories; progressive grouping of categories (initial → intermediate → final); inference and interpretation, supported by the theoretical framework. The Brazilian Resolution of the National Health Council 466/2012 was followed. This research has pledged to safeguard the integrity of all stakeholders, preserving privacy, seeking benefits, and protection. It gives free consent and clarification. It was submitted to the Research Ethics Committee (REC) and approved.   According to Oliveira, (2013, apud FREITAS et al, 2015), the RECs were created to defend the interests of the research subjects, with the purpose of protecting the integrity and contributing to its development through evaluation and monitoring within the ethical standards. "Having as guiding principles the referential of justice, equity, beneficence and non-maleficence" (OLIVEIRA, 2013, apud FREITAS et al, 2015, p.02).

Theoretical Framework

According to Ferreira (2015), one of the first doctors to try to define the set of signs and symptoms that is now known as fibromyalgia was Frederick Wolfe, director of the Arthritis Research Center in Wichita, Kansas, who was interested in this clinical condition in the decade. Like many other rheumatologists, he had seen an increasing number of patients who complained of diffuse muscle pain but who, upon physical examination, showed no evidence of injury or inflammation. Laboratory tests, X-rays, biopsies, and muscle tissues showed no evidence of the pathology. The lack of blood markers made it difficult to diagnose and, therefore, to treat. Only in 1990, however, did the term "fibromyalgia" formally receive a medical nomenclature, designating a condition of persistence. FM may involve genetic factors, inflammatory states, sleep disturbances, and various psychological factors.

The body is not just a set of skin and bones. By carrying meanings, the body becomes the main constituent of personal and social identity. Pain is understood as an unpleasant sensory and emotional experience associated with present damage or potency in terms of injury. This is the most common definition of pain, even described by the International Association for the Study of Pain - IASP. It was

officially launched on May 9, 1974, and its official journal, pain, was published in 1975. The question that has been asked for many years and is hardly answered is: is pain organic or psychogenic? Today we seek to answer this question in another way: pain is a biological, psychological, and social experience. It is therefore, biopsychosocial (MATOS, 2012).

According to Turk and Flor (apud TOMÁS, 2009) there are three underlying assumptions in the biopsychosocial aspects of patients with FM, the first of them concerns the biological issues that participate in their physical disorder; the second refers to psychological factors that influence the psychosomatic aspect of pain; Finally, social issues stimulate the patient's physical perception, which automatically changes his behavior. According to Turk and Melzack (apud TOMÁS, 2009) it is essential to understand the symptoms of FM, which go beyond isolated psychological and biological factors; this understanding is an effect of the interaction between social environment, body, and mind. Mainly because the central symptoms of FM, such as chronic pain, change all areas of personal progress, such as physical, emotional, social, and family relations.

According to Berber et. al (2005) FM patients have a poorer quality of life compared to other chronic diseases such as rheumatoid arthritis, cancer, chronic obstructive pulmonary disease, and systemic lupus erythematosus, due to FM symptoms patients suffer a sudden break in routine, This impact tends to be permanent, where there is a destabilization of social contact, as well as family relationships, as patients are constantly forced to adapt to their new condition. Given this scenario, Reich (apud MACEDO, 2015) says that there are worrying factors for both the patient with FM and the people who live with him, these factors refer to the frequency and intensity of symptoms, this generates a level of insecurity very great within this social life.

Berber et. al (2005) inform that psychosocial factors play an essential role in the evolution of FM, such as behavioral, cognitive and social factors, each viewed separately, but forming a set, examples, risk behavior and poor adaptation of coping forms, loss of self-control and victimization, interferences of the individual's activities in society. Given the chronic pain these problems can harm the patient, who moves away from friends, begins to have financial problems due to possible job loss and has no desire to perform physical activities, as the patient has cognitive impairment he has not adequate coping ability culminating in depressive symptoms and generating a vicious circle. According to Helfenstein Junior et. al (2012), social and psychological factors can directly influence the feeling of disability of FM patients, but this is not unique to these patients, but of all chronic pain patients, after all, the body is the physical environment of the subject.

According to Helfenstein Junior et al. (2012) the diagnosis of FM is clinical, the central point is generalized chronic pain, but in addition, there is diffuse musculoskeletal pain, fatigue, muscle stiffness, multiple tender points, pain after physical exertion, sleep alterations, may you also have symptoms of depression, memory impairment, anxiety, tension or migraine headache, dizziness, dizziness, paraesthesias, irritable bowel syndrome or restless leg syndrome, among other symptoms related to the locomotor system. [...] Fibromyalgia as a paradigm of chronic diffuse pain represents the well-finished summary of the interrelationship between human neurological - immune - endocrine - behavioral control systems. We now know that dysfunction in any of these sectors can translate into pain, which depending on the characteristics of each person, may vary from phenotype. To put it further, momentary imbalances in the control of various

stressors are common and do not cause disease, until they reach a critical level, either by the intensity of the stimulus or by the weakness of the individual's defense. Thus, the painful scenario represents the tip of the iceberg of a continuum, which becomes unbearable and requires medical attention. There is no doubt about the pathophysiological changes in patients with Fibromyalgia. The quality of life of these patients is poor, and regardless of their emotional state at that time (FELDMAN, 2008, p. 318).

Because it presents so many inconveniences to the patient's health, it is common to search for a pathology to explain the symptoms, and according to Sá et. al (2005) there is much controversy regarding the etiological and physiological causes of FM, of course, there is no denial that pain and symptoms exist, but there is no concrete laboratory evidence, even therapeutic approaches share this blurring. First indication that the diagnoses may be different depending on the medical specialty the patient is, such as going to the infectologist will be considered to have chronic fatigue syndrome, gastroenterology irritable bowel syndrome; rheumatology may eventually be diagnosed as Fibromyalgia. According to Kossoff (apud SÁ, 2005) other factors are being the focus of investigation, such as genetic factors, because FM can happen in certain families, scientists have pointed out a possible genetic vulnerability that, being triggered by a traumatic event could trigger the disease.

Helfenstein Junior et. al (2012), states that FM is influenced by environmental, hormonal, and genetic issues, triggering changes in the level of neurohormonal receptors. Any severe stressor could lead to a change in the pituitary-hypothalamic-adrenal axis that could involve the sympathetic and serotonergic nervous system. It is concluded that the pituitary-hypothalamus-adrenal axis plays an essential role in the lasting of FM symptoms. The psychosocial factors deserve particular attention, encompassing all facets of the life of this subject, such as possible psychiatric aspects, trauma experiences, financial problems, in short, a cultural perspective of pain. Therefore, as the individual is a group, the patient's entire experience is analyzed to obtain a better psychic understanding of the patient (SÁ et. Al 2005).

Oliveira (2000) suggests that pain can be a manifestation of psychological symptoms, such as psychiatric illness, depression, anxiety, and psychosis. However, some factors lead to FM classification, where phenomenological aspects predominate. Even some FM pictures are related to depressive patients, but there is no definition as to whether depression can lead to a FM picture or the opposite. Berber et. al (2005) tells us that FM causes feelings of vulnerability and helplessness due to its unknown origin and cure. The prevalence of depression among these patients ranges from 49% to 80%. Depression can influence FM symptoms, causing functional limitations, worsening the subject's quality of life. Helfenstein Junior et. al (2012) inform that FM can be diagnosed at any age, being much more frequent in women, according to studies conducted 40.8% of these women are in the age group of 35 and 44 years old. The prevalence of psychological symptoms in these patients worsens the clinical picture resulting from another study conducted in Brazil found that 30% of fibromyalgia patients had severe depression and 34% moderate depression, 70% of patients with FM had significant anxiety, and 88% had significant anxiety. The author mentions that the combination of depression and FM causes the exacerbation of symptoms, impairing coping strategies, he emphasizes the psychological profile of these patients, who present severe self-criticism, perfectionism and obsessive search for details.

However, according to Berber et al. (2005) depression worsens the course of the disease because it ends up increasing the sensation of pain, prevents adherence to treatment, deregulates the hormonal and

immune system, and destabilizes the social support of the patient who is isolated. Every sick person seeks a reason for their illness, a name for their illness, something that can justify their suffering. This nonconformity leads to the search for meanings for its physical limitation. In numerous studies, a close relationship between FM and psychopathological disorders can be noted. According to Branco (apud SÁ et al, 2005) there is some difficulty in distinguishing FM from other somatic functional syndromes and psychiatric disorders, such as depression and anxiety. Because of the emotional distress associated with physical pain, as well as limitation and diagnostic uncertainty, the picture worsens, also taking into account frustrating therapies and anxiety for relieving fibromyalgia pain.

Chiozza (apud. LIMA, 2008, p.02), say "the substitution of meaning carries with it a magnitude of affection sufficient to give it significance." Montagna (apud LIMA, 2008) also says that the reading of one's feelings by the subject, through verbal language, is full of gaps, voids, and it is up to the psychoanalyst to try to unravel and elucidate these feelings. From the cognitive point of view, this same author points out that verbalizing a traumatic experience, modifies memory, and organizes the emotional experience into something that can be more easily elaborated and worked on, in order to be put aside. According to the DSM-V, despite the classification of somatic symptom disorder, it is not appropriate to give a diagnosis of mental disorder simply because it cannot be proven by medicine. The medical diagnosis also does not exclude the possibility of a comorbid mental disorder. The presence of somatic symptoms of uncertain etiology is not in itself, sufficient to justify a diagnosis of somatic symptoms disorder. The symptoms of many people with fibromyalgia would not meet the criteria required to diagnose somatic symptom disorder (ARAÚJO, 2014). El-Hage et al. (apud MATOS et al., 2012), declares that when there is a chronic pain that is undiagnosed through a scientific explanation, it may be of psychological origin, a somatized suffering. Since fibromyalgia does not present real physiological changes in most cases, it gives room to believe that this is a psychopathology. Biomedical specialties fail to reach a diagnostic consensus, and many patients are referred to psychiatric outpatient clinics and subsequently diagnosed with depression. This is due to Western scientific medical rationality - the legitimacy of pathologies from imaging examinations. What then presents to the subject with FM, is a disease without a cure, which presents itself without a visual diagnostic examination, and limiting the functionality of the patient's body, leading him to the obligation to accept losses by him.

Chronic pain produces a permanent change in an individual's life. As stated by Angelotti (apud. LIMA, 2008), this permanent change modifies his behavior, his insertion in the family and in society. Chronic pain has psychological consequences, triggers low self-esteem, insomnia, anger, feeling of abandonment, and a high rate of depression (STRAUB, apud MILANI et al., 2012). "To fall ill is to endure something unpleasant, especially when one does not have the means to act on the causes and before which escape is impossible." (DANTAS & TOBLER, apud MILANI et al., 2012, p.03). According to Coelho (apud MILANI et al., 2012), every significant loss that happens in life, in the case of the patient with FM is health, it is necessary an elaborative process, which is accompanied by process of bereavement. Grief is an excruciating process of emotional elaboration, where there is the "farewell" of a person, condition, or situation so that it can adapt to the new reality that the subject is inserted. The pain of loss of health, physical abilities, social life, or limits is something that undermines the emotional structure of the chronic pain, and causes deep discouragement, a significant disinterest in the outside world, a loss of ability to produce.

Martinez (apud PROVENZA, JR et al., 2004), states that in addition to the suffering caused by pain, the worst consequence of fibromyalgia is the loss of quality of life. The fibromyalgia patient has his daily activities affected, limiting his social life and may even compromise family ties. For Kubler-Ross (apud VALIM, D'AAGOSTINI, 2018) the terminally ill patient goes through five stages: Denial, Anger, Bargaining, Depression, and Acceptance. These stages are also experienced by fibromyalgia sufferers. These stages are defense mechanisms, and there is no chronology between them, and the patient may go through one of these stages more than once. Desriaux (apud MATOS et al., 2012) says that musculoskeletal disorders are first among recognized occupational diseases. These disorders are sources of severe disabilities that compromise the health, employment, and life of those affected.

According to research by Sá et al. (apud MATOS et al., 2015), they find that between the onset of symptoms (pain) and the diagnosis, the delay is five to eight years. The fibromyalgia patient is labeled for years as a psychiatric patient, which despite complaints of widespread pain and fatigue, these are not justified. It is biomedicine's inability to deal with a subjective malady that categorizes these patients as psychiatric. However, according to Sasdelli and Miranda (apud LIMA, 2008), as the patient verbally externalizes the pain and its representations, the patient has more experience and understanding about the pain itself and can move from passive mode to a more active growth posture. However, it should be noted that pain, in many cases, will be present as a companion for the person who will have to undergo some restrictions. It is necessary to give meaning to the disease process.

Coelho (apud LIMA, 2008), the basis of the personality structure of the chronic patient comprises regression tendencies, which may facilitate primary care, as it adapts to the condition of 'patient', but also contributes to its chronicity. That is, the patient conforms to the position of dependent, fragile, and in a way this condition contributes to the fact that being cared for can be somewhat comfortable, and conformist. Through various studies in the early 1960s, psychiatrist Aron T. Beck developed Cognitive Behavioral Therapy (CBT) to address current depression problems and modify individuals' thoughts and behaviors through psychotherapy. According to Beck (1997), Cognitive Behavioral Therapy is a cooperative process of empirical investigation, a set of strategies and therapeutic techniques for the purpose of changing thought patterns, which are identified as automatic and dysfunctional. This process can take anywhere from three to six months, where strategies are worked out to deal with suffering. It intends to modify, during the sessions, the cognitive processes that are considered responsible for the behavior that happens outside the session. The main symptoms of fibromyalgia, especially chronic pain, disturb all areas of personal functioning, physical, emotional, social, family, and occupational functioning (TURK & OKIFUJI, 2002).

Camacho and Aarte (2001), empirical studies indicate that external attribution and catastrophic thinking contribute to pain intensity. Cognitive therapy, as described above, is the approach of choice for modifying such biases in patient information processing. Turk & Okifuji (2002), declare that pain is progressively recognized as a sophisticated perceptual experience, due to the influence of a broad range of psychosocial factors, which integrate the socio-cultural background, the social context and the surrounding environment, the meaning attributed to the pain, emotions, beliefs, expectations and personal attitudes. For Bailey et. al, (2003) chronic pain is really a demotivating condition for the patient, because in addition to facing the stress triggered by pain, also has to continue to deal with other "stressors" of their daily lives.

Psychological screening is an essential procedure in the comprehensive assessment of all

fibromyalgia patients, aiming to refer patients with psychological evaluation. Screening consists of obtaining sufficient information about the impact of symptoms on the patient's physical condition, mood, and perceptions of the responses of other significant people (Turk et al., 2002). For Bradley and Mckendree-Smith (2001), it is necessary to clarify to patients that psychological assessment aims at exploring and identifying interactions between psychological (emotions, cognitions, and behaviors) and altered physiological processes that influence symptoms and persistent pain, disability and social and family activities. Brandão (1999), mentions that pain generates essential psychological and social dysfunctions. Chronic pain is not suitable for one type of treatment because it is subject to a series of control mechanisms that act on the nervous system as a whole. In addition to medications should be used, other procedures that help reduce symptoms. According to the literature, patients who are diagnosed with fibromyalgia exhibit behaviors that need to be modified and / or replaced in order for people with the syndrome to cope better with their pain and, consequently, with their symptoms in a healthier way. This does not rule out the possibility of a combined treatment: rheumatologist, psychiatrist, physiotherapist, and psychotherapist. Based on the authors Turk, Meichenbaum and Genest (1983), through exercise, the patient can learn to identify pain-related negative emotions and stressful events and recognize dysfunctional thoughts and cognitive biases associated with them. With exercise, he can gain better control over the symbolic processes related to pain management and experience.

Results

Laurence Bardin (apud CAMARA, 2013), professor at the University of Paris V, content analysis is one of the data approach techniques in qualitative research. Another aspect raised by Bardin is that content analysis has been used for a long time since humanity's first attempts to interpret holy books, being structured in the 1920s as a method by Leavell. The definition of content analysis comes only in the 40-50s with Berelson, aided by Lazarsfeld, Bardin's work came to be published only in 1977 "Analyze de Contenu" in which the technique was adjusted to the minutiae that serve as direction today (CAMARA, 2013).

[...] The term content analysis refers to: "a set of communication analysis techniques aimed at obtaining, by systematic procedures and objective description of the message content, indicators (quantitative or not) that allow the inference of relative knowledge. The conditions of production / reception (inferred variables) of these messages (BARDIN, 2011, p. 47, apud CAMARA, 2013 p. 182).

Godoy (apud CAMARA, 2013) states that content analysis from Bardin's perspective is a methodological technique that can be applied to all types of expression and communication. In this analysis, the researcher seeks an understanding of the characteristics, structures, or models that are hidden in message elements that are considered. The analyst has two functions: understanding the meaning of communication as if it were his own, as well as seeking another meaning, another message, which can be seen through or beside the first.

Bardin (apud CAMARA, 2013) content analysis is a method that can be applied to both quantitative and qualitative research. In order to answer the research objectives, we prioritize the use of Bardin's Content Analysis for the discussion of data, by dividing and associating narrative excerpts, based on thematic

similarities, for the formation of categories. The division into categories is a result based on analysis, aiming at the systematization of internal contents, subjective in nature.

The categories discussed below each have their specificity and thus result in the subject's pure and particular experience content. Due to the analysis of the interviewees' statements, we reached the following initial categories: Physical and social limitations; Dependency; Difficulties at work; Memory and concentration; Ache; Tiredness; Acceptance of the diagnosis; Guilt and Frustration; Depression and anxiety; Self image. These categories concern the first interpretations. Later, in continuity with the analysis of thematic similarities, we find three final categories: Implications of the diagnosis in Social Relations; Diagnostic repercussions on quality of life; Psycho-affective symptoms experienced by fibromyalgia patients. The table below presents for better visualization of the correlation between final categories and the first categories.

Table 1 – Category analysis procedure

Final Categories		Initial categories	
1.	Implications of diagnosis in social relations	1.	physical and social limitations;
		2.	Dependence;
3.	Diagnostic repercussions on quality of life	4.	Difficulties at work;
		5.	Memory and Concentration;
		6.	Pain;
		7.	Tiredness;
8.	Psycho-affective symptoms experienced by fibromyalgic patients.	9.	Acceptance of the diagnosis;
		10.	Guilt and Frustration;
		11.	Depression and Anxiety;
		12.	Self Image

We interviewed 10 female patients with fibromyalgia. The table below shows the sociodemographic data of the interviewees studied. The average age of the interviewees is 40.2 years; most of them are married, highly educated, and have children.

Table 1 - Sociodemographic characteristics of respondents with fibromyalgia

Sample	10
Age	40,2 years (32-49)
Marital Status	
Single	2 (20%)
Married	8 (80%)
Educational Level	
High School	3 (30%)
Univeristy Degree	4 (40%)
Pos-grad	2 (20%)
Master	1 (10%)

Childres	
Yes	7 (70%)
No	3 (30%)

The interviews conducted pointed to a significant loss of health, which according to WHO, health is a "state of complete physical, mental and social well-being and not only due to the absence of disease or illness" (Revista Saúde Pública 1999). Moreover, as a result of this lack of well-being, 100% of respondents said that the physical limit was compromised, and as a result, 90% of them stopped going out, doing something they had done socially before. According to Millani (2012), the pathology is real and debilitating, and the fibromyalgia patient experiences persistent and widespread body pain. Even the pains get worse because of the pain of misunderstanding. The conditions of the patients affect the productive life of this person. Interviewee 4 reports:

"I am no longer in the mood for many things. It had a huge impact on my life. Because I was always very active. For example: gym, if I go, I'll just do a treadmill. I can get nothing more. I was very antisocial. I don't like to be with people anymore. I can't explain, I think I'm kind of impatient. Meetings, birthday parties, other parties, all night at the party today, I don't like it, I don't go, I don't have patience anymore and I get tired and irritated. I'm not very nice anymore. And even in the church I can't stand it. Also even play with my 5-year-old son. I get tired, it hurts me. And I can't play with him anymore. "

Most of the interviewees pointed out difficulties as much for work as for those who studied as well. Even Goldenberg (apud MILANI, 2012), mentions that the worst consequence of fibromyalgia, due to pain and other symptoms, the patient ends up limiting both social contacts and there are cases of breakup with family members. However, the consequences of a chronic illness are a person's life compromised, and depending on the emotional state even before the onset of the illness. Those consequences get even worse. The pain is so intense that the limiting aspects can be inferred in many areas of patients' lives, which can be noticed in the interviewee's speech 2:

"I stopped working, stopped doing activities I liked in the church, walking also became difficult."

Often there is nothing that can be seen physically in the body of patients with chronic FM pain. However, the individual complains of pain, and the slightest tasks at home can be cumbersome. These limitations can be interpreted as unwillingness, laziness, exaggeration by family and friends. For this reason, people who live with the patient have difficulty validating symptom complaints. According to interviewees 1 and 3:

"It stirred the mood - total physical limitation. It stirred my family, it stirred my activities, I worked, I don't work anymore. With the family, I was that mother who gave the reinforcement, and now I can't anymore. There were so many medicines I need to take, the spending on the medicines."

"To do things by hand, especially in the morning. I also can't do the things I did before, like going out to parties, I get tired soon and I want to go to bed. "

The impact that FM has on the patient's life, whether social, individual or family, involves considerable social limitation. Failure to live the life she lived affects the social circle of this patient. According to Santos et al (apud LIMA, 2008), research conducted in São Paulo, which points out the

precarious life of FM patients compared to people considered healthy. This research reports that the physical symptoms of the subject with the syndrome lead to a decline in vitality and functional skills. Even some of the interviewees said they missed who they were before. Although the disease is not visible, simple tasks are left undone, such as walking in a mall, hanging out with friends, socializing with family, and people's misunderstanding makes the pain even greater. As reported by interviewee 1:

"I wanted to go out with friends, I can't, but they do not understand, they ask me to react as if it was something I had in my control."

These FM carrier disruptions have an impact on quality of life. It was observed in the interviewees' speech a frustration about bringing dependence on other people, as interviewee 1 said:

"I do not accept. I hope that one day I will get rid of these pains. It is very difficult to live dependent on others."

When we look at the interviewee, we can see that it is not only she who suffers, but a human being who belongs to a family, to a society that suffers, and this subject with his particular subjectivity and history that is compromised. In this respect, Le Breton (apud. MATTOS, 2012) "pain is not only a physiological fact, but mainly a fact of existence". Not only the patient suffers from pain, but what this patient represents as an individual in the social life that gets sick. Thus, what was observed is that the physical, mental and social impairment of the patient reflects directly on the quality of life of this subject.

According to the interviewees, there is a considerable decline in quality of life, where almost 100% of them mention that tiredness, lack of memory, disposition, decreased libido and especially pain end up being factors that generate a significant disability, such as It was also seen only 40% of them can do physical exercises. While, it is called "quality of life", or assessment of global health, the determination of the personal, physical, psychological and social impact of the patient, imposed by the disease (MARTINEZ et. Al, 1998).

"I can no longer live as before, before I was faster, pain all the time, all joints hurt when I'm in crisis. When I am not in crisis, there is some pain in parts of the body. Or the head, or the spine, or another. Examinations show inflammation, but nothing visible. Marriage changes, I can't have libido anymore. " Interviewee 2.

"I also can't do the things I did before, like going out to parties, I get tired soon and I want to go to bed." Interviewee 3.

"Stuck intestines, Tiredness, blurred vision, tingling, very sensitive soles, forgetfulness (memory), fluctuating mood, irritability, weight gain, lack of concentration and much anxiety" Interviewee 4.

"I walk 3 times a week" Interviewee 2.

Velkuru (apud ABREU, 2011) says that FM does not have such a dominant diagnosis if affected patients make use of the broad spectrum of therapeutic specificities, patients who are more committed and motivated manage to have a "normal" quality of life while discouraged and non-collaborative patients have more severe clinical conditions.

On the other hand, this lack of disposition may be linked to secondary symptoms such as depression. Santos et. al (2006) states that fibromyalgic patients have a lower quality of life, where there may be a relationship between FM and depression. Depressive symptoms compromise the quality of life of patients with FM, increasing the sensation of pain and the perception of functional disability. In fact, depression is

an independent predictor of variation in physical performance in these patients so depressive symptoms should be controlled to ensure improved quality of life (HOMANN et. Al, 2012).

"Stomach pain, depression, difficulty sleeping, irregular bowel, weight gain, physical limitation, and as I said, tiredness. It's a pain we don't want for anyone. " Interviewee 5.

Loose bowel, sleep too much, weight gain, tired waking, depression, isolation, sensitive hearing. And what disturbs me the most is the memory. I took vitamins and tests accused nothing. Frustration. Foot pain. Horrible "Interviewee 6.

The impact that Fibromyalgia has on patients' quality of life after diagnosis, mainly due to physical symptoms, is a disabling consequence. They begin to feel frustrated that they cannot be as they were before their illness, unable to do what they did when they were in full health, leading to social isolation, creating a dependency on others, and especially being hostage to their new condition.

"The routine for sure. Today my routine began to adapt according to Fibromyalgia. I had to adapt my work at home, there was a need to transfer my office here home, because I make my schedule and if I feel bad, I can go to my room and work the time I feel better. Today my husband is worried even when I'm driving, the drugs are drowsy and I ended up avoiding driving more". Interviewee 9.

"Yeah, I had a very nice life. Full of friends, going out every weekend, playing volleyball, and now I'm here, in pain. I'm not active anymore, I just want to know about my house, my bed." Interviewee 7.

Martinez et. al (1998) states that Fibromyalgia significantly affects patients' quality of life. Degradation is expressed in various areas, such as functional capacity, sleep quality, sexuality and working life. Patients with Fibromyalgia should receive a multidisciplinary approach, not only in relation to complaints and musculoskeletal function, but mainly due to the presence of psycho-affective symptoms.

The research participants had a high prevalence of psycho-affective symptoms considering depression and anxiety at higher levels, but other symptoms were emphasized, considering their individual and social consequences, such as guilt and frustration for being a chronic syndrome with undefined etiological factors, emotional instability in the process of accepting the diagnosis, support and understanding of family members and the changes they suffer in their self-image.

The contents of the answers are strong because they portray the psychic suffering caused by pain, as we can see below:

"In the crisis I get completely in bed. I can not do anything. Lots of fatigue. It strikes an anguish, a sense of abandonment and even being unable. Here comes the cry of pain that depresses us. " Interviewee 5

"I get anxious, nervous, I want to go home soon. I feel too tired. I don't want to go anywhere, just lie down, very tired. I think this is worse. People don't understand, they think it's freshness. And because of all this, I isolate myself, and it's even making me afraid of reunion. " Interviewee 6.

"I had a very nice life. Full of friends, going out every weekend, playing volleyball, and now I'm here, in pain. I'm not active anymore, I just want to know about my house, my bed ... I can't settle for it. I

know I need to obey my body, but I ask God for healing. I don't know how I will live like this. I take medications and how will I live taking medications all my life? ". Interviewee 7.

As well portrayed by Berber (2005), the predominance of psychiatric imbalances, especially depression, is high among patients with fibromyalgia, ranging from 49% to 80%. Depression can trigger or aggravate the characteristic symptoms of fibromyalgia, leading to reduced functionality, greater perception of stress, and greater intensity of depressive symptoms than healthy individuals. (HOMANN et al, 2012).

According to Straub (2005), fibromyalgia patients, suffering from chronic pain, have psychological consequences and triggers feelings of abandonment, low self-esteem limiting their social life and may even compromise family ties.

"The marriage changes, I can't have libido anymore, I gained a lot, I'm ashamed. I can no longer have a nice sex as before. Everything has changed, I feel guilty, I feel heavy, I feel frustrated because I can't make food anymore, I can't do the cleaning. I cry constantly because I can't get my house dirty, and staying home without work is very frustrating and I feel very guilty. " Interviewee 2

"My son's father, he reads, has heard, but doesn't help me, doesn't understand the disease, so he does nothing to help me in the crisis. It's no use knowing if you don't understand. He doesn't work, does nothing to help. I'm the one supporting the house. Even my marriage is falling apart. " Interviewee 4

"They didn't understand, and I didn't feel understood. They don't understand ... They think I'm not fighting, I'm not trying. It's too bad, I don't feel welcomed. People want me to drive, to drive, and I can't anymore. But I have to put up with it. " Interviewee 6.

The statements also point to feelings of vulnerability and helplessness due to the demotivating conditions of the origin of the unknown diagnosis and cure. The simultaneous appearance of psychic disorders causes more significant functional limitations, negatively impacting people's quality of life, both in physical, intellectual, and emotional aspects, and reducing the ability to work, family, and social life (TORRES, TRONCOSO & CASTILLO, 2006).

"I was very fast at work, and now I can't anymore. I am slow. This is not me, and having no prospect of improvement is very sad. Doctors even give me vitamins, change my diet, but I can't improve. And I didn't want to live on prescription drugs. And I have many thoughts of inferiority, unable to do certain things." Interviewee 6

"All. It stirred the mood - total physical limitation. It stirred my family, it stirred my activities, I worked, I don't work anymore. With the family, I was that mother who gave the reinforcement, and now I can't anymore. There were so many medicines I need to take, the spending on the medicines." Interviewee 1

In this sense, as portrayed by Sasdelli and Miranda (2001), pain is associated with the psychological functioning of the singular being, and when approaching the subject, it is essential to consider that it is fundamental to use the condition of empathy, to put oneself in the other's place. try to understand what pain represents to him, try to understand if the patient can have any secondary gain with it.

