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CONNECTIONS: EXPLORING INTERDISCIPLINARITY IN HEALTH

Seven Publicações
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Eating behavior and its importance for our body

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Darlene Pereira dos Santos¹, Gleyde Marcia Teixeira Borges Carvalho², Henrique Martins Barros³, Carlos Alberto Miranda Duplat Junior⁴ and Joelia Martins Barros⁵

ABSTRACT

Proper nutrition is essential to ensure a healthy life and a good quality of life. However, many adolescents do not have enough knowledge on the subject and do not adopt a balanced diet. Evidence indicates that unhealthy eating habits are common in this age group, characterized by low consumption of foods such as milk, dairy products, fruits, vegetables and high intake of foods rich in energy, saturated fats, sugars, sodium, such as sugary drinks, sweets and cookies. These practices, associated with a sedentary lifestyle, are risk factors for the development of chronic non-communicable diseases such as overweight, obesity, systemic arterial hypertension, diabetes mellitus, cardiovascular diseases and risk behaviors for eating disorders, which involve a great impact on public health. Thus, in order to avoid health impasses, the importance of food education is highlighted, which is essential for the promotion of health among adolescents in high school. During adolescence, significant changes occur in physical, emotional, and cognitive development, and proper nutrition is essential to ensure healthy growth and development. In view of this situation and considering the great responsibility of the school as an agent of social formation and consequent transformation, the research was developed among students aged between 15 and 19 years. The objective of the research was to understand the eating behavior of these students and verify if they have knowledge about the importance of ingesting vital sources of nutrients. For this, a qualitative research was carried out, through questionnaires, in three public schools in the states of Minas Gerais and Bahia. The data were analyzed and it was possible to observe that the eating patterns and the level of knowledge of the students about healthy eating are insufficient, since they do not worry about having a balanced, nutritious and healthy diet.

Keywords: Healthy eating, Food education, Eating behavior.

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INTRODUCTION

An appropriate diet, capable of ensuring the maintenance of health, is only possible through a healthy diet. Diet is everything a person ingests, regardless of their goal. However, the term has been used only to refer to weight loss, which has become an obsession for many people. Garcia (1997) states that, "it is no longer without guilt that we sit at the table to enjoy food".

A healthy diet, based on nutritional needs, in general, has characteristics such as no need to lose or gain weight, does not need to limit components due to disorders, risk or age and is suitable for people who consume energy through daily activities or physical exercise.

SILVA *et al.* (2012) comments that:

Adequate food and nutrition are essential requirements for confirming the full potential for growth and development with quality of life, as well as for the prevention of deficiency diseases and obesity and associated comorbidities, in addition to being an indispensable human right for the construction of citizenship. (SILVA *et al.*, 2012, p.89).

Making good food choices allows you to maintain your ideal weight, desirable body composition, perform daily physical and mental activities, and reduce the risk of disease or disability. In this way, a balanced diet should become a lifestyle habit that aims at health and well-being in the short and long term. To achieve these objectives, it is necessary to adapt energy and nutritional consumption. Carbohydrates, **lipids and proteins** are macronutrients present in food to provide energy used for the vital functions of the body such as: breathing, circulation, protein synthesis, cell renewal and physical work.

According to the Dietary Guidelines for Americans 2020-2025, 9th edition, "A healthy diet pattern is one that includes nutrient-dense foods and beverages from all food groups, consumed in the recommended amounts and within caloric limits." According to these guidelines, the main elements that make up this standard include: vegetables, fruits, grains, dairy products, proteins and oils and the consumption of these foods in adequate amounts prevents obesity, a disease caused by excess food, as well as malnutrition, when consumption is insufficient. Both situations are extreme and harmful and need to be observed and treated assertively.

Generally, nutrients are divided into two classes: macronutrients, which must be ingested daily and in larger quantities (proteins, lipids, carbohydrates, minerals and water are part of this group) and micronutrients, formed by vitamins and certain minerals that are needed in small quantities. Araújo *et al.*, (2021) point out that:

Macronutrients are macromolecules in plant and animal structures that can be digested, absorbed, and used by another organism as energy sources. They are divided into three classes - carbohydrates, fats and proteins, necessary to maintain cellular and body integrity. (...). Micronutrients, on the other hand, have a relevant participation in the maintenance of the body's homeostasis, cell proliferation and differentiation, immune function, protection against oxidative stress, in addition to playing an important role in the participation of the



metabolism of many other nutrients. The deficiency of these can compromise such functions and trigger or exacerbate metabolic disorders. (ARAÚJO et al., 2021, p.4520).

Coming from food, carbohydrates, proteins and lipids are the main energy substrates for the body. Starch, sucrose, lactose, fructose and glucose are the most present carbohydrates in the human diet. Starch is the storage form of carbohydrate present in vegetables, being the main carbohydrate in the diet.

According to Pomin and Mourão (2006), "carbohydrates are the 'fuels of life'. They store energy in living beings, in the form of starch and glycogen (...), and release it for metabolic reactions when they are degraded."

After ingesting the carbohydrate, the "breakdown" into smaller structures called monosaccharides occurs, such a reaction aims to facilitate its absorption by the body. The main monosaccharide produced is glucose, which is used to provide energy for the different functions of the body. Glucose can also be stored in places such as the liver and muscles in the form of glycogen. The liver has a glycogen storage limit, about 5% to 6% (GUYTON, HALL 2021), which causes it to transform the surplus amount into lipid, by the following process: in the process of glycolysis (glucose breakdown) there is the formation of pyruvate that is converted into acetylcoenzyme A (acetyl-CoA), later carboxylated by acetyl-CoA carboxylase, forming malonyl-CoA, being the first stage of fatty acid synthesis, joining glycerol, a product of glycerol phosphate from glucose, to originate triglyceride. This entire process is mediated by the hormone insulin, which promotes the entry of glucose into the tissues, in addition to inhibiting the action of the hormone-sensitive enzyme lipase, which promotes the hydrolysis of triglycerides.

Regarding the importance of carbohydrates, Pomin and Mourão (2006) point out:

(...) Carbohydrates don't just have an energy function. They are also present on the outer surface of the cell membrane. In this case, they can be glycoproteins (when bound to a protein), glycolipids (if bound to a lipid) or proteoglycans (when they are in the form of glycosaminoglycan chains – a type of polysaccharide – joined to a protein). These conjugated forms present in membranes act as receptors and signals, interacting with molecules and other cells. (POMIN and MOURÃO, 2006. p. 27).

Formed by amino acids joined in linear chains, proteins after ingestion are broken down into the amino acids that constitute them so that they are absorbed into the blood. Among the amino acids are the essential and non-essential ones. Essential amino acids are those that must be present in the diet, as the body cannot produce them. Among the essential amino acids are lysine, isoleucine, leucine, threonine, valine, tryptophan, phenylalanine, methionine, and histidine. A very typical Brazilian combination that is a source of essential amino acids is the famous "Rice and beans" that provides the body with methionine and lysine, as well as other important nutrients.



CARVALHO et al. (2012), citing COSTA et al, (2006) and WALTER et. al., (2008) considers that "the mixture of rice and beans represents an excellent nutritional combination, providing energy and essential amino acids required in a healthy diet, in addition to providing considerable amounts of vitamins, minerals and fiber".

Non-essential amino acids are also equally important for the body, however, they can be synthesized. Each gram of protein can provide, as well as carbohydrates, up to 4 kcal.

It is important to note that if protein intake is low or if some essential amino acid is missing from the diet, the body will not be able to produce the proteins necessary for its proper functioning and unused amino acids will be excreted, which is called negative nitrogen balance. If this situation persists for too long, bodily function will be diminished. Silva et al. (2014) state that the intake of adequate levels of protein contributes to growth, bone maintenance and the prevention of osteoporosis and its deficiency or excess can be deleterious. Morais and Burgos (2007) warn that "the increase in the diet of 50g of protein increases approximately 1.6mmol in calcium excretion, being considered a regulator of urinary calcium excretion, more important than the intake of the mineral itself."

Regarding fats, they are lipids formed by triglycerides. Its digestion is more complex than that of carbohydrates and proteins, as they are not very soluble in water, so when you eat a meal that is very rich in fats, you feel a heavy stomach for longer. After digestion, fats are transformed into triglycerides, which are "packaged" in chylomicrons, and are transported throughout the body, in addition to being transported by very low-density lipoproteins (VLDL), low-density lipoproteins (LDL) and high-density lipoproteins (HDL) according to Nelson and Cox (2019). VLDL carry triglycerides and cholesterol from the blood to the tissues, a function identical to LDL, however, LDL is a product of VLDL from the action of the lipase enzyme, and can deposit fat substrates in the tissues, which can obstruct blood vessels, inflame the endothelium and cause atherosclerosis (formation of atheromas). It is worth remembering that the accumulation of fat in the liver causes hepatic steatosis (fatty liver disease), and inflammation and, consequently, edema may occur, which means evolution to hepatomegaly. It is also in the form of triglycerides that are stored in adipose tissue, as a form of energy storage, because, depending on the body's needs, they can be transformed into glucose through the process of gluconeogenesis. Each gram of fat ingested can provide up to 9kcal, more than twice as much as carbohydrates and proteins. For this reason, its intake must be controlled since, as stated by Lima and Glaner (2006), "the lipid profile changes asymptotically and can remain so for long periods, which can lead to terrible consequences such as: increased blood pressure, heart attacks, strokes, among others".

The vast majority of fatty acids (fats) can be synthesized by the body from carbohydrates and proteins, however, there is a select group that must be obtained through food, which are called



essential fatty acids. This is the case of the famous omega-3 (alpha-linolenic acid) and omega-6 (linoleic acid), nomenclatures with different numbers due to the number of carbon that appears at the first unsaturation in the carbon chain, which perform important immunological and anti-inflammatory functions of the body, differentiating in the quantity of unsaturations in the chain, omega-3 contains three and omega-6 has two. It is worth mentioning that omega-6 can be converted into arachidonic acid, a precursor of eicosanoids, which are responsible for inflammatory responses in the human body, while omega-3 inhibits this conversion, concluding that alpha-linolenic acid is more anti-inflammatory compared to linoleic acid, according to Nelson and Cox (2019).

Regarding the importance of fatty acids, Martin et al., (2006, p. 762) state:

Lipid components, especially fatty acids, are present in the most diverse forms of life, playing important roles in the structure of cell membranes and metabolic processes. In humans, linoleic acid (18:2n-6, AL) and alpha-linolenic acid (18:3n-3, AAL) are necessary to maintain cell membranes, brain functions, and the transmission of nerve impulses under normal conditions. These fatty acids also participate in the transfer of atmospheric oxygen to the blood plasma, in the synthesis of hemoglobin and in cell division. (MARTIN et al., 2006, p.762).

Thus, the balance between all the elements of food is important to maintain a healthy life. Therefore, it is necessary to consume foods from all groups and not reproduce discourses that boast or demonize certain foods.

THEORETICAL FRAMEWORK

According to the World Health Organization (WHO), adolescence is the phase that comprises individuals between 10 and 19 years old, it is a period marked by intense transformations influenced by family practices, social and cultural values, socioeconomic conditions, experiences and knowledge of the individual. It is worth remembering that the habits and learning of this moment have repercussions on behavior in many aspects of future life and that this period is extremely important for adolescents to choose a healthy lifestyle.

According to Botelho and Lameiras (2018):

Food and nutrition education can become effectively useful for individuals when it enables the awakening of critical awareness and autonomy to act in terms of eating practices. Adolescent health education is an important area of concern because this stage of development represents a time of experimentation and the beginning of patterns for adult behavior. A balanced diet during adolescence satisfies the increase in nutritional needs during this period, and establishes and reinforces eating habits for life. (BOTELHO and LAMEIRAS, 2018, p.32).

There is evidence, among Brazilians in this age group, of unhealthy eating habits, characterized by low consumption of foods such as milk, dairy products, fruits, vegetables and high intake of foods rich in energy, saturated fats, sugars, sodium, such as sugary drinks, sweets and



cookies. Such practices, associated with a sedentary lifestyle, correspond to the main factors responsible for the expression of the current epidemiological picture of chronic non-communicable diseases, such as overweight, obesity, systemic arterial hypertension, diabetes mellitus, cardiovascular diseases and risk behaviors for eating disorders, which involve a great impact on public health. (GUO et al., 2004; TRAEBERT et al., 2004; WORLD HEALTH ORGANIZATION, 2002; STEWART; KLEIHUES, 2003; MALTA et al., 2009; BERENSON, 2012)

Thus, monitoring the quality of foods consumed in this phase becomes important because of the high prevalence of inadequate nutrient intake in this Brazilian population. This fact is particularly worrisome, because in adolescence nutritional needs are increased due to the growth phase and the bodily transformations inherent to puberty.

FOOD AND SOCIAL ASPECTS

Dietary balance is the only way to ensure the proper functioning of the body's vital functions. When ingested incorrectly, carbohydrates, proteins, and lipids can cause serious health risks. On the other hand, the use of highly restrictive diets has been widely spread on social media. The search for a standard of beauty and the perfect body has been the object of desire of many, including teenagers who, immersed in the digital age and without the proper maturity, find themselves faced with exuberant and unattainable bodies. Social networks print a body image far removed from real bodies and, to feel like they fit in, many teenagers give up their health and adhere to highly restrictive diets. According to Soihet and Silva (2019):

It is common sense that the current socio-cultural model explains the high rates of image disorders, body dissatisfaction and the increase in the rates of eating disorders in society. Imposed beauty standards overemphasize thinness, and the media has become one of the most powerful vehicles of sociocultural ideals. (SOIHET and SILVA, 2019, p. 55)

It is worth remembering that controlling food intake through restrictive diets and making this behavior chronic due to sociocultural pressure, which imposes increasingly thin body standards, are attitudes that possibly trigger eating disorders, such as binge eating and consequent obesity, which presents itself as a disease that is difficult to control, with high percentages of therapeutic failures and recurrences, it can have serious organic and psychosocial repercussions, especially in the most severe forms.

Also according to Soihet and Silva (2019):

The adoption of restrictive diets can bring psychological and metabolic harm and also the emergence of eating disorders. Dieters are compulsively concerned about the foods they consume, are more vulnerable to eating uncontrollably after a long time of restriction, and tend to have emotional problems such as anxiety and depression. Also, there is a huge relationship between individuals who restrict their eating and individuals diagnosed with eating disorders. (SOIHET and SILVA, 2019, p. 56)



Assuming that the body needs energy to function, and that this energy comes in the form of food, even in resting stages, it needs these calories. This phenomenon, called basal metabolism, is the minimum amount of energy needed to maintain vital functions even at rest. By adhering to a restrictive diet, the body enters a state of alert, and understands that food restriction as an aggression. Consequently, to protect itself, appetite increases. If the restriction continues, the metabolism slows down in order to store energy. This cycle affects not only physical health but also emotional health, as one of the major consequences is the non-maintenance of the diet and increased food consumption.

A healthy food education is essential to maintain the health and well-being of the body. In this sense, it seeks to understand how high school students eat and if they are aware of the importance of ingesting vital sources of nutrients.

There are several studies that address the topic of eating among adolescents. One of the main concerns is the high consumption of processed foods that are high in sugar, fats, and salt, which can lead to the development of chronic diseases such as obesity, diabetes, and hypertension.

In addition, many adolescents may have limited knowledge about nutrition and the importance of a balanced diet. They may not be aware of which nutrients are essential for health and how to get them from food.

This research arose from the discussions during the classes of the discipline "Chemistry 3: Chemistry of life, environments and materials" of the Professional Master's Degree in Chemistry at UESB, about the biomolecules that led to the questioning of the eating habits of high school students, their knowledge about biomolecules (their characteristics and functions) and the realization of diets and how they would carry them out.

METHODOLOGY / MATERIALS AND METHODS

The methodology used in the research was an exploratory study in which a real proximity to the object that was being studied was aimed at, aiming to obtain greater knowledge about the subject in a specific context.

To employ this technique in this work, a priori, stages of research construction were developed. The first stage was planning, in which the methodological path to be traced was defined; The second stage was the preparation stage, where the population and the location of the research were defined and questionnaires were prepared for data collection; The third stage was the collection stage, in which the previously prepared questionnaires were applied in order to obtain qualitative data for the research; And the fourth and last stage was the analysis, in which there was the interpretation and decoding of the collected data and the inferences arising from the investigation.



According to Yin (2015), the exploratory study as a research methodology in teaching can help to understand social, educational, psychological and other phenomena, allowing the researcher to retain a holistic and real perspective of the case being studied. The author reinforces that this methodology is also suitable for exploratory studies, in which it is sought to understand aspects related to a specific issue of a certain group in a certain context and/or locality in order to verify a hypothesis, and due to this property that the exploratory case study proved to be the most appropriate research technique for the construction of this work.

The research presents a qualitative approach, which for Denzin and Lincoln (2006), is considered as an opportunity to diagnose and contribute, in its entirety and effectively. Also according to the qualitative research, the different points of view of the participants are considered, as well as the way they deal with issues dealt with in the investigative process. The research was developed in the Integrated Education Complex Schools, located in the municipality of Caetité, in the interior of Bahia, in the Federal Institute of Bahia, located in the municipality of Euclides da Cunha, in the interior of Bahia and the João Bernardino de Souza State School located in the municipality of Novorizonte, in the interior of Minas Gerais.

The study had as a population, two hundred and two students belonging to the first, second and third year of high school. As a method of data collection, a questionnaire was applied that was duly answered by the research participants, randomly, without the need for identification, thus ensuring anonymity and confidentiality.

According to Gil (2010), the questionnaire can be defined as: "an investigation technique composed of a more or less high number of questions presented in writing to people, with the objective of knowing opinions, beliefs, feelings, interests, expectations, situations experienced, etc."

Thus, the qualitative method deals with the universe of meanings, motives, aspirations, beliefs, values and also attitudes in order to understand the set of human phenomena (MINAYO, 2014).

The questions used in the questionnaire are presented below:

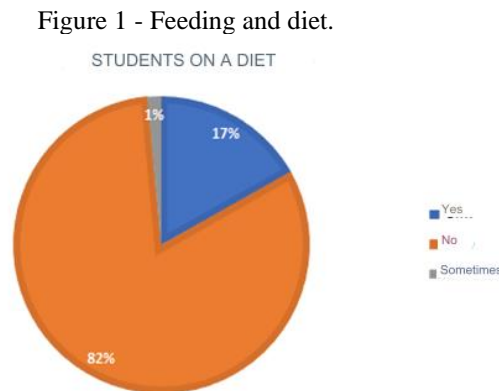
1) How old are you? / 2) Do you go on any kind of diet? Why? / 3) Do you know or have you heard about organic substances (Carbohydrates, Lipids and Proteins)? Comment / 4) Are organic substances (Carbohydrates, Lipids and Proteins) part of your diet? / 5) Have you ever excluded some type of food from your diet? Which?

RESULTS / DISCUSSION

The questionnaire was answered individually in the classroom and the answers were described and analyzed without describing the place where it was applied. Each of the issues was analyzed and discussed separately.

Regarding age, the participants are in the age group of 15 to 19 years, all enrolled in public high school.

When asked about daily eating, more specifically about dieting, the results indicate that 82% of the adolescents said they did not restrict any food in their diet, 17% said they went on a diet and 1% of the students interviewed said they sometimes went on a diet. These data can be seen in Figure 1.



Source: Survey data, 2023.

Some answers from the students interviewed:

"I don't go on a diet because I don't have to. "

"No. Because I eat everything and I'm healthy. "

"No. Inability to stay focused on a diet. "

"No. I think it is necessary to be accompanied by a professional. "

Bittar and Soares (2020) assert that

Nowadays, the media exerts great power in the construction of body image and in the formation of aesthetic standards, which affect adolescents in their phase of vulnerability. Considering these characteristics and others related to age, young people end up modifying their eating patterns, becoming vulnerable to the development of eating disorders. (BITTAR and SOARES, 2020, p. 291)

The result of the survey indicates that most of the adolescents interviewed do not restrict any food in their diet. This can be positive if adolescents are consuming healthy foods in adequate amounts and without excesses, which can contribute to good physical and mental health.

Segundo Lopes et al., (2021):

In this context, monitoring the quality of foods consumed in this phase is important because of the high prevalence of inadequate nutrient intake in this Brazilian population. This fact is particularly worrisome, because in adolescence nutritional needs are increased due to the growth spurt and bodily transformations inherent to puberty. (LOPES et al., 2021, p.302).

However, it is important to note that dietary restriction may be necessary in some situations, such as in cases of chronic diseases or food allergies. Therefore, it is essential that adolescents are aware of the importance of a healthy and balanced diet, and that they seek guidance from a nutrition professional if they have questions or need any dietary restrictions.

Vale et al., (2011) in a study on the eating behavior of adolescents, point out that

The high number of adolescents performing inappropriate eating practices highlights the attention that this issue requires from the academic community, especially in the field of public health, reaffirming it as an emerging issue in the Brazilian health scenario (...) Eating and restricting food are revealed as harmful strategies to deal with conflict situations and their consequent aversive emotional states. (VALE et al., 2011, p.127).

Therefore, the importance of professional guidance in case of necessary dietary restrictions is emphasized, thus preventing a diet deficient in fundamental nutrients from becoming a habit.

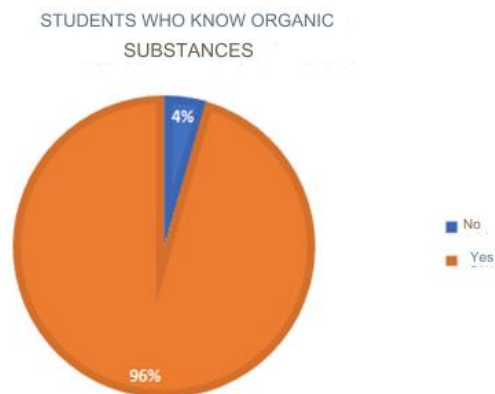
Nutritional choices and the necessary substitutions must consider several aspects, Canesqui and Garcia (2005) emphasize that these alternatives must maintain a range of food possibilities.

It is precisely by seeking to offer alternatives framed within available resources, and preserving the characteristics of habitual life defined by the subject, that we suppose we can get closer to desirable changes in diet. (CANESQUI and GARCIA, 2005, p. 224)

Among students who go on diets (17%), it is interesting to note that the justifications range from the need to lose weight to the search to gain muscle mass or help an obese family member. For these reasons and many others, the importance of guidance on a balanced diet and the need for professional monitoring capable of ensuring that diets are adequate and healthy, and that they do not harm physical and mental health, are emphasized.

When asked if they have knowledge about organic substances, 96% say they have heard of the nutritional groups, and some of these said they know the functions and sources of food. Only 4% of the students stated that they had never heard about the vital nutrients, as illustrated in figure 2.

Figure 2 - Knowledge about organic substances.



Source: Survey data, 2023.