According to the authors, as the subject expresses verbally about pain and its representations, the subject has more significant experience and greater understanding about it, being able to leave the passive

position of experience and assume a posture of growing in the experience. It is also noteworthy that pain, in many cases, will be an eternal companion of the person, who will have to undergo some restrictions. It is necessary to give meaning to the disease process.

"Thanks to this follow-up with the psychologist I didn't get into a deep depression. The follow up with the psychologist helped me in this acceptance process. Because the pain is demotivating you. But today I already accept." Interviewee 8

The data collected validate with the literature, regarding the impact that these psychological symptoms can have on patients with fibromyalgia, either through the intensification of pre-existing psycho-affective symptoms or the production of additional symptoms. According to Coelho (apud BRADLEY, LA & Mckendree-Smith, 2001) the pain of loss of health, physical abilities, social life, or limits is something that shakes the emotional structure of the chronic pain subject, and causes deep discouragement, a critical disinterest in the outside world, loss of ability to produce, do and be.

FINAL CONSIDERATIONS

The development of the present study sought to analyze the possible biopsychosocial causes that interfere in the process of fibromyalgia syndrome. For this, we sought to describe the biopsychosocial aspects of Fibromyalgia Syndrome; identify the possible meanings to suffering, seeking to contribute to elucidate the psychogenic phenomena related to the pain of Fibromyalgia Syndrome; as well as seeking to investigate the benefits of the interviewees who do psychotherapeutic follow-up regarding the symptoms caused by the chronic pain of Fibromyalgia. It is important to emphasize that this comorbidity brings severe pain, limitations, and that Fibromyalgia has no prospect of cure so far. Therefore, the implications that this syndrome transfers to the patient go beyond the biological aspects, bringing social and psychological implications. Through semi-structured interviews with ten women with FM, it was observed that the interviewees had different degrees of suffering. Similarly, different coping with comorbidity, both physical, exercise, adherence to medical and psychological treatment.

It was concluded that there is a considerable aspect of psychological distress for these subjects. Also, both patients who have to deal with this disease daily and people who are in some way connected with the diagnosed individuals, in any of the aspects mentioned during the work, we observed some kind of dazzle of positive points by the affected. However, it was noted that the carriers who are accompanied psychotherapeutically, showed a better coping with the syndrome, and consequently worked more positively their frustrations and limitations that Fibromyalgia imposed on them.

Fibromyalgia has proved to be a complete mystery in many ways, it has no cause leading to it, it has no cure, so many authors associate the disease with psychological factors, such as extensive trauma that some people cannot internalize, for students. Psychology has been a subject of much learning and clarification to help in the search for new knowledge about this so distressing syndrome of living, to understand how these women mostly coexist with this disease and how it completely affects their lives, family, your social circle, your body and your mind. Due to these particularities, it has proved to be a topic of fundamental importance for the health area in general, not only physical but also primarily mental. Therefore, this study is only one among several that seek to understand and help people who have this

pathology, with information to explore understanding in the face of suffering in chronicity. It was a work of extensive acquisition in the academic context and with possible paths to broader and deeper contexts on the subject in question.

For psychologists, understanding how the chronic pain patient is affected globally by the implications of this comorbidity is very essential. Fibromyalgia Syndrome is in fact a pain that exceeds the physical, due to the biopsychosocial losses that the subject suffers. In this fact of no longer being healthy, no longer who he was before, the individual goes through many emotional pains and needs to elaborate all this suffering, so that he can resignify his new physical, emotional and social condition. In this respect, the reception and psychotherapeutic accompaniment are critical. As researchers, we could understand the extent of the details surrounding fibromyalgic individuals.

By doing the interviews with the carriers, we were able to experience interview cancellations because the interviewee was unable to receive. We also note that there is a great need to exchange experiences with other carriers and to have a place where this individual can open. We offer psychotherapy at the University through the Psychology Clinic. We also offer to email the survey to the carriers interviewed. The contribution to the unfolding of other researches on the same theme is fundamental so that new knowledge can be acquired.

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Wind Effect on Microclimate and Thermal Comfort Index in Open-air Public Spaces in the Brazilian Rainforest Cibes

Deisiane Santos da Cruz, Beatriz Cordeiro Costa, Patrícia Mie Suzuki, Jéssica Costa da Silva, Otavio Andre Chase, Glauber Tadaiesky Marques, Emerson Cordeiro Morais, Pedro Silvestre da Silva Campos, José Felipe Souza de Almeida

Federal Rural University of Amazonia (UFRA), Cyberspatial Institute (ICIBE), Brazil.
e-mail: deisecruz10@gmail.com, pereiralopes89@gmail.com, miesuzuki1997@gmail.com, jessclash5@gmail.com,
{otavio.chase; glauber.marques; emerson.morais; pedro.campos; felipe.almeida}@ufra.edu.br.

Abstract

Amazon cities and rural villages came to fragment its green spaces, implying changes in the quality of life of its population. Despite clear warning signs, this picture of environmental degradation processes has affected flora and fauna with severe consequences throughout the forest, from points that tend to widen over time. Supported on a literature review of microclimate research in environments, which is based on the dew point temperature, another suitability has been formulated considering the importance of wind speed. By using computational records, when this variable is contained in the characterization of a person's sense of well-being in a given outdoor environment, a thermal comfort index can be established to assist in planning the construction of appropriate leisure areas, as well as identifying unhealthy environments. The results were obtained in different places, during drier summer months in the Amazon rainforest, around the city of Belém, located in the extreme north of Brazil. The best responses were registered in an environment characterized by arboreal architecture planning, followed by an environment with an intact vegetation forest.

Keywords: Arboreal planning; Thermal comfort; Rainforest; Wind speed.

1. Introduction

The Amazon rainforest covers a 4.2 million km² area, corresponding to 49.3% of Brazil's territory and 5% of the planet's surface [1]. Its complex canopy ecological systems functions like an elaborate adapted sea suspended in the air that contains a myriad of living cells, having evolved over the last 50 million years is the primary technology park the Earth has ever known because each of its organisms (numbering among trillions) is a marvel of miniaturization and automation [2]. Instead, deforestation causes effects that can modify this setting on the ecosystems of utmost importance in maintaining the planet's environmental oxygen balance [3-5]. Currently, based on deforestation rates [6], this region is targeted by agribusiness expansion, as well as illegal selective logging [7] and mining industries of commercial interest, drivers of population density, and enlargement of unhealthy cities [8].

The transition from the countryside to the cities is a natural habit of the human being who is looking for jobs, opportunities, and comfort [9]. With the growth of cities, the lack of planning related to the excess

of constructions, sanitation, garbage, and all the implications for human health or the environment [10]. As a result, in the Amazon, the effects of these actions bring wreak havoc on the ecosystems, and without a project or order that comes to be attached to government programs of organization and occupation of the soil, the anthropogenic interference impacts on the rivers and the forest [11-12]. Therefore, the combination of this disastrous association requires studies and decisions about which problem should be dealt with immediately, as the population of the Amazon grows every year.

Motivated by global warming and its effects due to the lack of planning in the arborization of Brazilian cities, many researchers have proposed models of thermal comfort for public spaces in Brazilian cities. France et al. [13] consider the use of thermal discomfort index (TDI) and temperature and humidity index (THI) for tropical regions, due to the practicality of application at open environments, as indicated by [14]. Still, according to [15], these indices of thermal comfort were evaluated in the city of Vitória, Brazil, and from THI index they establishes three levels of comfort for the external environment, which are: Comfortable, for sensations between 21°C and 24°C; Slightly uncomfortable, for sensations between 24°C and 26°C; And, extremely uncomfortable for thermal sensations above 26°C. This index is appropriate for tropical regions and evaluates the stress in the urban environment [14].

In work presented by [16], the dew point temperature indicator has to determine critical thermal sensation experienced by people in a closed environment, like factories, hospitals, or schools. From this publication, using data collected over four years, we have formulated a thermal comfort index (TC index) by including the wind speed in the equation proposed by them. So, this proposal aims to present the results with this novel modification when comparing different open-air environments in the city of Belém, considered as the Metropolis of the Brazilian Amazon rainforest.

2. Material and Methods

The chosen environments are three locations around to the urban center of Belém and one in the forest place, retaining its original features. Figure 1 shows an image of select locations for study.

Figure 1.   Selected environments. **(A)** Arboreal planning near the urban center. **(B)** Poor arboreal planning at forest fragment. **(C)** Parking lot nearby the A. **(D)** Intact natural forest around 100 km distant from Belém.

The green areas of each one are differentiated by A with landscape planning integrated into

environmental preservation. Another (B), is located at a fragmented forest around A, but no planning its arborization form. Also, measurements were made in a parking lot (C), near to A, and inside a preserved natural forest (D), with difficult access for people, so far 100 km from A, B, and C.

To obtain data on environmental variables, we employ a mini mobile weather station, shipped with sensors, simple hardware, and compatibility with record storage [17]. The variables considered as an object of study are air temperature (T), relative air humidity (RH), dew point temperature (Td) and wind speed (v). The meteorological records were obtained in the course of four consecutive years, in the Amazon summer, between September and October, i.e., for the period 2016 to 2019, between 11:00 am and 3:00 pm, Responses were processed, and this collection was subsequently used for the presentation of results.

Among what is considered to be planning arboreal architecture are the wind corridors, which are free areas that allow pathways with openings towards the wind. It is notable that the direction of the wind during the summer period in Belém is constant and comes from the Atlantic, which flows across the surface in a close-to-parallel formation with the shape and direction of A (Figure 2). Also, trees are pruned at the same height and spacing between them. Its crowns start from 3 meters high so that the intercalary vegetation are shrubs planted in tracts made with reuse of materials obtained by donations. This site is a project of the Technological Institute at the Federal University of Pará.

Figure 2. Illustration of wind corridor at A location.
(1°28'19.9"S, 48°27'21.2"W)

The thermal sensation index presented by [16], was modified for an algorithm that considers the wind speed. This modification is given by:

$$TCI = 0.116 \times (T + Td) \times v.$$

This equation is valid for 0<V<5 m/s, with weak to moderate winds. It is worth mentioning that, winds considered of strong intensity, above 5 m/s, can cause trees falling during high winds in wooded environments. However, when v is not considered in the equation, the observations that set the value approximately +3 (very hot thermal environment) are valid and converge to the Talaia-Vigário equation [16]. To calculate Td, the following recurrence equation was used:

$$Td = T - (100 - UR)/5.$$

The data collected were measured and stored in the database using the computational module [17], show in Figure 3.

Figure 3. Data acquisition system [17].

3. Results and Discussion

The Amazon rainforest is in the Ecuadorian range and this geographical position influences climatic factors in the region. An essential feature in the composition of its equatorial climate, characterized by being hot and humid, is the presence of the vast Amazon basin, but there are also many local variations resulting from the topography. This combination of features creates a natural moisture flow that intensifies the heat as the incidence of sunlight is higher, causing the temperature to vary slightly throughout the year but preventing it from having the same proportions as a desert. Therefore, it is within this scenario that this proposal was developed, in which we propose a methodology based on an adequate thermal index that considers at least the basics of all this complexity.

Tables 1 shows the measurements of air temperature and relative air humidity in the four selected locations A-D (Figure 1), Table 2 shows the measurements of dew point temperature and wind speed, and Table 3 presents the TCI in these places.

Table 1. Average rates of Temperature, Relative Humidity

(September/October between 11:00 am and 3 pm)

	2016	2017	2018	2019
Temperature (°C)				
A	31.0	30.5	31.2	29.2
B	30.0	30.5	31.0	30.0
C	37.6	38.0	37.7	35.4
D	29.5	29.2	30.7	28.7
Relative Air Humidity (%)				
A	76.2	77.5	78.7	79.5
B	72.0	69.5	69.9	77.8
C	54.5	53.5	53.7	56.2
D	83.5	84.0	83.7	84.3

Source: Authors (2019).

Table 2. Average rates of Dew Point Temperature and Wind Speed

(September/October between 11:00 am and 3 pm)

	2016	2017	2018	2019
Dew Point Temperature (°C)				
A	26.4	26.0	26.9	25.1
B	24.4	24.4	24.9	25.5
C	28.5	28.7	28.4	26.6
D	26.2	26.0	27.4	25.5
Wind Speed (m/s)				
A	1.4	1.5	1.3	1.4
B	0.8	0.8	0.7	0.8
C	0.4	0.5	0.4	0.5
D	1.1	1.1	1.0	1.1

Source: Authors (2019).

Table 3. TCI to the environments assessed

Wind Speed (m/s)				
A	1.4	1.5	1.3	1.4
B	0.8	0.8	0.7	0.8
C	0.4	0.5	0.4	0.5
D	1.1	1.1	1.0	1.1

Source: Authors (2019).

To compare the comfort levels proposed by the index, the average values over the sampling period in Table 1 and Table 2 (shown in Figure 4), were used. In order to estimate the index at each location, a

database was developed on a computer platform, and the results are shown according to the monitoring of the environments. With this methodology, we can infer that from the modification implemented in the Talaia-Vigário equation [16], this TC index is ideally suited for the humid tropics due to its practicality and is an evaluation method for the open-air index that allows quantifying heat stress in an urban environment.
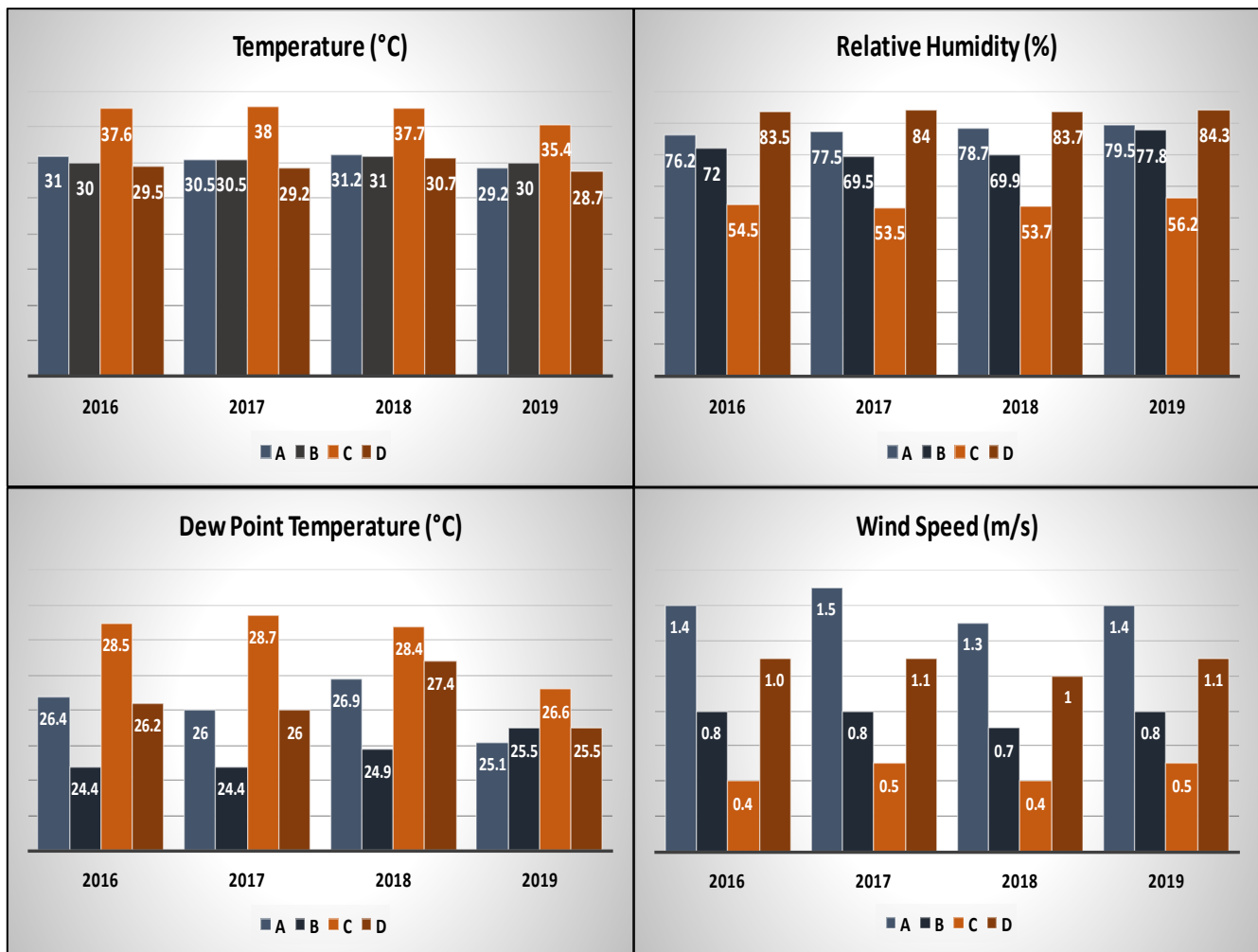
Figure 4. Average values of microclimatic variables measured between 11:00 am and 3 pm (September/October).

Except for the measurements on the parking lot, the average temperature showed no significant difference among environments. The forest also acts as a barrier for wind, which allows it to retain its moisture. Further information can be obtained from observing Figure 4: First, in deforested environments, the wind tends to be stronger; however, this does not occur in the parking lot (C), as the vegetation has been replaced by buildings that play the same role, destabilizing the systems in such a way that makes the humidity dropped rapidly (averaging 30%). In the fragmented area (B), the undergrowth has also been removed, facilitating loss of moisture and causing a decrease in the environment. The environmental conditions (landscape, climate, soil and wind) given in A, help preserve adequate soil moisture even when the precipitation in a particular season or year is reduced. It is observed that the difference in relative air humidity is slightly accentuated between A and D. This situation is associated for the fact that from A to C is a fragmented amount of vegetation, including C, which we believe is on account of the presence of a

concentration of moisture, present in the region.

From the implementation of the TCI equation, the average value obtained in the A space with planning during the observation period was 9.1, while at B maintained with fragmented natural vegetation, but without planning, was 4.9 (Table 3 and Figure 4). This difference shows a significant difference in terms of the thermal sensation experienced in each of the environments. About the C parking lot, there was 3.3 which is a situation close to a hostile environment to the presence of people (TCI prox. to 3). In area D with dense forest, it remained within the average, which is a reasonable thermal comfort for the region. However, a problem of extreme heat concerning the thermal unhealthiness is found inside the urban area in the city of Belém, where it was registered that during this summer period the measurements at these times are similar to those obtained in C. Figure 5 shows the TC index (TCI normalized by the average of the best values from A).

Figure 5. TC index at locations A, B, C, and D.

As a final remark, for the use of this formulation should be emphasized that, as the work presented by [16], the conceptualize thermal sensation index, is related to critical situations of extreme cold or heat (-3 <TCI< +3). In the case of extreme heat, with risk or presence of fire, the wind is a direct participant of spreading. Thus, the use of the equation proposed by them, is related to the detection of fire risk or indoors critical situations, without the air circulation and heat conditioning, such as interiors of factories or schools. When the wind speed is considerate, the results of the combination of its speed into the equation, as is the case of public squares or parks, becomes a tool useful and effective management for evaluation of open-air space planning.

4. Conclusion

Based on the modification of a formulation presented in the technical-scientific literature, this text aimed at applicability for deforested cities located in the Amazon. The records were obtained by a sensor module in an embedded system, in which the values of air temperature, dew point temperature, humidity and wind speed have been stored. The results were verified *in situ*, among which there is an area built with the planning of wind corridors and where the highest speed was registered, followed by an intact forest, during

all experiments concerning the other areas evaluated. Thus, we can conclude that the implemented TC index allows us to evaluable the thermal comfort that better represents the climatic conditions in the open-air of fragment forest. Furthermore, it is essential to consider the need to research and update this theme that is little discussed, due to the knowledge that space is much more pleasant where a larger volume of vegetation predominates. Also considering the climate can get out of control in the Amazon rainforest by a simple natural condition and by raising awareness on the deforestation problems in the region has been increasing, it may safely be stated today that the thermal sensation is becoming increasingly unbearable due to human intervention in its natural habitat. However, when unfolding this study, it is seen that some authors claim that it is not enough to plant any tree because there are some criteria to consider before planting in order to obtain thermal comfort. Studies such as this, related to local microclimate, are essential in assisting the planning and management of urban space, contributing to the construction of thermally more delightful environments, mainly in cities with a hot and humid tropical climate, with a strong tendency to become a desert, if its forest disappears.

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Teacher Knowledge as A Student: Socialization Practices by Pedagogical Reflection

Camila Kuhn Vieira

MSc student of the Postgraduate Program (PPG) in Sociocultural Practices and Social Development, University of Cruz Alta (UNICRUZ). CAPES scholarship holder. Graduation in Nursing – UNICRUZ, Rio Grande do Sul, Brazil. ORCID: https://orcid.org/0000-0002-6303-4318. E-mail: camilakuhn1994@hotmail.com

Carine Nascimento da Silva

Master of the Postgraduate Program (PPG) in Sociocultural Practices and Social Development, University of Cruz Alta (UNICRUZ). CAPES scholarship holder. Graduation in Physiotherapy - UNICRUZ, Rio Grande do Sul, Brazil. ORCID: https://orcid.org/0000-0001-9908-5291. E-mail: kaca_nascimento@hotmail.com

Bibiana Medeiros Araujo

Student of the 5th semester of the Physiotherapy Course at the University of Cruz Alta. PAPCT / UNICRUZ Scholarship. Cruz Alta, Brazil. Email: bibianamed99@gmail.com

Vaneza Cauduro Peranzoni

PhD in Education - Professor of the Master Course in Sociocultural Practices and Social Development of the University of Cruz Alta (UNICRUZ), Rio Grande do Sul, Brazil. ORCID: https://orcid.org/0000-0003-2415-6504. E-mail: vperanzoni@unicruz.edu.br
University of Cruz Alta, Rio Grande do Sul, Brazil.

"[...] Teaching is the art of the arts, because no one would learn without those who have the sublime gift of teaching!" (Edenice Fraga).

Abstract

The teaching knowledge starts from the premise of reflection and dialogue of the practices experienced by the teacher. Thus, the objective of this research is to analyze the main discussions of the research project 'Teaching Knowledge of Students of the Pedagogy Course - PARFOR (National Program for Basic Education Teacher Training). The method adopted was through dialogued workshops, with a total of four workshops with themes and discussions about teaching knowledge, entitled as: 'The teaching practice in the classroom'; 'I woman, I academic'; 'Pleasure and Suffering in teaching practice'; 'The academic life'. The new epistemology of knowledge leads the teacher to reflect in a critical perspective to find a solution, but also to learn new knowledge and transmit in their work / school context.
Keywords: teaching; education; knowledge; school;

1. Introduction

Education is mediated by the teacher, as it involves the teacher's wisdom to transmit knowledge and transform the student into a reflective subject / citizen. Thus, "[...] the wisdom of the teacher is defined as something complex, coherent, of knowledge from professional training and disciplinary, curricular and experiential knowledge" (TARDIF, 2014, pp. 36).

The know encompasses the dimension of the educational sciences, making the teacher transform his teaching into praxis (action and reflection). With this, Pimentel (1993, pp. 46) highlights:

"The teacher needs to raise hypotheses of the school reality, studying more and producing new hypotheses that can work one day and not another, because the students move, the social context moves, the teacher also realizes it, in a unique world , like ours".

The practice of teaching involves constant and diverse knowledge, for this, the teacher is always in professional education (training, improvement, undergraduate course). It is noteworthy: "[...] the knowledge related to the professional formation of teachers (educational sciences and pedagogical ideology) depends, in turn, on the university and its body of formators" (TARDIF, 2014, pp.41).

With this in mind, this research aims to analyze the main discussions of the research project 'Teaching Knowledge of Students of the Pedagogy Course - PARFOR (National Program for Basic Education Teacher Training).

2. Methodology

The research is characterized as qualitative and exploratory. According to Minayo (2001, pp.22-22) the qualitative study "[...] works with the universe of meanings, motives, beliefs, values and attitudes, which corresponds to a deeper space of relationships, processes and phenomena that cannot be reduced to the operationalization of variables ". Exploratory research builds ideas and discovers facts according to the objectives proposed by the researcher. These researches are also formed by bibliographic survey, instruments and data analysis (GIL, 2010).

The present work comes from the Support Program for Scientific and Technological Production - PAPCT of the University of Cruz Alta - UNICRUZ (2018-2019), entitled as: Teaching Knowledge of Students of the Pedagogy Course - PARFOR. It is also linked to the UNICRUZ Pedagogy Course, the Human and Pedagogical Studies Group (GPEHP) and the Human Development Laboratory (LDH) of the UNICRUZ Postgraduate Program in Sociocultural Practices and Social Development. The proposed method of this project was through workshops, with a total of four workshops with themes and discussions about the wisdom of the teacher. The participants were seven students from the 8th semester of UNICRUZ's Pedagogy Course (PARFOR), in which they work in school education (Early Childhood Education and Elementary School).

Workshop discussions were recorded on a mp3 player with the consent of the students / participants, which was later transcribed in a Word document and analyzed according to Bardin (2011). To ensure the organization of data analysis related to the participation of guests / students was used the code name "Student" followed by a sequential numbering (1, 2, 3 ...) to facilitate the understanding of readers.

3. Results and discussions

Socializing about the educational practices experienced in daily school life is essential to discover new work strategies and new knowledge. Socialization is defined as "[...] a process of formation of the individual that extends throughout life history and involves ruptures and continuities" (TARDIF, 2014, pp.71).

Thus, in this topic will be presented each workshop held in this project and the main themes discussed.

3.1 Workshop 1 - Teaching practice in the classroom

Practicing teaching requires knowledge: disciplinary, professional, experience and curriculum (TOZETTO, 2015). Thus, this workshop aimed to reflect with the project participants on their work strategies and on the development of pedagogical activities in the field of early childhood education.

The work strategies and the pedagogical activities are used according to the school reality and the students profile, the following reports stand out:

Student 1: "The strategies used are: dialogue with the children, explanation of the tasks, and, of course, the feeling of affection and love with them."

Student 7: "The activities are: drawings, paintings, music, songs, dance, reading of children's books".
In early childhood education, pedagogical activities such as play and games enable different forms of expression, communication and student interest in the proposed content (TOZETTO, 2015).

"[...] the teacher's practice is not only the knowledge of the educational sciences, it is also an activity that mobilizes various knowledge that can be called pedagogical. Pedagogical knowledge is presented as doctrines or conceptions arising from reflections on educational practice in the broad sense of the term, rational and normative reflections that lead to coherent systems of representation and orientation of educational activity "(TARDIF, 2014, pp. 37).

Another issue addressed in the workshop was about the main difficulties encountered in teaching practice in early childhood education and what is most rewarding in the view of participants.

Student 2: "The main difficulty encountered is in the infrastructure, that is, the school does not have enough materials necessary to carry out the classes, and our gratification is to see the student literate, reading alone".

According to Campos (2013, pp.39) "[...] The teacher's work is complex, interactive and practical". However, this work can often be influenced by the lack of teaching materials and poor infrastructure causing challenges for the teacher and even for self-esteem. With this in mind, those responsible for this project planned another workshop (workshop 2) involving the theme of self-esteem and well-being.

3.2 Workshop 2 – I woman, I academic

The purpose of this workshop was to improve project participants' self-esteem and to recognize and value themselves as a professional and as a woman. Self-esteem is known to be the self-confidence of the individual, being "a mixture of knowledge, value, confidence, self-confidence together with the behavior that the subject has in interaction with the environment, with the world" (NICODEMOS, 2017, pp. 180).

This workshop had the collaboration of the Course of Aesthetics and Cosmetics of UNICRUZ, with the

aesthetic production (makeup and hair) in the participants. Some reports from the participants:

Student 3: "This workshop was wonderful, I feel renewed and beautiful".

Student 5: "I feel so good physically, mentally and spiritually. This makeup shop raised my self-esteem. "

Student 6: "This workshop shows our essence as a professional and as a woman, we are transforming agents, kindergarten teachers, our duty is to teach, but we are also women and we like to put on makeup and look beautiful.

Some highlights of the workshop:

Figure 1. Overview of the moment 'Beauty'.
Source: personal archive.

Figure 2. Makeup being finalized in one of the participants.
Source: personal archive.

Teixeira and Melo (2019, pp.12) point out that: "[...] It's not just about looks, but about being good about

yourself and the world around you. One of the ways to lead a light and enjoyable life is to have your self-esteem high. " Still the authors point out: "[...] Self-acceptance makes obligations not become a difficulty, but a joy to perform them, making peace with their appearance and personality" (TEIXEIRA; MELO, 2019, pp.12).

Self-esteem, makeup and well-being are intertwined, as they transform and improve the individual's quality of life, especially when education professionals feel undervalued.

3.3 Workshop 3- Pleasure and Suffering in teaching practice

Occupational health is a theme that involves worker health in the workplace. The context and working conditions can be determinant for the health-disease process (FIOCRUZ, 2011). Thus, this workshop aimed to reflect on the professional experiences lived in the school work environment related to occupational pleasure and suffering. As the reports below point out:

   Student 4: "My pleasure is when I can achieve school goals. And my suffering, in fact, is not suffering, but a concern related to the students, especially in the student's transition from kindergarten to elementary school. "

   Student 1: "The pleasure of teaching practice is at the time of literacy, when a student reads alone. One of the sufferings that I feel is when there is some occurrence of abuse with the child, this situation is very sad ".

Thus, it is clear that the pleasures in teaching practice are in student literacy, when they reach their goals and objectives proposed in the semesters. Already, on the suffering highlighted by the participants are the transition of students from kindergarten to elementary school and in situations related to social vulnerability. The school transition from kindergarten to elementary school is based on the assumption of a continuation of schooling, being a compulsory trajectory of the child / student, because it is the student's evolution in the face of their learning. However, this transition is often a challenge for the teacher, so that the teacher adapts to the reality of his students, and thus, suggests curricular activities aimed at better understanding of the student in relation to school content (MARCONDES , 2015).

According to Freitas and Knives (2013, pp.18):

   [...] the suffering of teachers at work comes from work overload; intense pressure from parents and government for student learning; poor working conditions; lack of respect for education managers; lack of student interest; obstacles to working with students who need more attention; and the numerous difficulties students have.

To close this workshop, some guidance was given and occupational disease prevention exercises were performed, in which it is called Occupational Gymnastics, with delivery of teaching material (folder) showing each step of the exercises.

Figure 3. labor gymnastics.
Source: personal archive.

Occupational Gymnastics is a sequence of stretching exercises that should be performed in the workplace, as it prevents occupational diseases, as well as Work-Related Musculoskeletal Disorders (WRMD) and Repetitive Strain Injury (RSI), these exercises are essential for improve the quality of life of the teacher as a worker (OLIVEIRA, 2007).

3.4 Workshop 4- The academic life
In this workshop, a general account was first made of all the moments of the present project, that is, of the previous workshops. Subsequently, the participants were asked about the academic background, the challenges and facilities imposed on pedagogy undergraduate.

Student 2: "Graduation is very difficult, especially the TCC, but when I see that I can do well in a subject I feel grateful".

Student 6: "We work during the day, at school teaching, and at night we are taught. It's hard, yes, we face a lot of obstacles, but we learned a lot here in the Pedagogy Course".

"[...] Pedagogy is the art of teaching" (TARDIF, 2014, pp. 121). And teaching work is defined in the pedagogical scope as the teacher's performance in different school and non-school contexts associating culture, teaching, science, ethics and pleasure (CAMPOS, 2013).

Other issue highlighted in this workshop was related to the contents seen in the course and whether it can be employed in teaching practice. Following are the reports:

Student 7: "Yes, a lot of content discussed here in the classroom, I can take to my kindergarten students."

Student 2: "Yes, I use some activity methods to teach my students because they are interactive methods and make the student better understand the content."

Macenhan and Tozetto (2015) show the importance of academic knowledge, that is, the contents seen in undergraduate studies.

The transformation of academic knowledge occurs as the teacher reflects on his practice, overcoming the difficulties with establishing relationships between assimilated knowledge in training and knowledge built on the basis of action (MACENHAN; TOZETTO, 2015, pp. 267).

The recognition of knowledge is constituted by experience, practice, action, but mainly reflection through dialogue. Freire (1987, pp. 09) exposes that dialogue is a "[...] constitutive movement of world consciousness [...], it seeks itself in a world that is common; because this common is world, to seek oneself is to communicate with the other ".

The possibility of reflecting on professional / teacher knowledge, didactic models learned as undergraduate students should be essential for academic formation, both in the initial process and in the continuing education of teachers. The purpose of this project was to discuss and reflect the diverse knowledge of teachers in their work practices through a new epistemology starting from a critical reflection to form the student as a teacher as an inspiring agent of knowledge.

4. Conclusion

Paulo Freire already said: "[...] Education does not transform the world. Education changes people. People transform the world." The new epistemology of knowledge leads the teacher to reflect in a critical perspective to find a solution, solve a problem, but also to learn new knowledge and transmit it in their work context, that is, in the school context.

In conclusion, the project "Teaching Knowledge of Students in the Pedagogy Course - PARFOR" sought to reflect and contribute to the participants' working practice, since it is within the university that it expands knowledge and transforms it into praxis (action and reflection) through from an interdisciplinary and contemporary view.

5. Acknowledgement

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Murine Experimental Models in Carcinogenesis Studies Are Efficient?

Antonio Carlos de Abreu

Fellow Master degree, Postgraduate Program in Health and Development in the Midwest Region, UFMS, Campo Grande-MS, Brazil.

Evair Moisés de Lima Santiago

Fellow medical undergraduate, Faculty of Medicine, UFMS, Campo Grande-MS, Brazil.

Gislaine Recaldes de Abreu

Fellow PhD, Postgraduate Program in Public Health Epidemiology, Fiocruz Mato Grosso do Sul.

Eliza Miranda Ramos

Fellow Master degree, Postgraduate Program in Health and Development in the Midwest Region, UFMS, Campo Grande-MS, Brazil.

Marcelo Barbosa Neves

Fellow Master degree, Postgraduate Program in Health and Development in the Midwest Region, UFMS, Campo Grande-MS, Brazil.

Rondon Tosta Ramalho (Corresponding author)

Full Professor, Postgraduate Program in Health and Development in the Midwest Region, UFMS, Campo Grande-MS, Brazil.

Abstract

Economic and social development has essential repercussions on the health of populations, as it alters the morbidity and mortality profile and favors the increase in exposures and risks to human health, especially the risk of cancer. Cancer is considered a significant public health problem worldwide, and remains with high incidence rates, being considered a complex disease, with multifactorial causes. The permanent incidence rates of prostate cancer prove to be one of the most prevalent, considered the second most common cancer in men worldwide, and a leading cause of deaths from chronic noncommunicable diseases. Among the different types of cancer, prostate cancer has been the subject of great scientific interest. In this context, animal models are valuable for studying cancer-related aspects, the use of animal models has the potential to increase our understanding of carcinogenesis, tumor biology, and the impact of specific molecular events on tumor biology. Animal models with specific human cancer characteristics can be used to test cancer prevention and treatment strategies. In this review, we aim to show how the use of animal models as an essential tool in the study of the molecular mechanisms of carcinogenesis.
Keywords: Neoplasms, Immunology, Neoplasm Transplantation, Oncogenesis

1. Introduction

Cancer is considered a public health problem in the world, and a significant cause of mortality, presenting a significant psychosocial and economic burden[1].

It is noteworthy that cancer is responsible for one-third of deaths worldwide, and this impact is felt mainly by countries with miserable subsistence and underdeveloped conditions, such as Brazil. For example, when addressing early mortality, it is estimated that in 2008, 36 million deaths (63%) occurred as a result of chronic noncommunicable diseases, in this case, câncer[2,3]. Therefore, the current relations between society, physical environment, and health are complex and dynamic. For, the economic and social development brings direct repercussions on the environment and the health of the populations, being one of the main consequences of the alteration of the morbidity and mortality profile[4].

As an example of chronic aggravation, we can mention the risks to human health associated with the use and exposure to pesticides, specifically the risk of cancer, which has been the object of great scientific interest[5,6].

According to WHO (2019), "Cancer is a generic term for a large group of diseases characterized by abnormal cell growth beyond their usual limits that can then invade adjacent parts of the body and/or spread to other organs"[7].

The term cancer, is a common term used for all malignant neoplasms,   being considered to be a multifactorial disease, in which its development depends on genetic (hereditary or sporadic mutations) and environmental (carcinogenic agents) factors. On the other hand, the term neoplasia means "new growth", defined as "an abnormal tissue mass that grows uncoordinated and over normal tissue and persists to grow in the same way after the stimulus that caused its change has ceased"[8].

In this review, we provide an overview of prostate cancer, the purpose of which was to describe the use of animal models as an essential tool in the study of the molecular mechanisms of carcinogenesis in an attempt to test preventive and therapeutic potential strategies for cancers.

2. Literature selection and analysis procedure

The narrative study aims to broaden the understanding of the studies considered, in this case, the use of mice in experimental models in studies of carcinogenesis. We used the electronic libraries "Scientific electronic Library Online (SCIELO-BRAZIL) and PubMed to perform this narrative review. We chose those databases because they are considered the two most significant free platforms in the scientific literature in Brazil.

3. Results and analysis

3.1 Thematic analysis

The selected articles were thoroughly analyzed and then divided into thematic categories, with the following topics: Prostate Cancer, Experimental Cancer Models, and Prostate Cancer Experimental Models.

3.2 Prostate cancer

According to Quijada et al. (2017), prostate cancer has high frequency worldwide, is present in all countries of America, Europe, Australia, and Africa, being considered the second most common cancer in men worldwide. And in 2012, around 1 million new cases were estimated; in Brazil, it is the most common type of cancer in all regions, disregarding non-melanomic skin tumors, and in 2016 around 61,200 cases per 100,000 inhabitants were estimated. According to the same authors: "Most prostate cancer diagnoses are associated with men over 65 years and less than 1% to men under 50 years. Is expected to increase by 60% of the number of new cases due to the increase in world life expectancy "[9].

Data from the American Cancer Society (2015) show that prostate cancer strikes men of all races, "being a silent threat to men's health," ranking third as the cause of deaths from chronic noncommunicable diseases. American statistics show that one in six men in the world will develop prostate cancer (CP) throughout their lifetime[10].

The incidence of prostate cancer (PC) proves to be one of the most prevalent in the world, being one of the most intensely studied diseases. According to the American Cancer Society, in 2016, over 180,000 new cases of PC diagnosed in the US were estimated, resulting in about 26,000 deaths[10].

In Brazil, the National Cancer Institute (INCA) estimated for 2018 and 2019 the risk of 66,120 new cases per 100,000 Brazilian men, which is much higher than in developed countries such as the United States, Canada, and England.[2].

According to Araújo, Conceição, and Zago (2019), "the cure for PC is a phenomenon investigated by multiple scientific perspectives, and each year discoveries are evidenced". Where having the disease and living with it is still challenging, especially in the care given to patients and the implementation of public policies in the health system directed to the treatment of the disease[11]. In Brazil, for example, available treatments have side effects such as sexual dysfunction, changes in body image, and social stigma, which often make the patient even more vulnerable, especially concerning aspects that involve his masculinity[12,13].

3.3 Experimental cancer models

Several animal models are valuable for researchers to study aspects related to cancer biology. In this context, the use of animal models has the potential to increase our understanding of carcinogenesis, tumor biology, and the impact of specific molecular events on tumor biology. However, it is crucial for the researcher to bear in mind that no animal model can faithfully reproduce all aspects of human disease[14,15,16].

With the advent of knockout technologies, the studies were based directly on the concept of immunological surveillance. Becoming evident that spontaneous or chemically induced murine tumor models are useful in demonstrating that the immune system continually watches for the appearance of aberrant cells and plays a crucial role in preventing tumor formation. Through the use of murine T lymphoma, the authors were able to unravel the functions of some immune system cells in immunological surveillance against tumors[17,18,19].

The *Mus musculus* is considered one of the best model systems for cancer investigations due to several factors including its small size and propensity to breed in captivity, its three-year shelf life, extensive physiological similarities and molecular with humans and a fully sequenced genome[14,15,20,21].

According to Shen (2010), transplantable models (xenographic and syngeneic) are the most used because they allow a better study of metastases and more easily reproduce the tumor microenvironment. They can favor the modeling of experiments and enabling various approaches, and these models are designed in immunodeficient mice such as NUDs[22].

In any case, mouse transplant models present the essential conditions such as high graft rates, association between malignant and adjacent benign tissue, reproduce tumor heterogeneity and genetic profiles and reproduce the hormonal state of the human tumor, in addition to enabling use of human cancer cell lines or human primary cancer tissues, xenographic transplantable models[21,23].

According to Lin et al., (2014), among the specific characteristics, and according to the site of inoculation, there are advantages and disadvantages for murine cancer models. In subcutaneous cancer cell inoculation, the advantages are easy implantation and easy monitoring of the tumor, and the disadvantages: less nutrient supply and low development rate, being difficult in these conditions to have advanced cancer. In orthotopic models, the advantages are a microenvironment similar to that of primary cancer and the possibility of spontaneous metastases. The disadvantages are difficult implantation, the low rate of tumor development, and limited cancer development[23]. On the other hand, subrenal capsule (CRS) inoculations have the advantage of having good blood supply and a higher rate of tumor development, as well as more significant heterogeneity, being the hard implantation a disadvantage[24].

3.4 Experimental models of prostate cancer

A significant limitation in the study of prostate cancer in the recent past has been the lack of adequate animal models that faithfully recapitulate all stages of disease progression[25].

The NCI Mouse Models of Human Cancers Consortium has convened a group of human and veterinary pathologists to analyze current animal models of human prostate cancer (PCa) and make recommendations on the pathological analysis. They reviewed more than 40 different models with 439 samples, including xenograft models, genetically modified rat, and canine models. They are reporting that were developed numerous relevant models in the last 15 years, and each approach has strengths and weaknesses[21].

According to Ittmann et al. (2013), for over 15 years, the first generation of genetically modified prostate cancer (GEM) models has been introduced. These transgenic models used prostate-specific promoters to express SV40 oncogenesis in the prostate epithelium. Animal models, particularly rat models, played a central role in the study of the etiology, prevention, and treatment of PCa. While tissue culture models are useful in understanding PCa biology, they cannot recap the complex cellular interactions within the tumor microenvironment, which play a crucial role in cancer initiation and progression[21].

The development of optimized PCa models has already accelerated our understanding of the biological complexity of PCa and in the future will improve the development of new approaches to prevention, detection, and treatment of this malignancy[15,21,23].

Pavese et al. (2013) demonstrated an orthotopic implantation model of PCa. In this model, cells are implanted directly into the ventral prostate lobe in Balb / c mice and may progress for 4-6 weeks. This

model provides an image of the ability of cells to invade and escape the primary organ, enter and survive the circulatory system, and implant and grow at a secondary site[26].

Since death by PCa is not due to the primary tumor, but instead to the formation of distinct metastases, the ability to effectively a model of this preclinical progression is of high value. Thus models such as that used by Pavese et al. (2013) have been used effectively to measure the metastatic response to both changes in protein expression, as well as the response to small molecule therapy in a short response period[26].

Due to the molecular complexity of cancer and the cost of therapy, the researchers still looked for functional in vivo genomic characteristics to support patient care. Cancer models often faithfully recap basic biology, tumor microenvironment, and their interactions, drug responses, and therapeutic resistance similar to human disease, and effectively favor the search for responses to PCa[18,27].

The xenographic or xenotransplantable transplant models, allow the use of human cancer cell lines as well as the use of primary human cancer tissues. Accordingly, the classical models for human prostate cancer consist of immunodeficient mice carrying subcutaneous prostate cancer cell line xenograft generated by injection of cultured prostate cancer cells (e.g., LNCaP, PC3 or DU145) or co-injection of cultured prostate cancer cells and stromal cells[23,27] (LIN et al., 2014; HUANG et al., 2016).

4. Conclusion

The use of cancer animal models has provided an alternative means for disease-related research. They represent immense potential in understanding cancer in its many aspects of cell proliferation and development, as researchers can observe and manipulate murine models with cancer, increasing the sophistication of modeling, providing new knowledge and advances in research.

We conclude that murine models characterize efficient methods to elucidate the mechanisms involved in tumor progression and metastasis development, and thus allow the development of specific drugs for the treatment of cancer patients.

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Delta-aminolevulinate dehydratase activity and oxidative profile in pregnant women with pre-gestational type 2 diabetes and gestational diabetes

Hellen Lopes de Paula[a], Fabiane Rodrigues[a], Leidiane de Lucca[a], Silmara Ana Vendrame[a], Walter Santos Neme[b], Thissiane de Lima Gonçalves[a*]

[a]Departamento de Análises Clínicas e Toxicológicas, Centro de Ciências da Saúde, Universidade Federal de Santa Maria (UFSM), Santa Maria, RS, Brasil.

[b]Hospital Universitário de Santa Maria (HUSM), Santa Maria, RS, Brasil.

Hellen Lopes de Paula: hellen_lopes89@hotmail.com

Fabiane Rodrigues: fabianeufsm@gmail.com

Leidiane de Lucca: leidi_lucca@hotmail.com

Silmara Ana Vendrame: silmaravendrame@yahoo.com.br

Walter Santos Neme: wsneme@yahoo.com.br

Thissiane de Lima Gonçalves: thissianegoncalves@yahoo.com.br

*Corresponding author:

Thissiane de Lima Gonçalves,

E-mail: thissianegoncalves@yahoo.com.br,

Departamento de Análises Clínicas e Toxicológicas, Centro de Ciências da Saúde, Universidade Federal de Santa Maria (UFSM), Santa Maria, RS, Brasil, 97105-900.

Abstract

The aim of this study was to perform a comparative evaluation between pregnant women: healthy, with pre-gestational type 2 diabetes (T2DM) and gestational diabetes mellitus (GDM), to determine if diabetes mellitus developed at different times interferes with the oxidative impact on the pregnant woman maternal body. A total of 90 pregnant women were recruited in the third trimester of pregnancy, subdivided into the three groups, and evaluated through their clinical characteristics, oxidative stress markers and delta-aminolevulinate dehydratase (δ-ALA- D) activity. Pregnant women with diabetes mellitus (DM) showed an increase in: age, pre-gestational and gestational body mass index (BMI), blood pressure, blood glucose and platelet count; those with T2DM had higher pre-gestational BMI and glycated hemoglobin A1c (HbA1c). The levels of thiobarbituric acid reactive substances were higher and the levels of non-protein thiols and catalase activity were lower in the DM groups compared to the control. Vitamin C was decreased in the T2DM group. The δ-ALA-D activity was decreased in pregnant women with GDM and the rate of enzymatic reactivation was higher in the DM groups. DM presented in gestation, regardless of the moment of its development, generates increase of the oxidative stress and decrease of the antioxidant defences, representing the largest difference with the control group. It is suggested that the insulin used in the treatment of T2DM acts in a beneficial way in the δ-ALA-D activity.

Keywords: biomarkers; δ-ALA-D; diabetes mellitus in pregnancy; oxidative markers; pregnant women.

1. Introduction

Diabetes mellitus (DM) consists of a systemic disorder characterized by consistently high glycemia and defects in the release and/or action of insulin produced by the body (Sociedade Brasileira de Diabetes, 2017). It is considered the most frequent metabolic problem that affects women in the gestational period (Araújo, Keating, Martel, 2015). It may be present before conception, such as type 1 or type 2 DM (T2DM), increasing incidence, or it may develop during pregnancy, called gestational diabetes mellitus (GDM), which affects about 3-25% of pregnancies, varying according to with the population, ethnicity and diagnostic criteria used (Sociedade Brasileira de Diabetes, 2017; Witczak et al., 2017). This pathology can lead to long-term complications for both mother and fetus (Toljic et al., 2017) being associated with an increase in the rate of spontaneous abortion, congenital abnormalities and macrosomia, which are largely related to the hyperglycemic conditions to which the organism is exposed (Lambert, Holt, 2013).

Closely involved in the pathophysiology of many diseases, including diabetes and complications related to pregnancy, is oxidative stress (Burton, Jauniaux, 2011; Chikezie, Ojiako, Ogbuji, 2015; Pescosolido, Campagna, Barbato, 2014). This state is described when oxidizing substances, especially reactive oxygen species (ROS), overlap with the neutralizing capacity of antioxidants in the body (Cuffe, Xu, Perkins, 2017; Zanini et al., 2014).

Physiological gestation is a period in which oxidative stress is elevated by increased oxygen demand for the placenta, rich in mitochondria, as well as by a decrease in antioxidant power (Hastie, Lappas, 2014). Complementing this physiological structure, in the presence of a hyperglycemic environment, advanced glycation end products are generated, which are involved in the production of free radicals, causing the oxidation state to be exacerbated (Souza et al., 2007; Witczak et al., 2017). These species can react with biomolecules, such as membrane lipids, proteins and DNA, generating irreversible damage through their ability to induce biochemical changes (Cuffe et al., 2017; Zanini et al., 2014).

Research has revealed increased free radical production and depletion of antioxidant levels in pregnant women with DM, leading to an increased risk of complications during these pregnancies (Murthy, et al., 2018; Rueangdetnarong et al., 2018; Toljic et al., 2017). Thus, markers of oxidative stress are one of the main targets of research related to DM, since they are the viable option for the prognosis and management of this disorder (Bonfanti et al., 2011; Cuffe et al., 2017).

The δ-aminolevulinate dehydratase (δ-ALA-D), an essential enzyme in aerobic organisms, participates in the formation of the heme group and other tetrapyrrol molecules. This enzyme has sulfhydryl groups that are sensitive to oxidizing agents and can be reduced in situations of oxidative stress (Bonfanti et al., 2011; Souza et al., 2007). The decrease of the enzymatic activity ends up affecting the biosynthesis of compounds and also, leads to the accumulation of its substrate 5-aminolevulinic acid, contributing to the overproduction of ROS (De Lucca et al., 2016). In the DM scenario, this enzymatic analysis may provide additional information to determine the dysregulation of glucose metabolism (Souza et al., 2007), functioning as an indirect marker of oxidative stress (De Lucca, Gallarreta, Gonçalves, 2015).

The objective of this study was to perform a comparative analysis between pregnant women: healthy, with pre-gestational T2DM and GDM, evaluating clinical characteristics, oxidative and antioxidant markers, as well as δ-ALA-D enzyme activity, not yet evaluated in this relation.

2. Materials and Methods

2.1 Study population

The study population consisted of 90 pregnant women, subdivided into three experimental groups. The control group (C), composed of healthy pregnant women, undergoing prenatal at the Wilson Paul Noal Basic Health Unit in the city of Santa Maria, Brazil. Pregnant women with T2DM and those developed GDM, from the University Hospital of Santa Maria (HUSM), which were distributed in groups according to the parameters established in the Clinical Protocol - Diabetes Mellitus and gestation (Hospital Universitário de Santa Maria, 2015). According to this protocol, pregnant women with GDM had altered and confirmed fasting glucose results (92-125 mg/dL) (up to 23 weeks gestation) or the Oral Glucose Tolerance Test (OGTT) (between 24 - 28 weeks). Samples were collected in the third trimester of gestation and the data obtained by consulting the medical records. Pregnant women with multiple gestation, smokers, alcoholics, hypertensives or any other condition than pre-gestational T2DM and GDM, including other types of diabetes, were excluded from the study. Pregnant with T2DM controlled diabetes with insulin administration and did not have major complications caused by the disease, whereas those in the GDM group only controlled with diet. This work was approved by the Research Ethics Committee with Human Beings of the Federal University of Santa Maria (UFSM, 33665314.4.0000.5346), and the participants agreed to the study by signing the Free and Informed Consent Term.

2.2 Sample Collection

Blood samples in EDTA (hemogram and glycated haemoglobin (HbA1c)), sodium fluoride (plasma glucose) and heparin (oxidative stress) were collected after 8h of fasting. From heparin, plasma was obtained by centrifugation, and after washing with 0.9% sodium chloride, it was obtained the red blood cells. The analyzes were performed after obtaining the material.

2.3 Clinical and laboratory parameters

Body mass index (BMI) was obtained by dividing weight by squared height (kg/m²). Blood pressure was measured with calibrated aneroid sphygmomanometer (mmHg). Biochemical parameters, such as glucose, determined by hexokinase/glucose-6-phosphate dehydrogenase (Siemens, USA) and glycated hemoglobin A1c by high performance liquid chromatography with cation exchange Analyzer D-10 (Bio-Rad, USA). Hematological analysis was performed using Sysmex® XE-5000 (Sysmex Corporation, Kobe, Japan).

2.3.1 Pro-oxidant

To evaluate lipid peroxidation, thiobarbituric acid reactive substances (TBARS) were determined in plasma and erythrocytes, as described by Lapenna et al., 2001. Malondialdehyde (MDA) was used as

standard, and reaction product measured spectrophotometrically at 532 nm and expressed in nmol MDA/mL plasma and nmol MDA/mL erythrocytes.

2.3.2 Antioxidants

Plasma quantification of protein (P-SH) and non-protein thiol groups (NP-SH) in erythrocytes was verified as proposed by Boyne and Ellman, 1972, changed by Jacques-Silva et al., 2001. The reaction product was read at 412 nm, and the results were expressed as nmol P-SH/mL plasma and nmol NP-SH/mL erythrocytes.

Plasma vitamin C dosage was performed as described by Galley et al., 1996, modified by Jacques-Silva et al., 2001. Ascorbic acid was used as standard and the orange reaction product was measured at 520 nm and expressed in µg VIT C/mL plasma.

2.3.3 Enzymatic activity

The activity of the catalase enzyme was determined according to Aebi, 1984. This was measured by the rate of decomposition of hydrogen peroxide, which was verified in a spectrophotometer at 240 nm and expressed in K/mg Hb.

The δ-ALAD activity was determined as described by Berlin and Schaller, 1974. The porphobilinogen formed, is read at 555 nm and expressed as U/L (nmol PBG/h/mgHb). The reactivation index was determined by the concomitant test of tubes containing the same incubation medium, except for the addition of 2 mM dithiothreitol (DTT), a reducing agent. Being estimated by equation: A-B/A*100, where A = δ-ALA-D absorbance with DTT and B = δ-ALA-D absorbance without DTT.

2.3.4 Statistical analysis

GraphPad Prism software version 6.01 (GraphPad Software, San Diego, CA, USA) was used. The Shapiro-Wilk normality test was applied to evaluate the sample distribution. When analyzed three groups, analysis of variance (ANOVA) was used, for data with normal distribution, followed by the Tukey test for comparisons between groups, the results expressed as mean ± standard deviation (SD), and the Kruskal-Wallis test for non-parametric data, with the results presented as median (interquartile range). However, when two groups were evaluated, the Student t test was used for normally distributed data and the results expressed mean ± SD, whereas the Mann-Whitney test was used for non-parametric data and the results presented as median (interquartile range). The analysis of gestational parameters was performed using the chi-square test. Correlations among all participants were assessed by the Spearman correlation coefficient. $p < 0.05$ were considered significant.

3. Results

The clinical and laboratorial parameters evaluated, presented in Table 1, show significant differences in the increase in maternal age, pre-gestational and gestational BMI, systolic and diastolic blood pressure, fasting plasma glucose levels and platelet count in pregnant women with DM, when compared to the control group. Only pre-gestational BMI and HbA1c (measured in patients with the pathology) revealed

a considerable difference between the types of diabetes, showing an increase in the T2DM group compared to GDM. The gestational characteristic cited as a victim of previous fetal death was considered when the pregnant woman had any loss in pregnancy or stillbirth.

The levels of oxidative stress markers were shown in Table 1, indicating that TBARS levels (erythrocytes and plasma) were considerably higher in pregnant women with DM compared to the control group. Significantly lower levels of NP-SH and catalase activity in DM groups, while vitamin C levels decreased significantly only in the T2DM.

Table 1. Characteristics and parameters analyzed.

Parameter	C (n = 30)	T2DM (n = 30)	GDM (n = 30)	p
Clinical characteristics				
Maternal age (years)	23.0 (20.0–28.0)	33.0 (30.0–35.5)[a]	29.5 (25.7–35.2)[a]	
Gestational age of collection (weeks)	33.0 (31.0-37.0)	32.0 (28.0-35.0)	33.0 (30.0-36.0)	
Pre-gestational BMI (kg/m²)	24.9±3.8	33.8±5.7[a,b]	29.8±5.8[a]	
Gestational BMI (kg/m²)	29.4 ± 4.3	35.3 ± 5.1[a]	32.6 ± 5.3[a]	
Systolic pressure (mmHg)	110.0 (100.0–110.0)	112.5 (108.0–120.3)[a]	115.0 (110.0–120.0)[a]	
Diastolic pressure (mmHg)	70.0 (60.0–70.0)	70.0 (62.7–80.0)[a]	70.0 (70.0–80.0)[a]	
Laboratory parameters				
Glucose fasting plasma (mg/dL)	78.0 (68.7–80.2)	119.0 (98.5–154.5)[a]	95.0 (85.0–105.0)[a]	
HbA1c (%)		6.4 ± 1.1[b]	5.4 ± 0.5	
Erythrocytes (10⁶/mm³)	4.0 ± 0.3	4.1 ± 0.3	4.1 ± 0.3	
Hematocrit (%)	35.6 ± 2.6	36.1 ± 2.3	35.9 ± 2.8	
Hemoglobin (g/dL)	11.6 (10.8–13.2)	12.0 (11.7–12.5)	12.1 (11.4–12.6)	
Platelets (×10³/mm³)	161.5 ± 6.6	222.4 ± 38.1[a]	222.1 ± 50.0[a]	
Gestational characteristics				
Suffered previous fetal death (%)		40.0	26.6	0.273
Macrosomia (fetal weight > 4Kg) (%)		10.0	3.3	0.301
Oxidative stress parameters				
TBARS erythrocytes (nmol/mL)	15.7 (10.4–18.5)	25.2 (20.4–32.2)[a]	24.9 (22.3–27.9)[a]	
TBARS plasma (nmol/mL)	3.9 ± 1.6	5.2 ± 2.0[a]	5.4 ± 1.6[a]	
NP-SH (nmol NP-SH/mL)	824.7 ± 152.4	705.0 ± 133.0[a]	691.9 ± 118.0[a]	

P-SH (nmol P-SH/mL)	153.4 (127.2–170.9)	137.3 (114.5–155.8)	140.1 (122.1–151.8)	
Vitamin C (µg vit C/mL)	14.0 ± 5.3	10.5 ± 3.2[a]	11.7 ± 3.2	
Catalase (K/mg Hb)	53.5 (40.6-59.5)	45.2 (35.5-50.0)[a]	45.0 (36.8-49.0)[a]	
Correlations			Spearman r	
δ-ALA-D vs. TBARS, erythrocytes			-0.233	0.048*
δ-ALA-D vs. Glucose			-0.267	0.035*

The parametric results were analyzed by ANOVA, followed by the Tukey test and expressed in mean ± SD, and the non-parametric values determined by the Kruskal-Wallis test and represented as median (interquartile range). Analysis of the levels of HbA1c was used Student's t-test, the data being expressed as mean ± SD. [a]p < 0.05 when compared to the control group. [b]p < 0.05 when compared to the group of pregnant women with GDM. Gestational characteristics were expressed as percentage (%) and the p value obtained by the chi-square test. Correlation of the data using the Spearman correlation coefficient. *p <0.05 was considered statistically significant. BMI, body mass index; C, control group; δ-ALA-D, delta-aminolevulinate-dehydratase; GDM, gestational diabetes mellitus; HbA1c, glycated hemoglobin; NP-SH, non-protein thiol groups; P-SH, protein thiol groups; TBARS, barbituric acid reactive substances; T2DM, pre-gestational type 2 diabetes mellitus.