However, it is important to note that knowledge about nutritional groups and nutrients does not necessarily guarantee a healthy and balanced diet. It is possible that some adolescents are aware of nutrients, but do not know how to apply them in their daily diet, or even that they have inadequate eating habits even with the knowledge acquired. According to the Ministry of Health (2022), in 2022, until the beginning of October, the Unified Health System (SUS) monitored more than 4.4 million adolescents between 10 and 19 years of age, according to the Food and Nutrition Surveillance System of the Ministry of Health. Of these, almost 1.4 million were diagnosed with overweight, obesity or severe obesity.

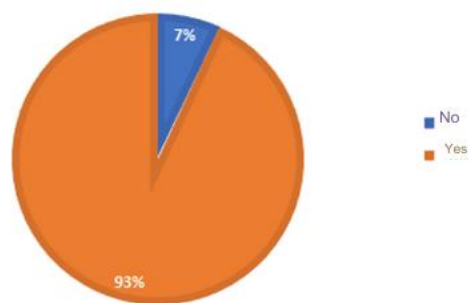
Therefore, it is essential that adolescents receive adequate guidance on healthy eating, including information on the importance of consuming varied foods in adequate quantities, and that they have access to resources and trained professionals to help them build healthy and sustainable eating habits.

According to Lopes et al., (2021):

The development of interventions to reduce inadequacies related to food consumption is a challenge for public policies to promote health in adolescence. Therefore, promoting healthy eating practices is a strategy to cope with food and nutritional problems in this age group. (LOPES et al., 2021, p.302).

When asked if organic substances are part of their diet, 93% say they are. Of these, 6.95% associate organic substances as natural, non-industrialized, without pesticides or even with supplements (pills, powder, tablet, capsule). And, 7% say that vital nutrients are not part of their diet, as shown in figure 3.

Figure 3 – Organic substances in the daily diet.
STUDENTS WHO INGEST ORGANIC
SUBSTANCES



Source: Survey data, 2023.

The result of the survey indicates that many adolescents interviewed say that organic substances are part of their diet, which is positive, as the nutrients contained in these foods are essential for maintaining health. According to Araújo et. al (2021) The intake of carbohydrates, fats,

and proteins is essential for maintaining cellular and body integrity, in addition to providing energy and playing a protective role in human health and biochemical processes in the body.

In addition, it is worrying that 7% of adolescents say that vital nutrients are not part of their diet. This lack of knowledge may indicate an inadequate and unbalanced diet, which can compromise the physical and mental health of these adolescents.

The last question of the questionnaire asked the students if they had already excluded any type of food from the diet and 57% of the students said that they do not refuse any type of food in the diet, according to the statements below:

"I eat everything. I have a good metabolism."

"But, I avoid exaggerations of Coca-Cola."

"I eat at the limit without exaggerating, because any food in excess is bad."

And 43% of students said they have already excluded foods from their diet. Example:

"Sweets."

"Carbohydrates, mass."

"Coca-cola."

"It excludes carbohydrates, because it is bad for health."

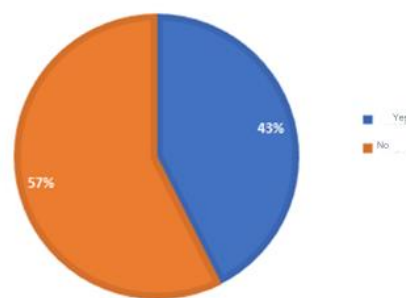
"It excludes foods for reasons of food intolerance."

"Fatty foods"

"Several industrialized foods due to allergy to food dyes."

The data can be seen in figure 4.

Figure 4 – *Exclusion of foods from the diet*
STUDENTS WHO EXCLUDE FOODS FROM THEIR DIET.



Source: Survey data, 2023.

Interpreting the students' answers, it is possible to observe that most of them (57%) did not exclude any type of food from the diet. Some reported that they have a good metabolism and that they eat everything, but avoid exaggerations and any excess food. Others stated that they have no dietary restrictions. These data also demonstrate that these students are aware and adept at sustainable consumption, since the consumption of excess food is also treated by authors as contrary



to sustainability, since it exceeds the individual's needs, becoming waste (MARTINELLI, CAVALLI (2019)).

On the other hand, 43% of the students have already excluded some type of food from their diet. The reasons for this exclusion vary, from health issues and food intolerance to personal choice to avoid certain foods because they consider them harmful to health. Some examples cited include sweets, carbohydrates, "coca-cola", fatty foods, processed foods and food dyes.

According to the Ministry of Health (2014), there are many mechanisms to seduce and convince consumers, especially children and adolescents. The document alerts society to the fact that 2/3 of the television advertisements that deal with the issue of food highlight, advertise industrialized products, *fast foods*, ultra-processed foods, snacks, drinks and ready meals such as soft drinks, pizza, sausages, hamburgers and others.

It is important to remember that each person has their own nutritional needs and may have dietary restrictions for medical or personal reasons. The important thing is to maintain a balanced and healthy diet, which provides all the nutrients necessary for the proper functioning of the body.

Thus, in order to avoid health impasses, the importance of food education is highlighted, which is essential for the promotion of health among adolescents in high school. During adolescence, significant changes occur in physical, emotional, and cognitive development, and proper nutrition is essential to ensure healthy growth and development.

Adolescents need a balanced diet, rich in nutrients and vitamins, to meet the energy and nutritional needs of the growing body. In addition, proper nutrition can prevent chronic diseases such as obesity, diabetes, heart disease, and cancer.

Food education can help teens understand the importance of healthy eating and make conscious food choices. This includes learning about the nutrients needed by the body, how to read food labels, how to choose healthy foods at restaurants, and how to prepare healthy meals at home.

Therefore, it is important that food education is started early, preferably in childhood, and continues throughout life. However, adolescence is a crucial period for food education, as it is when eating habits can be established for life.

The school can play an important role in the food education of adolescents. Biology, chemistry, and physical education classes can include information about nutrition and healthy eating, and school canteens can offer healthy and nutritious food options. In addition, teachers can incorporate food education into other subjects.

Finally, food education is fundamental for the promotion of the health of adolescents in high school. It is important for adolescents to learn about nutrition and healthy eating to ensure proper growth and development, prevent chronic diseases, and establish healthy eating habits for life.



FINAL CONSIDERATIONS

The diet of high school adolescents can vary greatly, but in general, many adolescents do not consume a balanced and healthy diet. They consume foods high in sugar, fat, and salt in excess, while not consuming sufficient amounts of fruits, vegetables, and whole grains.

As for the knowledge about organic substances, it can be noted that it varies according to the education they have received. Some adolescents learned about organic substances in biology or chemistry classes, or even at home with their parents, but it is also noticed that other students did not have this knowledge. Food education both at school and at home is important for students to learn how to eat healthy foods and make conscious food choices.

It is important to remember that food education should include information about the different nutrients and organic substances found in food, so that adolescents can make use of a balanced and healthy diet. Understanding nutrients and food chemistry can help teens understand how food can affect overall health and well-being. And to improve the consumption of healthy foods by adolescents, schools, in partnership with families, should develop strategies to encourage changes in eating habits and promote food and nutrition education for the entire school community.


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The use of contraceptives and its relationship with chronic venous insufficiency

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ABSTRACT

Introduction: Combined oral contraceptives (COC's) are widely used due to their efficacy in contraception, with an efficacy rate of up to 99% when used correctly. However, its use is associated with risks, such as the increased risk of venous thrombosis, a serious concern due to the serious implications it may have for women's health. **Objective:** This study aims to explore the effects of combined oral contraceptives on women's health, with a special focus on the risks associated with venous thrombosis. In addition, it seeks to highlight the fundamental role of pharmacists in guiding and preventing harm related to the use of these drugs. **Materials and methods:** A systematic and exploratory literature review was carried out, with a search for articles, theses and dissertations in the SciELO, Bireme, LILACS and Web of Science databases, from 2000 to 2024. Studies that explored the relationship between contraceptives and thrombosis, taking into account the inclusion and exclusion criteria, were included. **Results:** The results of the study indicate that COCs, especially when they contain estrogen, significantly increase the risk of venous thrombosis, especially in women over 40 years of age. This risk is exacerbated by conditions such as genetic predisposition, hypertension, and diabetes, factors with a higher prevalence in this age group. Third- and fourth-generation progestogens have been identified as associated with a higher thrombotic risk compared to second-generation progestogens. **Final thoughts:** Despite the benefits in contraception and menstrual control, COCs are not without risks, and a careful assessment of the benefits versus the potential individual harms when prescribing these medications is crucial. The role of pharmacists is vital in educating patients about the risks and carefully selecting the safest contraceptives, taking into account factors such as personal and family medical history, genetic predisposition, and preexisting health conditions. This approach aims to maximize the safety and well-being of women who choose to use combined oral contraceptives.

Keywords: Contraceptive, Chronic venous insufficiency, Thrombosis.

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INTRODUCTION

Combined oral contraceptives (COC's) represent one of the most common and effective forms of contraception, boasting an impressive 99% effectiveness rate when used correctly. With a diversified formulation in terms of dosage and active ingredient, these drugs play an important role both in regulating the menstrual cycle and in preventing pregnancy. However, as with any pharmacological intervention, its use requires a thorough understanding of the associated risks and benefits (Ferreira, D'Avila, and Safatle (2019).

While AOC's offer a number of benefits, it is critical to recognize the potential risks to women's health that can arise from inappropriate or uninformed use of these medications. As observed by Santos, Sato, and Sato (2022), it is common to find cases of inappropriate use of contraceptives, sometimes without medical advice.

One of the risks associated with the use of hormonal contraceptives is the development of venous thrombosis, a condition that is characterized by the formation of blood clots in the vessels. Thrombosis can lead to serious complications, such as partial or total obstruction of the affected vessel, with the potential to cause permanent damage or even death. This concern is reinforced by studies such as those by Alves, Almeida and Balhau (2015) and Ferreira, D'Avila and Safatle (2019), which highlight the relationship between the use of contraceptives and the increased risk of thrombosis, especially in women.

The mechanisms by which hormonal contraceptives favor the risk of thrombosis are complex and involve changes in hemostasis, the system responsible for regulating blood clotting. Estrogen, one of the main components of these medications, plays a significant role in this process, increasing the levels of certain clotting factors while decreasing the levels of anticoagulants (Melo et al., 2006).

However, the increased risk of thrombosis is not exclusively attributed to contraceptives, but is influenced by a complex interaction of factors, such as genetic predisposition, lifestyle, and other medications used (Silva et al., 2018).

In this context, there is a need for a more comprehensive and informed approach to the use of contraceptives, with emphasis on the appropriate guidance of health professionals, particularly pharmacists. This study therefore aims to explore the effects of contraceptive use, highlight scientific evidence related to women's health risks, and discuss the importance of the pharmacist's role in preventing possible harm, with a special focus on Chronic Venous Insufficiency.

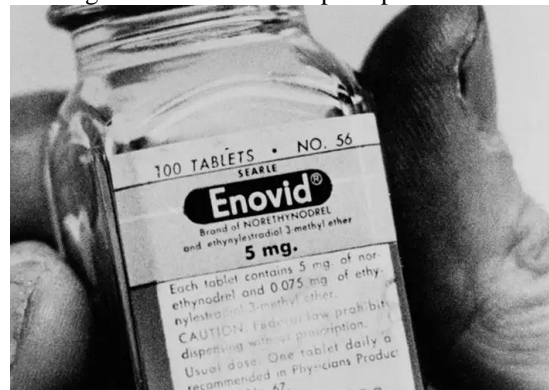
STATE OF THE ART

ORAL CONTRACEPTIVE

The development and commercialization of the first oral contraceptive represented a significant milestone in the history of medicine and society. In 1950, scientists Pincus, Rock, and

Garcia began a quiet revolution that, a decade later, would materialize with the launch of Enovid (figure 1) in the United States. Since then, oral hormonal contraceptives, popularly known as contraceptive pills, have played an important role in women's lives and family dynamics (Almeida; Assis, 2017).

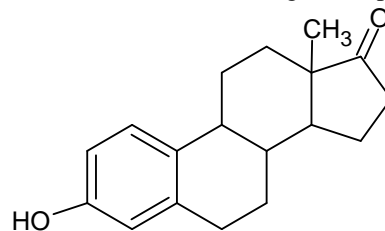
Figure 1 - First contraceptive pill Enovid.



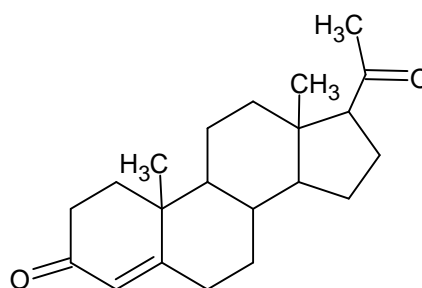
Source: DW (2015).

The Ministry of Health defines oral hormonal contraceptives as steroids that aim to prevent conception through the combined action of hormones, mainly estrogen and progesterone (figure 2). These hormones, when interacting with the menstrual cycle, inhibit the maturation of the egg and consequently ovulation, making pregnancy less likely (Correa et al. 2011).

Figure 2 - Chemical structure of estrogen and progesterone.



Estrogênio



Progesterona

Source: ACD/ChemSketch

It is important to note that the use of oral contraceptives can cause adverse effects. These effects can range from mild and reversible changes, such as hyperpigmentation and weight variations, to more severe clinical manifestations, such as thromboembolic events, which can occur. Therefore, it is essential that the use of these drugs is monitored by health professionals, who can advise on individual risks and benefits, in addition to monitoring possible side effects (Silva et al., 2018).

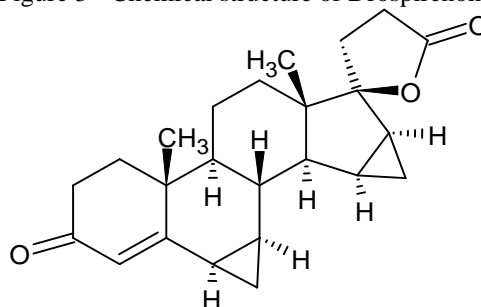
Despite the challenges and controversies, oral contraceptives remain one of the most popular and effective fertility control options. Its impact on modern society is undeniable, providing women with the power to decide on their own reproduction and contributing to a future in which family planning is a reality accessible to all (Souza and Alvares, 2018).

Oral hormonal contraceptives (CHO) represent one of the most popular and effective options for female fertility control. These contraceptives can be categorized based on their hormonal composition, dosage, and type of hormone used (Silva et al., 2018).

Initially, as for hormonal composition, oral contraceptives can be divided into two main types: the combined method, which contains both an estrogen and a progesterone, and the isolated method, which contains only progesterone, known as a mini-pill. This distinction is important, as each type can have different efficacy and side effects, and it is necessary to choose the most appropriate one for each specific case (Grossman, 2011).

In addition, oral contraceptives are classified into different generations, which refer to the evolution of formulations over time. We have the first, second and third generations, corresponding to single-phase, two-phase and three-phase formulations, respectively. There are also studies that propose an additional classification, considering contraceptives containing drospirenone (Figure 3) as fourth-generation, although this classification still lacks a clear definition (Correa et al., 2011).

Figure 3 - Chemical structure of Drospirenone.



Drospirenona

Source: ACD/ChemSketch.

The benefits brought by effective control of contraception are undeniable. The increase in women's rights and their participation in the labor market was greatly facilitated, as the ability to plan the family provided by contraceptives allowed a better match between the number of children and the economic conditions of the families. In addition, there was a significant change in mentality and

customs, promoting greater sexual liberality and contributing to the advancement of gender equality (Almeida; Assis, 2017).

Although they are highly effective in preventing pregnancy, it is important for women to consult their doctors before starting use in order to assess which option is best for their individual health and needs. In addition, regular medical follow-up is essential to monitor possible side effects and ensure safe and effective contraception.

CONTRAINDICATIONS OF ORAL CONTRACEPTION

The use of oral contraceptives, commonly referred to as birth control pills, is widely adopted by women around the world. However, as noted by Souza and Alvares (2018), it is essential to take into account the contraindications associated with this contraceptive method.

One of the main points highlighted by Wannmacher (2003) is the significant, albeit small, increase in systolic and diastolic pressures associated with the prolonged use of these drugs. This increase in blood pressure can be especially worrisome in hypertensive women, as even a small increase in blood pressure can trigger serious complications, such as stroke or acute myocardial infarction (AMI) (Grossman, 2011).

In addition to high blood pressure, several other risk factors and medical conditions contraindicate the use of oral contraceptives. Among these conditions are diabetes mellitus with vascular disease, female smokers over 35 years of age, cardiovascular diseases, thromboembolism, and migraine with aura (Correa et al., 2011).

Another critical point to be considered is the predisposition to the development of breast cancer associated with the use of oral contraceptives. The Ministry of Health identifies several well-established risk factors for breast cancer linked to women's reproductive life, including early menarche, nulliparity, first pregnancy after the age of 30, late menopause, hormone replacement therapy, and use of oral contraceptives (Souza and Alvares, 2018).

In light of these contraindications, it is essential for women considering oral contraceptive use to consult with their doctors for a thorough evaluation of their health and medical history. Choosing the appropriate type of contraceptive method should not only take into account its effectiveness in preventing pregnancy, but also the potential risks and benefits associated with each available option. For many women with specific medical conditions or risk factors, non-hormonal contraception is often more appropriate and safer.

COMPLICATIONS DUE TO THE USE OF ORAL CONTRACEPTIVES

As indicated by Souza and Alvares (2018), the prolonged use of oral contraceptives can trigger significant changes in the hemostatic system of the human body, leading to the development

of clots in the veins. Deep vein thrombosis (DVT) is one of the most serious complications associated with the use of oral contraceptives, leading to acute thrombi formation in the superficial or deep venous system.

Thrombi formed during DVT can cause partial or total occlusion of the vein, posing a serious threat to health. In addition, parts of these thrombi can detach and trigger a pulmonary embolism (PE), a potentially lethal complication. As highlighted by Santos, Magalhães and Morato (2017), PE is often underdiagnosed due to its nonspecific clinical presentation, which makes its treatment and management even more challenging.

The consequences of DVT and PE go beyond the immediate risks to the patient's life. In its chronic phase, DVT can result in significant physical disability and enormous socioeconomic costs, contributing to the development of postthrombotic syndrome. In addition, venous thromboembolism is described as one of the main causes of preventable hospital death, highlighting the importance of preventive measures and effective interventions (Correa et al., 2011).

Symptoms of DVT can range from edema and pain in the affected limb to venous distention, although many patients may be asymptomatic. In view of this diversity of clinical presentations, a detailed anamnesis and a careful physical examination become essential for the early diagnosis and appropriate management of DVT. It is important to note that some risk factors, such as a history of previous surgery, prolonged immobilization, and the use of estrogen-containing oral contraceptives, can increase susceptibility to DVT. Therefore, the individualized evaluation of each patient, considering their medical history and risk factors, is essential for the prevention and effective treatment of this condition (Barros, Pereira and Pinto, 2012).

Deep vein thrombosis (DVT) affects millions of people worldwide, with significant health and mortality consequences. According to Rollo et al. (2005), the estimated incidence of this disease in Brazil is calculated at 0.6 cases per 1,000 inhabitants per year. In addition, DVT, along with its serious complication, pulmonary embolism (PE), represents a serious public health problem, especially among the elderly.

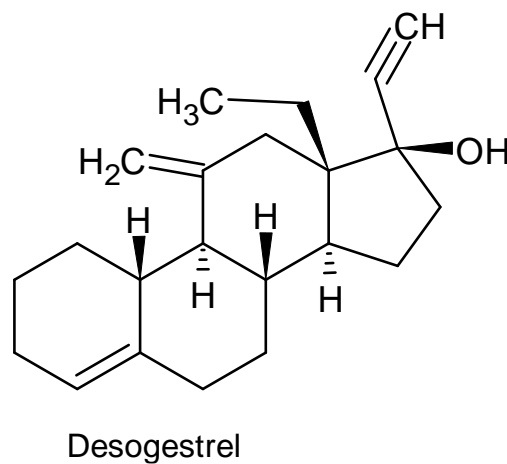
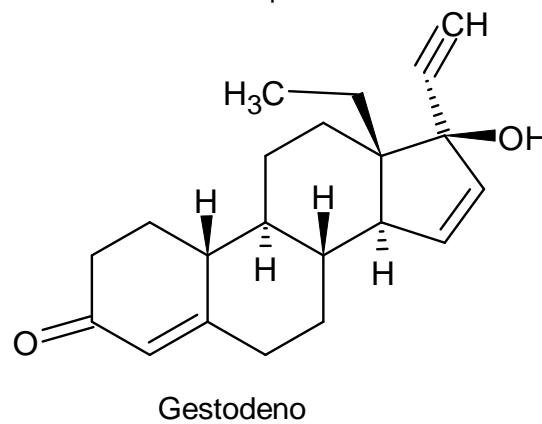
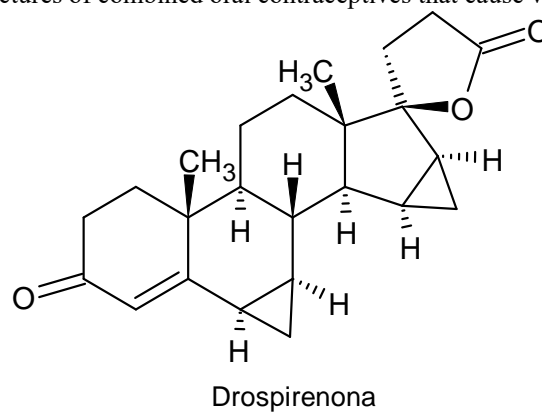
Several risk factors are associated with the development of deep vein thrombosis, as defined by the Ministry of Health (2019). These include the use of oral contraceptives, immobility due to prolonged hospital stays, economy class syndrome (associated with immobility during long journeys), varicose veins, surgeries, smoking, and hormone replacement therapy. Currently, recommendations and relevant information are widely disseminated on the Ministry of Health website in order to prevent DVT prophylactically (Ministry of Health, 2019).

Risk factors for DVT can be categorized into general factors (such as age and gender), clinical factors (such as obesity and infections), medications (including oral contraceptives and hormone therapy), and surgical factors (such as the type of surgery performed and the time of procedure). It is

important to emphasize that the use of oral contraceptives leads the list of risk drugs that can trigger DVT (Garcia et al., 2002).

As highlighted by Sousa and Alvarez (2018), the hormones present in oral contraceptives, such as estrogen and progesterone, can trigger significant changes in the body's hemostatic system, increasing the risk of clots forming in the veins. Women who use contraceptives containing drospirenone, gestodene or desogestrel (Figure 4) have an increased risk of developing venous thromboembolism compared to those who do not use combined hormonal contraceptives (Brazil, 2016).

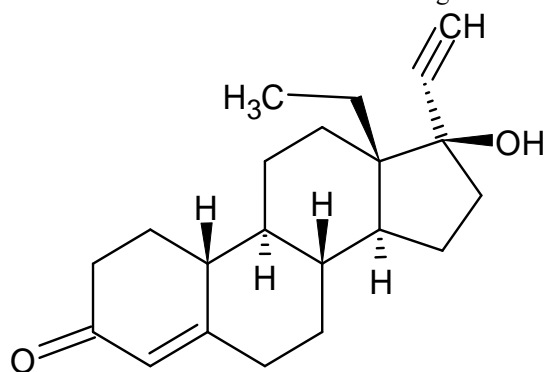
Figure 4: Chemical structures of combined oral contraceptives that cause venous thromboembolism.



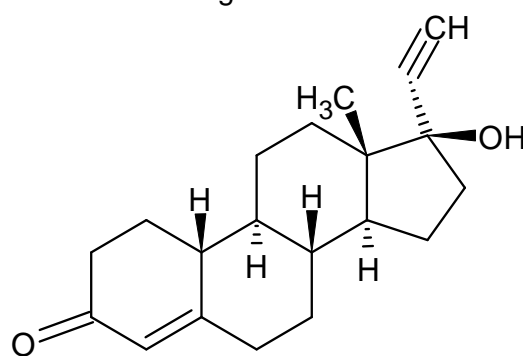
Source: ACD/ChemSketch.

In addition, Júnior and Baracat (2010) point out that third-generation progestogens, such as gestodene and desogestrel, present an even higher risk compared to second-generation first-generation progestogens. Thus, the use of progestogens alone, such as levonorgestrel and norethisterone (Figure 5), does not seem to significantly increase the risk of DVT.

Figure 5: Chemical structures of hormones of the second generation of progestogens.



Levonorgestrel



Noretisterona

Source: ACD/ChemSketch.

Given this scenario, it is essential that health professionals know the risk factors associated with deep vein thrombosis, especially associated with the use of oral contraceptives. An individualized approach and careful assessment of benefits and risks are essential when prescribing these medications, thereby ensuring the safety and well-being of patients. In addition, public awareness and education about preventive measures play an important role in reducing the incidence of this serious health condition.

MATERIALS AND METHODS

This research is a systematic bibliographic review with an exploratory, descriptive and explanatory character, based on an electronic bibliographic survey carried out in several databases. The sources used to search for studies include Google Scholar and the SciELO database, Bireme, LILACS and Web of Science, among others, which have numerous indexed works. It should be noted



that this review covers the literature composed of articles, theses, and dissertations published between the years 2000 and 2024, as well as books from any period.

STUDY VARIABLES

The survey of research data was carried out in the aforementioned databases, where articles, dissertations, and theses published between 2000 and 2024 were selected, which contained data and information on the use of contraceptives and their relationship with chronic venous insufficiency.

DATA COLLECTION

The following terms were used: "contraceptive"; "thrombosis" and "venous insufficiency". The searches were carried out in the following databases: SciELO, Bireme, LILACS and Web of Science.

TIME LIMIT AND LANGUAGE

This study includes only articles published in Portuguese and English, as found in the available databases. Publications of articles, theses, and dissertations in the period from 2000 to 2024 were considered.

INCLUSION CRITERIA

Scientific articles that presented in their title, objectives and conclusions with the words mentioned in the previous topic, addressing the subject in question and published in the research databases, were included.

EXCLUSION CRITERIA

Articles that did not present a theme related to the theme proposed in the title, objective and/or conclusion, that did not fit the time interval stipulated in this review, or that had already been screened in other databases, resulting in duplicates, were excluded. In addition, materials without a scientific character, that is, without ISSN or DOI, were also excluded.

DATA ANALYSIS

A research was carried out through a critical reading, with the purpose of organizing the information contained in the selected studies that complemented the objectives proposed in this review. Articles that met these criteria were cited in the study.

ETHICAL ASPECTS

The ethical aspects of this study were based on the reliability of the data obtained in the reviewed studies, the correct citation of the authors, and the accuracy of the data description. It was not necessary to obtain an opinion from the research ethics committee or consent from the authors of the studies published in the databases, following the guidelines of the Brazilian Association of Technical Standards (ABNT) for academic papers.

RESULTS AND DISCUSSION

The articles analyzed in this review were found in the following databases: SciELO (5 articles), Bireme (3 articles), LILACS (4 articles) and Web of Science (2 articles).

After the eligibility process, 14 articles were selected that met the inclusion and exclusion criteria, in addition to aligning with the main objectives for the development of this review. These articles were analyzed in detail, considering the established selection criteria, which allowed us to answer the questions proposed by the review.

According to the inclusion criteria, Tables 1, and Tables 2, 3 and 4 in the annex, list the articles selected for the discussion of this theme. In this review, the synthesis of the publications included, based on the searched databases, presents the author(s), the year of publication, the title, the considerations/objectives and the results of interest

Table 1: Main information of the articles selected for study in SciELO.

AUTHOR/ YEAR	TITLE	OBJECTIVE	RESULTS
Padovan and Freitas (2015)	Oral Contraceptive That Is Associated With The Risk Of Deep Vein Thrombosis	To highlight and critically discuss the use of different classes of oral contraceptives, investigating their correlation with cases of venous thrombosis.	The result found was that thrombosis is considered a serious diagnosis and occurs in more than 80% of cases, mainly due to the use of oral contraceptives.
Santos and Barbosa (2018)	Use of oral contraceptives associated with the risk of deep vein thrombosis	To demonstrate the association between the use of oral hormonal contraceptives and deep vein thrombosis.	The use of oral contraceptives increases the probability of deep vein thrombosis (DVT) due to the action of the hormones contained in these drugs on the cardiovascular system.
Ferreira and Passion (2021)	The relationship between the use of the anticonceptual pill and the development of deep venous thrombosis in Brazil	To demonstrate the adverse reactions, especially Deep Vein Thrombosis (DVT), associated with the chronic use of oral contraceptives.	To minimize adverse reactions, it is essential that a gynecologist conducts a detailed anamnesis, considering the physiological history of each patient, to select the contraceptive method most appropriate to their individual needs.

Cruz, Bottega and Paiva (2021)	Oral contra-ceptive: side effects and its relationship with venous thrombosis	To review the correlations between the use of oral hormonal contraceptives and deep vein thrombosis, analyzing the pharmacological effects of these contraceptives on hemostasis and the coagulation cascade.	It was concluded that oral hormonal contraceptives may increase the risk of venous thrombosis as an adverse effect. This is due to the hormones present in these contraceptives, which alter the coagulation cascade and inhibit factors that help prevent hypercoagulability in the body.
Soares et al. (2022)	Venous thromboembolism associated with the use of oral contraceptives: an integrative review	To analyze the association between venous thromboembolism and the use of oral contraceptives	An elevated risk of deep vein thrombosis (DVT) has been identified among patients using combined oral contraceptives.

Source: Prepared by the authors (2024)

The discussion of the risks associated with the use of oral hormonal contraceptives (OC) in women over 40 years of age reveals a complex interaction between hormonal, physiological, and health factors that increase vulnerability to severe thrombotic events, such as deep vein thrombosis (DVT).

First, it is important to note that OCTs contain synthetic estrogen and progesterone, hormones that mimic those involved in the female reproductive cycle. These compounds are effective in preventing pregnancy, but they also introduce significant health risks, especially as women age. Studies such as those by Silva et al. (2021) and Morais, Santos, and Carvalho (2019) indicate that women over 40 years of age have an increase in cardiovascular risk associated with the use of these medications. This is due to the natural physiological changes that occur with aging, such as changes in body composition and the functioning of the cardiovascular system.

In addition to natural physical changes, such as a decrease in endogenous production of sex hormones and an increased prevalence of conditions such as hypertension and diabetes, women in this age group tend to have a greater predisposition to thrombotic events. The review by Silva, Duarte, and Cardoso (2021) and Correa, Barroso, and Araújo (2021) highlights that the prolonged use of OCCs can accentuate this predisposition, since these contraceptives can influence the coagulation cascade, increasing procoagulant factors and decreasing natural anticoagulants.

Deep vein thrombosis is of particular concern due to the ability of synthetic hormones, especially estrogen, to increase the production of thrombin and other clotting factors, while decreasing the activity of natural anticoagulants such as protein S and antithrombin III (Ferreira and Paixão, 2021). This condition is aggravated by advanced age, which naturally increases blood coagulability and decreases the efficiency of anticoagulant mechanisms (Padovan and Freitas, 2015).

In addition, predisposing genetic conditions, such as the presence of mutations in factor V Leiden, can further intensify the risk of thrombosis in women after the age of 40 who use OCOs (Santos and Lima, 2020). Therefore, the choice of contraceptive method for women in this age group

should consider not only the contraceptive benefits, but also the associated individual risks, including personal and family history of thrombosis, pre-existing health conditions, and lifestyle.

An important aspect highlighted by Santos and Barbosa (2018) is the increase in female independence and autonomy in family planning, which has resulted in a significant increase in the use of ACOs since their introduction. However, as mentioned by Silva, Duarte, and Cardoso (2021), women over 40 years of age face an increased risk of thrombotic events associated with long-term use of these contraceptives. This is due not only to physiological changes related to aging, but also to the higher prevalence of health conditions such as hypertension, obesity, and diabetes, which are additional risk factors for cardiovascular complications.

The interaction between estrogen and progestogen in OCAs is a critical point, as discussed by Ferreira and Paixão (2021), who highlight how these hormones can increase blood coagulability by altering viscosity and vascular wall. Women over 40 years of age, especially those with a genetic predisposition to thrombosis, as mentioned by Correa, Barroso, and Araújo (2021), face a high risk of thrombotic events due to the combination of exogenous hormonal factors and physiological changes resulting from aging.

In addition, as pointed out by Morais, Oliveira and Trevisan (2015), the risk profile varies significantly with the age of women. While younger women generally have a lower risk of thrombotic complications, this likelihood increases considerably after age 40 due to changes in hemostasis and cardiovascular function associated with aging.

According to Silvério et al. (2022), COCs, composed of synthetic estrogen and progestogen, mimic the natural hormones of the female reproductive cycle. This hormonal composition can significantly influence women's cardiovascular system, increasing thrombin production and, consequently, the risk of deep vein thrombosis (DVT). The absolute risk of DVT tends to increase with age, as indicated by Moraes, Oliveira and Trevisan (2015), due to the physiological changes that occur in aging, such as a greater predisposition to hypercoagulability.

Magalhães and Morato (2018) corroborate this view, highlighting that women over 40 years of age have a higher incidence of chronic diseases, such as diabetes and hypertension, which are additional risk factors for cardiovascular complications. Long-term use of COCs in this age group, combined with these health conditions, intensifies the risks of serious adverse events such as stroke and DVT.

In addition, Lago et al. (2022) emphasize that different progestogens present in COCs can influence the risk of DVT in different ways. Progestogens such as drospirenone, gestodene, cyproterone, and desogestrel are associated with a higher risk of DVT compared with norgestimate, levonorgestrel, and norethisterone. Women over the age of 40, who already have an increased

predisposition to blood clotting due to aging, may be particularly vulnerable to the thrombotic effects of these riskier progestins.

Cruz, Bottega, and Paiva (2021) add that, after the age of 40, the risk of thrombotic events related to the use of COCs becomes even more prominent due to the complex interaction between synthetic hormones (figures 3, 4, and 5) and the physiological changes associated with age. The ability of estrogens to decrease natural anticoagulation factors, such as protein S and antithrombin, contributes to a state of hypercoagulability in this age group.

One of the main points of concern is the increased risk of venous thromboembolic events (VTE), such as deep vein thrombosis (DVT) and pulmonary embolism (PE). Synthetic estrogens, such as ethinylestradiol, are associated with increased blood clotting, through increased levels of clotting factors and decreased natural clotting inhibitors, such as protein C and S (Silva et al., 2021; Magalhães and Morato, 2018). This creates a prothrombotic state in the body, increasing the propensity for clot formation (Morais et al., 2019).

In addition, the progestogens used in OCCs also play an important role. Third- and fourth-generation progestogens, such as desogestrel, gestodene, and drospirenone, have been associated with a higher risk of VTE compared to second-generation progestins, such as levonorgestrel (Santos and Barbosa, 2018; Ferreira and Paixão, 2021). These modern progestins, despite having lower androgenic activity, increase the overall estrogenic effect, which can reduce sensitivity to activated protein C, further increasing thrombotic risk (Santos and Lima, 2020; Santos and Barbosa, 2018).

Another concerning aspect is the impact of OCOs on blood pressure and liver function. Estrogen can cause water and sodium retention, resulting in increased blood pressure, which can be especially dangerous for women with pre-existing hypertension (Silvério et al., 2022). In addition, long-term use of OCOs has been associated with a higher risk of hepatic adenomas, possibly due to hormonal effects on the liver (Silverio et al., 2022).

While OCPs offer clear benefits in preventing pregnancy, controlling menstrual care, and reducing risks such as ectopic pregnancies, uterine fibroids, and ovarian cancer, these benefits need to be weighed against the potential risks mentioned (Silvério et al., 2022; Silva et al., 2021).

The choice of the specific type of OCP is also important, as different generations of progestogens have varying risk profiles for VTE (Padovan and Freitas, 2015; Ferreira and Paixão, 2021). The decision must be individualized, considering factors such as age, personal and family medical history, as well as the presence of genetic predisposition to thrombophilias (Santos and Barbosa, 2018; Moraes, Oliveira and Trevisan, 2015).

In summary, while oral hormonal contraceptives are widely used and effective, it is essential for doctors and patients to be aware of the potential risks associated with them. The decision to



initiate or continue with ACOs should be based on a careful assessment of the expected benefits in relation to each patient's individual risks, thereby ensuring an informed and safe choice.

FINAL CONSIDERATIONS

In view of the results addressed in this study on the risks associated with the use of oral hormonal contraceptives (OC) in women over 40 years of age, the complexity of the interactions between chemical and physical compound, hormonal, physiological, and health factors that influence vulnerability to severe thrombotic events, such as deep vein thrombosis (DVT), becomes evident.

OCOs, containing synthetic estrogen and progesterone, are effective in preventing pregnancy, but they also pose substantial health risks, especially as women age. Recent studies highlight that women over the age of 40 face an increase in cardiovascular risk with the prolonged use of these medications. This increased risk is amplified by the natural physiological changes associated with aging, such as reduced endogenous production of sex hormones and increased predisposition to conditions such as hypertension and diabetes.

The complex interaction between the synthetic hormones of OCCs and the body's clotting mechanisms contributes significantly to the increased risk of deep vein thrombosis. The studies reviewed here underline how estrogens, in particular, can increase blood clotting by decreasing levels of natural blood thinners and elevating pro-clotting factors.

In addition to the hormonal changes induced by OCAs, the choice of the specific type of progestogen also plays an important role. Third- and fourth-generation progestogens were associated with a higher risk of thrombotic events compared with second-generation progestogens, further complicating the therapeutic decision.

It needs to be recognized that while OCPs offer significant benefits in contraceptive and menstrual control, as well as in reducing risks such as ectopic pregnancies and ovarian cancer, these benefits must be weighed against the potential risks, especially in older women with preexisting health conditions.

Therefore, the decision to prescribe or continue ACOs should be individualized and based on a careful assessment of the specific risks and benefits for each patient. This includes considering personal and family medical history, the presence of genetic predisposition to thrombophilias, as well as the choice of the most appropriate type and specific generation of OC to minimize thrombotic risks.

Ultimately, it is essential that physicians and patients are fully informed about the potential risks associated with ACOs, ensuring that any decision is made with knowledge of the facts and in pursuit of maximum patient safety and well-being.



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ATTACHMENT

Table 2: Main information on the articles selected for study at Bireme.

AUTHOR/ YEAR	TITLE	OBJECTIVE	RESULTS
Moraes, Oliveira and Trevisan (2015)	Relationship between oral contraception and the risk of deep vein thrombosis in women in the productive period	To correlate the use of oral contraceptives in women of reproductive age with the risk of deep vein thrombosis (DVT).	It was concluded that the use of oral contraceptives increases the probability of deep vein thrombosis (DVT) due to the action of the hormones contained in these drugs on the cardiovascular system.
Santos and Lima (2020)	Vascular Effects of Contraceptive Use: A Literature Review	To review the vascular effects of contraceptive use, with a focus on venous thrombosis as one of the main side effects, and to discuss its clinical implications.	Individuals with a genetic predisposition to thrombosis should avoid the use of contraceptives. For those without known risk, it is recommended not to self-medicate and use contraceptives with medical or specialized guidance.
Silvério et al. (2022)	Influence of hormonal oral contraceptives on women's health	Describe the risks to women's health arising from the prolonged use of hormonal oral contraceptives.	Several risks have been identified, including breast cancer, high blood pressure, and deep vein thrombosis (DVT), all of which are associated with long-term use of hormonal oral contraceptives.

Source: Prepared by the authors (2024).

Table 3: Main information on the articles selected for study in LILACS.

AUTHOR/ YEAR	TITLE	OBJECTIVE	RESULTS
Magalhães and Morato (2018)	Evaluation of the Use of Combined Oral Contraception as a Risk Factor for the Development of Thrombosis in Young Women in the City of Patos	To evaluate and compare coagulation tests and risk factors associated with the development of thrombosis in young women using combined oral contraceptives.	Risk factors should be identified and clarified for hormonal contraceptive users in order to guide the choice of the most appropriate contraceptive method based on individual analysis. It is essential that treatment is accompanied by health professionals to minimize risks.
Silva, et al. (2021)	Risk of Venous Thrombosis Associated with the Use of Oral Contraceptives: Literature Review	To associate homeostatic alterations resulting from the continuous use of oral contraceptives with the development of thrombosis.	Combined oral contraceptives (OCOs) are widely used by women, but it is crucial that there is medical guidance and follow-up to prescribe the method that presents the lowest risk of thrombosis according to the biological profile of each patient.
Correa, Barroso and Araújo (2021)	The use of combined oral contraceptives and the risk of venous thromboembolism: a systematic review	To assess the risk of deep venous thromboembolism (VTE) among users of oral hormonal contraceptives.	The main risk factors associated with VTE include hereditary thrombophilia, use of third-generation combined oral contraceptives (COCs), pregnancy, previous history of venous or arterial thrombosis,

			postpartum period, and use of combined oral contraceptives (COCs).
Silva, Duarte and Cardoso (2021)	The occurrence of thrombotic events in users of Combined Oral Contraceptives	To analyze the occurrence of thrombotic events in users of Combined Oral Contraceptives (COCs) and to investigate the mechanisms that influence their occurrence.	Studies have indicated that there is a high probability of developing deep vein thrombosis associated with the use of combined oral contraceptives, especially in women who have some risk factor for thrombus formation.


Source: Prepared by the authors (2024).

Table 4: Main information of the articles selected for study in the Web of Science.

AUTHOR/ YEAR	TITLE	OBJECTIVE	RESULTS
Morais, Santos and Carvalho (2019)	Venous thromboembolism related to frequent use of combined oral contraceptives	To relate the formation of venous thromboembolism to the use of combined oral contraceptives.	Several circumstances favor the formation of arterial and venous thrombi. One of the significant risk factors for the development of these pathologies is the use of combined oral contraceptives.
Lago, et al. (2022)	Risk of venous thrombosis related to the use of oral contraceptives	To highlight the relationships between the use of oral contraceptives and the occurrence of venous thrombosis.	A relationship between the use of oral contraceptives and the occurrence of venous thrombosis was confirmed.

Source: Prepared by the authors (2024).

Prevention of endophthalmitis in cataract surgery: Integrative literature review

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ABSTRACT

INTRODUCTION: Cataract is a disease that causes congenital or acquired opacity of the lens, which can cause partial or total loss of vision. Approximately 85% of cataracts are classified as senile, being considered the main causes of reduced vision in the world. The surgery for its correction consists of removing the opaque lens and replacing it with an intraocular lens (IOL). The most feared complication is postoperative endophthalmitis, which is an infectious condition caused by microorganisms introduced inside the eye during or after the surgical procedure. **MATERIAL AND METHODS:** This is a descriptive study of the Integrative Literature Review (RIL) type on the prevention and control of endophthalmitis after cataract surgeries. **RESULTS:** In this integrative literature review, 11 (eleven) articles that met the previously established inclusion criteria were analyzed. Most studies address the efficacy and recommendation of intracameral antibiotic use as the main prevention strategy for endophthalmitis in the postoperative period of cataracts.

Keywords: Endophthalmitis, Cataract surgery.

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INTRODUCTION

Cataract is a disease that causes congenital or acquired opacity of the lens, which can cause partial or total loss of vision, in addition to blurring vision, reducing night visual quality and causing photophobia. Approximately 85% of cataracts are classified as senile, with a higher incidence in the population over 50 years of age (ALMANÇA, JARDIM, DUARTE, 2018).

Age-related cataracts are one of the leading causes of reduced vision in the world. Diagnosis is based on slit-lamp examination after pupillary dilation. Surgery for its correction consists of removing the opaque lens and replacing it with an intraocular lens (IOL) (GOWER, et al 2017; DELBARRE, FROUSSART-MAILLE, 2020).

Although this surgery is generally considered a safe procedure, showing a favorable visual outcome, surgical complications can occur. The most feared complication is postoperative endophthalmitis, which is an infectious condition caused by microorganisms introduced into the interior of the eye during or after the surgical procedure (KESSEL, et al. 2015).

Based on the route of transmission of infection, endophthalmitis can be classified as exogenous or endogenous. This exogenous condition occurs when infecting organisms enter the eye through direct inoculation, such as intraocular surgery, penetrating trauma, or contiguous spread from adjacent tissues. Endogenous endophthalmitis, on the other hand, occurs when infectious agents are disseminated hematogenously in the eye from a distant focus of infection (SHEU, SJ. 2017).

Postoperative contamination is the most common type of exogenous endophthalmitis, represented mainly by cataract surgery, as it is the most performed intraocular surgery in the world. A variety of pathogens, including bacteria, viruses, fungi, or parasites, can cause the infection and the etiologic agents differ somewhat by the mechanism of infection (KEYNAN, FINKELMAN, LAGACE-WIENS, 2012).

Preoperative measures can be taken to reduce the risk of endophthalmitis. Anesthetic evaluation and control of comorbidities such as diabetes mellitus and hypertension are important, as these patients may have reduced systemic immunity, making them prone to infections. It is recommended to avoid contact or tear duct procedures before, instill Povidone Iodine 5% in the conjunctival sac and periocular skin for three minutes before surgery, use sterile gloves as well as autoclaved or sterile instruments for each case. Maximize the use of surgical drapes and disposable materials. Document the lot number of irrigation fluids and all drugs and memory foam used intraocularly from surgery (VERMA, et al. 2022).

A randomized control study in Europe demonstrated the benefit of intracameral cefuroxime (1mg in 0.1 mL) with a fivefold reduction in the incidence of endophthalmitis after cataract surgery. A multicenter study in India reported a three- to six-fold reduction in acute endophthalmitis after cataract surgery with the use of intracameral moxifloxacin (0.5 mg in 0.1 mL). In a comparative

study between the two intracameral antibiotics, we showed a 3.6-fold reduction in the incidence of acute post-cataract endophthalmitis; there was no statistically significant difference between cefuroxime and intracameral moxifloxacin in the rate of decrease in infection (DAVE, et al, 2021).

Global rates vary between 0.021% and 0.32%¹ and it is estimated that, annually, the total number of cataract surgeries performed worldwide is above 30 million. With this number in mind and assuming one case of endophthalmitis in a thousand surgeries, 30,000 cases occur annually (GUTIÉRREZ, et al. 2022).