Figure 1A depicts the activity of δ-ALA-D in the presence and absence of the reducing agent DTT. Considerable difference was found in relation to control and GDM. However, the rate of enzymatic reactivation was significant in both DM groups compared to the control (Figure 1B).
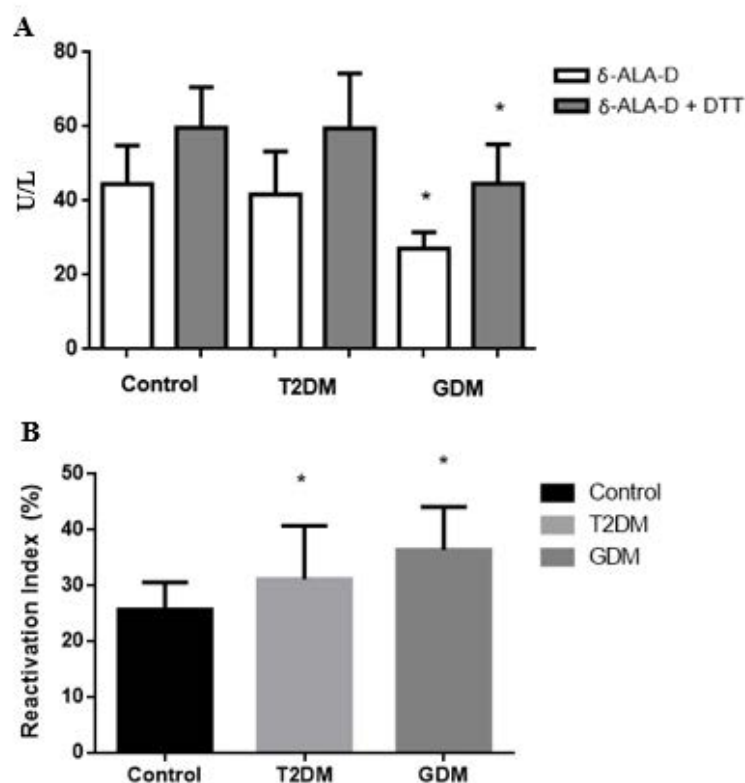
Figure 1. (A) Enzymatic activity of δ-ALA-D in the groups of pregnant women analyzed, results expressed as U/L. (B) Reaction index of δ-ALA-D in the different groups, data expressed as percentage (%). The results analyzed by ANOVA, followed by the Tukey test and expressed in mean ± SD. * $p < 0.05$ when compared to the control group. δ-ALA-D, δ-aminolevulinate-dehydratase; DTT, dithiothreitol; GDM, gestational diabetes mellitus; T2DM, pre-gestational type 2 diabetes mellitus.

Correlations between δ-ALA-D activity and oxidative stress markers (Table 1), show a negative correlation between enzymatic activity and TBARS erythrocytes, and glucose.

4. Discussion

This study aims to evaluate the clinical and oxidative differences between pregnancies in which DM is present. It also evaluates the activity of the δ-ALA-D enzyme, which, to our knowledge, has not yet been verified in this comparison.

In general, risk factors for the development of DM are similar for their subtypes and include advanced maternal age and obesity (Dirar, Doupis, 2017) and therefore this pathology develops more easily in these individuals. This issue is confirmed by the significant difference between the ages of the mothers and gestational BMI, higher in the presence of the condition, and the significant pre-gestational BMI in the T2DM group. Maternal obesity or higher weight has been associated with adverse outcomes in pregnancy such as pre-eclampsia and cesarean section (Sato et al., 2014) and pre-gestational BMI as a factor influencing fetal growth (Alberico et al., 2014).

Possible explanations for the increase in blood pressure may be the effects of hyperinsulinemia, weight gain and renal sodium retention (Dirar, Doupis, 2017), however, in both groups blood pressure values do not exceed the reference limits to be classified as hypertensive.

In pregnant women with DM, fasting glycemic levels were higher than those in the control group, as expected, for their diagnoses. The results of HbA1c were higher in pregnant women with T2DM, probably because the condition was present before pregnancy. These data together may suggest that the pre-gestational group with T2DM would have a higher degree of carbohydrate intolerance compared to the GDM group (Sugiyama et al., 2014).

Higher platelet count was obtained for pregnant women with DM, consistent with the results of Sahbaz et al., 2016, for the GDM. It is known that platelets play an important role in homeostasis and blood coagulation, currently in conjunction with other platelet parameters, is associated with inflammatory diseases. Obesity, as an important risk factor for this disorder, is considered a chronic inflammatory state. And inflammation in turn is said as one of the main causes to increase insulin resistance. Therefore, inflammation is implicated in the pathogenesis of diabetes (Sahbaz et al., 2016).

One of the most well known products of lipid peroxidation is MDA, which is used as a measure of damage and changes in the structure and function of cell membranes (Shang et al., 2015).   In the present study, an increase in lipid damage in plasma and erythrocyte levels was observed in pregnant women with DM. Shang et al., 2015, also revealed an increase in MDA in women with GDM, suggesting a relationship between lipid peroxidation and changes in prostaglandin synthesis, which could also be related to fetal

malformations attributed to DM (Arribas et al., 2016). The negative correlation between erythrocyte TBARS and glucose dosages, and δ-ALA-D activity suggest a high ROS production (De Lucca et al., 2016) in pregnant women with DM.

It is also relevant to note that there was a decrease in the levels of thiol groups, which are molecules containing a sulfhydryl functional group attached to a carbon atom and have an important action against free radicals (De Lucca et al., 2016). This result is consistent with that of Rajdl et al., 2005.

Vitamin C plays an important role in non-enzymatic antioxidant defense (Gonçalves et al., 2005). In this study, vitamin C levels were significantly decreased in the groups of pregnant women with T2DM. As these play an important role in the protection of thiol groups, their decreased levels may reduce their antioxidant activity.

The enzyme catalase is an important participant in the enzymatic antioxidant defense system (Polachini et al., 2016). Our results showed that the decrease of the enzymatic activity was significant in the groups with the pathology, data consistent with those of López-Tinoco et al., 2013, for the GDM.

In general, these results show that there is a decrease in the antioxidant defense, which may have occurred due to the inactivation caused by the excess free radicals (Palma et al., 2014; Rajdl et al., 2005) leading to a greater consumption of the same.

A decrease in δ-ALA-D activity was observed in pregnant women with GDM compared to the other groups (Figure 1A), which is consistent with the results of Rodrigues et al., 2018. Pregnant women with T2DM exhibited similar levels of δ-ALA-D activity with the control group, which may be explained by the fact that pregnant women with pre-existing T2DM use insulin. Palma et al., 2014, showed that the use of insulin prevented the reduction of δ-ALA-D activity in mice with induced type 1 DM, and its decrease occurred when it was not used. The enzymatic reactivation index (Figure 1B) shows significant results in both DM groups in relation to the control group, which shows the involvement of thiol groups in the reestablishment of δ-ALA-D activity in the presence of DTT in vitro (De Lucca et al., 2016).

5. Conclusion

The parameters evaluated confirmed an increase in oxidative stress and were associated with the reduction of the antioxidant response in DM in both T2DM and GDM, which may be an adaptive and protective response. Although both disorders are generated by carbohydrate intolerance and are differentiated events for the organism, they present many similarities between the evaluated markers, representing the largest difference with the control group. Considering the data, we identified some differences between the groups, such as the high pre-gestational BMI observed in pregnant women with T2DM, representing an important risk factor for complications. For the knowledge, this is the first time that this comparative evaluation of δ-ALA-D enzyme activity was performed, and shows that the use of insulin in pregnant women with T2DM may have been beneficial in preventing the reduction of δ-ALA-D enzyme activity, preventing an even greater increase of oxidative stress and, consequently, the possibility of damages to both the fetus and the mother.

6. Acknowledgments

7. References

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Protein supplement obtained from almonds of bacuri fruit (*Attalea phalerata* Mart. Ex Spreng.): elaboration, nutritional characterization and sensory acceptability

Rayan Semidei

Academic Nutrition, Faculty of Pharmaceutical Sciences, Food and Nutrition (Facfan), Federal University of Mato Grosso do Sul,
Campo Grande, Brazil.

Flávio Conche da Cunha

Post-Graduate Program in Health and Development in the Mid-West Region, – Medical School (Famed) - Federal University of Mato Grosso do Sul,
Campo Grande, Brazil.

Roberta Serafim de Souza

Post-Graduate Program in Health and Development in the Mid-West Region, – Medical School (Famed) - Federal University of Mato Grosso do Sul,
Campo Grande, Brazil.

Maria Lígia Rodrigues Macedo

Professor of the Post-Graduate Program in Biotechnology, Faculty of Pharmaceutical Sciences, Food and Nutrition (Facfan), Federal University of Mato Grosso do Sul,
Campo Grande, Brazil.

Priscila Aiko Hiane

Professor of the Post-Graduate Program in Health and Development in the Mid-West Region – Medical school (Famed) - Federal University of Mato Grosso do Sul,
Campo Grande, Brazil.

Bruna Paola Murino Rafacho

Professor of the Faculty of Pharmaceutical Sciences, Food and Nutrition (Facfan), Federal University of Mato Grosso do Sul,
Campo Grande, Brazil.

Fabiane La Flor Ziegler Sanches

Professor of the Post-Graduate Program in Biotechnology - Faculty of Pharmaceutical Sciences, Food and Nutrition (Facfan), Federal University of Mato Grosso do Sul,
Campo Grande, Brazil.

fabiane.sanches@ufms.br
5506733457060

Abstract

Bacuri (Attalea phalerata Mart. Ex Spreng.) is a fruit belonging to Palmae family, found in Mato Grosso do Sul - Brazil with great nutritional potential. The objective of the present study was to perform processing, elaboration, nutritional analysis and sensorial acceptability test of protein supplement formulations with bacuri almonds aiming its use by vegetarian public and sportsmen. Bacuri almonds were processed to lyophilized flour of the protein isolate, and then mixed with other ingredients to produce two supplement formulations: F1 containing 70% bacuri lyophilized almond flour, and F2 containing 35% bacuri lyophilized almond flour and 35% commercial supplement. Nutritional composition analysis, amino acid determination and sensory analysis were performed. Both supplements presented high protein content. F1 and F2 were significant different for energy, moisture, ashes, proteins and carbohydrates content. Amino acid profile was satisfactory for methionine, cysteine, phenylalanine and tyrosine for both. Sensory analysis showed acceptability indexes above the minimum limit of 70%, which is considered accepted. Thus, bacuri almond is an alternative ingredient in plant food supplements. However, its isolated use (F1) still needs further testing for sensory acceptability indices improvement.

Keywords: Cerrado Fruits; Food, Formulated; Food Analysis; Dietary Supplements.

1. Introduction

In Brazil there is an increase in the number of exercise practitioners who use dietary supplements, especially in gyms [1]. Many people intake supplements, mainly protein and carbohydrate sources, aiming to improve physical performance at the time of training and competition, as well as body aesthetics [2]. Many of supplements consumers are vegetarian, intending to prevent protein and some micronutrients deficiencies that may arise as a result of vegetarian diet [3]. Vegetarianism can be classified into ovolactovegetarianism, lactovegetarianism, ovovegetarianism and strict vegetarianism, and veganism fits more closely with a matter of choice in the individual's way of life [4].

Practitioners and athletes, in most cases, have a significant protein intake, higher in comparison to nutritional recommendations. This fact can be explained due to the higher protein requirement during training and competition [5].

Given the search for adequate nutrition and supplementation, native fruits of the Cerrado and Pantanal appear as a good option for food intake, offering significant amounts of nutrients that might help achieving daily nutrient requirements in humans [6]. Their use in food products formulation might be of great interest due their potential organoleptic and nutritional characteristics. Furthermore, food products based in Cerrado and Pantanal fruits are an important tool to popularize their intake [7].

Bacuri is a fruit extensively distributed throughout the state of Mato Grosso do Sul - Brazil. Also known as acuri or acurizeiro, presents good amount of proteins, monounsaturated and polyunsaturated fatty acids, fibers, carotenoid pigments, iron, copper, phosphorus and zinc [8]. Its almond has an adequate amount of protein, displaying great potential to be included or used as food supplement, specially as a plant

based product and with a lower cost [9]. Similarly to other native fruits of the Brazilian Cerrado and Pantanal, very little is studied about their application in the area of sports nutrition. Futhermore, it is noteworthy that, for the development of new products, sensory analysis is a very important tool, evaluating the quality of the attributes through the sense organs by the use of specific methods [10].

Thus, the present study aimed to elaborate a protein supplement of vegetable source using the bacuri fruit almonds, and to perform its nutritional and sensorial characterization.

2. Material and Methods

2.1 Material

Bacuri fruits were obtained with local producer in the city of Campo Grande in the state of Mato Grosso do Sul - Brazil, in the geographic coordinates -20.4600517, -54.5962478, presenting the SisGen (National Management System) registration number A516D8E Genetic Heritage and Associated Traditional Knowledge). After collection, from March to June, the fruits were taken to laboratories for almonds acquisition and processing.

The vegetable-source protein supplement were formulated with raw materials obtained in Campo Grande (MS): xylitol and dextrose (Atlhetica®), stevia (R&S Blumos®), cocoa powder (Nestlé®), chocolate flavoring (Doremus ®), vanilla flavoring (Robertet®), xanthan gum thickener (Nestlé®); freeze-dried bacuri almond flour were obtained by laboratory processing and protein supplementation of pea and rice Reaction Vegan Cocoa Flavor (Atlhetica®) composed of the following ingredients: isolated pea protein and concentrated rice protein, medium chain triglycerides, cocoa powder, methylcobalamin, vanilla and cocoa natural flavoring and natural sweeteners xylitol, steviol glycosides and thaumatin.

2.2 Methods

2.2.1 Fruit processing

The collected fruits were washed in running water, broken using a hand press and pulped to obtain the almonds, which were then crushed in an electric grinder (brand Bermar®, model BM 77 NR), in order to obtain the whole flour. To remove the oil from this whole almond flour, a chemical method of hot extraction was used, with petroleum ether solvent (brand Neon®) in the Soxhlet.

After obtaining the defatted bacuri flour, the flour was placed in a ventilated oven at 30ºC for 48 hours to preserve the protein value of the product and especially to eliminate any residue of the solvent used for lipid extraction.

To obtain the lyophilized flour, lyophilization procedure was performed: a drying method that extracts the moisture brought into the material by freezing the liquid part followed by subsequent sublimation of ice [11]. Afterwards, aqueous extracts were prepared using defatted bacuri flour and distilled water at a concentration of 1:10 (weight /volume) by mixing them through an industrial blender (Colombo® brand, model JL inox). Subsequently, the product was stirred for 3 hours [12]. After stirring, the suspension supernatant was collected and centrifuged for 15 minutes at 2,000 rpm.

Lyophilization using the LIO1 model L101 lyophilizer and also the ALPHA 2-4 lyophilizer LD Plus from Christ® brand. For the freezing phase of the samples, which precedes the freeze-drying phase, the Christ® Cooling bath model CB 18-40 in LPPFB and liquid nitrogen in LAPNEM were used.

Figure 1 shows the flowchart of the processing of bacuri fruits and almonds until the preparation of the protein supplement formulations.
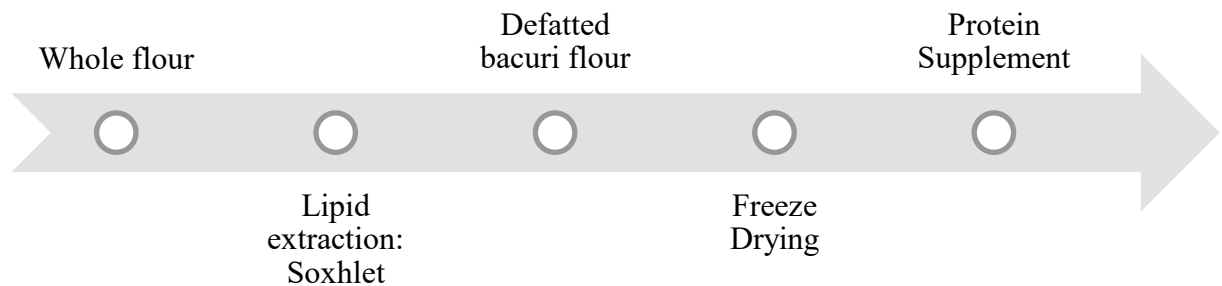

Figure 1. Processing flowchart. Source: own.

2.2.2 Preparation of protein supplement formulations

Supplements were prepared after laboratory pre-tests evaluating different concentrations, sources and proportions of bacuri lyophilized flour, sweeteners, thickeners and flavorings, adapting the characteristics of the formulations for better acceptance of the public. The pre-test formulations were sensorially evaluated by untrained tasters, such as students, teachers and servants of an educational institution. The following attributes were analyzed: appearance, aroma, taste, texture, sweetness, color and general acceptance, as well as the evaluation of the purchase intention of the product. From the unsatisfactory results of sensory acceptance of the first pre-tests, reformulations in ingredients concentrations were performed.

It is important to note that there was no significant difference between the averages of formulations F1 (70% bacuri) and F2 (35% bacuri and 35% commercial pea and rice supplement) for any attribute analyzed in the pre-test, with averages in most of assessed attributes ranked on the hedonic scale between "slightly liked" and "very liked" (data not shown). These results of improved composition and acceptance of the formulations were observed for acceptability indices, which were close to or above 70% for most attributes. Thus, final supplement formulations used in the study were chosen after the pre-test and a final sensory analysis was performed, as described below.

2.2.3 Nutritional composition

Nutritional composition of the final formulations was performed in triplicate following the analytical methodologies defined by the Adolfo Lutz Institute [13]. Moisture was obtained by desiccation at 105ºC until constant weight was obtained. The ashes were determined by incineration in muffle furnace at 550ºC. The determination of total carbohydrates was made by the Lane-Eynon method, based on volume reduction of Fehling to cuprous oxide. Lipid was determined on Soxhlet by extraction with petroleum ether as a solvent. The total protein value was determined by the Kjedahl method, considering the factor 6.25. The amount of total fiber was obtained by difference by theoretical calculation, according to the formula:%

fiber = 100 - (% moisture +% protein +% lipid +% ash +% carbohydrate). The total energy value (kcal) was calculated by the following values: lipids (9.03 Kcal / g), protein (4.27 Kcal / g) and carbohydrates (3.82 Kcal / g) [14].

2.2.4 Total amino acid profile

Determination of the essential and non-essential amino acid profile of bacuri lyophilized flour was carried out at the Laboratory of Protein Sources of FEA/UNICAMP. The constituent proteins of the samples were hydrolyzed with 6 N hydrochloric acid for 24 hours. Amino acids released in acid hydrolysis were reacted with phenylisothilcianate (PITC), separated by reverse phase high performance liquid chromatography (HPLC) and detected by UV at 254 nm. Quantification was performed by multilevel internal calibration with the aid of α-aminobutyric acid (AAAB) as internal standard for total amino acids and methionine sulfone for free amino acids. Fruit samples, where quantitation of free amino acids are required, were deproteinized with 0.1M HCl acidified methanol (80% MeOH / 20% 0.1M HCl) at a ratio of 7: 2: 1 volume / weight / volume. methanol / sample / internal standard respectively. In this paper we present modifications in the methodology proposed by White et al. [15], for total amino acids using a Kinetex C18 100Å 5u 100x4.6mm ME0-9165 column and for free amino acid determinations we used Luna 3u C18 (2) 100A 250x4.6mm 00G-4251-E0 HPLC Column.

Tryptophan determination was performed by spectrophotometric analysis with reading at 590 nm, as proposed by Spies [16].

2.2.5 Chemical score of essential amino acids

Chemical Essential Amino Acid Score was determined using the Henley and Kuster methodology [17], associating FAO / WHO adult reference standard amino acids [18] with the concentration of each of the essential amino acids in the lyophilized flour of the bacuri in the study, using the following expression:

$$EAE = \frac{\text{mg amino acids / g test protein}}{\text{mg amino acids / g standard or reference protein}}$$

2.2.6 Final sensory analysis

Based on pre-tests results and the choice of the most accepted formulations, the final sensory analysis was performed with the target audience at the OnFit academy in Campo Grande - MS. A total of 30 tasters, practitioners of both sexes, not sensorially trained, collaborated with the analysis. Three samples of protein supplement of vegetable origin were analyzed, two formulations developed and one sample of commercial supplement, called F1 (70% bacuri); F2 (35% bacuri and 35% commercial pea and rice supplement) and Commercial Supplement (containing pea and rice proteins).

The attributes appearance, color, flavor, aroma, sweetness, texture and overall acceptance were evaluated using the 9-point hedonic scale: 9 = very much liked, 8 = very liked, 7 = moderately liked, 6 = slightly liked, 5 = neither liked / disliked, 4 = slightly disliked, 3 = moderately disliked, 2 = disliked a lot and 1 = disliked very much; and also a 5-point hedonic scale for purchase intent, where: 5 = surely buy, 4 = possibly buy, 3 = maybe buy / maybe not buy, 2 = possibly wouldn't buy, 1 = certainly wouldn't buy [19, 20].

In the sensory analysis sheet, questions were also verified for the definition of the tasters' profile, such as: sex, age, education, if the fruit was known, if it consumed protein supplements, if it consumed protein supplements of vegetable origin, sport practiced, frequency and time of practiced exercise.

The formulations were coded into 3 digit numbers and supplied in disposable cups, monadic and balanced. Each participant received between 15 and 20 mL of each supplement formulation, a glass of drinking water (white), pen, napkin, Informed Consent (IC) and the analysis form [19, 20].

The calculation of the acceptability index (IA) was determined by the formula: IA (%) = A x 100 / B; A = average grade obtained for the product; B = maximum grade given to the product.

2.2.7 Statistical analysis

Data were organized and analyzed using the Statistical Package for Social Sciences (SPSS) software. The results were submitted to ANOVA analysis of variance, and Tukey's post test was used to compare the means, considering a level of 5% of significance ($p < 0.05$).

3. Results Discussion

3.1 Preparation of protein supplement formulations

The final concentrations of ingredients used in the formulations chosen from the preliminary tests are shown in Table 1.

Table 1. Ingredient concentrations of the plant-based protein supplements.

Ingredients	F1 (%)	F2 (%)
Freeze-Dried Bacuri Flour	70	35
Commercial Supplement*	---	35
Xylitol	7	5
Dextrose	16.3	19.3
Cocoa Powder	3	3
Thickener Xanthan Gum	2	1
Stevia sweetener	0.2	0.2
Chocolate Flavorings	1	1
Vanilla Flavorings	0.5	0.5

*Reaction Vegan   (Atlhetica®) chocolate flavor, with pea and rice proteins.

Protein supplements are important for athletes and sport practioners, as they contribute significantly to hypertrophy, since protein is directly involved in the metabolism and development of body tissues, and enzymes activity that regulate energy generation and muscle contraction [21].

In this sense, plant-based protein supplements has emerged as an alternative to animal proteins. Despite their lower biological value, the supply of plant protein is higher[22]. In this context, the use of nutrients derived from native fruits of the Cerrado and Pantanal biomes   presents great potential in the food industry, due to their nutritional profile, as well as for the regional population, reducing its waste [23].

The other ingredients, especially xylitol, dextrose and stevia, were chosen aiming the benefit for the consumers, since products with a low glycemic index and low sugar content have a lower impact on postprandial glucose, resulting in stable process during physical exercise, thus becoming a nutritional strategy more suitable for this population [24].

3.2 Nutritional composition

Bacuri has great nutritional value, as previously shown by Lima e Silva et al. [25].   The authors analysed nutritional aspects of different types of bacuri almond flour, showing that the raw bauru flour, on dry basis, presented a protein value of 35.95%. Futhermore, in Table 2, adapted from the study by Cunha (2018), it is possible to observe the nutritional composition of the whole, unfatted and lyophilized bacuri almond flour [26].

Table 2. Nutritional composition of flours obtained from bacuri fruit almonds.

	Bacuri almond flours (g.100g^{-1})			
	Whole	**Unfatted**	**Freeze-dried**	**p-value***
Moisture	4.44 ± 0.07^b	6.68 ± 0.61^a	3.49 ± 0.19^c	0.0001
Ashes	$1.74 \pm 0,03^c$	5.20 ± 0.13^b	8.49 ± 0.22^a	0.0001
Lipids	60.72 ± 1.66^a	3.05 ± 0.51^b	1.78 ± 0.25^b	0.0001
Protein	12.72 ± 1.27^c	28.87 ± 2.34^b	51.39 ± 0.41^a	0.0001
Total Fiber	18.18	55.06	1.99	---
Carbohydrate**	2.20±0.49	1.14±0.16	32.86±0.44	---

Source: Adapted from Cunha (2018)[26]. ** Calculated by difference. * p-value obtained by ANOVA. Averages followed by equal letters on the same line do not differ from Tukey's Post Hoc at 5% probability.

Based on protein content of bacuri flour, the lyophilization process used in the present study was fundamental for supplement formulation, generating greater protein contribution after bacuri almonds processing, highlighting its potential use as a plant-based protein supplement.

The nutritional composition of the final supplement formulations (F1 and F2) were compared and presented in Table 3, which also shows commercial supplement information.

Table 3. Comparison of nutritional information (in 100 g) of formulations F1 and F2.

	F1	F2	p-value	Comercial supplement
Energy (Kcal)	328.85±1.64[b]	352.57±3.55[a]	0.0001	402.65
Lipids (g)	3.59±0.08[a]	4.15±0.33[a]	0.245	2.77
Proteins (g)	39.76±0.31[b]	44.29±0.46[a]	0.0001	61.11
Total Carbohydrates (g)	33.16±0.15[b]	33.73±0.,16[a]	0.012	30.55
Total Fiber (g) *	4.02±0.13[a]	3.49±0.02[b]	0.014	0

F1=70% bacuri; F2 = 35% bacuri and 35% commercial pea and rice supplement; Commercial supplement = commercial supplement of pea and rice. * Calculated by difference. Different letters on the same line indicate significant difference by Student's t-test (p <0.05).

There was significant difference (p<0.05) for moisture, ashes, fibers, protein, carbohydrates and energy value. Only for lipids, no difference was observed (p = 0.245) between F1 and F2.

By comparing the protein content found in the commercial supplement sample and the formulations F1 and F2, it was possible to identify that the commercial supplement presented a higher amount of protein in 100g of product (61.11%) than the two formulations.   However. an important point to note is that the percentages used in these formulations were not 100% of freeze-dried bacuri flour, but 70% and 35%. According to IN Supplementary Instruction N°. 28 of July 26, 2018 [27], the formulations containing bacuri flour are suitable for protein content, containing at least 8.4g of protein per portion of the product and also considered high protein product (minimum 12 g per serving) according to RDC N°. 54 of 12 November 2012 [28] - F1 contains 14.3g of protein/serving (one serving represents 36g and it is equivalent to a full dosing measure) and F2 contains 15.9g of protein/ serving.

Regarding body composition. Ramos et al. [9] evaluated the effect of diets with vegetable (defatted bacuri flour) and animal protein (whey protein) content in Wistar rats submitted to resistance exercise for three times a week for eight complete weeks. They concluded that bacuri almond protein was of good quality when compared to whey protein, recommending its use in the creation of nutritional supplements, based on a vegetable source.

3.3 Total amino acid profile and chemical score of essential amino acids

Babault et al. [29] conducted a study comparing a pea supplement (59.2% protein) with whey protein in lean mass gain in humans over a 12 week supplementation period. The researchers concluded that protein supplementation of plant origin provided increased muscle thickness in trained individuals, and that the results obtained for both supplementation with plant protein and animal protein were similar in muscle growth, evidencing an adequate amino acid profile. The same adequate amino acid profile of bacuri fruit almond flour is shown in the present study.

In Cunha's study [26], the freeze-dried bacuri almond flour presented 49.84g / 100g of proteins. In the current study, a small difference was observed - the total amount of protein was 44.00g / 100g. This difference can be attributed to several factors, from extraction and processing process to obtain the protein isolate until the harvest and maturation period, fruit, soil type and climate.

Amino acid composition was compared with data found by Babault et al. [29], who used lyophilized pea flour to obtain amino acid values. It was possible to observe that the pea presented higher amino acids concentration, except for methionine, cysteine, asparagine and arginine, as shown in Table 4.

Table 4. Amino acid composition of freeze-dried bacuri flour compared to pea protein.

Amino acids (g.100g of protein)	*Pea	Freeze-dried bacuri
Essential amino acids		
Leucine	6.40	2.75
Valina	4.00	2.22
Isoleucine	3.70	1.73
Histidine	1.90	1.05
Methionine	0.80	1.36
Cysteine	0.80	1.49
Phenylalanine	4.20	2.63
Tyrosine	3.10	1.50
Treonine	2.80	1.64
Lysin	5.70	2.38
Tryptophan	0.70	0.19
Non-essential amino acids		
Asparagin	ND	4.03
Glutamine	13.20	7.40
Serine	3.90	1.96
Glycin	3.10	1.72
Arginine	6.60	6.92
Alanin	3.30	1.52
Proline	3.40	1.50

*Babault (2015) [29].

The amino acid profile of freeze-dried bacuri almond flour was very similar to that found in the study of Togashi and Sgarbieri [30], where the amino acid composition of baru almond was analyzed (48,43g in100g of protein concentrates), confirming the protein potential of bacuri fruit.

The amino acid chemical score of freeze-dried bacuri almond flour was also compared with the FAO/WHO standard recommendations for adults [18], described in Table 5. The amino acid profile was satisfactory for methionine, cysteine, phenylalanine and tyrosine.. Tryptophan was the most limiting amino acid of freeze-dried bacuri flour.

Table 5. Essential amino acid score calculated based on FAO / WHO reference standard (2007) [18].

Essential amino acids (g/100g protein)	FAO/WHO	Freeze-dried bacuri	Amino acid score*
Treonin	2.30	1.64	0.71
Methionine + Cysteine	2.20	2.85	1.29
Valine	3.90	2.22	0.57
Leucine	5.90	2.75	0.46
Isoleucine	3.00	1.73	0.57
Phenylalanine + Tyrosine	3.80	4.13	1.08
Lisine	4.50	2.38	0.52
Histidine	1.50	1.05	0.70
Tryptophan	0.60	0.19	0.31*

*most limiting amino acid

3.4 Final sensory analysis

Final sensory analysis was performed with 30 participants, 93.3% (n = 28) were practitioners of physical exercises. The tasters' profile was mostly female (n = 17; 56.7%), with a mean age of 32.4 ±0.5 years, 73.3% consumed / knew food supplements, but only 23, 3% knew or consumed plant food supplements, as described in Table 6.

Table 6. Profile of the tasters.

	Total tasters (n = 30)	
	n	**%**
Gender		
Male	13	43,30
Female	17	56,70
Know protein supplement		
Yes	22	73,30
No	8	26,70
Know plant-based protein supplement		
Yes	7	23,30
No	23	76,70
Know Bacuri fruit		
Yes	12	40,00
No	18	60,00
Physical activity modality		
Bodybuilding	19	63,30
Bodybuilding + other activity	6	20,00
Other	3	10,00
None	2	6,70
Frequency of physical activity		
1 - 2 times a week	1	3,60
3 - 4 times a week	13	46,40
≥ 5 times a week	14	50,00
Training time		
Up to 1h	10	35,7
1 - 2h	17	60,7
Above 2h	1	3,6

* n = number of participants (absolute frequency); % = percentage of participants (relative frequency).

Among the participants, bodybuilding practice was more frequent (19 practitioners). representing

63.3%. Other modalities practiced included: dance, fitdance, walking, equestrian, running and pilates. The highest frequency of physical exercise was ≥ 5 times a week (50.0%) and the most practiced training time was 1 to 2 hours of exercise (56.7%).

Table 7 shows the mean scores of the sensory analysis parameters. It was possible to observe the acceptance of each attribute of the formulations developed, since there was no significant difference between the samples in most of the evaluated attributes: acceptance, appearance, flavor, texture, color and sweetness.

Table 7. Averages of affective sensory acceptance and purchase intent tests performed for plant-based protein supplement formulations.

	F1*	F2*	Comercial Supplement	p-value**
Appearence	6.77±1.524	7.23±1.695	6.77±2.063	0.504
Aroma	6.30±2.054^b	7.47±1.432^a	6.80±1.919^{ab}	0.050***
Flavor	5.07±1.999	5.93±1.893	5.90±2.139	0.174
Texture	6.70±1.841	6.80±1.669	6.00±2.319	0.233
Color	6.63±2.059	7.40±1.545	7.40±1.632	0.156
Sweetness	6.20±2.188	6.67±2.123	6.17±2.069	0.597
Global Acceptance	5.40±2.078	6.43±1.633	6.20±1.901	0.088

*Mean values ± Standard deviation. F1 = 70% bacuri; F2 = 35% bacuri and 35% commercial pea and rice supplement; Commercial supplement = Pea and rice commercial supplement. ** P value obtained by the ANOVA test of variance; *** p <0.05 Equal letters in the same line do not differ (p> 0.05) by the Tukey test.

Means of the aroma attribute (p = 0.050) differed between the samples, being higher for F2 compared to F. Commercial supplement did not differ from any of the formulations with bacuri (Table 7). Regarding the purchase intent, there was a significant difference between the samples (p = 0.032): F1 (70% bacuri) differed from the commercial supplement, with significantly lower average (2.43 versus 3.17, respectively), but did not differ from F2.

Regarding intention to purchase, F2 presented better rates, as well as the commercial supplement sample. F1 did not obtain as good results when compared to the others, as shown in Figure 2.
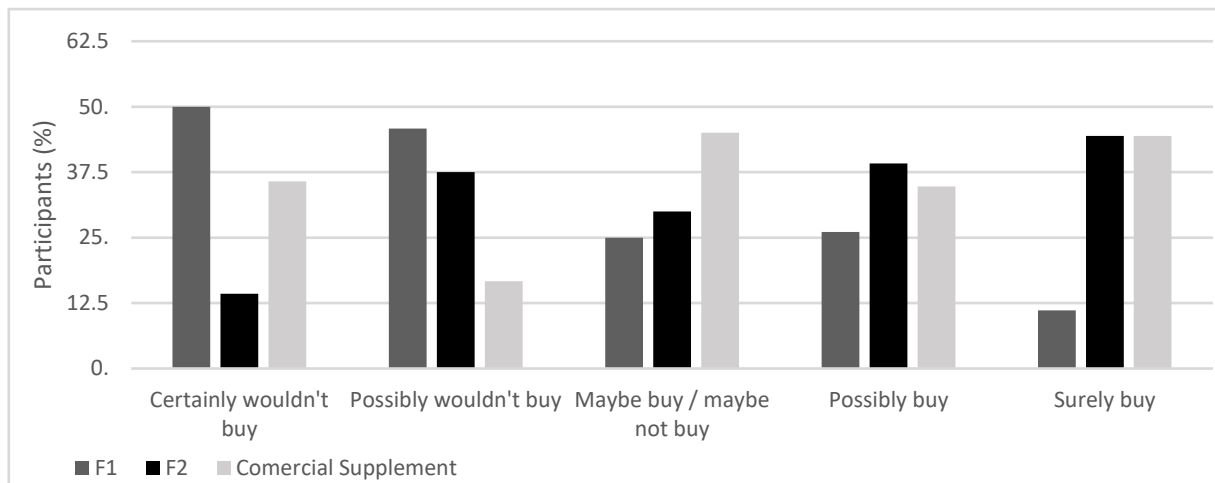
Figure 2. Purchase intention of plant-based protein supplement formulations. Caption: F1 = 70% bacuri; F2 = 35% bacuri and 35% commercial supplement; Commercial Supplement = Commercial Pea and Rice Supplement.

F2 formulation and commercial supplement presented good sensory acceptance by the tasters. In the study of Cunha et al. [31] who elaborated cereal bars with bacuri pulp flour, the formulation containing 10% bacuri obtained 82,2% of acceptability index, showing bacuri can also be used in the manufacture of other products - aiming at its full utilization. Figure 3 shows the acceptability index values of each supplement formulation.
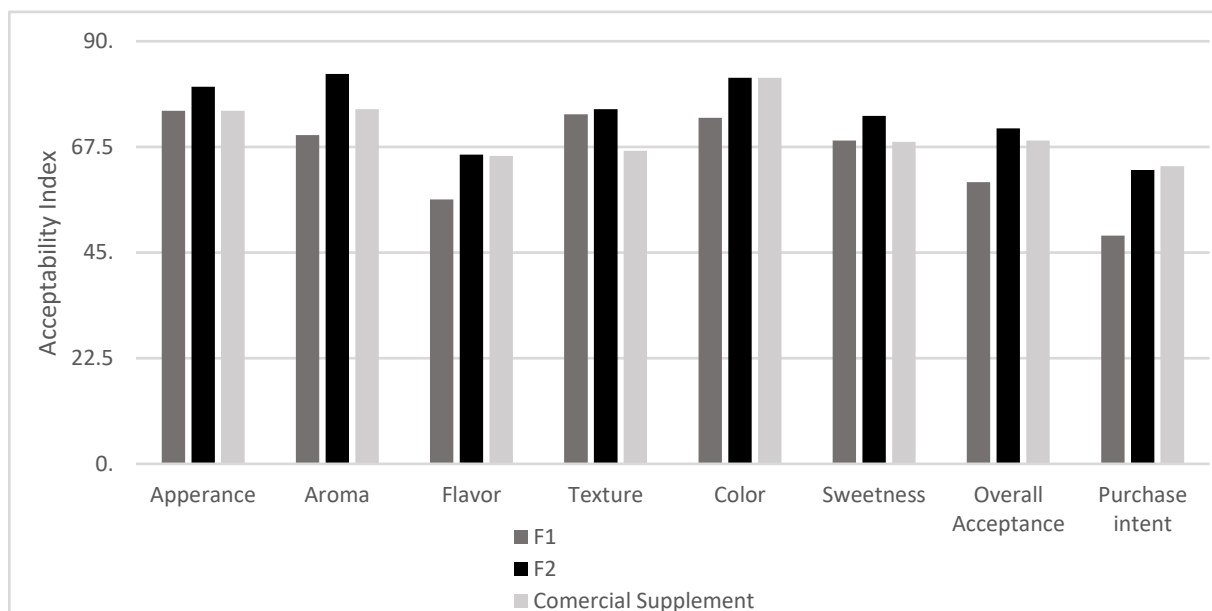

Figure 3. Acceptability index (%) of protein supplement formulations of plant origin. Caption: F1 = 70% bacuri; F2 = 35% bacuri and 35% commercial supplement; Commercial Supplement = Commercial Pea and Rice Supplement.

Regarding the acceptability index criteria, F2 (35% bacuri + 35% commercial supplement) displayed

better results for most of the evaluated parameters: appearance, aroma, taste, texture and sweetness. F2 had an overall acceptance rate of 71.44%, above the recommended percentage of 70% by Teixeira (1987) to be considered sensorially accepted.

Product acceptance might have been influenced by the fact that 76.7% of tasters did not know or consumed plant-based supplements. Futhermore, 60% of participants did not know bacuri fruit.

4. Conclusions

The present study provided improvement of the organoleptic characteristics of food plant-based supplement formulations. It is noteworthy that the processing of bacuri fruit almonds to their freeze-dried flour significantly increased protein content, constituting   an alternative option in the production of vegetable protein supplements, with good results of sensory acceptability. Further studies to enhance protein extraction and consequently amino acids profile in lyophilization process should be performed in different conditions.

We concluded that sensory analysis was satisfactory, considering the evolution in the products elaborated between the pre-test periods and the final formulations, especially for F2 (blend containing 35% bacuri almond lyophilized flour), which obtained a good acceptance by the target public. In isolation, as a sole protein source, 70% bacuri (F1) formulation needs further testing to optimize its acceptance.

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The Effectiveness of Using Costa and Kallick's Habits of Mind in Developing Achievement and Some Visual Thinking Skills of First Year Preparatory School Pupils

Aya Ahmed Ewais

Ph.D. researcher at curriculum and instruction department
Faculty of Education- Minia University-Egypt

Abstract

This research aims at investigating the effectiveness of using Costa and Kallick's Habits of Mind in developing achievement and some visual thinking skills of first-year preparatory school pupils. To achieve that, the researcher designed the following: a list of Habits of Mind in the light of Costa and Kallick and converting it into educational goals which can be achieved after teaching geometry for the first year prep school pupils; Teacher's guide and pupils worksheets for teaching "geometry and measurement" unit of the first year prep school pupils according to Costa and Kallick's Habits of Mind; an achievement test of "geometry and measurement" unit for the second term of the first year prep school pupils and finally, visual thinking skills test. The current research used quasi-experimental research through applying it to a group of female pupils of the first year prep school. The sample consisted of (100) female pupils of Beni Ahmed prep school (1) in Minia Governorate, Egypt. It was divided into two groups: the experimental and control group. The control group consisted of (50) pupils taught with the traditional method, while the experimental group consisted of (50) pupils taught using Costa and Kallick's Habits of Mind. The results have shown that pupils' grades of the experimental group are higher than other group grades on achievement and some visual thinking skills. The researcher introduced some recommendations such as the necessity to set up professional development programs for training mathematics teachers in order to develop pupils' Habits of Mind, the necessity also to train student teachers of mathematics in the faculty of education to develop Habits of Mind. Moreover, Geometric content in the preparatory stage should be enriched with different educational activities that contribute to developing learners' visual thinking.
Keywords: Costa and Kallick's model - Habits of Mind – Achievement- Visual thinking skills.

Introduction

Habits of Mind according to Costa and Kallick's model should be an integral part of the school's culture. This can be achieved by a type of integration between Habits of Mind and mathematics content. Its use appears in every unit and activity so pupils become aware of it. This helps them to be lifelong independent learners. Teachers should develop pupils' Habits of Mind through using the suitable methods for every topic.

Costa and Kallick defined Habits of Mind from the psychological viewpoint as the intellectual ability in which a person behaves intelligently when confronting a situation or a problem with unknown solution (Costa & Kallick, 2008a, 5).

A number of studies had proved the effectiveness of using Habits of Mind in the field of learning and teaching Mathematics in developing achievement such as: Elmotreb & Elshore's study (2014) , Kamal's study (2014) and Elmofty's et al study (2015).

Developing thinking skills is considered as one of the most important goals in teaching Mathematics. Visual thinking is considered as one of these types of thinking. It is an essential and effective element in the thinking system and mental activity as pupils use their sight to form mental images which enable them to do mathematic processes.

Visual thinking is represented in reading the optical form with converting the visual language into verbal one. The main skills of visual thinking are visual observation, visual comparison and visual imagination. These skills include a number of sub skills (strahy, 2011, 139).

A number of studies such as: Hamada's study (2006) , Mahdy's study(2006) ,Hamada (2009)   and Elhana's study(2015) had proved the importance of developing visual thinking .

Problem of the study:

The researcher as a mathematics teacher in the preparatory stage observed that there is a difficulty in pupils' learning of geometry. They didn't have perseverance in solving geometric problems to find a solution. They also had no more than one solution. They also could not draw geometric shapes in a right way. It was confirmed by their low scores of the results at the end of year (2016-2017) as indicated in table (1)

Table (1)

Results of Geometric Test at the End of the Second Term (Academic Year, 2016-2017) for the First Year Beni Ahmed Prep School (1)

Stage	Number of students	Number of successful students	percentage	Number of students who failed	percentage
First Year Preparatory School Pupils	323	180	55.7%	143	44.2%

The researcher conducted a survey for teachers' opinions in Minia (20 teachers) to identify the current position of teaching geometry in the preparatory stages and determine pupils' knowledge of some Habits of Mind. The results had shown that:

 -75% of teachers use the traditional methods of teaching depending on lecturing and using board to deliver the information.

 -85% of teachers do not know anything about Habits of Mind and how to use and develop them in geometry in the preparatory stage.

-80% of teachers attribute the weakness in learning geometry to the content and its massiveness, the relation between subjects of geometry and their ordering with the primary stage and the following stages is not found , the curriculum does not reflect life situations and special goals for teaching geometry are not found.

-70% of teachers do not use geometric shapes or means to achieve geometric goals and indicate that geometry is interesting in its nature and requires perseverance and more effort to get better results.

In view of the foregoing, problem of the study is identified in answering the following main question:

 What is the effectiveness of using Costa and Kallick's Habits of Mind in developing achievement and some visual thinking skills of first year preparatory school pupils? and the following two questions are branched from it:

1- What is the effectiveness of using Costa and Kallick's Habits of Mind in developing achievement of first year preparatory school pupils?

2- What is the effectiveness of using Costa and Kallick's Habits of Mind in developing some visual thinking skills of first year preparatory school pupils?

Research Objectives: The current research aimed to identify

1- The effect of using Costa and Kallick's Habits of Mind in developing achievement of first year preparatory school pupils.

2- The effect of using Costa and Kallick's Habits of Mind in developing some visual thinking skills of first year preparatory school pupils.

Research significance: The significance of the current research lies in the following:

1- This research identified a list of Habits of Mind in the light of Costa and Kallick converting it into educational goals which can be achieved after teaching geometry for the first year prep school pupils.

2- The current research provides Teacher's guide and pupils worksheets for teaching "geometry and measurement" unit of the first year prep school pupils according to Costa and Kallick's Habits of Mind.

3- The current research provides (An achievement test of "geometry and measurement" unit - Visual thinking skills test) may benefit teachers of teaching mathematics for this purpose.

Research delimitations: The current research was limited to:

1-Mind habits according to the "Costa and Kallick's " model, of which thirteen habits were chosen: (Perseverance - Thinking flexibly - Thinking about thinking - Striving for accuracy - Questioning and posing problems - Applying previous knowledge in new situations - Thinking and communicating with clarity and precision - Gathering data through all senses - Creating, imagining and innovating - Taking responsible risks - Finding sense of humor – Thinking interdependently – Remaining open to continuous).

2- CAPS achievement levels (knowledge - understanding and application - critical thinking and problem solving).

3- Visual thinking skills (visual discrimination, visual closure and connecting relationships in the shape).

Research Terms:

1- Effectiveness: It is defined as the extent of success of a particular way or method in achieving an impact on students which can be measured by tests and scales (Allekani & Algaml, 2003, 67)

It is also defined as desirable results or the power of achieving desirable results (Ibrahim, 2006, 86).

The operational definition of effectiveness:

The change that is undergone on first year prep school pupils' performance after studying "geometry and measurement" unit in the light of Costa and Kallick's Habits of Mind in increasing achievement and some visual thinking skills which is indicated by the difference between mean scores of pupils in the post test of achievement of the experimental and control groups and the visual thinking skills test using the effect size equation.

2- Costa and Kallick's Habits of Mind: Costa and Kallick abstracted a list of sixteen Habits of Mind contributing in thinking which describes how people behave intelligently and is considered as characteristics of intelligent people when coming across problems with no obvious or immediate solutions. These habits are (Perseverance - Thinking flexibly - Thinking about thinking - Striving for accuracy - Questioning and posing problems - Applying previous knowledge in new situations - Thinking and communicating with clarity and precision - Gathering data through all senses - Creating, imagining and innovating - Taking responsible risks - Finding sense of humor – Thinking interdependently – Remaining open to continuous)(Costa & Kallick,2005,12-84) (Costa & Kallick,2008b,44-49) and converting it into educational goals to be achieved within the content of "geometry and measurement" unit..

3- Achievement: The learner's acquisition of knowledge, mathematics skills and educational experience after studying the specified unit which can be inferred from the pupil score in an achievement test of geometry of first year prep grade.

4- Visual thinking: It is defined as one of the thinking patterns which arouses learner's mind with visual stimuli aiming to realize the relationship between mathematical information, its understanding, its representation and organization then integrating it into his knowledge with aligning between it and his past experience to correct acquirable meaningful experience (Amer & Elmasry, 2016, 49).

It is also defined as one of the thinking patterns that arouses mind using visual stimuli to realize the relationship between concepts (Mohamed, 2006, 82).

The operational definition of visual thinking:

It is emerged as a result of arousing mind with visual stimuli resulting in realizing concepts and relationships of geometric shape which can be achieved by a number of mental processes reflecting pupil's ability to understand the geometric shape and changing the visual language into verbal one, It included some skills such as visual discrimination, visual closure and connecting relationships in the shape and is measured by the pupil score in the prepared visual thinking skills test.

Theoretical background and related studies:

Firstly: Costa and Kallick's Habits of Mind:

According to Costa and Kallick's model, Habits of Mind were abstracted from studies conducted on a number of people. These habits are more than gathering physical objects that one learns in a school. They are features which distinguish who are proficient in their performance in all places whether in work, school settings, home or etc. These Habits of Mind represent a force which leads to the right behavior because they are the keystone of integrity and regulated decision-making tools (Costa & Kallick, 2009: 38-65).

This study depended specifically on Costa and Kallick's classification of Habits of Mind because:

1- It depended on the researches' results of Feuerstein, Baron, Steinberg and Goleman which made this classification more comprehensive   for Habits of Mind (Naofal, 2010, 90)

2- Habits could be converted into educational goals which were included in mathematics goals.

3- There was a broad agreement between Costa and Kallick's classification of Habits of Mind and the seven dimensions of tendency towards Mathematics   determined by NCTM" National Council of Teachers of Mathematics"(Elsayed, 2016, 27)

"Habits of Mind" is considered as one of the effective models in developing achievement and different forms of thinking which is confirmed by a number of studies such as Marshal(2004),Amor(2005) ,Hu(2005),Kreizel &lincoin(2006) ,Rayane(2012), Elbarsan& Abd(2013) , Abd elhamid(2014), Elmotreb &El shore (2014) , Elmofty et al(2015), Elsayed(2016) in using Habits of Mind to develop achievement .And studies such as Rayane(2012) , Kamal(2014) to develop creative thinking ; the development of analytical thinking such as the Elbale's study (2013), the development of critical thinking such as Elkarki's study (2007), imaginative thinking such as Yousef's study(2012).

Secondly: visual thinking

The importance of using visual thinking lies in providing the opportunity for seeing the geometric shapes and making visual comparisons among the properties of these shapes to be directly learned by students. This leads to stabilize the properties of shapes in learners' minds and the survival of the impact of learning. It helps in the acquisition of mathematical skills through recognizing the steps of acquiring and practicing every skill. Visual thinking also helps learners to be connected with others through discussions (Amer & Elmasry, 2016, 63).

A number of studies had been conducted which aimed to develop visual thinking skills in Mathematics such as:Alkhazindar (2008), Hamada(2009) ,Shath(2009) , Strahy(2011), Haciomeroglu & Chicken(2012),Zaghlol(2015), Mahmoud(2017) and Godat (2017) that   proved the effectiveness of using different teaching strategies and samples in developing visual thinking skills.

This current study differs from previous studies as it deals with Costa and Kallick's model in developing visual thinking. Visual thinking is considered one of the most important types of thinking which is used in teaching mathematics generally and geometry in particular. It directs learners to visualize the geometric shapes for identification. This helps learners to realize the spatial relationships in a shape. It also helps to analyze information on the visual shape. Habits of Mind are considered as one of the main models in developing visual thinking as they can express the same concepts and ideas with various ways. When learners outline and visualize their ideas, they can understand the geometric relationships.

Research hypotheses: This research tried to test the following hypothesis:

1-There would be a statistical significant difference (favoring the experimental group) between the mean scores obtained by the experimental group(using Costa and Kallick's Habits of Mind in teaching geometry and measurement unit) and the control group(studying the same content with the traditional method) on the post achievement test.

2-There would be a statistical significant difference (favoring the experimental group) between the mean scores obtained by the experimental group(using Costa and Kallick's Habits of Mind in teaching geometry and measurement unit) and the control group(studying the same content with the traditional method) on the post test of visual thinking skills.

Research Method

It indicates the procedural steps of research including research design, variables, sample and its selection, instruments and their design and statistical constant calculation as following:

Research design

The current research adopts the quasi-experimental design which is based on the two groups: an experimental group (using Costa and Kallick's Habits of Mind in teaching geometry and measurement unit) and control (studying the same content with the traditional method).

Research variables:

1- The independent variable: Teaching using Costa and Kallick's Habits of Mind in teaching "geometry and measurement" unit.

2- The dependent variables are: Developing achievement and some visual thinking skills (visual discrimination, visual closure and connecting relationships in the shape) of first year preparatory school pupils.

Educational material and measurement tools:

To achieve the research goals, the researcher designed the educational material and measurement tools as following:

1-Educational material:

- The researcher designed a list of mind habits according to Costa and Kallick's model which was translated into educational goals. These educational goals can be achieved after teaching the content of geometry for first year prep school pupils (first term). The researcher developed an initial questionnaire for this list presented to jury members to check its validity and reliability. The researcher obtained the final form of this list after doing the needed modifications.

- designing a teacher's guide and pupils' worksheets for teaching "geometry and measurement" unit of first year prep school pupils according to   Costa and Kallick's Habits of Mind including: introduction, the model of Costa and Kallick's Habits of Mind, Geometers Sketch Pad(GKP) program, GeoGebra program, the general aims of   "geometry and measurement" unit of first year

prep school pupils(first term) according to Habits of Mind, the unit content, the time distribution of sessions in the unit according to the plan, presenting the unit topics according to Costa and Kallick's Habits of Mind, evaluation methods (formative and summative evaluation).

2- **Measurement tools**:

A-The researcher designed an achievement test of geometry and measurement unit for the first year prep school pupils (first term). She obtained a final form of this test through these steps:

- identifying the objective of this test: this test aims to measure achievement of first year prep school female pupils in aspects of learning included in geometry and measurement unit in the first term.
- designing a table of specification of the test in the light of the test length (the test items are 30), the relative weight of every topic, the objectives' levels of every topic(knowledge-comprehension and application-critical thinking and problem solving), the researcher designed a table of specification of the test.
- designing an initial form of the achievement test: according to the table of specification, the researcher designed the initial form of the test which composed of 30 items. Test items were formulated as following: (5) completion items, (5) true and false items, (15) essay items.
- The method of test correction:
  • Objective questions: the researcher puts one point for the correct answer.
  • Essay questions: the researcher puts one point for every correct step. The final grade of questions is calculated according to the number of correct steps. For the items of drawing geometric shapes, the researcher puts one point for every correct drawing. As a result of that the maximum score of the test is (45) points.

The test validity:

The initial form of the test is presented to a number of jury members from teaching staff specialized in mathematics and methodology to make sure of the comprehensiveness of test items that measure aspects of learning included in "geometry and measurement" unit and the validity of every item in the test and its purpose. The researcher did the needed modifications according to jury members' viewpoints.

Piloting of the test:

After doing the required changes referred by jury members, the test was applied on the piloting sample after teaching "geometry and measurement" unit to calculate the statistical treatment of the test. The results were as follows:

Test item validity is calculated by calculating the correlation coefficient between the grade of every item in the test and the overall score of the test (internal consistency). The correlation coefficients ranged (from 0.31 to 0.75) which all are statistically significant. Test reliability is high as reliability coefficient using Alpha Cronbach's equation was (0.87). The test item was suitable in its facility as the facility index of items ranges between (0.17- 0.84). the results also indicated that the discrimination index of items ranges between (0.13- 0.25). This means that the test has the ability to distinguish between pupils.   The mean of the test

time was calculated from test items of the piloting sample. It is found that the time needed for the test is (120) minutes. Thus, the researcher designed the final form of the achievement test.

B- Designing the visual thinking skills test:

The researcher designed the final form of visual thinking skills test through identifying the test goal which measured some of the visual thinking skills of first year prep school pupils.

- Preparing the initial form of visual thinking skills test: The researcher designed the initial form of visual thinking skills test which was composed of (20) items. These items were formulated in multiple choice questions.
- Preparing the key answer of the test: the researcher puts one point for the correct answer for each item in the test. Therefore, the overall score of the test was (20) points.

The test validity:

The initial form of the test is presented to a number of jury members from teaching staff specialized in mathematics and methodology to make sure that each item is suitable for the level of goal that it measures, the scientific accuracy of the items, the appropriate language formulation of the items,. The researcher did the needed modifications according to jury members' viewpoints.

Piloting of the test:

After doing the required changes referred by jury members, the test was applied on the piloting sample after teaching "geometry and measurement" unit to calculate the statistical treatment of the test. The results were as follows:

Test item validity is calculated by calculating the correlation coefficient between the grade of every item in the test and the overall score of the test (internal consistency). The correlation coefficients range (from 0.31 to 0.59) which all are statistically significant. Test reliability is high as reliability coefficient using Alpha Cronbach's equation was (0.84). The test item was suitable in its facility as the facility index of items ranges between (0.28- 0.86). the results also indicated that the discrimination index of items ranges between (0.12- 0.25). This means that the test has the ability to distinguish between pupils.   The mean of the test time was calculated from test items of the piloting sample. It is found that the time needed for the test is (60) minutes. Thus, the researcher designed the final form of the visual thinking skills test.

Conducting the research experiment

The implementation of the experiment began on (13-10-2019), as "geometry and measurement" unit was applied to the pupils of the research groups (experimental and control). Teaching lasted for (20) session, namely 2 sessions per week. The research experiment ended in (18-11-2019), after that the achievement test and the visual thinking skills test were applied (post- application) to the students of the research groups.