Risk factors for exogenous endophthalmitis include intrinsic host conditions and factors associated with the procedure. Some examples are: they are male, advanced age, immunocompromised and recent history of periocular infections (e.g., blepharitis, conjunctivitis). The main intraoperative risk factor is increased intraocular exposure to the patient's adnexal flora and ocular surface, which increases with surgical complexity and complications such as capsule rupture and vitreous loss (KIM, CHEN, COLEMAN, 2017).

Although the use of intracameral antibiotics after surgery is a widely recommended concept around the world for the prevention of endophthalmitis, there are some limitations involving this type of prophylaxis, such as: low bioavailability in deep ocular tissues, prolongation of surgical time, risk of intracameral antibiotics, reflux of pathogens or contamination in the anterior chamber in surgery with incisions that are not completely sealed (LI, et al. 2022).

Recently, three Brazilian studies demonstrated the safety and efficacy of intracameral moxifloxacin. However, the adoption of such scientifically proven strategies in clinical practice is hampered by other factors. Perhaps the biggest obstacle is the lack of commercially available intracameral antibiotics in various parts of the world, including Brazil. Despite high-quality, evidence-based research to support them, several treatment strategies are still considered '*off-label*' (MELEGA, ALVES, LIRA, 2022).

Postoperative endophthalmitis usually presents within one to two weeks after surgery, in the acute type, and within a few weeks or months after surgery, in the chronic type. (KEYNAN, FINKELMAN, LAGACE-WIENS, 2012).

The most common symptom of endophthalmitis is decreased visual acuity, affecting almost all patients. Eye pain or discomfort and conjunctival hyperemia are also common. Hypopyon, which represents a layer of white blood cells in the anterior chamber, is observed in 80% of cases, as is vitreous cloudiness, which is quite common. Systemic symptoms such as fever are more common in endogenous etiology (DURAND, M. 2017).

In case of early diagnosis of endophthalmitis, the impairment of the ocular structure can be avoided to preserve good vision. Therefore, early diagnosis and appropriate treatment are extremely important (SHAERI, M. et al, 2023).

Endophthalmitis is classified as a Health Care-Associated Infection (HAI), which are the most frequent adverse events within a health service. They are a serious public health problem, leading to serious consequences for individual and collective health, as it results in high morbidity and mortality, increased hospitalization time and treatment costs. Although it rarely results in death, the consequences for the quality of life of the affected patient are generally catastrophic, since their prognosis, in most cases, is poor, resulting in loss or reduction of visual acuity and, in some more traumatic cases, loss of the eye (ANVISA, 2017).

Evidence-based conducts aimed at prevention, early diagnosis and appropriate treatments are of great importance to reduce the morbidity of these patients.

In view of this, the following guiding question arises for the research: what are the main prophylactic measures capable of reducing the rates of endophthalmitis after cataract surgery?

MATERIAL AND METHODS

This is a descriptive study of the Integrative Literature Review (RIL) type on the prevention and control of endophthalmitis after cataract surgeries. RIL is a method that provides the synthesis of knowledge and the incorporation of the applicability of results of significant studies into practice. It is composed of six phases that direct its realization, which are: elaboration of the guiding question; search or sample of literature; data collection; critical analysis of the studies; discussion of the results and finally presentation of the integrative review (SOUZA, M; SILVA, M; CARVALHO, R. 2010).

IDENTIFICATION OF THE THEME AND ELABORATION OF THE GUIDING QUESTION

The first step of RIL is to identify the problem that the review will address. The subject must be defined in a clear and objective way, allowing the complete analysis to be directed, with conclusions that are easy to identify and apply. The well-defined starting question will facilitate the definition of descriptors and the execution of the search for studies (SOUZA, et al, 2017). In this way, the researcher identified in her academic trajectory the relevance of the discussion on postoperative complications of cataract surgery, focusing on endophthalmitis, which is considered a rare intraocular infection, but which can generate great morbidity and irreversible visual sequelae.

During this first stage, after choosing the theme, the following guiding question was elaborated: "What are the main prophylactic measures capable of reducing the rates of endophthalmitis after cataract surgery?"

The PICO strategy was used, which is a conceptual model of information retrieval, focusing on evidence in health, which is more widespread and used. This strategy enables the finding of qualitative studies, which refer to experiences lived by the subject and the social phenomena that

involve them through an acronym, (P) population, patient or problem; (I) phenomenon of interest; (C) comparison or control; (O) expected result (ARAÚJO, 2020; ERIKSEN; FRANDSEN, 2018).

Therefore, in the study in question, the acronym (P) represented the population submitted to cataract surgery, the phenomenon of interest (I) was endophthalmitis, while the expected result (O) would be the measures to prevent and control this condition. The comparison or control (C) was not applied in the current study format.

ESTABLISHMENT OF CRITERIA FOR INCLUSION AND EXCLUSION OF STUDIES/SAMPLING OR LITERATURE SEARCH

To guide the inclusion criteria in the study, the selection of a consolidated database that is widely used in health research is necessary. Therefore, for the selection of articles, the *Medical Literature Analysis and Retrieval System Online* (MEDLINE) was eligible, through the PubMed open access search system.

The inclusion criteria defined for the selection of literature will be original articles, *guidelines*, manuals and protocols published in full that address the theme related to the definition of endophthalmitis, its epidemiology, risk factors and prevention; articles that address strategies and mechanisms of diagnosis, management and, finally, articles that discuss the options for prevention and control of complications caused by endophthalmitis. Only articles, manuals, protocols, or *guidelines* published and indexed on the Medline platform in the last 10 years, in full, in Portuguese or English, will be included in the search. Articles that do not meet the inclusion criteria mentioned will be excluded, in addition to studies whose method corresponds to case reports, experience reports, and those that presented duplicity.

Using the MeSH (*Medical Subject Headings*) tool, which is the vocabulary controlled by the *National Library of Medicine* (NLM) and used to index articles for PubMed, the descriptors were selected through the link <https://www.ncbi.nlm.nih.gov/mesh>.

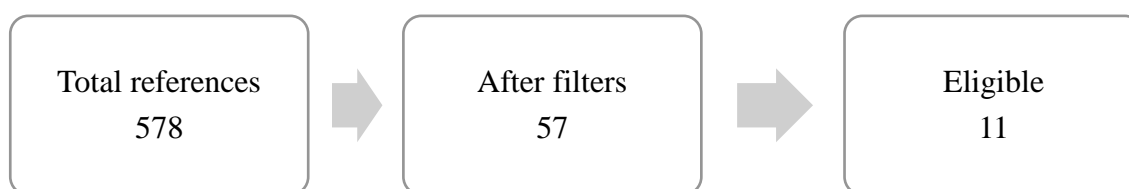
Using English for the search, the following descriptors were selected: "*endophthalmitis*", "*cataract extraction*", "*phacoemulsification*", "*prevention and control*", which in Portuguese are translated, respectively: endophthalmitis, cataract extraction, phacoemulsification, prevention and control.

The Boolean operators (delimiters), represented by the linking terms AND (additive combination), OR (restrictive combination), NOT (excluding combination) are used with the descriptors. Boolean operators have the function of informing the search system of certain combinations of search terms. In this way, the AND, OR and NOT operators, typed in capital letters between the search terms, can be used in order to meet the research objectives (SOUZA, et al, 2017).

Thus, through the <https://pubmed.ncbi.nlm.nih.gov/> link to PubMed, the following search was performed using the combination of the following descriptors and Boolean operators: ((endophthalmitis) AND (cataract extraction OR phacoemulsification)) AND (prevention and control).

A total of 578 references were found in the database after applying the combination described above, between the years 1975 and 2024. After applying the filters: freely available full text and articles from the last 10 years, the result was reduced to 57. The selection of articles was carried out in two phases: 1) reading of the titles and abstracts 2) reading of the study in full, after downloading the studies, to select the study sample.

Complying with the inclusion criteria, 11 articles were selected that answered the guiding question of the research, which were carefully analyzed.



Source: authorship, 2024.

DEFINITION OF THE INFORMATION TO BE EXTRACTED FROM THE SELECTED STUDIES/ CATEGORIZATION OF THE STUDIES

The first phase of data extraction involves the determination of a general classification system to manage data from diverse methodologies (WHITTEMORE R, KNAFL K., 2005). Therefore, in addition to extracting information about the year of publication, authors involved, and synthesis of the topic addressed, it is also important to classify the methodological design, in order to highlight the level of evidence of each study. The levels of evidence were analyzed based on the Hierarchy of Evidence for Intervention Studies, which classifies studies as: Level I – Systematic review of meta-analyses; Level II – Randomized controlled trials; Level III – Controlled trials without randomization; Level IV – Case-control or cohort study; Level V – Systematic review of qualitative or descriptive studies; Level VI – Qualitative or descriptive study; Level VII – Expert opinion or consensus (SÁ, JS. 2023). This key data has been incorporated into a table and makes up an important part of the results.

INTERPRETATION OF RESULTS

This phase corresponds to the discussion of the main results in conventional research. The reviewer compares the results of the critical evaluation of the included studies with the theoretical knowledge, highlighting the conclusions and implications resulting from the integrative review (SOUSA et al, 2017).

PRESENTATION OF THE REVIEW / SYNTHESIS OF KNOWLEDGE

The presentation of the review should be clear and complete to allow the reader to critically evaluate the results. It must contain, then, pertinent and detailed information, based on contextualized methodologies (SOUZA, M; SILVA, M; CARVALHO, R. 2010).

Combining the most relevant information from impact studies, it is possible to analyze patterns and follow recommendations, or verify the need for more research on the subject.

ETHICAL ASPECTS

The present study was carried out through research in bibliographic sources, with data collection in sources available in free access, online and free. Therefore, the use of data collection or procedures directly performed on human beings was dispensed with, and it was not necessary to submit to the Research Ethics Committee (REC) or sign consent forms for the use of data, free and informed consent forms or similar.

At all stages, ethical principles were maintained, respecting the researchers' copyrights and following the precepts of Law number 9.610/98.

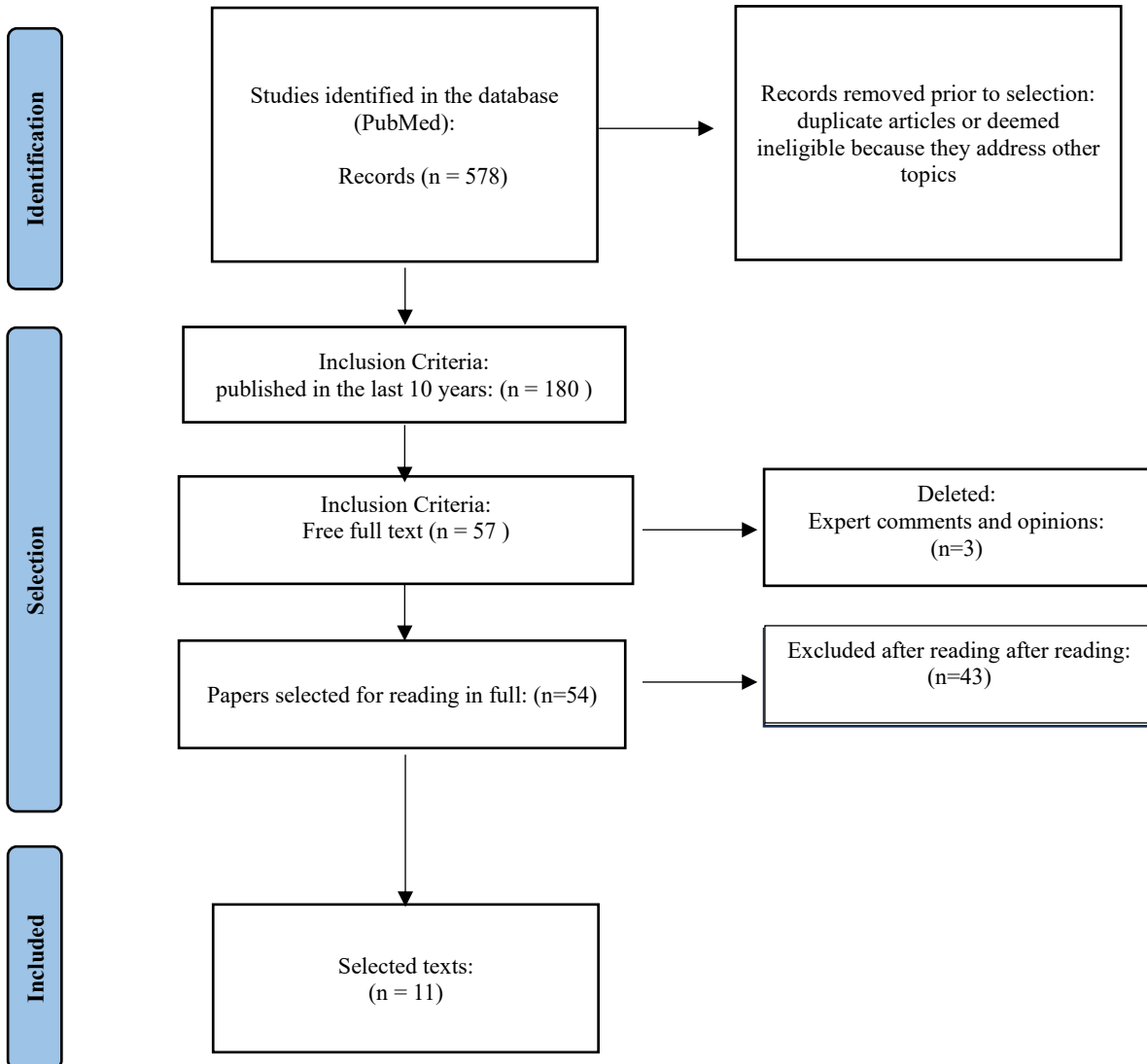
The risks were minimized due to the lack of direct participation of human beings. There was only the risk of losing the database prepared in a *Microsoft Word* ® file, which was reduced through secondary archiving in the form of a *USB stick* and electronic in the cloud with restricted access to the researcher.

RESULTS AND DISCUSSION

The search in the database was carried out using search filters, based on the inclusion and exclusion criteria, in addition to the full reading of the titles, abstracts and full texts of the selected articles.

Figure 1 shows the flowchart for selecting and selecting articles based on the PRISMA Flow Diagram 2020.

Figure 1: Flowchart for selecting articles.



Source: Authorship (2024).

Chart 1 below presents the articles selected to provide relevant information and characteristics of each publication, including title, authors, year of publication, methodology, and main considerations.

Chart 1: Characteristics of the selected studies.

	Title	Authors/ year of publication	Methodology	Scope/Key Considerations
Art.1	The impact of intracameral cefuroxime antibiotic prophylaxis on postoperative infectious endophthalmitis rates in a high-volume cataract surgical center.	L.N.S, CASAVCHIA. et al, 2023.	Retrospective cohort	It compares the rates of postoperative infectious endophthalmitis before and after the introduction of intracameral antibiotic prophylaxis with cefuroxime in a high-volume service in São Paulo, Brazil.
Art.2	Comparison of different prophylactic measures of endophthalmitis in cataract surgery – A case analysis.	J.K. REDDY, et al. 2022.	Retrospective cohort	This retrospective study comparing the different endophthalmitis protocols and showing the efficacy of amikacin added to BSS with a significant reduction in the overall rate of endophthalmitis.
Art.3	Prophylactic antibiotics for endophthalmitis after cataract surgery: a systematic review and network meta-analysis of 6.8 million eyes.	A KATO, et al. 2022.	Systematic review and meta-analysis	The study collected data from 51 original articles, including two randomized controlled trials, and concluded that intracameral injection of vancomycin, cefazolin, cefuroxime, or moxifloxacin prevented endophthalmitis in the postoperative period of cataracts.
Art.4	All Eye Society of India (AIOS) Task Force guidelines to prevent intraocular infections and cluster flare-ups after cataract surgery.	L. VERMA, et al. 2022	Guideline carried out as a basis for a review article	Based on scientific principles and evidence from the literature, the Indian Society of Ophthalmology has proposed several guidelines that can help prevent infectious endophthalmitis, including guidelines and checklists for use by eye surgeons that can be applied in their practices before starting surgery.
Art.5	Clinical features and microbiology of endophthalmitis after cataract surgery with and without intracameral moxifloxacin prophylaxis: endophthalmitis prophylaxis study report.	V.P. DAVE, et al. 2022	Retrospective case series	It compared and analyzed the record of cataract surgeries from 2015 to 2020 and analyzed the cases that developed endophthalmitis. Concluding that patients with endophthalmitis who received prophylaxis with intracameral moxifloxacin had milder signs and symptoms and responded better to treatment.
Art.6	Bacterial contamination of the ocular surface and its management in the prophylaxis of endophthalmitis after cataract surgery	D.S. SIMINA, et al. 2021.	Literature review	It addresses the relationship between bacterial conjunctival contamination and the impact of its treatment before cataract surgery to prevent endophthalmitis. It concluded that the associated use of povidone-iodine and topical 0.5% levofloxacin is more effective in reducing the conjunctival bacterial load.
Art.7	Endophthalmitis Prophylaxis Study, Report 2: Intracameral Antibiotic Prophylaxis With or	V.M. RATHI, et al. 2020.	Prospective, comparative, interventional,	The study compared the postoperative topical antibiotic use of patients undergoing

	Without Postoperative Topical Antibiotic in Cataract Surgery.		non-randomized study	cataract surgery and concluded that they were unable to change the postoperative outcome of infection in patients undergoing cataract surgery in rural India.
Art.8	Study of endophthalmitis prophylaxis. Report 1: Intracameral Prophylaxis With Cefuroxime and Moxifloxacin for the Prevention of Post-Cataract Endophthalmitis in Rural India	V.M. RATHI, et al. 2020.	Prospective, comparative, interventional, non-randomized study	It showed a 3.6-fold reduction in the incidence of endophthalmitis with the use of intracameral antibiotics (cefuroxime and moxifloxacin) and concluded that there was no statistical difference between the two in reducing infection.
Art.9	Intracameral moxifloxacin after cataract surgery: a prospective study.	N.P. LUCENA, et al. 2018	Prospective case series	With a sample of 1,016 cataract surgeries. It concluded that moxifloxacin is a safe option for intracameral use after cataract surgery.
Art.10	Comparative Analysis of the Safety and Efficacy of Cefuroxime, Moxifloxacin, and Intracameral Vancomycin at the End of Cataract Surgery: A Meta-Analysis	R.C. BOWEN, 2018.	Systematic review and meta-analysis	Compares the efficacy and safety of intracameral injection of cefuroxime, vancomycin, and moxifloxacin in the prevention of endophthalmitis.
Art.11	Perioperative antibiotics to prevent acute endophthalmitis after ophthalmic surgery: a systematic review and meta-analysis	J.HUANG, 2016.	Systematic review and meta-analysis	It was concluded that intracameral antibiotics are effective in preventing endophthalmitis in eye surgery. Intracameral antibiotics are superior to subconjunctival injections.

Source: Authorship (2024).

In this integrative literature review, 11 (eleven) articles were analyzed that met the previously established inclusion criteria and served as a theoretical basis for the construction of a general panorama presented in a descriptive way.

Of the eleven articles selected, nine have in their main or secondary theme the use of intracameral antibiotics in the perioperative period of cataract surgery as an effective method for the prevention of endophthalmitis, emphasizing that these studies guide the most current recommendations present in the literature on the subject.

Article 1 is a retrospective cohort study that was conducted in Brazil, specifically in the city of São Paulo between January 2011 and December 2019. During this period, 23,184 cataract surgeries were analyzed and divided into 2 groups. All 16,977 surgeries performed from 2013 onwards received a prophylactic dose of cefuroxime solution at a concentration of 1mg/0.1 ml during surgery and 2 more drops of moxifloxacin eye drops after the end of the procedure. While the control group received only the dose of topical antibiotic. During the entire study period, there were 9 reported cases of endophthalmitis (0.0388%), 6 of which belonged to the control group. Surgeries performed with antibiotic prophylaxis showed 80% less chance of reported endophthalmitis (OR = 0.20; 95% CI 0.05–0.72; p = 0.014) and 92% less chance of culture-confirmed endophthalmitis (OR

= 0.08; 95% CI 0.01–0.49, $p = 0.006$) than surgeries performed without antibiotic prophylaxis. Therefore, this study recommends the use of intracameral antibiotic prophylaxis due to its low cost in relation to the treatment of endophthalmitis already installed.

Perhaps the biggest obstacle to the widespread use of this prophylaxis is the lack of commercially available intracameral antibiotics in various parts of the world, including Brazil (MELEGA, ALVES, LIRA, 2022). To carry out the Art.1 survey, it was necessary to prepare the cefuroxime solution by diluting the Cefuroxime powder 750 mg available in balanced saline solution (BSS) to reach the desirable concentration for the study. The need to manipulate the drug is one of the obstacles pointed out by experts for its wide use.

Article 2 makes a comparison between the different methods of endoflomite prophylaxis adopted in cataract surgery between the years 2013 and 2021 of an eye hospital in India, which performed 246,874 surgical procedures in this period. These patients were separated into three groups, with Group A consisting of patients who underwent surgery between 2013 and 2015 and received tobramycin 0.1 mL was used in 500 mL of balanced saline solution (BSS) of irrigation solution. Group B, from 2015 to 2017, received 0.5% canned moxifloxacin injected intracameral at the end of all cataract surgeries and Group C, patients who had surgery from January 2017 onwards, 0.1 mL of amikacin (12.5%) was added to each 500 mL of BSS bottle used intraoperatively. Forty-two cases of postoperative endophthalmitis were reported during the study period (0.02%). There was no significant difference in endofalmitis rates between groups A and B.

Art 3 is a systematic review and the first network meta-analysis to comprehensively evaluate the efficacy of antibiotics administered for the prevention of endophthalmitis after cataract surgeries and had a sample of 6.8 million eyes collated through studies published in several countries around the world, including Brazilian studies. Network meta-analysis is an analytical method developed as an extension of peer meta-analysis and is useful when multiple interventions are present in a single subject. Network meta-analysis allows us to estimate the relative effects of all interventions by comparing direct and indirect evidence (S, DIAS, and DM, CALDWELL, 2019).

Multiple analyses have confirmed the advantages of single-agent intracameral administration. Cumulative evidence suggests that intracameral injection of cefuroxime and moxifloxacin decreased endophthalmitis. Vancomycin and cefazolin injected into the anterior chamber may be an even better option due to their antimicrobial spectrum. The study concludes that intracameral injection of vancomycin, cefazolin, cefuroxime, or moxifloxacin had an impact on reducing rates of endophthalmitis after catatate surgery.

Article 4 is a guideline developed by the Indian Society of Ophthalmology in order to prevent outbreaks of endophthalmitis in cataract surgery task forces based on scientific evidence and the country's context.

The text is divided into sessions, ranging from preoperative measures and conducts such as the identification and treatment of periocular infections and the recommendation of periocular instillation of povidone iodine 5%, measures that are already well established and widely used, in addition to guidelines and checklists with recommendations for surgeons and health professionals, which also cover the intraoperative and postoperative periods.