Research results and their interpretations:

1-To verify the first hypothesis "There is a statistical significant difference (favoring the experimental group) between the mean scores obtained by the experimental group(using Costa and Kallick's Habits of

Mind in teaching geometry and measurement unit) and the control group(studying the same content with the traditional method) on the post achievement test", the researcher used "T" test for the independent groups. The following table indicates the application results:

Table (2)

The Statistical Significant Difference between the Mean Scores Obtained by the Experimental Group and the Control Group on the Post Achievement Test of "Geometry and Measurement" Unit.

Group	N	Mean	SD	df	T-Value	Sig.
Experimental	50	32.32	7.55			
Control	50	22.9	9.12	98	5.62	0.01

Table (2) showed that there is a statistical significant difference (0.01) between the mean scores obtained by the experimental group and the control group on the post achievement test favoring the experimental group. As a result of that, the first hypothesis was achieved η2 has been calculated (0.244). It is a value that exceeds the pedagogic importance value of the statistical results in educational and psychological researches which was (0.14). This means the impact of the independent variable (Costa and Kallick's Habits of Mind) on the dependent variable (the achievement test of the unit of "geometry and measurement") was high as η2 value refers. This indicates the effectiveness of Costa and Kallick's model in increasing achievement of female pupils of the experimental group.

Marshal(2007), Amor(2005) ,Hu(2005),Kreizel & Lincion(2006), Rayane(2012), Aljizani & Ward(2012), Elbarsan& Abd(2013) , Abd elhamid(2014), Elmotreb & Elshore (2014) , Elmofty et al(2015) and Elsayed(2016)   agree with the results of using Habits of Mind in developing achievement. Therefore, the research question was answered and the research hypothesis was verified.

The results indicated the excellence of first year prep school female pupils of the experimental group who studied "geometry and measurement" unit in geometry course in the first term using Costa and Kallick's Habits of Mind than those pupils of the control group who studied the same course with the traditional method in developing achievement because of using Costa and Kallick's Habits of Mind in teaching the unit. This development occurred due to:

1. using activities that motivate female pupils on perseverance during problem solving and geometric exercises through giving examples of some mathematicians and their discoveries and applying origami activities(they are manual activities pupils use to design shapes which learn them patience during answering exercises of higher order thinking). This helped them to increase their level of achievement.

2. using the previous knowledge in new situations helped them in recalling and the survival of learning impact through continuously practicing to memorize what they studied and using it in new situations. This achieved coherence in their knowledge which helped them in increasing their level of achievement.

3. using some activities based on cooperative learning provided the chance for pupils to share with themselves in groups. This helped them to develop reciprocal thinking and thinking about

thinking through pupils' rethinking of their peers' answers to improve the group level and avoid mistakes. This leads to rapidly understanding and increasing their achievement.

4. asking questions during doing activities helped to clarify the problem for pupils as it helped to find answers to these questions which helped in understanding and finding solutions through questioning. Therefore, this helped to increase their achievement.

5. using activities helped in thinking flexibly through introducing different methods of solution, introducing problems with different higher order thinking and changing the modes of geometric shapes while doing exercises. This helped pupils to deduce various alternatives for solving geometric problems and was not restricted by only one solution. Therefore, this helped to increase their achievement.

6. using activities helped in creating a sense of humor for pupils by using question bank, mathematical fallacies and caricatures. This stimulates pupils to do the activity and discover the fallacy. Therefore, this helped to increase their achievement.

7. using activities developed pupils' imagination, innovation and creativity through introducing unusual problems, giving untraditional solutions for these problems, using GeoGebra and GSP in drawing the geometric shapes by computer. These programs helped to draw the geometric shape rapidly and more accurately. This helped them in enhancing their performance of solving geometric exercises and increasing their achievement which is confirmed by Costa and Kallick's Habits of Mind.

8. the continuous evaluation before, during and after the lessons of the unit and the continuous feedback of pupils contributed in increasing the effect size and their achievement.

2-To verify the second hypothesis "There is a statistical significant difference (favoring the experimental group) between the mean scores obtained by the experimental group(using Costa and Kallick's Habits of Mind in teaching geometry and measurement unit) and the control group(studying the same content with the traditional method) on the post test of visual thinking skills", the researcher used "T" test for the independent groups. The following table indicates the application results:

Table (3)

The Statistical Significant Difference between the Mean Scores Obtained by the Experimental Group and the Control Group on the Post Test of Visual Thinking Skills of "Geometry and Measurement" Unit.

visual thinking skills	Group	N	Mean	SD	T-Value	Sig.	η2 Value	Sig. of Effect Size
visual discrimination skill	Experimental	50	6.34	1.398	5.18	0.01	0.215	High
	Control	50	5.14	0.847				
visual closure skill	Experimental	50	5.04	0.83	6.62	0.01	0.309	High
	Control	50	3.80	1.03				
	Experimental	50	5.60	1.14	6.21	0.01	0.284	High

connecting relationships in the shape skill	**Control**	50	4.06	1.33				
Total skills	**Experimental**	50	16.98	2.17	7.92	0.01	0.390	High
	Control	50	13.00	2.81				

Table (3) showed that there is a statistical significant difference (0.01) between the mean scores obtained by the experimental group and the control group on the post test of visual thinking skills as a whole and in each major skill separately favoring the experimental group. As a result of that, η2 as calculated for the visual thinking skills as a whole and for each major skill separately, and it became clear that the values of η2 exceed the value indicating the educational importance of the statistical results in educational and psychological research and ranges between (0.215-0.39). This means the impact of the independent variable (Costa and Kallick's Habits of Mind) on the dependent variable (test of visual thinking skills) was high as η2 value refers. This indicates the effectiveness of Costa and Kallick's model in increasing visual thinking skills of female pupils of the experimental group.

This finding is consistent with the findings of Al khazindar (2008), Hamada (2009) ,Shath(2009) , Strahy(2011) ,Haciomeroglu & Chicken(2012) ,Zaghlol (2015), Mahmoud (2017) and Godat (2017), which confirmed the effectiveness of using different teaching strategies and samples in developing visual thinking skills. Therefore, the second   research question was answered and the second research hypothesis was verified.

The results indicated the excellence of first year prep school female pupils of the experimental group who studied "geometry and measurement" unit in geometry course in the first term using Costa and Kallick's Habits of Mind than those pupils of the control group who studied the same content with the traditional method in developing visual thinking skills because of using Costa and Kallick's Habits of Mind in teaching the unit. This development occurred due to:

1. converting Habits of Mind into educational goals and striving to achieve them in the unit. This helped pupils to do performances related to developing their visual thinking skills because pupils are required to solve the observed activity, visual sensation, sensory experience and geometrical drawing which leads to develop some of their visual thinking skills.

2. converting Habits of Mind into educational goals and striving to achieve them by implicit activities in geometry course. To do these activities, it is required to prepare some pictures and caricatures and to analyze and synthesize geometric shapes which helped in developing perseverance and sense of humor. This helped to develop their visual thinking skills.

3. converting Habits of Mind into educational goals and striving to achieve them in the unit's content requires some activities based on cooperative learning which developed the habit of reciprocal thinking. This leads to doing some kind of dialogue and discussion between group members, all groups as a whole and the teacher who got clarifications and deductions helped in doing the activity. This helped to develop their visual thinking skills.

4. converting Habits of Mind into educational goals and striving to achieve them in the unit's content served to tie relationships and find the connections between the current lesson, the previous one

and the lesson elements itself. It also helped in doing comparisons between shapes' features which helped in doing the activity through using the previous knowledge application habit in new situations. This developed their visual thinking skills.

5. converting Habits of Mind into educational goals and striving to achieve them in the unit's content required using proper verbal expressions. It also required using primary and secondary sources of information in doing the activity which developed the struggle habit to achieve accuracy. This contributed to develop their visual thinking skills.

Recommendations

In light of the findings of the present research, the following recommendations were drawn:

1- The need to pay attention to preparing professional development programs to train mathematics teachers to develop students 'Habits of Mind.

2- The need to pay attention to training students of mathematics teachers in colleges of education in developing Habits of Mind.

3- Enriching the geometric content in the preparatory stage with the various educational activities, which contribute to developing the visual thinking of learners.

The suggested studies:

In the light of the results, the researcher suggests some further studies such as:

1- Doing studies similar to the current study in other grades in different stages of education.

2- Developing the preparatory curriculum of Algebra in the light of Costa and Kallick's Habits of Mind.

3- Conducting researches similar to this research using Costa and Kallick's Habits of Mind in teaching different types of learners such as students with learning disabilities and underachievers.

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Analysis of Risk Factors for Osteopenia and Osteoporosis Among Adults and Elderly in Primary Health Care

Kátia Gianlupi Lopes [1] (Corresponding author)

[1] Health Education. State University of Mato Grosso do Sul, Dourados, Mato Grosso do Sul, Brazil. Telephone: +55 (67) 99973-2523. E-mail: katiagianlupi@hotmail.com

Márcia Regina Martins Alvarenga[1], Aniandra Karol Gonçalves Sgarbi[2]

[2]Epidemiologic Studies. Graduate Program on Health and Development in West Central Region. Faculty of Medicine, Federal University of Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil.

Abstract

Objective: To analyze the distribution of risk factors for osteopenia and osteoporosis among adults and elderly in primary care. Method: sectional study of quantitative approach. Random sample extracted from registered adults and elderly from the five Family Health Strategy units belonging to an Expanded Family Health and Primary Care Center in Dourados, MS. Data collected between March and December 2015. The sample consisted of 44 adults and 103 elderly, of which only 109 performed all examinations. Body mass index, bone densitometry, serum calcium, 25 serum hydroxyvitamin D and a structured questionnaire were used. Results: The factors that were significantly associated with the risk of osteopenia and osteoporosis (p <0,05) were female gender, alcohol consumption and normal body mass index. Conclusion: the identification of these risk factors made it possible to trace their distribution profile, which will be of great value for carrying out health promotion actions and prevention of these diseases in Primary Health Care.
Keywords: Risk factors; Elderly; Metabolic bone diseases; Osteoporosis; Healthy aging.

1. Introduction

The Osteoporosis and osteopenia are increasingly prevalent conditions that generate significant health consequences for fractured individuals [1]. They are considered similar and precursor diseases and are characterized by a reduction in bone mass and bone tissue, producing mechanical fragility and a greater predisposition to fractures, although this reduction is less severe among osteopenic individuals [2].

The Osteoporosis is the most frequent osteometabolic disease among the elderly [2]. Although it is seen as a female health problem, mainly due to weather-related changes, in the last 20 years male osteoporosis has been highlighted, since about 30% of hip fractures occur in men [3].

The main risk factors for osteoporosis and fractures are: age; female gender; white or oriental ethnicity; personal and family history of fracture; low Bone Mineral Density (BMD) of the femoral neck; low Body Mass Index (BMI); use of oral glucocorticoid (dose ≥ 5mg of prednisone for more than three months); environmental factors, among which smoking, excessive alcohol intake (≥ three units per day), physical inactivity, and low calcium dietary intake [4].

The Osteoporosis is a multifactorial disease, the most important result of which is the occurrence of low-impact fractures, affecting more than 200 million people worldwide [3]. A study among American postmenopausal women found that the costs related to hospitalization and treatment of osteoporotic fractures outweigh the costs related to other pathologies [5]. In 2018, more than 840.000 cases of osteoporotic fractures were estimated, generating a total annual cost of approximately $1,17 billion, according to a study conducted in four Latin American countries, including Brazil [6].

Researchers in southern Brazil identified a mortality rate above 25% after 12 months of a hip fracture and that this rate is 4,3 times the expected mortality for individuals over 50 years of age [7]. These fractures compromise the independence of individuals who survive them, with more than 50% of them becoming dependent for daily activities and many of them needing institutionalization [3].

About 80% of eligible patients do not receive treatment for the disease and may generate recurrent fractures [8]. It is necessary to intervene quickly after any fracture due to fragility, especially in postmenopausal women, since it can be a unique opportunity to prevent new fractures in a short period of time, considering their increased risk for such outcome[9].

Therefore, the main objective was to analyze the risk factors for osteopenia and osteoporosis among adults and the elderly of Basic Care.

2. Materials and methods

Sectional and quantitative approach study. The sample was randomized, taken from the population of adults and elderly registered in the five units of Family Health Strategy (FHS) that belonged to the area of coverage of the Expanded Core of Family Health and Basic Care (ECFH-BC) in the Northern region of the municipality of Dourados, Mato Grosso do Sul, according to data from the Information System of Basic Care (ISBC) [10]. The data were collected from March to December 2015.

The sample calculation was based on the study that estimates proportions from the finite population of 4048 people, using the 95% confidence interval, 10% margin of error and 50% expected proportion of people with osteoporosis [11].

People of both sexes from the age of 50 were considered as inclusion criteria, and individuals belonging to the indigenous ethnicity, as well as bedridden individuals, incapable of locomotion or with limitations to respond to it, due to some mental illness, were excluded from the survey.

The sample consisted of 147 persons, 44 adults (aged between 50 and 59 years) and 103 elderly (60 years and over).

Body Mass Index (BMI), bone densitometry, serum calcium, 25 serum hydroxivitamin D and a structured questionnaire were used.

Considered the parameters of BMI for elderly, The Pan American Health Organization [12]. The variables were reclassified into two categories: normal (BMI <28kg/m2) and overweight (BMI ≥28 kg/m2).

For the BMI for adults, the World Organization Health parameters were used. In this case, they were grouped into: normal (BMI <24.9 kg/m2) and overweight (BMI ≥25 kg/m2). This dichotomous reclassification of the BMI variable was necessary due to the low number of individuals per category to perform regression calculations.

The research was developed through home visits, where the weight and height of those assessed were measured. The structured questionnaire was also applied, upon acceptance of the individuals to participate in the research and signing of the Free and Informed Consent Term (FICT).

The criteria for requesting bone densitometry (BOD) were the same as those adopted by the Dourados Municipal Health Department (MS) until the beginning of the collection date (March 2015).

The individuals with indication for the DO examination were scheduled by the Regulation System (REGSYS) and later, referred to the Center for Women's Service (CWS) of Dourados (MS), to perform the examination of bone densitometry and diagnosis [13].

Bone densitometry examination was performed by absorptiometry densitometry and radiography with dual energy (DXA – *Double Energy X-Ray Absorptiometry*). The results were considered, according to the World Health Organization (WHO) consensus, as normal, when densitometry showed up to -1 T Score standard deviation (SD); osteopenia, from -1 to -2,5 SD T Score and osteoporosis when the result is below -2,5 SD [14].

Complementary tests were also performed, such as serum calcium and 25 hydroxyvitamin D. The cut-off points considered for serum calcium were between 8,6 and 8,8mg/dl for lower limit and 10,2 and 10,3mg/dl for upper limit of normality [15]. As for the levels of 25 hydroxivitamin D it was considered: deficient (< 20ng/ml), insufficient (20-29ng/ml) and sufficient (30-100ng/ml) [16].

A questionnaire containing sociodemographic data (gender, age, marital status, education, income and family arrangement) and health characteristics was used to check the interference of control variables [17]. Regarding health characteristics, the following variables were evaluated: smoking; alcohol intake; fracture history; family history of osteopenia and/or osteoporosis; history of maternal osteoporotic fracture; age of menopause; sun exposure; use of sunscreen; physical activities and use of drugs/supplements.

The data collected were tabulated and with the help of Predictive Analytics Software (PASW) version 21 statistical analyses were performed using absolute and relative frequency, mean, median and standard deviation (dp).

The univariate analytical approach and later the univariate logistic regression model were used to verify the association of the variables that contribute to the incidence of osteoporosis. The association between bone densitometry classification and the other variables evaluated in this study was evaluated using the chi-square test, with Bonferroni correction when necessary.

The multivariate logistic regression technique was then applied. All variables with a significance value, p < 0,20, were included in the regression model in the univariate analysis. The logistic regression model used was the Enter method for estimating prevalence ratios and applying the likelihood ratio test to obtain statistical significance (p<0,05) [18].

The collection of data met the guidelines of CNS Resolution 466/2012 and only occurred after the approval of the Ethics and Research Committee of the Dom Bosco Catholic University (UCDB) under protocol 866.086.

3. Results

Of the 147 evaluated, 108 (73,5%) were female. The mean age of the participants was 65,3 years (dp=±9,6; median=64), ranging from 50 to 89 years old.

The majority (70,0%) were elderly, 55,1% were married or had a stable union, 82,0% were educated, 84,3% lived with spouse and/or relatives and 70,7% had family income below two minimum wages. It should also be noted that 40,1% of the individuals were diagnosed with overweight.

Considering the risk factors evaluated and that only 109 individuals performed all the tests, 92,5% presented some type of risk factor for osteopenia or osteoporosis and only 7,5% did not present the factors for these diseases.

Of the 109 patients evaluated 38,5% (n=42) had osteopenia and 26,6% (n=29) already had osteoporosis.

Table 1 shows the distribution of factors associated with the diagnosis of osteopenia and osteoporosis in the lumbar region or femur or both, referring to adults and elderly people served by NASF North.

Most patients were female (73,4% - n=80), older than 60 years (70,6% - n=77), had no maternal family history of osteoporosis (84,4% - n=92), did not consume alcohol (83,5% - n=91), was not a smoker (61,5% - n=67), had no history of fractures (75,2% - n=82), did not perform physical activity (66,1% - n=72), did not use hormone replacement (only among women); 75,0% - n=60), menopause had started after 50 years (only among women; 57,5% - n=46), was overweight (85,3% - n=93), did not use antacids (91,7% - n=100), did not use calcium supplementation (91,7% - n=93) or vitamin D (92,7% - n=101) and had normal serum vitamin D dosage (65,3% - n=64).

There was an association between bone densitometry and the following variables: gender (p=0,011), alcohol consumption (p=0,038), body mass index classification (p=0.001) and antacid use (p=0,001). The percentage of men with normal densitometry was higher than that observed among women (chi-square test, with Bonferroni correction, p<0,05). On the other hand, the percentage of women with osteoporosis was higher than that observed among men (p<0,05).

A percentage of patients who consumed alcohol presented normal densitometry when compared to those who did not use alcohol (p<0,005). In addition, a higher percentage of overweight people presented normal densitometry when compared to those with normal BMI (p<0,05). In contrast, a lower percentage of overweight patients presented osteoporosis when compared to those with normal BMI (p<0,05).

When using antacids, a percentage of patients who did not use antacids had normal densitometry when compared to those who used antacids (p<0,05). On the other hand, a higher percentage of patients who used antacids had osteoporosis when compared to those who did not use antacids (p<0,05).

The other variables evaluated in this study were not significantly associated with bone densitometry of patients (chi-square test, p-value ranging from 0,081 to 0,920).

A multivariate analysis of the evaluation of the association of bone densitometry and the other variables evaluated in this study was performed, initially including in the logistic regression model all the variables in Table 1 that presented a value of *p*<0,20, which are: gender, age range, family history of osteopenia or osteoporosis, use of alcohol, body mass index and use of antacids.

In Table 2 presents the results of the multivariate logistic regression model for osteopenia and Table 3 presents the results of the multivariate assessment for osteoporosis.

In multivariate analysis the only variable that was shown to be associated with osteopenia was the use of alcohol (logistic regression test, p=0,049), in which case the use of alcohol was protective in relation to osteopenia (Odds Ratio=0,23).

The gender of the patients was significantly associated with osteoporosis (p=0,022), being more prevalent in female patients (Odds Ratio=9,64).

Age has also been associated with osteoporosis, which is more frequent in people aged 60 and over (Odds Ratio=7,52). The other variables were not associated with osteoporosis.

Table 1. Distribution of factors associated with the diagnosis of osteopenia and osteoporosis in the lumbar region or femur or both, referring to adults and elderly attended by NASF North. Dourados, MS, 2015 (N=109).

Variable	Bone mineral densitometry						Total (%)	Value of p
	Normal		Osteopenia		Osteoporosis			
	N	%	N	%	N	%		
Gender of evaluation								
Male	15	51,7a	12	41,4a	2	6,9b	29 (26,6)	0,011
Female	23	28,8b	30	37,5a	27	33,8a	80 (73,4)	
Age (years)								
Less than 60	12	37,5	16	50,0	4	12,5	32 (29,4)	0,081
60 or more	26	33,8	26	33,8	25	32,5	77 (70,6)	
Maternal family history of osteoporosis								
No	31	33,7	33	35,9	28	30,4	92 (84,4)	0,102
Yes	7	41,2	9	52,9	1	5,9	17 (15,6)	
Alcohol consumption								
No	27	29,7b	38	41,8a	26	28,6a	91 (83,5)	0,038
Yes	11	61,1a	4	22,2a	3	16,7a	18 (16,5)	
Was or is a smoker								
No	25	36,8	22	32,8	20	29,9	67 (61,5)	0,293
Yes	13	31,7	20	46,7	9	21,4	42 (38,5)	
History of fractures								
No	30	36,6	33	40,2	19	23,2	82 (75,2)	0,368
Yes	8	29,6	9	33,3	10	37,0	27 (24,8)	
Performs physical activity								
No	26	36,1	25	34,7	21	29,2	72 (66,1)	0,492
Yes	12	32,4	17	45,9	8	21,6	37 (33,9)	
Hormonal repositioning								
No	16	26,7	21	35,0	23	38,3	60 (75,0)	0,324
Yes	7	35,0	9	45,0	4	20,0	20 (25,0)	
Period when menopause began								
Before 50 years	12	35,3	14	41,2	8	23,5	34 (42,5)	0,232

After 50 years	11	23,9	16	34,8	19	41,3	46 (57,5)	
Body mass index								
Normal	1	6,3b	5	31,3a	10	62,5a	16 (14,7)	0,001
Overweight	37	39,8a	37	39,8a	19	20,4b	93 (85,3)	
Use antacid								
No	38	38,0a	40	40,0a	22	22,0b	100 (91,7)	0,001
Yes	0	0,0b	2	22,2a	7	77,8a	9 (8,3)	
Use supplemental calcium								
No	35	35,0	38	38,0	27	27,0	100 (91,7)	0,920
Yes	3	33,3	4	44,4	2	22,2	9 (8,3)	
Use a vitamin supplement D								
No	36	35,6	39	38,6	26	25,7	101 (92,7)	0,730
Yes	2	25,0	3	37,5	3	37,5	8 (7,3)	
* Dosage of serum vitamin D								
Normal	20	31,3	27	42,2	17	26,6	64 (65,3)	0,625
Deficient	13	38,2	11	32,4	10	29,4	34 (34,7)	
No information	5		4		2			

* Serum vitamin D dosage: the sum was 98, because only this number of individuals took the test. Different letters in the column represent difference between categories of the variable, in that category of bone densitometry (chi-square test with Bonferroni correction, $p<0,05$).

Table 2. Joint analysis of osteopenia classification in relation to gender, age group, family history of osteopenia or osteoporosis, alcohol use, body mass index and antacid use of adults and elderly attended by NASF North. Dourados, MS, 2015 (N=109).

Variables	**Categories**	**OR [IC95%]**	**Value of p**
Sex	Male	1	0,941
	Female	0,96 (0,29 - 3,15)	
Age group	Less than 60	1	0,371
	60 or more	0,62 (0,22 - 1,77)	
Family history of osteopenia or osteoporosis	No	1	0,920
	Yes	0,94 (0,28 - 3,21)	
Use of alcoholic beverages	No	1	0,049
	Yes	0,23 (0,06 - 0,99)	
Body Mass Index	Normal	1	0,156

	Overweight	0,19 (0,02 - 1,87)	
Use of antacid	No	1	0,999
	Yes	*TDA	

Estimates: Log likelihood ratio = 99,63; Nagelkerke R^2 = 0,172.

Model adjustment. $X^2_{(6)}$ = 33,98; p = 0,680. Global correct rank percentage = 61,3%.

*TDA= Test does not apply.

Table 3. Joint analysis of osteoporosis classification in relation to gender, age group, family history of osteopenia or osteoporosis, alcohol use, body mass index and antacid use of adults and elderly attended by NASF North. Dourados, MS, 2015 (N=109).

Variables	**Categories**	**OR [IC95%]**	**Value of p**
Sex	Male	1	0,022
	Female	9,64 (1,38 – 67,30)	
Age group	Less than 60	1	0,031
	60 or more	7,52 (1,20 – 47,11)	
Family history of osteopenia or osteoporosis	No	1	0,998
	Yes	*NSA	
Use of alcoholic beverages	No	1	0,754
	Yes	0,73 (0,10 – 5,28)	
Body Mass Index	Normal	1	0,055
	Overweight	0,08 (0,01 - 1,06)	
Use of antacid	No	1	0,998
	Yes	*TDA	

Estimates: Log likelihood ratio = 49,01; Nagelkerke R^2 = 0,632.

Model adjustment. $X^2_{(6)}$ = 42,66; p < 0,001. Global correct rank percentage = 82,1%.

* TDA= Test does not apply.

4. Discussion

In this study it was possible to verify that the percentage of women with osteoporosis was higher than that of men. In addition, osteoporosis was more observed in individuals with normal BMI and who used antacids. However, in the multivariate analysis, only the use of alcohol was associated with osteopenia, as a protective factor.

On the other hand, the age group was associated with osteoporosis, and the risk of people aged 60 years and over for osteoporosis was 7,52 times higher than that of individuals under 60 years of age.

Further investigation is recommended in future studies, considering a more representative sample, in order to identify other factors that may be interfering with the risk of osteoporosis and that have not reached the proposed level of significance or have not been studied in this work.

The relationship between the use of antisecretory (proton pump inhibitors) and bone metabolism has been pointed out in the literature by some researchers [19,20], although it is not yet well elucidated. It is supposed that this fact is explained by the elevation of the gastric hydrogen ion potential (pH), which would affect the absorption of calcium, since the mineral is insoluble in basic medium.

An experimental study in which 50 rats were submitted to prolonged use of omeprazole, in different dosages, observed bone demineralization of the femur of animals exposed to high doses of omeprazole, which may suggest susceptibility to bone fractures [19].

The Brazilian Consensus of Potentially Inappropriate Medicines for the Elderly recommends that proton pump inhibitors be prescribed with caution and that their use be discontinued before eight weeks of treatment or that their dosage be reduced, considering their potential for the development of osteoporosis/fracture, among other consequences [20].

With the results of Table 3, it is possible to conclude that there was a strong relationship of significant dependence between normal body mass index and positive diagnosis of osteoporosis. People who presented normal body mass index presented 10 times more chances of presenting positive diagnosis of osteoporosis than an overweight individual. People who do not consume alcohol are 3,9 times more likely to be diagnosed with osteoporosis than individuals who consume moderately alcoholic beverages. On the other hand, the data showed that the use of antisecretory results in a 100% chance of being diagnosed with osteoporosis in this population.

It should be noted that although these three variables are jointly significant and important, they represent only 24% of the total variation ($R^2 = 0,241$) and that for future studies further investigation is recommended, considering a more representative sample, in order to identify other factors that may be interfering with the risk of osteoporosis and that have not reached the proposed level of significance or have not been studied in this work.

Another study [21], aiming to determine the prevalence of osteopenia and osteoporosis among women in a specialized clinic in southern Brazil, found age after 50 years and menopause in this period as risk factors for osteoporosis, which converges with our results, although these variables did not present a significant association in this study.

This higher prevalence of the disease in women can be explained by the balance between bone formation and bone resorption, which becomes progressively negative with advancing age and the greatest bone loss occurs after the age of 65. However, men are less likely to develop the disease for two reasons: first, they gain more bone mass during puberty and second, they lose less bone mass during aging because they do not experience sudden loss of estrogen, as occurs with menopausal women [21].

A cross-sectional clinical study with 107 women attended in the Health Integrality Practices Program (HIPP) identified sedentarism as one of the risk factors for osteoporosis. On the other hand, this study showed a higher prevalence of individuals who perform physical activity among those diagnosed with osteoporosis; however, this association was not significant and may have occurred at random [22].

Regarding the alcohol intake factor, in the present study there was a significant association between the absence of alcohol use and the risk of osteoporosis, and this finding is controversial in the literature. Another researcher found that the absence of alcoholism was one of the protective factors for the disease [21]. It is known that excessive alcohol intake is harmful to bone, reducing the number of osteoblasts and increasing bone resorption [23], however, in the population studied, 86,4% do not ingest alcohol on a weekly basis, which can represent that a low or moderate intake of alcohol has a protective effect on bone health. In terms of BMI and risk of osteoporosis, the results show in the literature [21,24] that the higher the BMI, the lower the risk for osteoporosis, since obese individuals have a higher peripheral conversion of gonadal hormones, which improves bone mass maintenance and protects against the deleterious effects of hypoestrogenism. Another study showed [25] that obese women had a lower prevalence of osteopenia compared to eutrophic women, as well as a lower prevalence of osteoporosis compared to eutrophic and overweight women.

5. Conclusion

The identification of the prevalence of osteopenia and osteoporosis and their risk factors in this population made it possible to trace their distribution profile, enabling health promotion and disease prevention actions in Primary Care.

The limitations of the study are the type of study (cross-sectional), the sample size and that only one region of the municipality was contemplated. In addition, a large number of individuals did not perform all the tests.

It is essential to develop new studies, including a larger number of individuals, with greater proportionality between genders, as well as inserting new tests and even with representativeness of macro-regions in the state of Mato Grosso do Sul, in view of the scarcity of studies in this region.