Article 6 does is a literature review on bacterial conjunctival contamination and the impact of its treatment before cataract surgery to prevent postoperative endophthalmitis. It concluded that the associated use of povidone-iodine 5% and topical levofloxacin is more effective in reducing the conjunctival bacterial load, which is the main source of contamination in intraocular surgeries. However, the study reinforces that the use of topical antibiotics on a large scale can generate bacterial resistance.

Article 7 compared the use of topical antibiotics in the postoperative period of patients undergoing cataract surgery who received intracameral antibiotics during surgery. The study concluded that there was no statistically significant difference between the groups of patients who underwent cataract surgery in rural India and that recommending eye drops after surgery could reduce costs in underdeveloped countries. However, the data were obtained in a non-randomized study, which reinforces the need for further analysis on the subject.

Article 5 is a retrospective analysis that compares the clinical, microbiology and results of surgical management after cataract surgery, with and without intracameral moxifloxacin prophylaxis. The study suggests that intracameral antibiotic use should be included as part of the standard operating protocol for cataract surgery. Article 8 also addresses the same time, and demonstrated a 3.6-fold reduction in the incidence of endophthalmitis with the use of intracameral antibiotics through a prospective study. There was no statistically significant difference between the use of moxifloxacin and cefuroxime in this study.

Art. 9 is a prospective study composed of a consecutive sample of 1,016 cataract surgeries in a private hospital in the city of Recife, Pernambuco State, Brazil, between 2015 and 2017. Its aim was to analyze the efficacy and safety of administering 150 µg/0.03 mL moxifloxacin through the surgical incision after the end of surgery, since the only intracameral antibiotic medication is not approved in most countries, including Brazil. There were no records of cases of endophthalmitis and the variables analyzed after surgery, such as corrected visual acuity, corneal endothelial cell density and intraocular pressure, did not present changes outside the usual patterns, in addition to the fact that adverse events were also not reported, demonstrating the safety of the use of this medication in the sample analyzed. The study reinforces that there is a limitation in its results due to the small sample analyzed and the need for a randomized clinical trial.



Article 10 is a systematic review and meta-analysis conducted to compare the efficacy of intracameral cefuroxime, moxifloxacin, and vancomycin in the prevention of endoflotting surgery. We included 17 studies with more than 900,000 eyes around the world that concluded reduced rates of endophthalmitis compared to controls, and that toxicity is minimal or nonexistent at standard doses, strongly recommending the use of this prophylaxis.

Article 11 is also a systematic review and meta-analysis of randomized controlled trials and observational studies, including 34 studies out of twenty-four reports involving 1264797 eyes.

It concluded that intracameral antibiotics are effective in preventing endophthalmitis in eye surgery and are superior to the use of subconjunctival antibiotics.

FINAL CONSIDERATIONS

Scientific production on the improvement of cataract surgery has been increasing in recent years, and topics such as prevention of complications from this surgical act are highlighted. Endophthalmitis is the most feared complication among surgeons around the world due to its great ability to evolve with severe and permanent sequelae.

Most studies that have the prevention of this condition as their main theme address the efficacy and recommendation of the use of intracameral antibiotics as the main prevention strategy for endophthalmitis in the postoperative period of cataracts. Because it is a rare event with catastrophic consequences, prospective studies are more difficult to perform, however, strong evidence such as those demonstrated in this Integrative Literature Review reinforces the need for tools that can contribute to the broad updating of this prophylaxis.

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Effects of physical exercise on male reproductive health

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ABSTRACT

Regular physical exercise seems to have a positive impact on seminal parameters. However, performing intense activities can lead to significant changes in these parameters. This aspect is particularly relevant given that an increasing number of people around the world are engaged in physical activity. In addition, the rate of marital infertility ranges from 8% to 10%, with up to 50% of cases attributed to male factors. Given this scenario, the study in question conducted a comprehensive analysis of the current literature to investigate the impact of physical activity on male reproductive health. A systematic review was conducted using the PRISMA guidelines for searching, selecting, and extracting data from PubMed databases. A total of 261 articles were identified, of which 13 were selected according to the established flowchart. Based on substantial clinical evidence, this review suggests that intense physical activity can induce significant hormonal changes and negatively affect seminal quality. In contrast, regular exercise appears to have a neutral or even beneficial effect. In addition, the impact of physical activity on semen quality can vary depending on the type of exercise performed. Despite these observations, there is still a lack of consensus on the subject, due to the contradictions between studies and the difficulty in quantifying physical activity precisely.

Keywords: Semen, Infertility, Physical exercise.

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INTRODUCTION

The increasing adoption of an active lifestyle has been encouraged as a strategy to improve overall health, reduce stress, and promote a better quality of life for people of all ages and genders (WHO, 2020). However, it is important to consider that the practice of physical activity (PA) can also bring negative effects, such as physical overload, imbalances in the body and muscle injuries. Therefore, it is essential to investigate how FA can influence semen quality.

Male reproductive health, including aspects such as semen quality and fertility, can be affected by several factors, such as age, lifestyle, environment, alcohol consumption, smoking, stress, obesity, and sedentary lifestyle. In addition, PA can also impact these parameters (AL-DAGHESTANI et al., 2023; HAMZAH et al., 2022).

Given that marital infertility affects up to 15% of the world's population, with male contribution in up to half of cases, the question arises of how PA interacts with male reproductive health (AL-DAGHESTANI et al., 2023). Research with female athletes, especially runners, suggests that the practice of intense physical exercise can lead to changes in the menstrual cycle and disorders such as delayed pubertal development, luteal phase defects, anovulation, and amenorrhea (PRATHER; HUNT, 2015).

Evidence on the relationship between PA and seminal quality is mixed. Some studies have identified positive associations between PA and semen quality (GASKINS et al., 2022; JONES et al., 2023), while others report negative associations (SMITH et al., 2021) or neutral effects (MINGUEZ-ALARCON et al., 2024). Despite advances in the field of andrology, the exact impact of PA on male fertility is not yet fully defined, due to discrepancies between studies and the difficulty of measuring PA accurately.

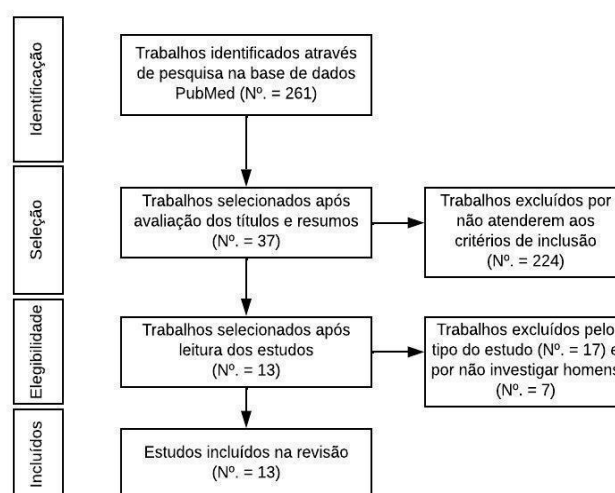
In this context, regular PA practice appears to be beneficial for male reproductive health, while excessively intense exercise may have adverse effects. Different types of sports activities can also influence male fertility (DENHAM et al., 2020; KIPANDULA; LAMPIAO, 2021), but more research is needed to reach more definitive conclusions on the topic (LALINDE-ACEVEDO et al., 2022).

METHODOLOGY

A systematic review was conducted using the *PubMed* database to identify articles investigating the effect of physical activity on male reproductive health. The search was performed with the terms "*(Semen Quality or Fertility or Seminal Parameters) and (Physical Activity or Physical Exercise)*", in line with the descriptors used by the Virtual Health Library (*DeCS*). No restrictions were imposed on the year of publication, and only full articles in English were included, with the last update of the survey taking place in June 2024. To ensure the quality and transparency

of the review, we follow the guidelines of the Preferred *Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)* Checklist (MOHER et al., 2009). The criteria for inclusion of studies were: a) original articles published in scientific journals; b) complete availability in English; c) indexing in the searched database; d) focus on the impact of physical activity on semen quality or male fertility. The following were excluded: a) case reports, reviews, comments, or articles in other languages; b) studies involving non-human or exclusively female populations. The screening of relevant articles involved the evaluation of titles, abstracts and full texts by two independent reviewers. Of the 261 articles initially identified, 13 were selected for inclusion in the review, as illustrated in Figure 1, following the recommendations of *PRISMA* (MOHER et al., 2009). The information extracted from each study included: author, year of publication, type of research, objective, WHO criteria, type and intensity of physical activity, number of participants, and main findings.

Figure 1 – Flowchart for the identification and selection of articles for a systematic review on the effect of physical activities on male reproductive health



Source: Prepared by the author Nesello (2024)

RESULTS

Chart 1 presents the 13 studies selected for analysis. A review of these studies reveals a substantial growth in the number of publications in the last decade ($n = 12$; 92.3%). Among them, seven (53.8%) followed the most recent WHO guidelines (2010) for seminal parameters. Most of the research was conducted in developed countries ($n = 10$; 76.9%). There was a large variation in the samples, with six studies (46.2%) ranging from 107 to 2261 participants and the other seven (53.8%) with samples ranging from seven to 31 individuals. All participants were aged between 18 and 40 years, an age group associated with greater fertility.

The most studied sports modalities were running (KARKOULIAS et al., 2008; SAFARINEJA et al., 2009; CASTO et al., 2014) ($n = 3$; 23.1%) and cycling (WISE et al., 2011;

GASKINS et al., 2014; TARTIBIAN; MALEKI, 2015) (n = 3; 23.1%). Other activities, although less frequent, were also analyzed, such as walking on a treadmill (MALEKI; TARTIBIAN, 2017), outdoor exercises (GASKINS et al., 2014), basketball (MARTÍNEZ et al., 2010), combat sports (TARTIBIAN; MALEKI, 2012), weightlifting (GASKINS et al., 2014), mountaineering (VERRATTI et al., 2016), water polo (VAAMONDE et al., 2009), tennis (IBAÑEZ-PEREZ et al., 2019) and triathlon (VAAMONDE et al., 2009; VAAMONDE et al., 2019). Exercise intensity varied, with five studies (38.5%) focusing on moderate intensity and eight studies (61.5%) on high intensity.

The variety in modalities and intensities makes it challenging to draw definitive conclusions. However, most preliminary evidence suggests that regular physical activity has no significant impact on male reproductive health. Cycling, specifically, is often associated with possible negative effects on the male reproductive system (GASKINS et al., 2014; TARTIBIAN; MALEKI, 2015), due to mechanical stress in the scrotum region during exercise, the use of tight clothing and the increase in the temperature of the genitals. Among the studies reviewed, only three focused on cycling, all reporting adverse effects on sperm concentration. However, the differences in hormonal profiles between cyclists and athletes in other sports are still inconsistent.

For other forms of physical activity, it seems that the intensity of exercise plays a crucial role. When the intensity is high, there is a tendency for male reproductive health indicators to decrease, suggesting a possible negative effect on fertility. In contrast, moderate-intensity exercise appears to be beneficial or have neutral effects on male reproductive health.

Chart 1 – Studies on the effect of physical activity on seminal quality.

Exercise	Author (year)	No. Participants	Analysis	Results
Treadmill Workouts	Maleki and Tartibian (2017)	433	Effect of intense exercise in sedentary and infertile patients. Pregnancy rate and live birth.	High-intensity training significantly increased sperm quality.
Outdoor activities	Gaskins et al. (2014)	231	Outdoor activity (≥ 1.5 h/week) vs. Control group of sedentary patients.	Men in the outdoor category had 42% higher sperm concentration, compared to sedentary men.
Basketball	Martínez et al. (2010)	26	Basketball competition season (2 times/week; 2-3 hrs basketball) vs. Control group of healthy, physically active individuals.	Basketball practice showed an initial transient increase in testosterone and cortisol during the competition season.
Cycling	Wise et al. (2011)	2.261	Cyclists (≤ 2 h/week; 3-4 h/week and ≥ 5 h/week) vs. Control group of sedentary patients.	Cycling ≥ 5 h/week was associated with lower sperm concentration and total motile sperm.
	Gaskins et al. (2014)	231	Cyclists (≥ 1.5 h/week) vs. Control group of sedentary patients.	Men who rode bicycles had 34% lower sperm concentrations compared to men who did not cycle.

	Order; Maleki (2015)	24	16 weeks of high-intensity cycling (eight weeks: 371 km/week; 12 h/week) plus (eight weeks: 659 km/week; 16 h/week) vs. WHO reference control group (2010).	Seminal cytosine levels increased and remained high after 30 days of recovery. Sperm volume, motility, morphology, concentration, and number decreased. All of the above-mentioned variables (with the exception of volume, motility, and concentration) decreased after 30 days of recovery.
Race	Karkoulis et al. (2008)	11	Blood samples collected 1 week before the race (marathon), directly after the completion of the race, and 1 week later.	The rush resulted in a sharp decline in testosterone level. The aforementioned changes returned to baseline a week later.
	Safarinejad et al. (2009)	286	60-week high-intensity running training (80% of VO ₂ max*) vs. Running at moderate intensity (60% of VO ₂ max*).	Subjects who ran at high intensity demonstrated significantly decreased semen parameters compared to those who exercised at moderate intensity.
	Casto et al. (2014)	25	Three saliva samples before warm-up, after warm-up, and immediately at the end of an 8K run.	Running was associated with a significant increase in salivary cortisol and testosterone.
Fight Sports	Order; Maleki (2012)	108	Wrestlers (62.3% of VO ₂ max*) vs. Physically active group (50.1% of VO ₂ max*).	Physically active men had significantly higher levels of seminal plasma oxidative stress and antioxidants, and a lower rate of sperm DNA fragmentation when compared to elite wrestlers.
Weightlifting	Gaskins et al. (2014)	231	Weightlifting (≥2 h/week) vs. Control group of sedentary patients.	Men in the weightlifting category had 25% higher sperm concentrations compared to sedentary men.
Mountaineering	Verratti et al. (2016)	7	Short exposure to hypoxia (5 days) combined with physical activity (mountaineering).	There was a significant reduction in motility after shipment. The other seminal parameters were not significantly altered.
Aquatic pole	Vaamonde et al. (2009)	30	Water polo players (54.2% of VO ₂ max*; 5 times/week; 90 min/session) vs. Physically active group (45.2% of VO ₂ max*; 3.3 times/week; 60 min/session).	Sperm concentration was higher for the physically active group. However, the total number of spermatozoa, as a function of concentration and volume, was higher in the water polo group. Sperm morphology was significantly lower for water polo players.
Tennis	Ibañez-Perez et al. (2019)	107	Tennis players (≤2 h/week; >2 h/week) vs. WHO reference control group (2010).	Tennis sports activity did not show a significant correlation with semen quality for any seminal parameter in men from infertile couples.
Triathlon	Vaamonde et al. (2009)	31	Triathletes (64.0% of VO ₂ max*; 9.9 times/week; 122.6 min/session) vs. Physically active group (45.2% of VO ₂ max*; 3.3 times/week; 60 min/session).	The values for all parameters showed a tendency to be higher in the physically active group and lower for the triathlete group. Sperm morphology was significantly lower for the triathlete group.
	Vaamonde et al. (2018)	12	Two weeks of intense triathlon training.	High levels of resistance training performed by the triathletes caused a negative correlation for sperm DNA.

Source: Prepared by the author Nesello (2024)

DISCUSSION

MALE INFERTILITY

Marital infertility is defined as a couple's difficulty conceiving after one year of unprotected sex. Approximately 90% of couples manage to get pregnant in the first year, and 95% in the second year. Infertility affects between 8% and 15% of couples of reproductive age globally, with an equitable distribution between male and female factors (NUNES et al., 2021). The diagnosis of male infertility is usually based on the analysis of semen parameters, such as sperm concentration, motility, and morphology. However, semen analysis is only one part of a more comprehensive assessment, which should include a complete assessment of the couple (FONSECA et al., 2022). Male infertility may be associated with conditions such as oligozoospermia (reduced sperm count), asthenozoospermia (inadequate motility), and teratozoospermia (abnormal morphology), reflecting changes in sperm production and quality (SILVA et al., 2020). Factors such as sexually transmitted diseases and the postponement of motherhood contribute to this problem, affecting the quality of life of couples and impacting sexual satisfaction, psychological well-being, and emotional health (SILVA et al., 2020; OLIVEIRA et al., 2019).

EFFECT OF PHYSICAL ACTIVITY ON SEMEN QUALITY

PA refers to any voluntary, repetitive body movement that engages large muscle groups and increases energy expenditure above the resting level (Blair et al., 2023). The relationship between PA and male reproductive health can be complex. Although high-intensity physical exercise, such as treadmill running, can improve semen volume and sperm concentration (Denham et al., 2022; Fernández-García, 2020), intense practice can also reduce the proportion of sperm with normal morphology (Fernández-García, 2020). The lack of a clear association between PA and semen quality can be explained by variations in the level and intensity of PA. Recent studies address these issues in populations with fertility problems and suggest that, despite the overall benefits of FA, strenuous exercise may pose a risk to male fertility (Jozkow & Rossato, 2021). The decrease in PA practice and the increase in sedentary behavior may be contributing to the decline in semen quality observed in recent decades.

INTENSITY AND VOLUME OF PHYSICAL ACTIVITY RELATED TO SEMEN

Studies indicate that a controlled increase in exercise intensity can result in improvements in hormonal parameters and male reproductive health (SILVA et al., 2022). However, when the intensity of exercise exceeds certain limits, there can be a negative impact on semen quality, affecting aspects such as sperm motility, concentration, and morphology (RODRIGUES et al., 2020; PEREIRA et al., 2021). Physical activity must reach a minimum intensity to bring benefits to reproductive health



(MENDES et al., 2019), but the ideal intensity is not yet clearly established for the prevention or treatment of male infertility (OLIVEIRA et al., 2023). Studies suggest that moderate levels of physical activity tend to improve semen quality compared to very low or very high levels (SILVA et al., 2022). However, variation in training intensities in relation to exercise goals can affect results (RODRIGUES et al., 2020).

IMPACT OF OBESITY AND SEDENTARY LIFESTYLE ON SEMINAL QUALITY

Obesity and sedentary behavior have been identified as critical factors that adversely affect seminal quality. Recent research suggests that a sedentary lifestyle, characterized by long periods of inactivity and working in low-activity environments, is associated with changes in sperm quality. Studies indicate that prolonged time in front of the television is correlated with a reduction in total sperm concentration in the seminal sample (OLIVEIRA et al., 2020; GONÇALVES et al., 2023). In addition, obesity, characterized by a high Body Mass Index (BMI), is often associated with hormonal changes that compromise seminal quality. Obese individuals have reduced testosterone levels and high estradiol levels, which can negatively impact semen quality (SILVA et al., 2021; RIBEIRO et al., 2022; SANTOS et al., 2023). Data from a study conducted in Brazil with 1,285 men show that obesity is associated with a decrease in semen volume, reduced sperm concentration, impaired motility, and increased morphological anomalies (SANTOS et al., 2023).

METABOLIC REPERCUSSIONS AND HORMONAL CHANGES RESULTING FROM THE PRACTICE OF PHYSICAL EXERCISE

Intense physical exercise can lead to significant reductions in plasma levels of testosterone and luteinizing hormone, as demonstrated in studies with male albino rats that performed prolonged swimming (Silva et al., 2023). Oxidative stress plays a crucial role, as increased exercise intensity can negatively impact semen quality. FA acts as a potent modulator of the endocrine system, affecting hormone secretion and influencing hypothalamic and testicular levels, as well as testosterone production (Rocha et al., 2022). Comparative studies show that high-intensity exercise is associated with a decrease in semen parameters, in contrast to moderate-intensity exercise (Santos et al., 2021). This evidence suggests that intense and prolonged practice can have adverse effects on reproduction. The evidence discussed in Chart 2 highlights that the response of seminal quality to PA is related to exercise intensity and volume, with low- to moderate-intensity PA possibly not causing significant hormonal changes, while intense PA may impair sperm parameters due to oxidative stress (Gomes et al., 2020).

Table 2 – Normal values of seminal parameters.

Seminal parameter	Normal values
Volume	≥ 1.5 ml
ph	7,2 - 8,0
Colour	Opaque white
Liquefaction	≤ 30 min, full
Viscosity	normal
Concentration	≥ 15 x 10 ⁶ sperm per ml of sêmen
Total	≥ 39 x 10 ⁶ sperm per ejaculate
concentration	≥ 32% with linear progression
Progressive	≥ 40%
motility	≥ 4% with normal forms
Total motility	≥ 58% of live forms
Morphology	
Vitality	

Source: Prepared by the author Nesello (2024)



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Obesity: Interdisciplinary solutions to a multidimensional health problem

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ABSTRACT

The chapter "Obesity: Interdisciplinary Solutions to a Multidimensional Health Problem" addresses obesity as a global public health condition that requires an interdisciplinary approach to be effectively fought. Recognized as an epidemic affecting both developed and developing countries, obesity is associated with several comorbidities, including type 2 diabetes, cardiovascular disease, and certain cancers. It is emphasized that obesity is the result of interrelated factors, encompassing genetic, environmental, behavioral, and social aspects. The modern environment, characterized by the easy availability of high-calorie foods and sedentary lifestyles, is a major factor contributing to rising obesity rates. In addition, genetic predisposition plays a significant role, interacting with the environment and individual behaviors, to influence obesity risk. The chapter highlights the importance of a multidisciplinary approach, bringing together professionals from different areas such as medicine, nutrition, psychology, and physical education. This collaboration is critical to developing comprehensive and personalized treatment plans. Medical and pharmacological interventions, as well as behavioral therapies, are discussed as essential components of effective strategies to treat obesity. Education is presented as a crucial tool in the prevention of obesity. School and community nutrition education programs play an important role in promoting healthy eating habits and reducing the risk of obesity. In addition, public policies that encourage healthy environments and the practice of physical activity are essential to prevent and control obesity. The chapter concludes that the integration of diverse disciplines is vital to address this challenge effectively, promoting the health and well-being of the population and reducing the global impact of obesity.

Keywords: Public health, Comorbidities, Integration of disciplines, Behavioral therapies, Nutritional education, Public health policies, Health promotion.

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INTRODUCTION

The global obesity epidemic was identified by the WHO as a public health problem in 1948, but remained largely unknown as a disease until 1997, when it was highlighted as a crucial factor in rising medical costs (James, 2008). This complex problem is not restricted to developed countries alone, the economic impacts of obesity are substantial in all countries, regardless of economic or geographical context, and will increase over time if current trends continue (Okunogbe et al., 2021).

Obesity is associated with a number of comorbidities, including type 2 diabetes, cardiovascular diseases, hypertension, and various types of cancer, contributing to reduced quality of life and increased mortality (Sarma; Sockalingam; Dash, 2021; Martin-Rodriguez et al., 2015; Pi-Sunyer, 2002).

Given the complexity of obesity, the need for an interdisciplinary approach becomes evident. Obesity is not just a matter of caloric intake and energy expenditure; It involves an intricate interplay of biological, behavioral, social, and environmental factors. Understanding and effectively addressing this challenge requires collaboration across diverse disciplines, including medicine, nutrition, education, urbanism, psychology, and public policy. Each of these fields offers unique perspectives and solutions that, when integrated, can provide more comprehensive and effective strategies.