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Computac Ionais Models for Prediction of Diseases: **Computer Models for Disease Prediction**

Ilka Kassandra Pereira Belfort, Isaura Danielli Borges de Sousa, Tatyanne Silva Rodrigues; Ana Paula Cunha, Vanessa Edilene Duarte Martins; Sally Cristina Moutinho Monteiro, Allan Kardec Duailibe Barros

ABSTRACT

With the increased computational power and ease of gathering medical information, Artificial Intelligence has helped all areas of health in developing algorithms and techniques for disease diagnosis and staging. The technology has been applied in several areas, due to its wide range of features, some activities become simpler with your help. Thus, this study aimed to identify the main computational models for disease prediction. Data collection was performed in the virtual databases present in the Health Library Research Portal (VHL): LILACS: Latin American and Caribbean Health Sciences Literature, Scielo - ScientificElectronic Library Online and Literature Analysis and Retrieval System Medical Online (MEDLINE). We found 52 articles and 10 of these in the review. From the reading and evaluation of the included articles, which can be aided by computer vision techniques, machine learning through neural networks and pattern recognition can be developed algorithms capable of identifying diseases. Thus, from this diagnosis provided by the algorithm, the health professional will have conditions for early prevention, diagnosis and treatment of diseases.

Keywords: Computational models. Prediction. Disease.

1. INTRODUCTION

Thes great technological advances, through the concepts conceived by it begin gradually to become a reality, especially with regard to the miniaturization of components and, above all, in relation to mobile devices (especially *smartphones* and *tablets*) at all times more present in an increasingly integrated way (FRANCO et al., 2011).

Due to these advances in information technology, it is dealt with a volume of data of greater complexity, due to different possibilities of uses that may exist in computerizedsystems. With this, it is necessary to use decisionsupport themes(SAD) (BONITA, BEAGLEHOLE, KJELLSTROM, 2010). These, touxiliam the man in tasks that involve decision-making, compiling a large amount of data to be analyzed, documents, prior knowledge on the subject or mathematical models to identify and find a solution that guides the decision required for the particular problem.

SAD are widely used in finance, credit analysis; marketing, in helping to define the target audience for campaigns; engineering, support project cost management and, in particular, in thehealtharea. Inthis area, the main objective of sad is to assist in the diagnostic and prognostic service in health units that

provide primary care, causing the health professional,from the   interaction with the system, to perform during screening, diagnosis and/or follow-up ofthe patient. Diagnosing is one of the most complex and important activities in the health area, as it involves several factors that depending on their values can define a treatment (BONITA, BEAGLEHOLE, KJELLSTROM, 2010).

In oncology,histopathological f guras in image collection libraries are also being tilized to foster research in image processing, computer-aided analysis and diagnosis as a way to assist in the decisions of traditional pathology. In radiation oncology, the use of these advanced technologies can predict the result of diagnoses and treatment that will be applied to patients(DANTAS, et al. 2018).

With the need to make use of as many formal methods as possible to collaborate in the performanceof thisactivity s,computational ones are being employed on a large scale,due to their characteristics of automation and optimization of tasks (GUSTAFSSON, 2011), which allows the realization of faster and more accurate diagnoses.

The increasing increase in information that may be available about the patient to the health professional can hinder clinical judgment, mainly in recognizing recurrent patterns, due to the inherent difficulty of the human being in dealing with data in high-dimensionality.

Computational evolution and application possibilities have caused this theme to be explored within universities and large companies in a short time. Thus, the present study aimed to identify the main computational models for predicting diseases. In view of the above, the study presents as a guiding question: What computational models are being used for the prediction of diseases?

Methodology

This was an integrative review. According to Whittemore and Knafl (2005) the integrative review has a great methodological approach to reviews, which allows experimental and non-experimental studies to be included, so that one has a complete understanding of the analysis.

The following steps were adopted for the preparation: identification (formulation of the problem); search in the literature (data collection); evaluation of the data; analysis of the articles included in the review; and presentation and interpretation of the results (WHITTEMORE; KNAFL, 2005).

Data collection was performed in the virtual databases present in the Health Library Research Portal (VHL), LILACS (LatinAmerican and Caribbean Literature in Health Sciences), Scielo (ScientificElectronic Library Online) and MEDLINE   (MedicalLiterature Analysis and Retrieval System Online) via PubMed.   The descriptors were used in Portuguese:Predição,Computational model and disease.

The PICo strategy was adopted, in which the P corresponds to the Participants, the I to the phenomenon of Interest and, the Co to the Context of the study (KARINO; FELLI, 2012). Controlled and uncontrolled descriptors (DNC) were selected from the consultation with Descriptors in Health Sciences (DeCS) and, Medical *Subject Headings (MeSH),*which are presented in Chart 1.

Table 1. Stratification of the study question following the PICo strategy, São Luís, Maranhão, Brazil,2019.

Description	PICo	Components	Descriptor	Type	DNC
Participants	P	Diseases	Disease Signs and Symptoms	DeCS MeSH	Diseases Illness Evolution of the concept of disease Disease Pathology Clinical Manifestations Clinical Observation Clinical Signs Symptom Clinical symptoms
Phenomenon of Interest	I	Computational model	Patient-Specific Modeling Fuzzy Logic Patient-specific Computational Modeling	DeCS MeSH	Fisioma Patient-specific modeling Patient-Specific Modeling
Context of the study	Co	Prediction	Precision Medicine Precision Medicine	DeCS MeSH	Individualized Medicine

Note: P- participants; I-phenomenon of interest; Co-Context of the study; MeSH = controlled vocabulary of pubmed base; DNC = descriptors

uncontrolled; Cinahl titles = controlled vocabulary of cinahl base; DeCS = controlled vocabulary of lilacs base

The inclusion criteria adopted were: primary studies that addressed the computational models that are being used for the prediction of diseases; published inEnglish, Portuguese or Spanish; articles available free of charge in full. The exclusion criteria adopted were: studies of narrative review of traditional literature/review, systematic or integrative; selected studies in the search in another database; and studies that did not answer the guiding question. No time clipping was performed for the selection of articles, since the search for a broad approach to the results was performed.

The selection began, by reading the titles and abstracts, based on the inclusion criteria, totaling 1567 articles, of which 52 were considered adequate and selected for reading in full. From this reading, nine were included in the final sample of this integrative review, according to Figura 1, which followed the PRISMA recommendations (MOHER et al., 2009).

Full reading of the selected articleswas performed and the data were extracted using anadapted data collectionriver(USSR; GAVÃO, 2006)   thepurpose ofensuring that all relevant data were extracted. The dataincluded:definition of subjects, methodology, sample size, and concepts used for basing.
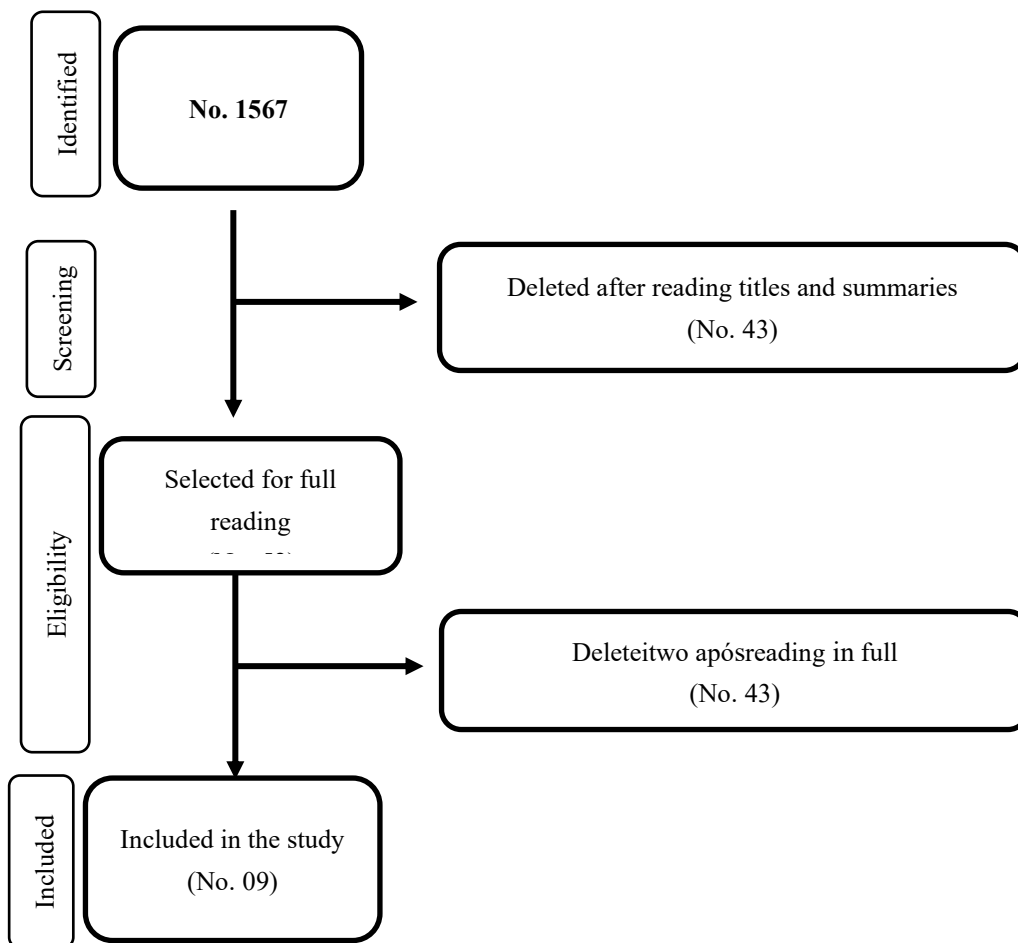

Figure 1 – Selection flowchart of studies according to Preferred Reporting Items for Systematic Reviews and *Meta-Analyses (PRISMA)*

The data found were presented in frame form. Regarding ethical aspects, there was concern to record the information necessary for the identification of the authorship of the articles.

3 RESULTS AND DISCUSSION

Through the interpretative reading of the material found, in the search for studies that met the objective proposed in this study, we can select 9 scientific articles that portray the theme analyzed in this integrative review as shown in table 2 below.

Table 2 - Distribution of the second articles: author/year, title, method and objective.

Author	Title	Method	Objective
David et al., 2018	Fuzzy computational models to assess effects of air pollution in children.	Fuzzy logic	Build a fuzzy computational model to estimate the number of hospitalizations of children up to 10 years of age due to respiratory diseases, based on data on pollutants and climatic factors in the city of São José do Rio Preto, Brazil.
Coutinho, et al. 2015	Fuzzy model estimating length of hospitalization for cardiovascular diseases.	Computational model using fuzzy logic tools	Build a computational model using the properties of fuzzy logic to estimate the average length of hospitalizations due to cardiovascular diseases, based on the concentrations of air pollutants in the city of São José dos Campos, Brazil.
Kock, et al. 2016	Computational model of hyperinflation in lungs with obstructive pattern to airflow	Computational simulation	Mathematically modeling, through computational simulation, the hyperinflation mechanism during spontaneous breathing in lungs with obstructive pattern to airflow through variables related to respiratory mechanics: complacency and resistance of the respiratory system
Vieira et al. 2019	Fuzzy logic and hospitalizations for respiratory diseases using data estimated by mathematical model	Model "fuzzy" for prediction of hospitalizations	Develop and validate a "fuzzy" linguistic model to predict the number of hospitalizations due to respiratory diseases.
Brandão et al. 2018	Nursing care for comfort of people with immunobous dermatoses: evaluation by fuzzy logic.	Application of fuzzy logic evaluation protocol.	Assess whether the interventions proposed in the client nursing care technology with immunobolhosa dermatoses contribute to reduce discomfort

Negreiro, et al. 2008	Integration of computational systems and logistics models of optimization for prevention and combat ing dengue	Logistics planning	Contemplate the use of operational research techniques in the organization and equation of logistics operations to combat dengue
Brazil; Days, 2017	Comparing computational optimization algorithms applied to the problem of predicting protein structures with HP-2D model.	Comparison between two methods applied to PSP using HP-2D model	Conduct a comparative study between these two optimization methods, in terms of minimum energy and computational times
Barreto et al. 2018	Using Artificial Neural Networks for the Diagnosis of Cervical Cancer	Prediction of cancer cases	Supporting clinical decision, network training was done in supervised mode using data from cervical cancer risk factors.
Navarro et al., 2014	Technological innovation and the reflective issues of the biosecurity field.	Literature Review	Reflect on the processes constructing of new technologies arising from the dynamics of the production of new scientific knowledge

Source: Belfort, 2019.

It is noted that all the articles selected from Quadro 1answered the objectives proposed in this review, because all publications sought to identify the computational models for prediction of some disease. Table 2 presents the distribution of studies according to the author and year of publication and the synthesis of the results that answered the objectives of this review.

Table 2 - Distribution of the results of the articles.

Author	*Results*
David et al., 2018	The model was effective in predicting the number of children's hospitalizations, and can be used as a tool in the hospital management of the studied region.
Coutinho, et al. 2015	This model can be used as a specialist system base, which can assist the municipal manager in assessing the risk of hospitalizations due to air pollutants.
Kock, et al. 2016	The implementation of this computational model demonstrated that respiratory mechanics variables can be used to predict air trapping.

Vieira et al. 2019	The fuzzy model is very simple and implies low computational expenses, making it possible to implement prediction of hospitalizations for pneumonia, bronchitis, bronchiolitis and asthma.
Brandão et al. 2018	Fuzzy's inferential analysis provided evaluating patterns of discomfort, pointing to the veracity of the hypothesis that technology contributes to promote the comfort of the clientele. Subjectivity in recognizing comfort patterns in clients with rare diseases directed the use of fuzzy logic due to attributes pain, mobility, sleep pattern, body exposure/injuries.
Negreiro, et al. 2008	The results of this computational application provided, after the tests, a better visualization of the dimension of the problem of coordination of combat for dengue managers, that is, they were fully successful in these pioneering experiments.
Drable, Rosana Gama; et. al. 2014	Use of an intelligent computational system, using nebulous logic as a method of reading the specialist in predicting the risk of development of preneoplastic lesion.
Navarro et al., 2014	Through this analytical dynamics, the essentiality of biosafety and its interface with technological innovations and bioethics are established by the aspects of the policy for the benefit of preventive actions, aimed at promoting the quality of innovative technological processes aimed at health.

Source: Belfort, 2019

It was demonstrated in the analysis of the 10 articles (Chart 2) that the computational vision has numerous applications, which help in the improvement of processes in general health,thus being a great object of study.

According to Brandão et al. (2018) in front of a clientele who needs care that goes beyond the competencies of the health professional,it is essential toproduce knowledge through clinical investigations with significant levels of evidence, directing the use of technologies to reduce discomfort and prevention of injuries.

David et al., (2018) emphasize that the fuzzy approach has been used as an alternative for several areas, including Medicine. Its great advantage is the ease to deal with linguistic terms and inaccurate and uncertain information, in addition to the low computational cost. Unlike classical theory, in which each element belongs or not to a set, fuzzy logic exists a degree of pertinence, and an element may be more or less belonging to a given set

For Coutinho, et al. (2015) fuzzy models emerge as a new tool option, due to its ability to deal with the inaccuracy and uncertainty of information, where values can be classified as partially true, has ease of understanding and low computational cost. This approach has been used in several areas such as in control of industrial processes and medicine.

In the study by Kock, et al. (2016), the importance of airway evaluation in the hyperinflation mechanism was noticed. As presented in computational simulation, increased airway resistance has a very important effect on the obstructive pattern.

In the study by Negreiro, et al. (2008),a computational framework was presented to support dengue prevention andcontrol activities. In other words, practical operational situations related to dengue prevention and combat logistics are described, which configure problems to be addressed.

In this study, it was found that computational methods emerged as a viable alternative to these methods still limited. Computational approaches to prediction of protandica structureare *ab initio, threading* and homology   (BRAZIL; DAYS, 2017).

The Scienceof Computing has positively influenced the development of algorithms and techniques for the diagnosis and staging of diseases. Clinical Decision Support Systems have the potential to reduce the amount of medical errors and improve the quality and efficiency of the clinical treatment offered. In this context, we highlight the use of Artificial Neural Networks (RNA), which are computational models inspired by biology and can be used in a wide variety of machine learning problems (BARRETOet al. 2018).

It should be noted that the use of the computer to aid the analysis of radiological images has been shown to be efficient in the aid of diagnosis in several medical specialties; thus, it does not initially need high accuracy and, yes, obtain a performance close to that of the specialist to serve as support and not substituto, even seeking to assist the medical teaching process.

The technological process and its innovations are presented to society as a paradoxical factor. It generates positive and negative expectations, uncertainties and challenges, such as demonstrative factors of constant constructions and reconstructions of the notions of risk, based on the informational impact and the social and conjuncture context that involves a certain risk. The dynamics of current technological processes are anchored from the perspective of the triple dialogue between scientific knowledge, industry and market interests, aimed at optimizing profit through the capacity of innovation potential (NARRARO et al., 2014)

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4 CONCLUSIONS

A list of computational procedures and technologies most used in the diagnostic activity for predicting diseases was found, which can be used to serve as a basis in new research in this area. This list is composed of supervised learning methods and image segmentation. However, it was seen that the term "computational methods" is not widely used.

It is believed that the use of these methods is greater than that found in this review, and the descriptors are named in different ways. This hypothesis could be proven in new reviews using other synonyms, such as "computational tools" or "computer science", and in other databases.

In one of the articles, it was found that the advance of the use of Artificial Intelligence in Clinical Decision Support Systems focused onncology, enabling the future elaboration of automated diagnostic systems, in order to help primary health care professionals to perform more accurately a diagnosis and early referral of cervical cancer, thus avoiding possible cases of death and improving treatment efficiency.

Finally, it should be noted that the use of the computer to help the analysis of prediction of diseases has been efficient in several medical specialties; thus, it does not initially need high accuracy and, yes, to

obtain a performance close to that of the specialist to serve as support and not substitute, even seeking to assist the teaching process-learning of health professionals.

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Brand value in times of crisis: brand and market value, revenue and profit of companies with the most valuable global brands during and in the post crisis of 2008.

Sérgio Crispim, Marcos Dornelles

Abstract

There is great pressure to improve Marketing accountability as well as its integration with the financial area in order to create shareholder value. In this sense, a research was carried out to evaluate the relationship between the value of the main global brands, revenue, profit margin and market capitalization of companies in the period from 2007 to 2016, with emphasis on the effect of the crisis and after the American crisis and global of 2008. The analysis was centered on the comparison of the indicators of a group composed of the companies holding the strongest brands in the world with a group of the world's largest companies in the concept of S & P 500, excluding the holders of the strongest brands in the first group. Among other points, the survey found that companies that have stronger brands, based on market value, have a net profit margin of 9.8% in the 10-year period, 42% higher than the 6.9% margin of largest companies in the world. The results also suggest that in the moment of external crisis the strong brands allow a relatively greater shielding of this margin.

Keywords: Brand value. Market capitalization. Intangible assets. Business Strategies

1. Introduction

In increasingly dynamic, turbulent and uncertain competitive environments, strategic issues emerge with increasing importance, but, according to McGovern, Court, Quelch and Crawford (2004), the link between strategy and marketing is weak in many companies. In general, Marketing is not responsible for ROI - Return on Investment, but mistaken marketing strategies are associated with the destruction of value of many companies. According to Haigh (2009), CEO of Brand Finance plc, there is a need to advance marketing accountability towards integrating traditional marketing and financial metrics, and it would be very desirable to integrate these metrics into a single measure of business value. company.

McDonald and Mouncey (2009) also claim that better integration between marketing and finance is needed, and marketers need to develop a better understanding of the process of creating shareholder value - which is a synthetic indicator of quality of business management - and the role of marketing activities in this process. From a finance perspective, the focus is on shareholders, and from a marketing perspective on customers. One of the main objects of marketing management is the brand and its attributes, and Haigh (2009) states that there is already much research and acceptance that brands have important influence on long-term financial indicators and the value of companies themselves. In this sense, brand value can be understood as an important link between marketing performance and financial performance that are directly reflected in the value of companies.

Given the above, the following research problem is proposed: "What is the relationship between brand value, revenue, profit margin and company value?" The objective is to evaluate the relationship between the value of the main global brands, revenue, profit margin and market value of the companies from 2007 to 2016, with emphasis on the effect of the crisis and after the American and world crisis of 2008.

2. Literature review

2.1 Importance of shareholder value creation

The 43.2 thousand publicly traded companies in the world were worth $ 64.8 trillion in 2016, or 46 times more than in 1976, about 10 percent per year. Over this period the number of publicly traded companies has increased 3-fold, and their share of global GDP has increased from 31% to 99% (World Bank, 2018). Despite the academic debate that opposes stakeholder-oriented governance to stakeholder-oriented governance, the above figures express the significant and growing relevance of corporate value in the global economy.

The shareholder theory approach was first proposed by Friedman (1962), and, according to Dunn and Burton (2006), widely disseminated from their 1970 New York Times Magazine article. states that the primary responsibility of companies is to maximize profit and shareholder value in the light of law and ethics. According to Tse (2011), the concept of agency cost is one of the cornerstones of the success of the shareholder value theory as it proposes the need for shareholder time and money investment as a way to monitor results and encourage professional managers, or agents, to maximize profits and increase business value.

Slywotzki (1997) also states that one of the main responsibilities of managers is the creation of shareholder value, but it must be recognized that managers do not have direct control over share price and company value. They have direct control over the business model and strategies that determine revenue, operating profit margin and investment, which, according to Rappaport and Mauboussin (2002), are the drivers of company value, ie, managers have a control indirect about the value. Company value can and should be indirectly managed in this sense, and according to Copeland et al. (2002) intrinsic value is based on future cash flows, as investors make monetary disbursements and take risks as expected. long-term performance. According to the OECD (2016) shareholder value-oriented management guidance became a principle in the United States and the United Kingdom throughout the 1980s, and as a reflection, the OECD itself published the Corporate Governance Principles in 1999, later updated in 2004 and 2015. In the late 1990s value orientation also gained prominence in European countries and Japan, according to Lazonick and O'Sullivan (2000). According to these authors, the origin of the adoption of administrative value orientation is associated with the shift from the classic principle of corporate governance from "retain and reinvest" to the principle of "downsize and distribute".

In this sense, Lazonick (2014) identified that until the late 1970s the US economy was dominated by large global corporations that based on their experience generated significant revenues and earnings, and based on the "retain and reinvest" principle they retained earnings. and people and reinvested in the expansion of physical and human capital. Reinvestment in physical infrastructure, and expansion and job security, accompanied by rising wages, enabled stable growth, called Lazonick (2014) "sustainable prosperity". In

the 1970s, the principle of governance began to present two problems of an internal and external nature: a) the loss of efficiency of organizations derived from growth based on mergers and acquisitions that involved very large and diverse organizations - in terms of companies and sectors - and difficult to control, which occurred very centrally and made innovation difficult; b) increased competition due to the acceleration of globalization and the gradual development of transnational corporations from the 1980s onwards, according to Borghhoff and Welge (2001).

Given the problems exposed, the "retain and reinvest" model started to give way to the "downsize and distribute" model from the 1980s onwards. This model favored the reduction of corporate size and cost reduction, on the one hand, and the creation and extraction of value by investors, on the other. As a result of this change in the principle of corporate governance, there has been a huge disconnect between labor productivity and hourly wages in the United States, favoring productivity from the 1980s.

There are researchers such as Piketty and Saez (2014), who also identified from the 1980s onwards a large concentration of income in developed countries directly associated with dividends and company valuation rather than wages, and which would lead to questioning the relationship between the value and prosperity of the people in general. Copeland et al. (2002), on the other hand, claim that GDP per capita is accepted by economists as one of the main measures of a nation's economic development, and that since the mid-1970s this indicator has grown more in Anglo-Saxon countries in the which companies adopt value orientation than in other developed countries.

Despite the debate about the relationship between value orientation and its effects on income distribution and overall prosperity, this management principle is still dominant in most developed and developing countries. According to Hansmann and Kraakman (2000) the convergence around the value orientation model was due to the competitive success of US and British companies that adopted it, the influence of economics and finance academics, the emergence of markets. capital markets and more active stockholders, as well as the problems experienced with alternative models. Additionally, according to Borghoff and Martin (2001) the historical process of globalization was marked by the emergence and development of transnational corporations from the 1980s onwards, and according to Ireland (2005) it was a network of large global corporations that drove the orientation towards value, as well as large accounting and law firms, and leading investment advisory and banking. The pressure came directly - through persuasion, incentives and coercion - and indirectly - through organizations such as the International Monetary Fund, World Bank and WTO - World Trade Organization. In countries such as France, Germany and Japan, value-oriented corporate governance has also expanded, but according to McSweeney (2008) organizations are still concerned about social issues and it is difficult to assess the potential advancement of value-oriented.

2.2 Intangible Assets and Value Creation

Market capitalization - or market value - of companies reflects the present value of a forward-looking flow of results, which in turn reflects investor expectations. Expectations were traditionally heavily influenced by tangible assets, but in recent decades, in parallel with the shift from a predominantly manufacturing to a service and informational economy, the influence of intangible assets on the value creation of companies has significantly increased, according to Ramaswami. Srivastava and Bhargava (2009). Boulton, Libert and

Samek (2001) found that in the early 1980s, for more than 10,000 companies traded in the US stock markets, about 5% of market value was defined by intangible assets and 95% by tangible assets. captured by traditional accounting in the form of balance sheets. By the late 1990s the share of intangible assets in total value had already risen from 5% to 72%. According to Mc Donald and Mouncey (2009) in 2006 the importance of intangibles in company value was already 80% in the United States and the United Kingdom. Elsten and Hill (2017) developed a periodic study called IAMV - Intangible Asset Market Value that identified an increase in the share of intangible assets in the value of S&P component companies from 17% in 1975 to 84% in 2015 and expanded Estimated share of intangibles in total value for European and Eastern companies in 2015: S&P Europe 350 for 16 European countries (71%), Kosdaq Asia Index (54%), Shanghai Shenxehn CSI 300 China (35%) and Nikkei 225 from Japan (31%). Figure 1 illustrates the evolution of the share of intangibles in the total value for S&P 500 from 1975 to 2015 and the importance in 2015 in the above regions. The Global Finance Institute (2017) estimated that intangible assets accounted for 52% of the value of global companies in 2016. Finally, from all perspective's intangible assets account for more than half of the value of global companies, and the continued growth of this importance as Sinclair and Keller (2014).
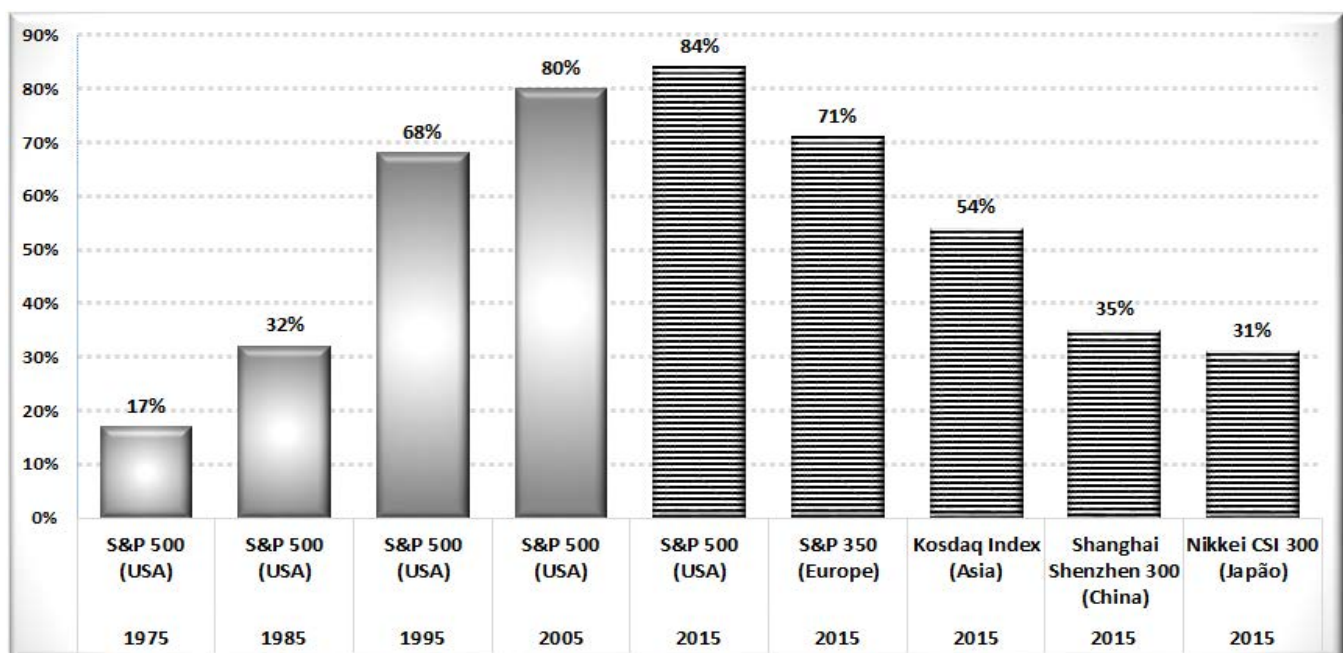

Figure 1 – Intangible Assets Share of Companies Market Value: Evolution of S&P and Status of Major Global Markets in 2015.