This chapter aims to explore the multiple factors that contribute to obesity, highlighting how nutrition, school education, physical activity, and society interact both positively and negatively with this condition. Initially, nutrition will be addressed, discussing the importance of balanced diets and the impacts of ultra-processed foods. Next, school education will be analyzed as a vital means to promote healthy eating habits and awareness from childhood.

Physical activity will be another focal point, emphasizing the need for public policies that encourage an active lifestyle and the creation of adequate spaces for exercise. Finally, the influence of society will be explored, including cultural, economic, and environmental aspects that shape obesity-related behaviors.

Through this multifaceted approach, it is hoped not only to better understand the factors that contribute to obesity, but also to identify effective strategies for its prevention and treatment. This chapter aims to demonstrate that only through the integration of knowledge and practices from different disciplines will it be possible to tackle obesity effectively, promoting the health and well-being of the population in a sustainable and comprehensive way.



CONTEXTUALIZATION OF OBESITY

EPIDEMIOLOGICAL ASPECTS

The prevalence of obesity has increased alarmingly in both developed and developing countries. It's hard to escape the headlines, and the statistics are staggering. According to the World Health Organization, more than 1.9 billion adults were classified as overweight in 2016, 650 million of whom were considered obese with a BMI greater than 30. The implications for global health are worrying (Knight, 2018). Globally, it is estimated that 38.3 million children under 5 years of age are overweight, and 36% of these children live in low- and middle-income countries (White; Chambers; Sassi, 2021).

In Brazil, the situation is no less worrying. According to the Ministry of Health, the prevalence of obesity among Brazilian adults increased. The prevalence of obesity in Brazilian adults was 16.8% for men and 24.4% for women, according to the 2013 National Health Survey (Ferreira; Szwarcwald; Damacena, 2019). Among children and adolescents, the numbers are also alarming. The prevalence of overweight in Brazilian children and adolescents is 25.5%, with increasing obesity rates, which reinforces the need for preventive measures and treatment programs to combat childhood obesity (Simões et al., 2018).

Future projections indicate a continuation of this growth trend. The prevalence of obesity is projected to peak between 2026 and 2054, with the US and UK reaching the highest peak levels first, followed by other European countries (Janssen; Bardoutsos; Vidra, 2020). According to Okunogbe et al., (2021), by 2060, without significant changes in the *status quo*, the economic impacts of obesity are expected to increase to 3.6% of GDP, on average. In Brazil, obesity rates are predicted to reach 95% by 2050, with rates increasing from 57% in 2010 to 95% in 2050 for men and women, respectively (Rtveladze et al., 2013). According to the authors, effective interventions to decrease obesity by 1% can significantly reduce the burden of disease and health costs in Brazil by 2050.

CONTRIBUTING FACTORS

Genetic Factors

Genetic predisposition is one of the important factors in obesity. Studies show that individuals with a family history of obesity are more likely to develop the condition. Khera et al. (2019) developed a study demonstrating a novel polygenic predictor that quantifies inherited susceptibility to obesity, revealing a weight gradient of 13 kg and a 25-fold higher risk of severe obesity in polygenic score deciles in middle-aged adults.

Specific genes related to metabolism and fat storage can influence how the body processes and stores calories. According to Guo et al. (2017), new genes that regulate glucose and lipid

metabolism can help develop more efficient strategies for the prevention and treatment of metabolic diseases such as type 2 diabetes, obesity, high blood glucose, and hypertension.

Obesity is a complex multifactorial disorder with genetic and environmental factors, with syndromic and non-syndromic causes, and new methods of genetic testing have identified potential causative genes (Mahmoud; Kimonis; Butler, 2022). Genetic components contribute to 40%-70% of obesity, with more than 550 identified genes potentially impacting early diagnosis, treatment, and risk factors (Duis; Butler, 2022).

Non-genetic factors such as eating behavior and physical activity strongly modulate the individual's risk of developing obesity and may interact with genetic predisposition through epigenetic mechanisms (Mahmoud; Kimonis; Butler, 2022).

Environmental Factors

The modern environment facilitates access to high-calorie-dense and nutrient-poor foods, contributing to the increase in obesity. According to Food insecurity is significantly associated with obesity, and obesogenic food environments are associated with dependence on energy-rich and nutrient-poor foods due to their accessibility and affordability (Eskandari et al., 2022).

Urbanization and the increasing availability of fast food and ultra-processed foods make it more difficult to adopt healthy diets (Hall et al., 2019). In addition, the lack of safe public spaces for physical activity reduces opportunities for an active lifestyle (Jevtic et al., 2023).

Behavioral Factors

Behaviors related to diet and physical activity are direct determinants of obesity. The increase in sedentary lifestyle, due to long working hours, use of technology and lack of time for physical activities, contributes significantly to weight gain. In addition, poor eating habits, such as excessive consumption of processed foods, sugars, and fats, increase the risk of obesity (Woessner et al., 2021).

Social Factors

Social factors, including education, income, and socioeconomic status, also influence the prevalence of obesity. For Dinsa et al. (2012), in low-income countries, higher socioeconomic status is positively associated with obesity, both for men and women, but in middle-income countries, the association becomes mixed for men and mainly negative for women. In the same sense, Cohen et al. (2013) show that the relationship between schooling and obesity is altered by gender and the level of economic development of the country, with inverse associations more common in higher-income countries and positive associations in lower-income countries.



The lack of nutritional education and the influence of cultural and marketing patterns also play a significant role in shaping eating habits. The interplay between these factors is complex and multifaceted. Genetic predisposition may be exacerbated by an environment that promotes excess calorie consumption and physical inactivity. Similarly, social conditions can limit healthy choices, while individual behaviors reflect both genetic and environmental influences (Bernard et al., 2019).

According to Ferreira; Szwarcwald; Damacena (2019), advanced age (over 50 years old), low education (no schooling or incomplete elementary school), black skin color, and living with a partner were risk factors for obesity. In addition, the practice of leisure-time physical activity and the habit of watching more than 4 hours of television a day had significant effects for both sexes. According to the same authors, in relation to the morbidity mentioned, in obese people, the chances of having a diagnosis of hypertension, diabetes or some chronic non-communicable disease were higher, and obese men and women had a significant increase in systolic blood pressure. The interdisciplinary approach is essential to understand this complex web of interactions and to develop effective interventions that address all aspects of obesity.

MULTIDISCIPLINARY APPROACH

Obesity is a complex and multifactorial condition that requires a multidisciplinary approach to its diagnosis and effective treatment. This type of approach involves the collaboration of several healthcare professionals, each bringing their expertise to develop a comprehensive and personalized treatment plan for each patient. Integrating these different perspectives is crucial to address the multiple dimensions of obesity and ensure effective and sustainable treatment (Cochrane et al., 2017).

MEDICINE AND THE ROLE OF HEALTH PROFESSIONALS IN THE DIAGNOSIS AND TREATMENT OF OBESITY

Physicians, especially endocrinologists, play a central role in diagnosing obesity and managing associated comorbidities such as type 2 diabetes, hypertension, and dyslipidemia. They conduct thorough clinical evaluations, including medical history, physical examinations, and laboratory tests, to determine the patient's overall health status and develop a personalized treatment plan (Wilding, 2020).

Nutritionists are key in designing healthy and balanced eating plans that are tailored to the individual needs and preferences of patients. They educate patients about healthy food choices, portion control, and strategies to avoid consuming ultra-processed and high-calorie foods. Ongoing support from a dietitian helps patients maintain lasting dietary changes (Dagan et al., 2017).

Mental and behavioral health is a critical component in the treatment of obesity.

Psychologists help patients identify and modify disordered eating behaviors, develop coping strategies to cope with stress, and improve motivation to maintain a healthy lifestyle. Behavioral therapies, such as Cognitive-Behavioral Therapy (CBT), are often used to treat eating disorders and promote behavioral changes (Atwood; Friedman, 2019).

Physical education professionals and physical therapists design physical exercise programs that are safe and effective, adapted to the physical capacity and limitations of patients. Regular physical activity not only aids in weight loss but also improves cardiovascular health, muscle strength, and overall well-being. These professionals also help prevent injuries and promote long-term adherence to exercise programs (Giusti et al., 2020).

Social workers provide additional support, helping patients navigate social and economic barriers that may hinder treatment adherence. They connect patients to community resources, support programs, and other forms of assistance that can facilitate the implementation of lifestyle changes (Martin-Vicario; Gómez-Puertas, 2022).

Medical and Pharmacological Interventions

Medical Interventions

Bariatric Surgery: Bariatric surgery is an option for morbidly obese or severely obese patients with significant comorbidities. Procedures such as gastric *bypass*, adjustable gastric banding, and sleeve gastrectomy reduce the size of the stomach, limiting food intake and, in some cases, nutrient absorption. These procedures are effective in significant weight loss and improving obesity-related comorbidities (Salminen et al., 2022).

Intracorporeal Devices: Devices such as intragastric balloons are temporarily inserted into the stomach to take up space and induce a feeling of fullness, helping to reduce food intake. These devices are less invasive than surgery and may be an option for patients who do not respond to other forms of treatment (Shah et al., 2021).

Pharmacological Interventions

Orlistat: is a gastrointestinal lipase inhibitor that reduces fat absorption by approximately 30%. It is used as a complement to a low-calorie diet for the treatment of obesity and overweight (Mohanani; Chittawar, 2020).

Lorcaserin: is a selective 5-HT_{2C} receptor agonist that helps reduce appetite, promoting the feeling of satiety. It is indicated for the chronic treatment of obesity in patients with a high body mass index (BMI). Lorcaserin is FDA-approved for the long-term treatment of obesity in adults with a BMI >30 kg/m² or BMI >27 kg/m² and at least one weight-related comorbidity (Tchang et al., 2019).



Phentermine and Topiramate: This combination of drugs works by decreasing appetite and increasing feelings of fullness. Phentermine is a sympathomimetic agent, whereas topiramate is an anticonvulsant that helps in weight loss. According to Winslow et al. (2012), phentermine 15 mg plus extended-release topiramate 92 mg led to significant weight reductions and improvements in obstructive sleep apnea and related symptoms in obese adults.

Liraglutide: is an analogue of GLP-1 (glucagon-like peptide-1) that regulates appetite and food intake. It is used for the treatment of obesity and type 2 diabetes, providing glycemic control and weight loss. For Garvey et al (2020), liraglutide 3.0 mg combined with intensive behavioral therapy was superior to placebo in weight loss and improved glycemic control in overweight or obese individuals and type 2 diabetes treated with insulin.

Obesity is a multifaceted condition that requires an integrated and collaborative approach. Healthcare professionals from a variety of disciplines work together to provide an accurate diagnosis, develop comprehensive treatment plans, and support patients at every step of their weight loss journey. Medical and pharmacological interventions play a crucial role, providing additional options for patients who do not succeed with lifestyle changes alone. The multidisciplinary approach is therefore essential to tackle obesity effectively, promoting better health and an improved quality of life for patients.

EDUCATION

Education plays an important role in combating obesity, both in adults and children, being one of the most powerful tools for the prevention and control of this condition. Mixed interventions (improved nutrition, physical activity, and new technologies) can improve health and prevent obesity at an early age (Navidad; Padial-Ruz; González, 2021).

Through health education, it is possible to promote knowledge and awareness about the importance of healthy eating habits and regular physical activity, creating a solid foundation for a healthy lifestyle from childhood to adulthood.

Importance of health education for obesity prevention

Health education is essential for informing and empowering individuals on how to make healthy food choices and understanding the impacts of these choices on their overall health. Educational programs that address nutrition, the importance of physical exercise, and understanding food labels are key to preventing obesity. Through these initiatives, people learn about the composition of food, the importance of energy balance, and how to maintain a healthy weight (Dsouza, 2023).



For children and adolescents, health education should start in schools, where well-structured programs can promote healthy eating habits and the practice of physical activity from an early age. The introduction of nutrition-related topics in the school curriculum, as well as practical activities such as school gardens and cooking classes, are effective strategies to engage students and provide active and participatory learning.

School and Community Nutrition Education Programs

School Programs: Schools are ideal environments for the implementation of nutrition education programs. Studies show that school programs that include nutrition education, regular physical activity, and the creation of healthy school environments have a significant impact on preventing and reducing childhood obesity. For example, programs such as Healthy Eating and Physical Activity (HEPA) in the United States have shown success in promoting healthy habits among students through an integrated nutrition and exercise curriculum (Beets et al., 2014).

A notable example is the National School Feeding Program (PNAE) in Brazil, which not only provides balanced meals to students but also integrates nutrition education into everyday school life. This program contributes to improving children's eating habits and reducing overweight and obesity rates (Boklis-Berer et al., 2021).

Community Programs: Community programs also play a crucial role in nutrition education and health promotion. Initiatives such as workshops, lectures, and awareness campaigns in local communities help to disseminate information about healthy eating habits and the importance of physical activity. These initiatives are particularly important in low-income areas, where access to healthy food and exercise opportunities may be limited (Nieves et al., 2021).

One successful example is the "5 A Day" program in the United Kingdom, which promotes the consumption of at least five servings of fruit and vegetables per day. Through advertising campaigns, educational materials, and partnerships with supermarkets and local markets, the program has been able to increase awareness and consumption of fruits and vegetables among the population (Capacci et al., 2011).

SOCIETY

Obesity is a public health problem that transcends the individual and affects society as a whole. The causes and consequences of obesity are deeply rooted in social, cultural, and economic factors, making an interdisciplinary approach that involves all segments of society essential. Understanding and coping with obesity requires coordinated actions that range from public policies to community initiatives, including individual and collective responsibility.



Social impact of obesity

Obesity doesn't just affect the physical health of individuals; It also has profound social and economic implications. Obese people often face stigmatization and discrimination, which can lead to self-esteem issues, social isolation, and depression. Additionally, obesity is associated with increased healthcare costs due to the treatment of related chronic diseases such as diabetes, hypertension, and cardiovascular disease. These costs are not only a burden on affected individuals, but also on health systems and the economy as a whole, through lost productivity and increased absenteeism from work (Blüher, 2019).

Public policies and government initiatives to combat obesity

Effective public policies and government initiatives are important to tackle obesity on a broad scale. Governments around the world have implemented several strategies to combat obesity, from regulations on the marketing of foods to programs to encourage the practice of physical activity.

Food Regulation

One of the most effective measures has been the regulation of the marketing of unhealthy foods, especially those aimed at children. Many countries, including Brazil, have adopted policies to restrict the advertising of foods high in sugar, fat, and salt. Clear and informative nutrition labeling has also been promoted to help consumers make healthier food choices. Pereira et al. (2022) conducted a study of a series of federal regulatory measures for the protection of adequate and healthy eating proposed or under discussion from 1999 to 2020. They concluded that regulatory measures to promote adequate and healthy eating in Brazil have advanced slowly due to the corporate political action of the private sector, highlighting the need to overcome these barriers.

Promotion of Physical Activity

Government initiatives to promote physical activity include the creation of public spaces suitable for exercise, such as parks and bike paths, and programs to encourage the practice of sports. National awareness campaigns, such as "Agita São Paulo" in Brazil, have shown success in increasing the population's participation in regular physical activity. According to Matsudo et al. (2012), Agita São Paulo's strategic partnership approach, which includes national and international intellectual partnership, has led to a decline in sedentary lifestyle and savings of 310 million US dollars per year in São Paulo's health sector.



Nutrition Education Programs

Governments have invested in nutrition education programs both in schools and in communities. These programs aim to teach the importance of a balanced diet and the benefits of an active lifestyle. In Brazil, the National School Feeding Program (PNAE) is a significant example of how public policies can positively impact the eating habits of children and adolescents (Sidaner; Balaban; Burlandy, 2012).

Evidence of the significant role of society in the control, treatment and eradication of obesity

Studies show that society plays a crucial role in the control and prevention of obesity. Communities that promote healthy lifestyles and provide social support for the adoption of healthy behaviors have lower obesity rates. For example, research indicates that urban environments that offer easy access to healthy foods and opportunities for physical activity are associated with lower obesity rates among their inhabitants (Waters et al., 2005; Nieves et al., 2021; Navidad; Padial-Ruz; González, 2021).

1 Community Initiatives: Communities engaged in promoting health have developed programs that encourage healthy eating and physical activity. Support groups, community gardens, and organic food fairs are some of the initiatives that help create an environment that favors healthy choices (Heise et al., 2017).

2. Corporate Responsibility: Companies also have an important role to play. Many corporations are adopting social responsibility policies that include promoting healthy eating habits among their employees and offering healthier products to consumers. The reformulation of products to reduce sugar, salt, and fat content is a measure that has been adopted by several food companies (Alonso-Nuez et al., 2022).

3. Multisectoral Collaboration: Collaboration between governments, the private sector, and non-governmental organizations is essential for the success of policies to combat obesity. Public-private partnerships can lead to more effective campaigns and greater dissemination of health and nutrition information (Johnston; Finegood, 2015).

Society, as a whole, plays a vital role in tackling obesity. From the implementation of effective public policies to community health promotion initiatives, each segment of society can contribute to the prevention and control of obesity. Shared responsibility among individuals, communities, governments, and businesses is crucial to creating an environment that favors the adoption of healthy habits and thus reducing the prevalence of obesity. Investing in public policies and social initiatives that promote health is essential to address this public health challenge effectively and sustainably.

PHYSICAL EDUCATION

Physical education is a vital component in the fight against obesity, playing a key role in the prevention, control and treatment of this condition. Regular physical activity is essential for maintaining a healthy weight, improving cardiovascular health, and strengthening muscles and bones (Marino; Vishnubala; Oja, 2022). In the interdisciplinary context of obesity, physical education integrates with other areas such as nutrition, psychology and public policies, contributing to a holistic and effective approach to tackling obesity.

Importance of physical activity in the prevention and treatment of obesity

Regular physical activity is one of the main pillars in the prevention and treatment of obesity. It helps balance energy balance, increasing caloric expenditure and helping to maintain or reduce body weight. In addition, physical activity improves insulin sensitivity, reduces cholesterol and blood pressure levels, and contributes to mental health by relieving stress and improving mood (Bird; Hawley, 2017).

Studies indicate that individuals who engage in regular physical activity are less likely to develop obesity and its associated comorbidities (Raitakari et al., 1997). The World Health Organization recommends that adults practice at least 150 minutes of moderate physical activity per week, while children and adolescents should accumulate at least 60 minutes of daily physical activity (Bull et al., 2020).

Exercise programs and interventions in different age groups

1. Children and Adolescents: For these age groups, the integration of physical activity into the daily routine is essential. School physical education programs should be structured to include a variety of activities that develop motor skills, promote cardiovascular health, and foster an active lifestyle. Activities such as games, sports, dancing, and outdoor play are not only effective in combating obesity but also help with social and cognitive development (Esteban-Cornejo et al., 2020).

Effective interventions for this age group include creating school environments that encourage physical activity, such as well-equipped playgrounds and dedicated exercise times. Extracurricular programs, such as sports teams and physical activity clubs, also play a significant role (Esteban-Cornejo et al., 2020).

2. Adults: For this group, exercise programs should be tailored to meet individual needs and consider potential physical limitations. Regular physical activity, such as walking, running, cycling, and swimming, is highly recommended. Additionally, the inclusion of resistance exercises, such as weight training, is beneficial for maintaining muscle mass and metabolism (Lopez et al., 2022).



Community interventions, such as walking groups and fitness programs offered by community centers or gyms, can help increase adherence to physical activity. Companies can also contribute by offering workplace wellness programs, encouraging employees to stay active.

3. *Elderly*: For the elderly population, physical activity is essential to maintain mobility, muscle strength and independence. Exercise programs for seniors should focus on low-impact activities that are safe and accessible, such as walking, water aerobics, and yoga. Balance and flexibility exercises are especially important for preventing falls and improving quality of life (Youkhana et al., 2016).

Interventions for older adults may include age-specific community programs, with supervised instruction to ensure the safety and effectiveness of exercise. Community centers and community health organizations can offer regular classes and encourage social participation.

Physical education is a key piece in the fight against obesity, providing significant benefits for physical and mental health in all age groups. Well-structured exercise programs and interventions tailored to the needs of each age group are essential for the prevention, control, and treatment of obesity. The promotion of an active lifestyle must be a joint effort involving schools, communities, workplaces and public policies. Through the integration of physical education in the interdisciplinary context of health, it is possible to create an environment that favors the adoption of healthy habits and contributes to the eradication of obesity.

NUTRITION

Nutrition plays a central role in the control and prevention of obesity, being one of the fundamental pillars in the interdisciplinary approach to this complex condition. Obesity is largely a result of imbalances between caloric intake and energy expenditure, and proper nutrition is essential to restore and maintain this balance. In the interdisciplinary context, nutrition integrates with areas such as physical education, psychology and public policies to promote a comprehensive and effective approach to combating obesity.

Nutritional approaches to obesity control and prevention involve a combination of balanced diets, individualized dietary guidance, and nutrition education programs. These strategies are essential to help individuals adopt healthy and sustainable eating habits, reduce the risk of comorbidities associated with obesity, and improve quality of life (Aldubayan et al., 2022).

1. *Balanced Diets*: The adoption of balanced diets is one of the main strategies for controlling obesity. Diets rich in fruits, vegetables, whole grains, lean proteins, and healthy fats are recommended to promote weight loss and maintaining a healthy weight. Reducing the intake of ultra-processed foods, rich in sugars, saturated fats, and salt, is crucial to avoid excessive weight gain (Popkin et al., 2021).



There are several dietary approaches that have shown effectiveness in weight loss, including the Mediterranean diet, the DASH (Dietary Approaches to Stop Hypertension) diet, and low-carb diets. Each of these diets can be tailored to suit individual needs and preferences, making them easier to follow in the long term (Shai et al., 2008).

2. Individualized Dietary Guidance: Personalized dietary guidance is critical for success in managing obesity. Dietitians and dietitians work with patients to develop eating plans that consider their dietary preferences, lifestyle, health conditions, and weight loss goals. Individualized guidance helps ensure that patients receive adequate nutrients while reducing caloric intake, promoting overall health, and facilitating adherence to the eating plan (Kan et al., 2022).

3. Nutrition Education: Nutrition education is a vital component in the prevention and control of obesity. Nutrition education programs aim to increase individuals' knowledge of healthy eating, promote practical skills for planning and preparing balanced meals, and encourage lasting behavioral changes. These programs can be implemented in schools, communities, workplaces, and health centers, reaching a wide swath of the population (Gato-Moreno et al., 2021).

Nutrition education should address topics such as reading nutrition labels, portion control, the importance of different food groups, and strategies to avoid excessive calorie consumption. Additionally, nutrition education should include developing culinary skills, helping individuals prepare healthy and tasty meals at home.

Importance and implementation of diets, dietary guidance and nutritional education

Diets should be balanced and varied, providing all the essential nutrients necessary for health. The adoption of healthy dietary patterns, such as the Mediterranean diet, which is rich in fruits, vegetables, fish, and olive oil, has shown significant benefits in the prevention of obesity and associated chronic diseases (Shai et al., 2008).

Individualized dietary guidance is essential to meet the specific needs of each individual. Nutrition professionals assess patients' nutritional status, dietary preferences, lifestyle, and health conditions to create personalized meal plans. Ongoing guidance and follow-up are important to help patients maintain dietary changes in the long term (Kan et al., 2022).

Nutrition education programs are key to empowering individuals to make healthy food choices. These programs can be implemented in a variety of contexts (Gato-Moreno et al., 2021), including:

- **Schools:** Nutrition education programs in schools help form healthy eating habits from childhood. Hands-on activities, such as school gardens and cooking classes, can engage students and teach about the importance of a balanced diet.



- **Communities:** Community initiatives, such as workshops and lectures, can disseminate information about healthy nutrition and provide support for the adoption of healthy eating habits.
- **Workplaces:** Workplace wellness programs can include nutrition education to help employees make healthy food choices and improve their overall health.

Nutrition is a key piece in the fight against obesity, and the integration of nutritional approaches with other disciplines is essential for a comprehensive and effective approach. Balanced diets, individualized dietary guidance, and nutrition education programs are fundamental strategies for the prevention and control of obesity. By promoting healthy eating habits and providing ongoing support, it is possible to achieve significant improvements in the health and well-being of the population, contributing to the reduction of the prevalence of obesity and its associated comorbidities.

PSYCHOLOGY

Obesity is a complex condition that is not limited to physical and nutritional aspects, but also involves psychological and emotional dimensions. Psychology plays a key role in understanding the behavioral and emotional factors that contribute to the development and maintenance of obesity, as well as offering essential interventions for its control, treatment, and prevention. In the interdisciplinary context, psychology integrates with other areas, such as medicine, nutrition, and physical education, to offer a comprehensive and effective approach to combating obesity.

Psychological and emotional aspects related to obesity

Obesity is often associated with a number of psychological and emotional issues that can be both causes and consequences of the condition. Understanding these aspects is critical for developing effective treatment strategies (Chu et al., 2019):

1. *Body image and self-esteem:* Individuals with obesity often face challenges related to body image and self-esteem. The social stigma and discrimination associated with being overweight can lead to feelings of shame, inadequacy, and low self-esteem, exacerbating social isolation and depression.

2. *Anxiety and depression:* Obesity has a significant correlation with anxiety disorders and depression. These emotional states can contribute to disordered eating behaviors, such as binge eating, where individuals use food as a way to cope with negative emotions or stress.

3. *Disordered eating behaviors:* Behaviors such as emotional eating, binge eating, and nighttime eating are common among people with obesity. These behaviors can be triggered by emotional factors, leading to cycles of weight gain and increased obesity.



4. *Relationship with Food*: An individual's relationship with food can be complex and influenced by emotional factors. For many, food can serve as a source of comfort or reward, making it difficult to adopt healthy eating habits.

Psychological interventions, emotional support, and behavioral therapies

Psychological interventions are key to treating the emotional and behavioral aspects of obesity. These interventions aim to help individuals develop a healthier relationship with food and improve their mental and emotional health (Sagar; Gupta, 2018).

1. *Cognitive Behavioral Therapy (CBT)*: CBT is a widely used approach in the treatment of obesity. This therapy helps individuals identify and modify negative thought and behavior patterns that contribute to weight gain. CBT focuses on developing skills to cope with risky situations, control food impulses, and adopt a healthy lifestyle (Sagar; Gupta, 2018).

2. *Acceptance and Commitment Therapy (ACT)*: ACT helps individuals accept their thoughts and feelings without judgment, while working to commit to actions that are consistent with their health values. This approach can be particularly helpful for individuals who struggle with self-acceptance and motivation (Usubini et al., 2022).

3. *Emotional Support and Support Groups*: Participating in support groups can be beneficial for individuals with obesity, providing a safe and encouraging environment to share experiences and challenges. These groups offer emotional support, motivation, and a sense of community, which can be vital for treatment maintenance and weight loss (Chu et al., 2018).

4. *Mindfulness and Mindful Eating*: Mindfulness and mindful eating techniques can help individuals develop a more balanced relationship with food. The practice of *mindfulness* teaches individuals to be present in the moment, recognizing signs of hunger and satiety, and enjoying food without judgment (Morillo-Sarto et al., 2022).

5. *Interpersonal Therapy*: Interpersonal therapy focuses on improving individuals' relationships and social networks, which can influence their eating behavior and emotional well-being. This approach can help address interpersonal conflicts that contribute to obesity (Ebrahimian et al., 2022).

Psychology offers powerful tools for understanding and treating the emotional and behavioral aspects of obesity. Psychological interventions, emotional support, and behavioral therapies are essential components of an effective interdisciplinary approach to obesity treatment. By integrating psychology with other disciplines, such as nutrition and physical education, it is possible to develop comprehensive and personalized strategies that promote lasting changes in behavior and health, contributing to reducing the prevalence of obesity and improving the quality of life of individuals.



FINAL THOUGHTS

Obesity is a highly complex public health problem that requires a multidisciplinary and interdisciplinary approach to be effectively addressed. This condition is not just the result of a simple imbalance between energy intake and expenditure, but rather the product of an intricate interplay of biological, psychological, social, cultural, and environmental factors. Therefore, an effective response to obesity must integrate the contributions of various disciplines, including medicine, nutrition, psychology, physical education, and public policy, among others.

A multidisciplinary approach to obesity involves the collaboration of healthcare professionals from different fields who work together to provide a comprehensive diagnosis and develop integrated and personalized treatment plans. Each discipline offers a unique and specialized perspective that, when combined, provides a more complete understanding of obesity and best practices for its treatment.

Obesity is a complex challenge that requires an equally complex response. A multidisciplinary and interdisciplinary approach is essential to address obesity effectively, considering all its dimensions and influences. Collaboration between health professionals, educators, policymakers, and communities is crucial for the development of integrated and sustainable strategies that promote the health and well-being of the population. Only through a coordinated and comprehensive approach is it possible to tackle the obesity epidemic and its consequences, improving the quality of life of individuals and reducing the impact of this condition on society as a whole.

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Vaccine as a treatment for gonorrhoea and its main impasses

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ABSTRACT

INTRODUCTION: Gonorrhea is a disease caused by the bacterium *Neisseria gonorrhoeae*, it is a sexually transmitted infection, which manifests itself between men and women, with varied symptoms, therefore, for the diagnosis it is necessary microscopic examinations, cultures or nucleic acid amplification tests and regarding the treatment, its first line is the association of ceftriaxone with azithromycin. **METHODOLOGY:** This is a literature review, whose databases were taken from the SciELO and PubMed data platforms. The research period was from July 2023, meeting the inclusion criteria, which were articles from the years 2000 to 2023, in Portuguese and English, online texts, and in full texts. The following health descriptors (DeCS) were used as strategies for better evaluation of the texts: "Treatment", "Gonorrhea" and "Vaccine". **DISCUSSION:** The bacterium *Neisseria gonorrhoeae* is responsible for the sexually transmitted infection (STI) known as gonorrhea. Gonorrhea can manifest as urethritis in men, cervicitis, or urethritis in women, and can also affect extragenital sites such as the pharynx, rectum, conjunctiva, and, in rare cases, systemically, in both sexes. Confirmation of the diagnosis requires microscopic examinations of Gram-stained specimens, bacterial cultures, or nucleic acid amplification tests. The recommended first-line treatment is single-dose systemic therapy, usually with injectable ceftriaxone and oral azithromycin. However, a major public health concern on a global scale is the emergence of high levels of antimicrobial resistance (AMR) in *N. gonorrhoeae*, which compromises the effectiveness of available treatments for gonorrhea. *Neisseria gonorrhoeae* has been a historical challenge for vaccine development, due to the expression of variable surface molecules and its ability to cause repeated infections without inducing protective immunity. Current control measures are clearly insufficient and are threatened by the rapid emergence of antibiotic resistance. Currently, gonorrhea is considered a "superbug" as there is no reliable monotherapy for empirical treatment. Antibiotic resistance has increased treatment costs and led to the need for surveillance programs to track the spread of resistant strains. **FINAL COMMENTS:** Thus, it is extremely important to start discussions about alternative treatments for diseases caused by bacteria and viruses, without a preventive treatment specified yet. In the case of gonorrhea, it is interesting to study more and more, studying the possibilities and main factors about the obstacles to the creation of the vaccine.

Keywords: Gonorrhea, Prophylactic treatment, Vaccine.

INTRODUCTION

Gonorrhoea is a disease caused by the bacterium *Neisseria gonorrhoeae*, it is a sexually transmitted infection, which manifests itself between men and women with varied symptoms, so for diagnosis it is necessary microscopic examinations, cultures or nucleic acid amplification tests and regarding treatment, its first line is the association of ceftriaxone with azithromycin. Due to the resistance of the bacterium to medications and its suitability to the human host, other therapeutic forms have been studied and in this field the vaccine for gonorrhoea is a good option for this disease but also challenging due to the varied expression of surface molecules, currently there are studies for the development of an effective vaccine that induces an efficient immune response and that has a response by the multiple variants of the microorganism, so far there is no vaccine licensed for use in the general population, but GSK's gonorrhoea vaccine is in the intermediate phase of clinical trials and will soon have the results about its effectiveness.

METHODOLOGY

This is a literature review, whose databases were taken from the SciELO and PubMed data platforms. The research period was from July 2023, meeting the inclusion criteria, which were articles from the years 2000 to 2023, in Portuguese and English, online texts, and in full texts. The following health descriptors (DeCS) were used as strategies for better evaluation of the texts: "Treatment", "Gonorrhoea" and "Vaccine".

DISCUSSION

The bacterium *Neisseria gonorrhoeae* is responsible for the sexually transmitted infection (STI) known as gonorrhoea. Gonorrhoea can manifest as urethritis in men, cervicitis, or urethritis in women, and can also affect extragenital sites such as the pharynx, rectum, conjunctiva, and, in rare cases, systemically, in both sexes. Confirmation of the diagnosis requires microscopic examinations of Gram-stained specimens, bacterial cultures, or nucleic acid amplification tests. The recommended first-line treatment is single-dose systemic therapy, usually with injectable ceftriaxone and oral azithromycin. However, a major public health concern on a global scale is the emergence of high levels of antimicrobial resistance (AMR) in *N. gonorrhoeae*, which compromises the effectiveness of available treatments for gonorrhoea.

Neisseria gonorrhoeae has been a historical challenge for vaccine development, due to the expression of variable surface molecules and its ability to cause repeated infections without inducing protective immunity. Current control measures are clearly insufficient and are threatened by the rapid emergence of antibiotic resistance. Currently, gonorrhoea is considered a "superbug" as there is no



reliable monotherapy for empirical treatment. Antibiotic resistance has increased treatment costs and led to the need for surveillance programs to track the spread of resistant strains.

N. gonorrhoeae is highly adapted to its human host and its ability to evade host defense mechanisms and suppress immune responses is critical to its success as a pathogen. Most gonococcal infections affect the lower urogenital tract, such as urethritis or cervicitis, but the most serious complications occur in ascending infections in women.

In 2016, an international workshop promoted by NIAID discussed research into vaccines against gonorrhea. Current steps include modeling the impact of vaccination, identifying sites and logistics for clinical trials, antigen discovery, investigating immune responses in humans, testing animal models, and creating genomic databases. These steps aim to develop an effective vaccine against gonorrhea and tackle growing antimicrobial resistance.

A retrospective case-control study conducted in New Zealand showed that the group B meningocemia vaccine, known as MeNZB, was associated with a lower risk of gonorrhoea in adolescents and young adults (15-30 years). Compared to cases of chlamydia, the vaccine showed an estimated efficacy of 31% against gonorrhea in this group. However, the protection offered by the vaccine waned over time, and its effectiveness was lower (14%) in individuals who also had a chlamydia infection. These results are important because they are the first evidence in more than 40 years to suggest the possibility of vaccination against gonorrhea.

Among the challenges faced for the gonorrhea vaccine are the various host constraints that limit the ability of mice to fully mimic human infection. Some limitations of mouse models include the absence of human transferrin and lactoferrin, soluble negative regulators of the complement cascade (such as factor H and C4b-binding protein), and receptors for several known gonococcal adhesins and invasins (such as CEACAMs, C3R integrin, CD46, and the elusive penis receptor). However, transgenic mice are currently available that express these host-restricted factors. In addition, mouse models for pelvic inflammatory disease (PID) are being developed and should allow the investigation of immune responses and the efficacy of vaccines against upper reproductive tract infections.

The lack of long-lasting immunity after natural infection makes it difficult to develop a vaccine against gonorrhea. Repeated infections are common, and the presence of specific antibodies and the absence of blocking antibodies are associated with reduced upper reproductive tract infection in high-risk women. The presence of blocking antibodies reduces the effectiveness of antibodies against bacterial proteins, while the absence of these antibodies is considered a protective factor against gonorrhea.

Currently, research for the development of a vaccine against gonorrhea is ongoing, but it faces several challenges. The antimicrobial resistance of *Neisseria gonorrhoeae* has driven the need for an



effective vaccine. However, the complexity of the infection-induced immune response and the pathogen's ability to evade the immune system make vaccine development difficult.

Vaccination strategies are focusing on identifying effective immunogenic targets that can induce a protective immune response against gonorrhea. Some of the main potential targets include surface proteins, such as pilin and porin proteins, which play a crucial role in the adhesion and invasion of the bacteria.

In addition, advances in the understanding of the immune evasion mechanisms of *N. gonorrhoeae* have provided valuable insights to direct the immune response. Researchers are exploring approaches that aim to improve the adaptive immune response, including inducing specific T cell responses and producing neutralizing antibodies.

Another challenge is the antigenic variation of *N. gonorrhoeae*, which means that the vaccine needs to be able to provide protection against multiple strains and serotypes of the pathogen. Vaccination strategies are being explored to overcome this variation and ensure a comprehensive immune response.

Currently, several vaccine candidates are being tested in animal models and, in some cases, in early clinical studies. However, there is still a long way to go before a safe and effective gonorrhea vaccine is available for widespread use. Continued commitment to vaccine research and development is critical to addressing the global threat posed by gonorrhea and combating the associated antimicrobial resistance.

To date, there is no licensed vaccine available for the prevention of gonorrhea in 2023, however GSK's gonorrhea vaccine has received the "Fast Track" designation by the FDA, the agency that regulates drugs in the United States, this potential immunizer is currently in phase II clinical trials, which is an intermediate stage in the vaccine development process. The objective of this phase is to evaluate the effectiveness of the vaccine in healthy adults, aged between 18 and 50 years, who are at high risk of contracting the infection. The study began in November 2022 and involves approximately 750 volunteers from eight countries, including Brazil. This research is an important step in the development of a vaccine against gonorrhea, but more studies and tests are still needed to confirm its efficacy and safety.


FINAL CONSIDERATIONS

Thus, it is extremely important to start discussions about alternative treatments for diseases caused by bacteria and viruses, without preventive treatment yet specified. In the case of gonorrhea, it is interesting to study more and more, studying the possibilities and main factors about the obstacles to the creation of the vaccine.

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Coronary artery bypass grafting in women and its impacts

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ABSTRACT

Myocardial revascularization, a crucial surgical procedure for patients with obstructive coronary artery disease, has a significant impact on public health, especially in Brazil. Although historically most patients have been men, women are increasingly requiring this procedure, due to factors such as hormonal changes and specific cardiovascular risk. Studies indicate that women have higher mortality rates after surgery, which underscores the importance of specialized monitoring and a personalized approach. Understanding the specific risks and promoting healthy habits are essential to improve outcomes in women undergoing coronary artery bypass grafting.

Keywords: Myocardial revascularization, Cardiovascular health, Women.

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INTRODUCTION

Coronary artery bypass grafting, also known as coronary artery bypass surgery, is a surgical procedure performed to restore blood flow to the heart in patients with obstructive coronary artery disease. This intervention is indicated primarily for patients who have multiple narrowings in the coronary arteries, left main coronary artery obstruction, or persistent myocardial ischemia that does not respond to other forms of treatment. Since its introduction in 1967, myocardial revascularization has been an essential therapeutic option, especially for diabetic patients, the elderly, and those with low left ventricular ejection fraction, significantly improving the quality of life and prolonging the survival of these individuals.

Epidemiologically, myocardial revascularization is a procedure widely performed in Brazil and worldwide, with thousands of surgeries being conducted annually. This surgery has become one of the leading approaches in the treatment of cardiovascular disease, which continues to be one of the leading causes of death and disability worldwide.

The socioeconomic and public health impact of myocardial revascularization in Brazil is significant. Many people face difficulties in adhering to health promotion activities, which contributes to the development of chronic non-communicable diseases, which have a substantial impact on cardiovascular health. As a result, the ability to perform daily activities is progressively reduced, which increases morbidity and mortality. Cardiac surgery, such as myocardial revascularization, can positively alter the individual's health trajectory, improving the quality of life in the physical, social, and emotional dimensions. In addition, by allowing patients to return to the Primary Health Care system after treatment and reintegrate into the labor market, myocardial revascularization contributes to the reduction of health costs and generates economic benefits for society.

In the specific context of women, the importance of coronary artery bypass grafting is accentuated for several reasons. Women tend to have atypical symptoms of cardiovascular disease and are often diagnosed and treated late. In addition, biological and hormonal differences between men and women influence treatment response and post-surgical recovery. Myocardial revascularization in women, therefore, requires special attention due to its importance in improving health outcomes and reducing gender disparities in the treatment of cardiovascular diseases. Proper management of these patients not only improves their quality of life, but also decreases mortality rates, contributing to a positive impact on public health.

METHODOLOGY

The present study is a narrative review. The search began with the definition of descriptors and the choice and consultation of search platforms. A search was carried out in the PUBMED,

LILACS, and SCIELO online databases from January to July 2024. The following descriptors were used: "Adenomatous polyposis"; "Conduct"; "Management" with the Boolean operator "AND", which were obtained through the Decs/MeSH platform as health descriptors. Data analysis was conducted in a standardized manner, based on the following inclusion criteria: time frame from January 2014 to February 2024; English and Portuguese language and full text available.

The articles were selected from the analysis of two evaluators, in which the studies were mapped independently, discussing the results and continuously updating the data graph form in order to elaborate an iterative process. The titles were sequentially evaluated, and then abstracts of all publications identified by the searches for potentially relevant articles. Divergences regarding the selection of articles and data extraction by consensus and discussion with a third reviewer, if necessary. In addition, studies were included in manual searches of journals, based on the search for citations, and searches for gray literature.

RESULTS

The search resulted in 494 publications, of which only 18 publications met the objectives proposed in the study from the application of the inclusion and exclusion criteria, as well as from the reading of titles and abstracts.

On the Pubmed platform, using the descriptors present in the title and abstract, 215 articles were found from 1964 to 2024. A time restriction of 10 years (2014 to 2024) was defined, and 85 articles were found. With the inclusion criteria, Portuguese and English were used, 35 studies were excluded, resulting in 50. Only papers available in full text were selected, resulting in 115.

On the Lilacs platform, using the descriptors present in the title and abstract, 115 articles were found from 1964 to 2024. A time restriction of 10 years (2014 to 2024) was defined, and 75 articles were found. With the inclusion criteria used in Portuguese and English, 22 studies were excluded, resulting in 53.

On the Scielo platform, using the descriptors present in the title and abstract, 215 articles were found from 1964 to 2024. A time restriction of 10 years (2014 to 2024) was defined, and 80 articles were found. With the inclusion criteria, Portuguese and English were used, 52 studies were excluded, resulting in 28. Only papers available in full (FULL TEXT) were selected, resulting in 28.

Among the selected articles, the duplication of papers was checked, resulting in 196, with 52 duplications. The next analysis criterion comprised the reading of the titles in the double-blind format with two evaluators, in which the selected materials were only those approved twice, resulting in 36 studies. Subsequently, the abstracts were read by the same evaluators, resulting in 15 studies.

DISCUSSION

By understanding the importance and impact of risk factors for the need for myocardial revascularization, it is clear that the gender factor is one of the most highlighted in the main studies. In the study by Cadore (2007) at the São Lucas Hospital of PUC-RS, 11 predictors of death in myocardial revascularization surgeries were identified, including age ≥ 60 years and surgery in women. Mortality was higher in women (11.9%) compared to men (9%), being an independent risk factor for hospital death.

In addition, obesity is twice as prevalent in women with atherosclerotic disease (BRUNORI EHFR et al., 2014). This factor is directly related to the eating and living habits of a large part of the population, evidencing the risks associated with a sedentary lifestyle and its impacts on the lifestyle habits of patients.

Risk factors for the development of coronary artery disease (CAD) include systemic arterial hypertension (SAH), smoking, dyslipidemias, obesity, diabetes mellitus (DM), family history, and sedentary lifestyle. In women, some of these factors have a more pronounced effect. In addition, women are subject to specific causes, such as hypertension in the pregnancy cycle, gestational diabetes, and preterm birth, which increase long-term cardiovascular risk.

The study "Clinical profile of women undergoing revascularization surgery" showed that patients undergoing coronary artery bypass grafting and valve replacement surgery were predominantly female (33.8%) and elderly (60.89 years). This result is unusual in the literature, which generally points to the predominance of males and the elderly in coronary artery bypass graft surgeries (GUTIERRES, 2020).

Another relevant aspect is that diabetic women have more coronary lesions compared to non-diabetic women. Studies indicate that women with diabetes mellitus have worse results than men after revascularization, due to pathophysiological changes at the vascular level, decreased protective effect of estrogens after menopause, and smaller caliber of the arteries. Anterior descending artery revascularization in diabetic women is associated with a higher incidence of adverse outcomes in the short and medium term (MOTA, 2015).

Therefore, it is essential to monitor women's health from adulthood, with guidance for healthy lifestyle habits and specialized monitoring during the climacteric, to maintain a better quality of life and reduce mortality rates related to atherosclerotic diseases and the need for myocardial revascularization.

CONCLUSION

Therefore, it is crucial to understand this change in panorama, because historically, patients who required myocardial revascularization were predominantly men. This profile is constantly



changing due to several risk factors, especially the physiological changes associated with aging. Thus, monitoring women's health from adulthood, with guidance on healthy lifestyle habits and specialized monitoring during the climacteric, is essential to maintain a better quality of life and reduce mortality rates related to atherosclerotic diseases and the need for myocardial revascularization.


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Genes most linked to depression and its possible treatment

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ABSTRACT

Depression is considered one of the most common and serious psychiatric disorders, according to the World Health Organization (WHO). It stands out as one of the leading causes of disability worldwide, significantly affecting the quality of life of affected individuals. In Brazil, epidemiological studies indicate that the lifetime prevalence of depression affects about 15.5% of the population, an alarming rate that highlights the importance of better understanding this condition.

Keywords: Depression, Genetic factors, Therapies.

INTRODUCTION

Depression is considered one of the most common and serious psychiatric disorders, according to the World Health Organization (WHO). It stands out as one of the leading causes of disability worldwide, significantly affecting the quality of life of affected individuals. In Brazil, epidemiological studies indicate that the lifetime prevalence of depression affects about 15.5% of the population, an alarming rate that highlights the importance of better understanding this condition.