Note: Adapted of "*Intangible Asset Market Value Study?"*, in C. Elsten & N. Hill, 2017. *Journal of the Licensing Executives Society*.

The importance of intangible assets is directly associated with the transformation of the nature of the economy from predominantly physical to informational and knowledge-based, making companies' ability to change and flexibility to be key competitive attributes, and according to Monika, Nitu and Latika (2013) the assessment Intangible assets have been the subject of research since the mid-1960s, since their concept evolved into the so-called intellectual capital. The value of intangible assets, or intellectual capital, reflects

their ability to influence a company's cash flow and market capitalization, or appreciation. In this sense, according to Vodák (2011), intellectual capital can be observed only if there is a connection with tangible assets through value added based on the greater competitiveness of products and the company as a whole. According to Edvinsson (1997) Skandia - a Swedish service company that pioneered experiments with intellectual capital and gave rise to many studies on the subject - defined intellectual capital as the ownership of knowledge, applied experience, organizational technology, supplier relationships and professional skills that can increase your market value and provide competitive advantage. The components of intellectual capital, including market-based assets, and their relationship to business value are illustrated in Figure 2.

2.3 Market-Based Assets, Brand Value and Company Value

Given the relationship of market capital, or market-based capabilities, and the value of companies, several authors have conducted research from different perspectives to explain it: Steenkamp (B1), Srivastava et al. (1998), Rasmawani et al. (2009), Madden et al. (2006) and Srivastava et al. (2001). In figure 3, two models proposed by Srivastava et al. (1998) and Srivastava et al. (2001) who recognize the challenge of linking marketing activities and creating shareholder value.

Proposes that marketing is devoted to the task of managing market-based assets, which have the ability to leverage marketing performance, which in turn influences drivers of company value or shareholder value. Market-based assets, and more specifically consumer-related assets, include the brand, which represented about 27% of the value of 75 Interbrand Ranking Companies (2016), and about 33% of the value. intangible assets, which in 2015 represented 84% of the value of S&P 500 companies, according to Elsten and Hill (2017).

Relating brand value to the goal of increasing shareholder value through brand equity growth has a growing interest in the literature. Brand value brings present value to future cash flows from corporate brand investments, which are built on efforts in research and development of new products, communication campaigns and other elements of the marketing mix. Moreover, it is possible to notice in several studies a positive relationship between the value of brands and the performance of the financial indicators of these companies (Mohan, 2016).

Gillis et al. (2007) suggest that brands, as an intangible asset, can also drive buybacks, thereby increasing customer loyalty, tightening price elasticity, enabling new products to be introduced, increasing the barrier to new entrants and thereby bringing greater security to customers. future cash flow forecasts.

3. Methodology

Financial indicators of revenue, net income and company value for the period 2007-2016 were obtained through the digital platform http://www.ycharts.com. There are several approaches developed by industry-based consultancies that have developed their own methodologies for determining brand value. Mizik and Jacobson (2009) highlight BrandZ, which was developed by marketing consultants Millward Brown and WPP and is based on the factors: presence, relevance; performance, advantage and bond. Another recognized methodology is Brand Finance which focuses on seven factors: (a) Calculating brand strength;

(b) determine the royalty rate; (c) Calculate the royalty rate according to brand strength; (d) Determine brand-specific revenues; (e) Determine the expected revenue for the brand under study; (f) apply the royalty rate to expected revenue; (g) Calculation of brand value.

Also noteworthy is Global Finance, which also presents seven steps for determining brand value: (a) Calculate brand strength; (b) determine the royalty rate; (c) Calculate the royalty rate according to brand strength; (d) Determine brand-specific revenues; (e) Determine the expected revenue for the brand under study; (f) apply the royalty rate to expected revenue; (g) Calculation of brand value.

 Mizik and Jacobson (2009) also cite consultancy Interbrand, a pioneer in creating a brand value ranking, establishes its model based on (a) identifying actual gains strictly related to the brand; (b) capitalization of these gains by applying a multiple to historical gains as a discount rate to future cash flow. For this, two factors are listed: (a) brand gains, which consists in accounting only for brand profitability; (b) strength of the brand in which it observes and analyzes points such as: positioning, market in which it operates, past performance, competition, future plans and risks. Brand strength is defined as a set of seven factors weighted as follows: (a) Leadership (25%): ability to be a dominant and influential force in your market; (b) Stability (15%): survivability of a brand over a long period of time; (c) Market (10%): evaluation of aspects such as growth of potential customers, volatility and barriers to new entrants; (d) Geographic expansion (25%): capacity of cultural adaptation of the brand according to its geographic capillarity; (e) Trend (10%): ability to remain relevant to consumers; (f) Support (10%): quantity and quality of marketing and communication activities invested in the brand; (g) Protection (5%): legal property right of the trademark.

Despite the absolute values produced by the different methodologies being different, a study by Jonoskova and Krizanova (2017) showed that the evolution of the values over time is very similar. It was opted for the brand values estimated with the Interbrand methodology because it is widely recognized and accepted by the market, having been the first company to have its methodology certified according to ISO 10668, which refers to the necessary requirements for monetary evaluation of brands. according to Jonoskova and Krizanova (2017) and be the most aligned with the objectives of this study. Data were collected directly from the consulting firm's website (www.interbrand.com).

Companies were selected in five economic segments according to the S & P500 criteria: Industrial, Healthcare, Information Technology, Discretionary Consumption and Essential Consumption. Revenue, net income and corporate value ratios were calculated based on 2007 results. For the simple linear regression analysis, the averages in dollars were used considering three periods: Total (2007 to 2016), crisis (2007 to 2011) and post-crisis (2012 to 2016) of each variable studied. The same periods for growth rates as each variable were also considered. For Maroco (2007), statistical analysis using simple linear regression can be used to "model the functional relationship between two variables, regardless of whether or not there is a cause-and-effect relationship that is not always easy to demonstrate." Measurements of R^2, adjusted R^2, Durbin-Watson, F, Sig. ANOVA, VIF, Sig. T, Stud. Deleted residual, Cock's Distance and Centered Leverage Value are important to ensure a consistent conclusion of what is intended to be studied (Hair et. Al, 2009; Maroco, 2007).

4. Results

Considering Interbrand's ranking of the 100 most valued global brands in 2016, 75 companies with corporate brands were selected, given the exclusion of 25 brands associated with product lines rather than companies, such as Nescafé, Gillette, Smirnoff, etc. With the value of each brand and its respective market value obtained at Ychart.com, it is possible to establish the percentage share of brand value in the total value of the company. Figure 2 illustrates five groups of 15 companies sorted in descending order by brand value. It is observed that the most important brands in the world represent a significant share of 27% of the total value of companies in 2016, and this share varies from 58.2%, in the group of extremely strong brands, to 6.6% in the fifth. group of the 75 most valuable brands.
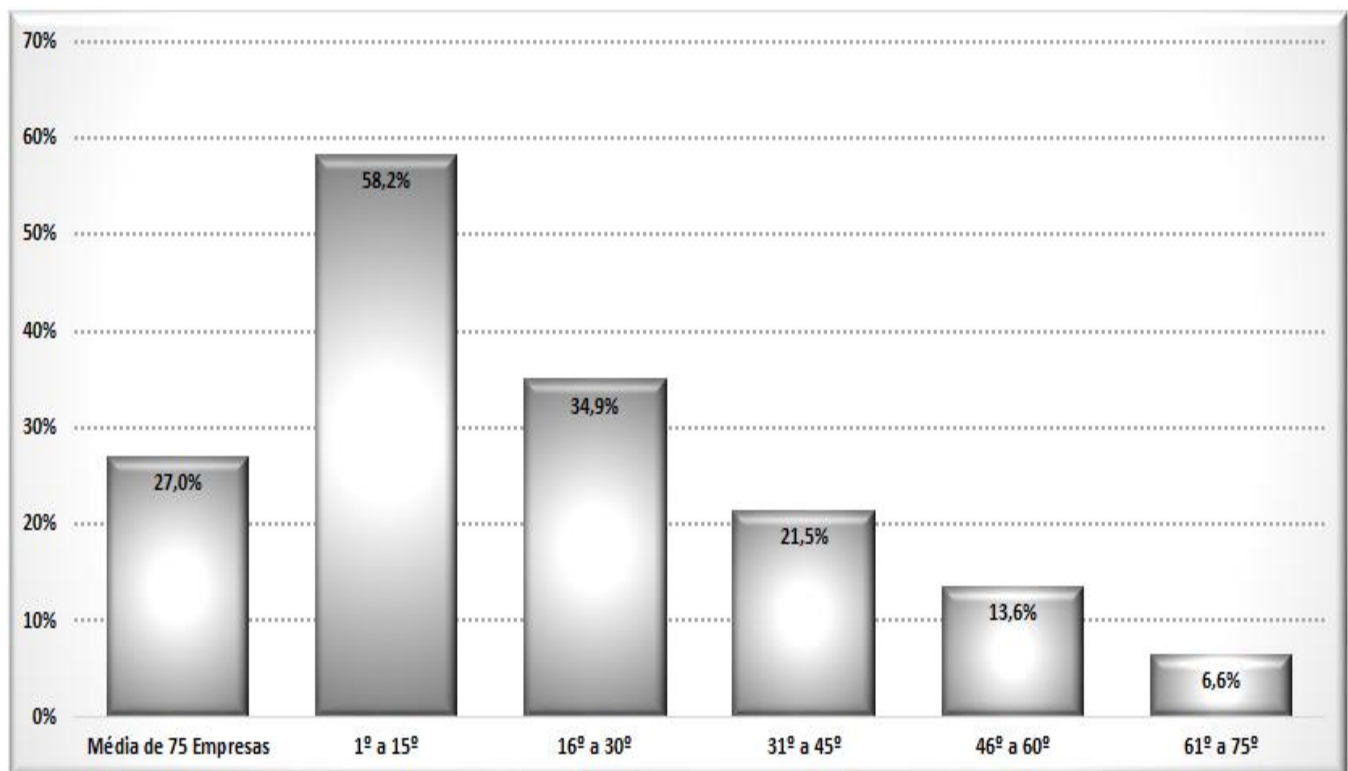

Figure 2 - Average Share of Brand Value in Market Value of 75 Companies with the Highest Brand Values in the World in 2016 *

Note: Prepared by the authors based on Interbrand (2016) brand values and Ychats.com (2016) company market values

* 75 companies were considered for which the brand name corresponds to the company name, and excluded brands that correspond to a part of the company's portfolio (eg Nescafé)

Considering the period from 2007 to 2016, the above analysis was expanded by comparing the value data of the brands with the highest value with the net profit, revenue and market value of the companies, and for this, we considered the data of the companies present. in the S&P 500 index, excluding the 46 companies that are also part of the Interbrand ranking, aiming to improve the quality of the comparison.

Assuming 2007 as the base (2007 = 1.00) for the index for the period analyzed and comparing the evolution of the value of companies in the Interbrand ranking with the market value of companies in the S&P 500

index (ex-Interbrand), it can be seen that the value of the companies with the most valuable brands evolves similarly to the value of the largest companies, even in the crisis period, as shown in figure 3. In the crisis period, the companies with the strongest brands had a 38% loss in market value, while the world's largest companies in the S&P 500 (ex-Interbrand) concept had a 35% loss in value, meaning that the former fell only 4.6% more. There is evidence, therefore, that at the time of the crisis the value of companies with the strongest brands is negatively affected in much the same way as the value of the largest companies in the world.

It is important to note that despite the loss of value of the two sets of companies, the value of the strongest brands was not affected by the crisis, having even increased by 4.1%, while the value of the companies that own them fell by 38%. In this sense it can even be concluded that the strong brands had a dampening effect of the crisis on the value of the companies, since excluding the value of the strong brands from the value of the companies holding them, the value of these companies would have fallen 46% and not 38% in the period 2008/2007. Past the peak of the 2008 crisis, the recovery of the value of the strongest branded companies and the largest companies in the world is similar, with both sets of companies recovering their pre-crisis value only in 2012, or five years later.
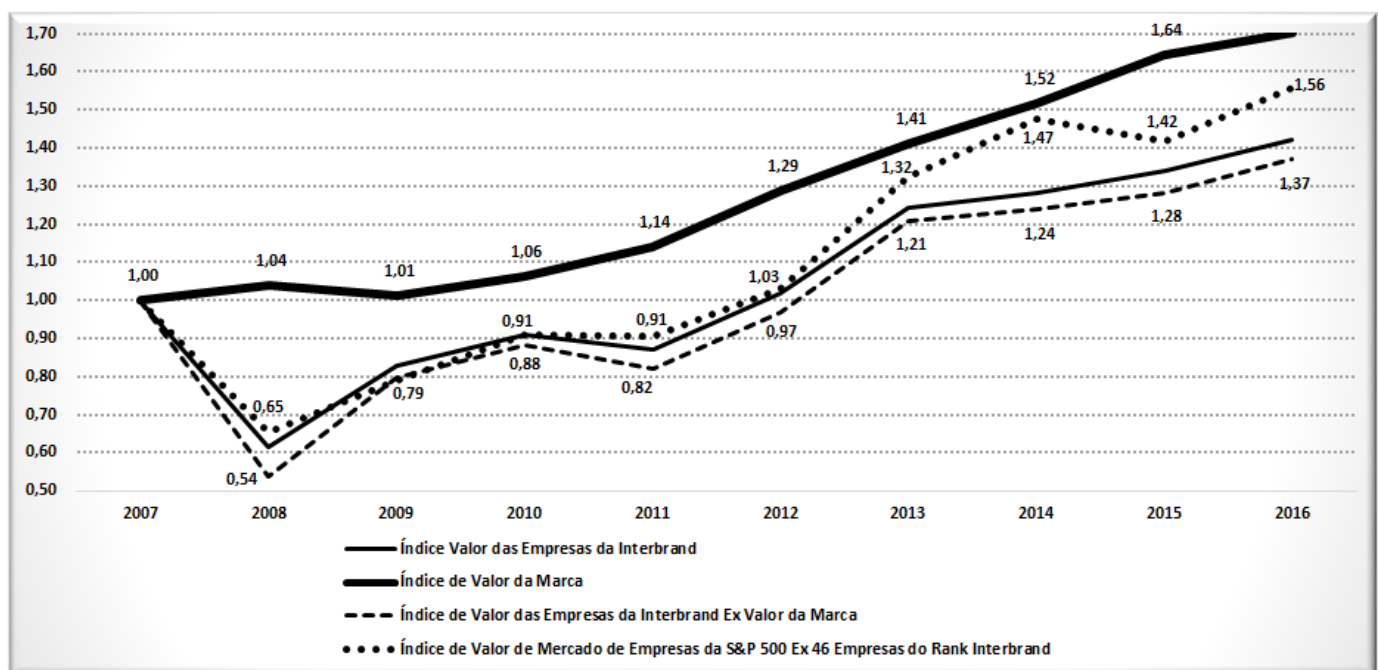

Figure 3 - Value Index of Companies with Highest Value Brands (Interbrand) and the World's Largest Companies (S&P 500 Ex Interbrand) by Value of Brands - 2007 = 1.00
Note: Prepared by the authors based on Interbrand (2007-2016) and S&P 500 brand values obtained from Ychats.com (2007-2016)

The curves in figure 4 show that both the group of companies with strong brands and the group of the largest companies in the world did not have their revenues affected by the crisis, and in the period 2008/2007 the revenue of both groups increased by 5%. On the other hand, in this period of peak crisis,

both strong-branded and larger companies saw a significant loss in net profit volume: strong-branded companies lost 37% of profit and larger companies lost 83% of net sales. net profit in just one year. The cost of maintaining revenue was therefore very significant, but it is clear that companies with strong brands were relatively more shielded in terms of profits, as the profitability of the largest companies in the world was 73% higher. While the recovery of corporate value, which depends on investor confidence, took 5 years, the recovery of net income for both groups of companies took only 3 years.
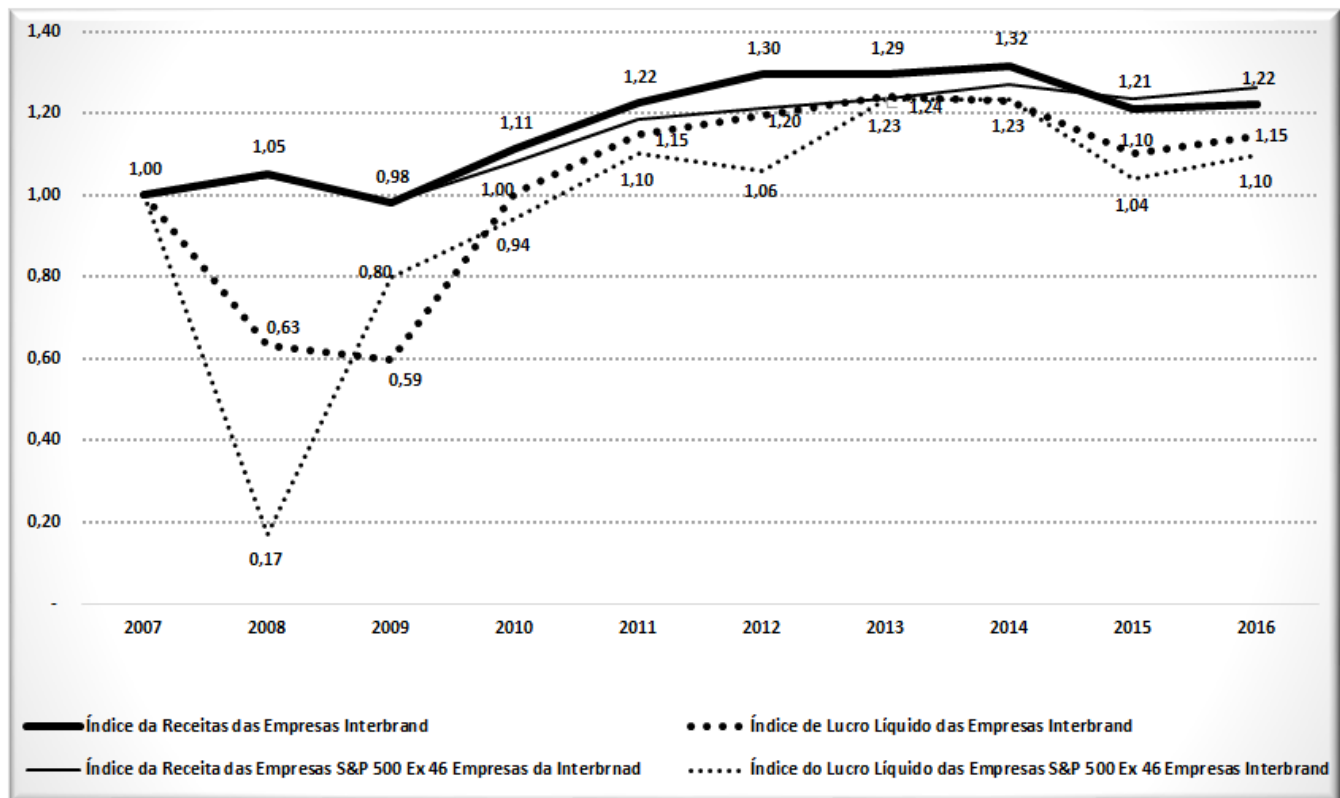

Figure 4 - Revenue and Net Income Ratio of Companies with the Most Valuable Brands (Interbrand) and the World's Largest Companies (S & P500 Ex Interbrand) - 2007 = 1.00
Note: Prepared by the authors based on Interbrand (2007-2016) and S&P 500 brand values obtained from Ychats.com (2007-2016)

Figure 5 reinforces and complements the results noted above for the same groups of companies, expressing net income as a proportion of revenue, or net margin. In the 10-year period, companies with strong brands had an average net margin of 9.8%, or 42% higher than the average net margin of 6.9% of the largest companies in the world. Excluding 2009, the margin of the first group of companies is consistently higher in the other 9 years. In addition to showing that companies with stronger brands have a margin consistently well above the margin of the largest companies in the world, the data suggest that the strong brand protects the profit margin in times of crisis, given that in the period 2008/2007 margin of the first group was 40%, and in the second group 84%.
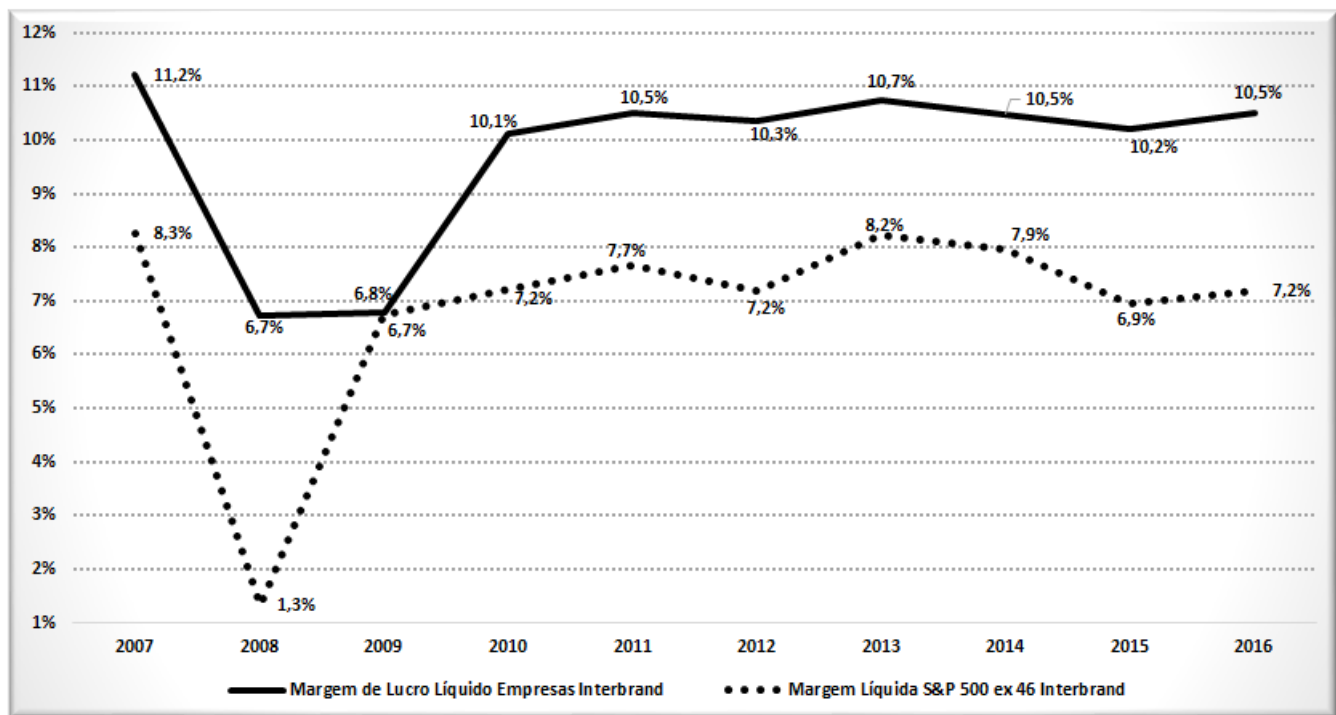
Figure 5 - Evolution in Net Profit Margin of Companies with the Highest Brand Value (Interbrand) and the World's Largest Companies (S&P 500 Ex Interbrand)

Note: Prepared by the authors based on Interbrand (2007-2016) and S&P 500 brand values obtained from Ychats.com (2007-2016)

Finally, considering the total analysis period of the 10 years and 2 other periods of 5 years each, i.e. one period under the influence of the 2008 crisis (2007 to 2011) and another post-crisis period (2012-2016). Simple linear regressions were performed between revenue growth rates and brand value growth rates. There was a strong, positive (adjusted $R^2 = 0.98$) and significant (ANOVA 0.00) relationship between revenue growth and brand value growth only for the post-crisis period, as shown in Table 1. Excluding the crisis period that implies atypical parameters, the post-crisis correlation is consistent with the theory that strongly associates the value of companies and their components with the growth in sales. In this sense, Rappaport & Mauboussin (2002) calls the recipe "value trigger", and Copeland et al. (2002) as a financial value vector.

Table 1. Linear regression of brand value growth rates with revenue growth rate. (2007 = 1)

Linear regression Método: Enter	Total (2007-2016)	Pré-crise (2007-2011)	Pós-crise (2012-2016)
R² ajusted	0.12	-0.32	0.98
Durbin-Watson	3.12	1.65	2.03
F	1.55	0.03	233.44
Sig. ANOVA	0.30	0.87	0.00
VIF	1.00	1.00	1.00

Sig. t	0.30	0.87	0.00
Asymp. Sig. (2-tailed)	N/A	N/A	0.20
Stud. Deleted residual	1.13	1.04	1.44
Cook's Distance	1.53	0.57	0.71
Centered Leverage Value	0.20	0.36	0.39

6. Considerations

There is great pressure to improve marketing accountability, as well as its integration with the financial area to create shareholder value. While in the financial perspective the focus is on shareholders, from the marketing perspective it is the customers, one of its main objects being brand management and its attributes. In this sense, brand value can be understood as an important link between marketing performance and financial performance, as it directly reflects the value of the company.

Given the above, a survey was conducted to evaluate the relationship between the value of major global brands, revenue, profit margin and market value of companies from 2007 to 2016, with emphasis on the effect of crisis and post-crisis. 2008. To support the analysis of the relationship between company value and brand value, a literature review was initially carried out in three steps:

1) Rescue of the academic debate that opposes governance oriented to the interest of shareholders to governance oriented to stakeholders. It was concluded that since the 1990s there is a significant trend towards shareholder orientation based on shareholder theory. As a result, there was a 3-fold increase in the number of publicly traded companies in the world from 1976 to 2016, and an increase in their share of global GDP from 31% to 99%;

2) Exploring the growing importance of intangible assets in creating value for companies given the increasingly informational and service content of the global economy. In the early 1980s intangible assets accounted for 5% of the value of the companies, by the end of the 1990s this share had risen to 72%, and by 2015 it was already 84% of the value of the S&P 500 component companies. if also that market capital is an important component of intellectual capital or intangible assets;

3) Identification of the relationship between market-based assets - key to the value creation of companies - and external relational assets, among which the brand stands out.

After the research that theoretically underpins the link between brand value and company value, the recovery of two databases was promoted, as well as its treatment aiming at compatibility and consistency of the time series from 2007 to 2016: 1st) Value of the 100 most important brands in the world, according to the Interbrand method; 2nd) Business value, revenue, and net income of S&P 500 component companies, based on Ychart.com. The analyzes were centered on comparing the indicators of a group of 75 companies holding the strongest brands in the world with a group of the largest companies in the world in the S&P 550 concept, excluding the strongest brands in the first group. The main results were:

1) The most important brands in the world represented a significant share of 27% of the total value of companies in 2016, and this share ranges from 58.2% in the extremely strong brands group to 6.6% in the fifth group of 75 companies. most valuable brands.

2) In the period of the 2008 crisis the companies with the strongest brands had a 38% loss in market value, while the largest companies in the world under the S&P 500 (ex-Interbrand) concept had a 35% loss in value. , the first fell only 4.6% more. There is evidence, therefore, that at the time of the crisis the value of companies with the strongest brands is negatively affected in much the same way as the value of the largest companies in the world.

3) The strong brands had a dampening effect of the crisis on the value of the companies, since excluding the value of the strong brands from the value of their companies, the value of these companies would have fallen by 46%, not 38%, in the period. 2008/2007.

4) Past the height of the crisis of 2008, the recovery of the value of the companies with the strongest brands and the largest companies in the world occurs similarly, with the two sets of companies recovering the pre-crisis value only in 2012, or five years later.

5) Both the group of companies with the strongest brands and the group of the largest companies in the world did not have their revenues affected by the crisis, and in the period of 2008/2007 the revenue of both groups even increased 5%.

6) On the other hand, during the peak period of the crisis, or 2008, both the strongest brand companies and the largest companies recorded a significant loss in net profit volume: the strong brand companies lost 37% of profit and the Larger companies lost 83% of net profit volume in just one year. The cost of maintaining revenue was therefore very significant, but it is clear that companies with strong brands were relatively more shielded in terms of profits, as the profitability of the largest companies in the world was 73% higher.

7) While the recovery of corporate value, which depends on investor confidence, took 5 years, the recovery of the net income of both groups took only 3 years.

8) In the 10 years period - 2007 to 2016 - the companies with the strongest brands had average net margin of 9.8%, or 42% higher than the average net margin of 6.9% of the largest companies in the world. Excluding 2009, the margin of the first group of companies is consistently higher in the other 9 years.

9) In addition to showing that companies with stronger brands have a margin consistently well above the margin of the largest companies in the world, the data suggest that the strong brand protects the profit margin in times of crisis, given that in the period 2008/2007 margin drop in the first group was 40%, and in the second group 84%.

10) The correlation between brand value and post-crisis sales growth is 98%, in line with and consistent with theory, which strongly associates the value of companies and their components with revenue growth. Finally, the survey concludes that companies with the strongest brands have significantly higher profit margins than those of the largest companies in the world and suggests that at a time of external crisis these brands offer relatively higher margin shielding. Complementary studies that consider the profile of companies and sectors, as well as other financial parameters, can help to better understand this important driver of shareholder value, a reflection of the value created for customers, which is the brand.

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