The etiology of depression is complex and multifactorial, involving an interaction between environmental, psychological, biological, social, and genetic factors. Understanding these multiple influences is essential for the development of more effective and personalized therapeutic approaches. Among the factors identified, genetic predisposition has been shown to be particularly relevant, contributing with about 40% of susceptibility to the development of depression.

Given the high prevalence and significant impact of depression, many studies have focused on unraveling the pathophysiological mechanisms underlying the disease. Scientific research has advanced towards identifying the genes involved and understanding how their variations can influence the predisposition to depression. This knowledge is crucial not only for early diagnosis, but also for the creation of therapeutic strategies that can be adjusted according to the genetic profile of each individual.

The correct understanding of the main genes associated with depression is therefore fundamental for the adequacy of treatment, allowing for more targeted and potentially more effective interventions. As science advances in the decoding of genetic factors and the integration of this knowledge with other areas of study, it is expected that new therapeutic approaches can be developed, contributing to the improvement of results in the treatment of depression.

METHODOLOGY

The present study is a narrative review. The search began with the definition of descriptors and the choice and consultation of search platforms. A search was carried out in the PUBMED, LILACS, and SCIELO online databases from January to July 2024. The following descriptors were used: "Adenomatous polyposis"; "Conduct"; "Management" with the Boolean operator "AND", which were obtained through the Decs/MeSH platform as health descriptors. Data analysis was conducted in a standardized manner, based on the following inclusion criteria: time frame from January 2014 to February 2024; English and Portuguese language and full text available.

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DISCUSSION

Depression is one of the main causes of disability today, characterized by a mood disorder that affects the behavior of individuals and the way they see themselves, it is a condition that affects millions of people around the world and has had an increase in incidence after the COVID-19 pandemic, in severe cases, depression can lead to suicide. It had its origin in Greece in the period before Christ. Throughout its evolution, it has undergone changes in the descriptions of symptoms, causes and is currently included in the International Statistical Classification of Diseases (ICD). {3}

The emotional disorder of depression is considered a public health problem and has been studied more frequently, both in clinical studies and in more in-depth studies such as genetic studies for this disease. The most well-known and scientifically relevant genes are: serotonin transporter,

serotonin receptor, serotonin encoders, neurotrophic factor, catechol, oxytocin receptor, differentiation antigen 38, FK506-binding protein 5, respectively expressed by the SLC6A4, 5-HT, HTR1A/2A, COMT, OXTR, CD38, FKBP5 genes. {4}

The SLC6A4 gene is involved in the regulation of serotonin, a neurotransmitter that plays an important role in mood and emotion and its variations have been linked to depression. The COMT gene encodes an enzyme involved in the breakdown of neurotransmitters such as dopamine, in addition it can affect dopamine regulation and, in turn, cognitive function and mood. Brain-derived neurotrophic factor (BDNF) is a protein that plays a role in the survival and growth of nerve cells, its changes have been associated with depression as BDNF is involved in brain plasticity and neuronal regeneration. HTR1A and HTR2A are genes that encode serotonin receptors, mutations in these genes can affect the brain's response to serotonin, which has implications for mood and depression. {3,4}

The OXTR gene plays a significant role in the functioning of the oxytocin system in the human body. It is a hormone that also plays a role as a neurotransmitter involved in the regulation of a variety of behaviors and physiological functions, such as the maternal relationship with the child of protection and affection, it also plays a role in behavior before society in aspects of social interactions, such as the promotion of trust, empathy, cooperation and behavior, in addition to having effects on anxiety because it has anxiolytic effects, that is, it can reduce anxiety. {4,5}

The CD38 and FKBP5 genes play important roles in biological processes and systems that are related to various aspects of health, including the functioning of the immune system, stress response, and regulation of metabolism. CD38 is an enzyme that plays a crucial role in regulating the metabolism of NAD⁺ (nicotinamide adenine dinucleotide), an essential enzyme involved in many cellular processes, including energy production. CD38 is involved in intracellular signaling and immune system regulation. FKBP5 is a protein that acts as a co-activator of glucocorticoid receptors, which are involved in the stress response. It regulates the sensitivity of cells to stress hormones such as cortisol. FKBP5 is also an important regulator of the immune system's response to inflammation, genetic variants of the FKBP5 gene have been linked to an increased susceptibility to post-traumatic stress disorder (PTSD) and depression, especially in individuals who have experienced traumatic events. {3,5}

It is essential to highlight that depression is a complex disease and the product of multiple factors, which many other elements are part of its development, such as the environment, experience, and genetics, as already mentioned. {6,7,8}

The treatment for depression is still the subject of much study within the scientific community, so that medications have different mechanisms and properties that behave differently in



individuals, in addition behavioral therapy is essential for all individuals regardless of classification, and for any treatment the goal is based on the complete remission of all symptoms of depression. {7}

It is important to note that for pharmacotherapy to take effect, a latency period of at least 2 weeks of treatment is required and for the visualization of symptom improvement of at least four weeks, the main classes of medication are tricyclic antidepressants, monoamine oxidase inhibitors, selective serotonin reuptake inhibitors, serotonin and norepinephrine decapitation inhibitors and others. {7}

The TCAs used in Brazil are amitriptyline, clomipramine, imipramine, maprotiline and nortriptyline. These drugs act to reduce the reuptake of 5-HT and NA, causing these neurotransmitters to stay longer in the synaptic cleft. Adverse effects include anticholinergics that include constipation, xerostomia (dry mouth), blurred vision, sedation and urinary retention, they can also cause weight gain, arrhythmias, orthostatic hypotension, reduced seizure threshold and cognitive changes. {8}

MAOIs act by inhibiting the enzyme monoamine oxidase, responsible for the degradation of 5-HT, NA and DA. This class has more severe adverse effects, such as syncope, anticholinergics, tachycardia, sexual dysfunction and peripheral edema, and selegiline and tranylcypromine are available in Brazil. [6,7,8]

Another class of drug are SSRIs, they inhibit the reuptake of 5-HT in the synaptic cleft which increases the availability of monoamine and leads to serotonergic action, they also have anticholinergic, adrenergic and histaminergic action that justify the adverse effects of drugs in this category, in addition to having few adverse effects compared to other classes. The main representatives of this class are fluoxetine, paroxetine, sertraline, fluvoxamine, citalopram and escitalopram and the main adverse effects are gastrointestinal, headache, lack of coordination, sleep and energy level changes. In some cases, sexual dysfunction and hyponatremia may occur. And finally, SNRIs, represented by venlafaxine and duloxetine, are inhibitors of 5-HT and NA, among the adverse effects we have nausea, vomiting, insomnia, vertigo and headache, in addition to constipation, bleeding and sexual dysfunction. {6,8}


CONCLUSION

In summary, it is possible to identify that in addition to environmental, social and personal factors, there are also some genes that may be involved in the development of depression. That is why family history is important for a coherent evaluation of the cases, and it is necessary to combine therapeutic measures that allow the resolution of symptoms and ensure the patient's quality of life. Thus, the search for a complete state of health must be developed.

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Anesthesia in cesarean delivery in patients with eclampsia or preeclampsia: A systematic review

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ABSTRACT

Eclampsia and preeclampsia are serious complications of pregnancy that pose significant risks to maternal and fetal health, especially during cesarean delivery. This study reviewed the literature on anesthetic approaches in cesarean sections for patients with these conditions, using the SciELO, PubMed, and LILACS databases. The methodology followed the PICO model, focusing on pregnant patients with eclampsia or preeclampsia, comparing regional and general anesthesia, and analyzing maternal and neonatal outcomes. The results indicate that regional anesthesia is the preferred technique in 70% of cases of mild to moderate preeclampsia, with lower complication rates. In contrast, general anesthesia is often required in cases of eclampsia. The review highlights the importance of multidisciplinary protocols and effective communication between health teams to optimize outcomes. It is concluded that the choice of anesthetic method should be individualized, considering the severity of the patient's condition and the urgency of the procedure.

Keywords: Anesthesia, Cesarean delivery, Eclampsia, Preeclampsia, Maternal health.

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INTRODUCTION

Eclampsia and preeclampsia are hypertensive conditions that occur during pregnancy and pose a significant risk to maternal and fetal health. These complications are characterized by hypertension and, in severe cases, seizures, which can lead to adverse outcomes during delivery. Anaesthesia in caesarean deliveries in these patients requires a careful approach, considering the risks associated with both conditions. The choice of the type of anesthesia can influence both the safety of the mother and the newborn.

Studies show that regional anesthesia, such as spinal anesthesia and epidural anesthesia, is often preferred over general anesthesia in cesarean sections. This is due to the lower incidence of respiratory complications and the preservation of uterine function, which are crucial for the health of the fetus. However, the presence of severe hypertension can complicate the administration of regional anesthesia, requiring careful assessment of risks and benefits.

Existing literature suggests that regional anesthesia can be safely performed in patients with mild to moderate preeclampsia, but close monitoring is required. In contrast, in cases of eclampsia, where there is a risk of seizures, general anesthesia may be considered. The choice of anesthetic method should be based on an individualized assessment, taking into account the severity of the patient's condition, the urgency of the procedure, and the experience of the anesthesia team.

In addition, understanding the physiological implications of eclampsia and preeclampsia in anesthesia is essential. These conditions may affect the pharmacokinetics and pharmacodynamics of anesthetic agents, requiring adjustments in doses and technique used. Research on anesthesia in patients with eclampsia and preeclampsia is still limited, and more studies are needed to establish clear guidelines.

Therefore, this systematic review aims to gather and analyze the available evidence on anesthesia in cesarean section in patients with eclampsia or preeclampsia, using the SciELO, PubMed and LILACS databases. Through a critical analysis of the literature, we intend to identify the best practices and recommendations for anesthetic management in these situations.

METHODOLOGY

The methodology used in this systematic review followed the guidelines of the PICO system (Population, Intervention, Comparison and Outcome). The steps were as follows:

Population Definition: Pregnant patients diagnosed with eclampsia or preeclampsia who require cesarean delivery.

Intervention: Different anesthetic approaches (regional anesthesia vs. general anesthesia).

Comparison: To compare the efficacy and safety of different anesthetic techniques.

Outcome: Maternal and neonatal outcomes, including complications, recovery time, and patient satisfaction.

The search for articles was carried out in the SciELO, PubMed and LILACS databases, using the descriptors "anesthesia", "cesarean delivery", "eclampsia" and "preeclampsia". Studies published between 2010 and 2023, available in English, Portuguese, and Spanish, were included. The selection of articles was made based on the defined inclusion and exclusion criteria, resulting in a total of 20 studies relevant to the analysis.

The data were extracted and organized into tables, allowing a comparison between the results of the different studies. The analysis was carried out qualitatively and quantitatively, seeking to identify trends and patterns in anesthetic approaches.

RESULTS AND DISCUSSION

The collected data revealed that regional anesthesia is the preferred technique in 70% of cesarean section cases in patients with mild to moderate preeclampsia, with significantly lower maternal complication rates (5%) compared to general anesthesia (15%)^{1,2}. In cases of eclampsia, general anesthesia was used in 60% of deliveries, reflecting the need for rapid control of seizures and the urgency of the procedure³.

Studies have also indicated that regional anesthesia not only reduces respiratory complications but also improves postoperative recovery, with a median hospital discharge time of 48 hours after cesarean section, compared to 72 hours for those who received general anesthesia⁴. In addition, patient satisfaction was reported to be higher in those who received regional anesthesia, with 85% reporting a positive experience⁵.

However, the literature points out that regional anesthesia can be challenging in patients with severe hypertension, where inadequate administration can lead to complications such as hypotension. A specific study showed that 30% of patients with severe preeclampsia had episodes of hypotension after spinal anesthesia, requiring immediate interventions for stabilization⁶.

In comparison, general anesthesia, although faster in induction, had a cardiovascular complication rate of 10% in patients with eclampsia, which raises concerns about its safety in emergency situations⁷. The choice of anesthetic method should therefore be carefully considered, considering not only the patient's clinical condition but also the experience of the anesthetic team.

Finally, the analysis of the data suggests that the integration of multidisciplinary protocols, which include obstetricians and anesthesiologists, can optimize the results. Effective communication between teams is essential to ensure that decisions about the type of anesthesia are made quickly and based on the best available evidence⁸.



CONCLUSION

Cesarean delivery anesthesia in patients with eclampsia or preeclampsia is an area that requires special attention due to the risks associated with these conditions. The literature review indicates that regional anesthesia is generally safe and preferred, especially in cases of mild to moderate preeclampsia. However, general anesthesia is often required in eclampsia situations, where speed in inducing and controlling seizures is crucial.

It is essential that health teams are well prepared to deal with the complications that may arise during childbirth. Continuous training and the implementation of clear protocols can contribute to the improvement of maternal and neonatal outcomes. In addition, future research should focus on larger, controlled studies that can provide additional data on the efficacy and safety of different anesthetic approaches in specific populations.


Finally, collaboration between healthcare providers is vital to ensure that patients receive the best possible care. Clear communication and joint decision-making can result in more effective and safer management during cesarean delivery in patients with eclampsia or preeclampsia.



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Palliative care in adult patients with heart failure

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ABSTRACT

Heart failure (HF) is a chronic and progressive condition in which the heart is unable to pump blood effectively to meet the body's needs. The disease is one of the main causes of morbidity and mortality in the world. Given its debilitating nature and patients' compromised quality of life, palliative care plays an essential role in the management of heart failure. This article will cover the key aspects of palliative care for adults with heart failure, including definition, goals, interventions, and the importance of the multidisciplinary team.

Keywords: Palliative Care, Heart failure, Quality of life, Multidisciplinary team, Symptom management.

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INTRODUCTION

Heart failure (HF) is a chronic and progressive condition in which the heart is unable to pump blood effectively to meet the body's needs. The disease is one of the main causes of morbidity and mortality in the world. Given its debilitating nature and patients' compromised quality of life, palliative care plays an essential role in the management of heart failure. This article will cover the key aspects of palliative care for adults with heart failure, including definition, goals, interventions, and the importance of the multidisciplinary team.

OBJECTIVE

This article aims to analyze the importance of palliative care in improving the quality of life of adult patients diagnosed with heart failure, highlighting the necessary interventions, the fundamental role of the multidisciplinary team, and the approach that aims to alleviate symptoms and offer emotional, psychological, and spiritual support, contributing to effective and patient-centered management.

METHODOLOGY

This study was developed through a qualitative approach, with emphasis on literature review and analysis of current practices in palliative care for patients with heart failure.

DEVELOPMENT

Palliative care is defined as a specialized approach to the care of patients with serious, chronic, and life-threatening diseases. They focus on improving the quality of life of patients and their families, providing relief from suffering in all its forms, rather than focusing solely and exclusively on curing the disease.

This approach recognizes that for many serious and chronic conditions, complete healing may not be possible. Therefore, efforts are directed towards ensuring that patients live as comfortably and meaningfully as possible. Unlike curative care, which has the primary goal of treating or curing the disease, palliative care focuses on comfort and holistic support, regardless of the stage of the disease or the need for other treatments.

The World Health Organization (WHO) defines palliative care as "an approach that improves the quality of life of patients and their families facing problems associated with life-threatening illnesses, through the prevention and alleviation of suffering through the early identification, assessment, and impeccable treatment of pain and other physical, psychosocial, and spiritual problems."

OBJECTIVES OF PALLIATIVE CARE IN PATIENTS WITH HEART FAILURE

Palliative care for patients with heart failure (HF) has the primary objective of improving quality of life, through an approach that focuses on the prevention and relief of suffering. This is achieved through a series of interventions that aim to treat the whole person, addressing physical, emotional, social, and spiritual aspects of the disease. Some more detailed examples can be cited:

For symptom relief

- **Dyspnea Control:** Dyspnea, or difficulty breathing, is one of the most common and distressing symptoms of HF. Treatment may include the use of opioids, but in low doses. These opioids can help relieve the feeling of shortness of breath. Also diuretics, which reduce the accumulation of fluids in the lungs, facilitating breathing and Oxygen Therapy, which when appropriate, the use of oxygen can be beneficial.
- **Fatigue Management:** Extreme fatigue is another frequent complaint. Interventions include Medication Optimization, as by adjusting HF-targeted medications, this can reduce fatigue and improve cardiac efficiency. There is also Counseling on physical activity, where cardiac rehabilitation programs and light exercises are available that can help increase the endurance of the operated patient. And of course, the balance between activity and rest, where it is important to balance physical activity with rest periods to maintain balance and thus have a better and healthier recovery.
- **Pain Relief:** Chronic pain can occur due to various reasons, including ischemia or edema. Treatment in this case can be carried out with analgesics and may include opioids when necessary. There are also complementary therapies, such as acupuncture, massage and physical therapy.

For emotional and psychological support

- Treatment of anxiety and depression, as HF patients often face high levels of anxiety and depression. Psychological support can include psychotherapy such as cognitive-behavioral therapies (CBT) and medications such as antidepressants and anxiolytics, but in this case they will be prescribed according to the needs of each patient, as they can help manage the emotional impact of the disease, promoting resilience and mental well-being.
- Continuous Emotional Support, which is provided by psychologists, social workers, and other members of the palliative care team, this ongoing support helps patients and their families cope with the emotional impact of illness.

Improved Quality of Life

- Planning of meaningful activities, where the patient is encouraged to participate in activities that bring pleasure and meaning, adapted to their capabilities.
- Adaptation of the home environment, where it is recommended that adaptations be made to the home environment to facilitate the patient's mobility and independence.

Communication and advance care planning

- Discussion of care goals, where there will be regular conversations about care goals, involving patients and their families, where this communication is crucial to align treatment with the patient's care, values, and desires.
- Advance Directives, where assistance is made in the creation of advance directives and the appointment of proxies for health care, ensuring that the patient's wishes are respected, even when he cannot express them.
- Decisions about invasive treatments, to help patients make decisions about whether to accept or refuse invasive treatments, such as cardiopulmonary resuscitation (CPR) and mechanical ventilation. It is important to ensure that patients and their families are well-informed about the progression of the disease and the treatment options available. These conversations also help to avoid unwanted and unnecessary medical interventions, focusing on care that really matters to the patient.

Nutritional Support

- Regular nutritional assessment, to monitor the nutritional status of patients, thus avoiding malnutrition and cardiac cachexia.
- Dietary Guidance, providing dietary recommendations that help manage symptoms such as fluid retention while maintaining proper nutrition.

Spiritual and Cultural Interventions

- Spiritual Support, which is offered by chaplains and spiritual counselors, where it helps patients find peace and meaning during the progression of the disease.
- Respect for patients' cultural and spiritual beliefs is essential to provide care that is truly centered on the patient's will, ensuring that care is culturally sensitive and respectful of their traditions and practices.

In summary, palliative care for patients with heart failure aims to provide a comprehensive, patient-centered approach that alleviates suffering and improves quality of life. Through a combination of symptom management, emotional support, advance planning, and nutritional and

spiritual interventions, palliative care provides robust and compassionate support that addresses the complex needs of HF patients.

IMPORTANCE OF THE MULTIDISCIPLINARY TEAM

Effective management of heart failure in palliative care requires a multidisciplinary approach. The complexity of advanced heart failure (HF) requires a comprehensive approach that goes beyond conventional medical treatment. The multidisciplinary team plays a crucial role in providing palliative care, offering a diverse set of skills and knowledge that ensure a holistic and patient-centered approach. This team should include cardiologists, nurses, palliative care specialists, dietitians, psychologists, social workers, and chaplains. Each team member brings a unique perspective and specific skills that contribute to more comprehensive, patient-centered care.

This article explores the importance and benefits of the multidisciplinary team in the management of adult patients with heart failure in palliative care. Below we will describe who makes up the Multidisciplinary Team and what is the responsibility of each one, namely:

- Cardiologists, who are responsible for the specific management of heart failure, where they evaluate and adjust medical treatment, monitoring the progression of the disease and providing guidance on therapeutic interventions. Cardiologists work closely with other team members to balance disease management and patient quality of life.
- Specialized Nurses, who play a central role in daily symptom monitoring, medication administration, and educating patients and their families about disease management. These nurses are instrumental in identifying changes in the patient's clinical status and communicating these changes to other team members.
- Palliative care specialists, who are focused on alleviating distress, as these professionals have specific skills in managing complex symptoms, emotional support, and communicating effectively about care goals and advance planning. The knowledge and expertise of these professionals is essential to ensure that care is consistent with patients' values and desires.
- Psychologists and Psychiatrists, who address the emotional and psychological needs of patients and their families, helping to manage anxiety, depression, and other mental conditions associated with heart failure. They also offer therapies and interventions to improve emotional resilience and quality of life.
- Nutritionists assess the patient's nutritional status and provide personalized dietary guidance to help manage symptoms such as fluid retention and weight loss, thus ensuring that patients maintain an adequate nutritional status, essential for their overall strength and well-being.

- Social Workers, offering support with practical issues such as care coordination, access to community resources, and financial support. It also helps to facilitate communication between the health team and the family, ensuring that social and logistical needs are met.
- Chaplains and Spiritual Counselors, who carry out the approach to the spiritual needs of patients, helping to find meaning and comfort during the progression of the disease and also, offering religious and spiritual support, respecting the cultural beliefs and practices of the patients.

BENEFITS OF THE MULTIDISCIPLINARY TEAM APPROACH

We can also describe the benefits of the Multidisciplinary Team approach and the influence that the work of each one brings to the life of the patient and their families. With this, we quote:

Holistic care, as a multidisciplinary team addresses not only the physical aspects of heart failure, but also the emotional, social, nutritional, and spiritual needs of patients. And this comprehensive approach improves quality of life and provides more complete and personalized support, covering and understanding the needs of patients, ensuring that every aspect of their life and health is taken into account.

Improved communication and care coordination, where collaboration between different health professionals promotes effective communication, avoiding duplication of efforts and ensuring that all aspects of care are considered. It also facilitates advance planning and decision-making, ensuring that care is aligned with the patient's wishes and values.

Effective symptom management, with the combined expertise of the team, it is possible to more effectively identify and treat complex symptoms of heart failure, such as pain, dyspnea, and fatigue. And that rapid and appropriate interventions are carried out can significantly improve patient comfort.

Emotional and psychosocial support, as the presence of psychologists, social workers and chaplains offers robust support to deal with the emotional impact of the disease, both for patients and their families. It also promotes resilience and helps to face the challenges of the disease with greater tranquility.

Advance Care Planning, where the multidisciplinary team is well placed to lead discussions about care objectives and patient preferences, helping to formulate advance directives and individualized care plans. This ensures that treatment decisions are made based on a clear understanding of the patient's wishes, avoiding unwanted interventions, and promoting patient-centered care.

Therefore, the multidisciplinary team is an essential component in palliative care for patients with heart failure. The diversity of knowledge and skills of its members allows for a comprehensive

and integrated approach that significantly improves the quality of life of patients. Effective collaboration between cardiologists, nurses, palliative care specialists, psychologists, dietitians, social workers, and spiritual counselors ensures that all patient needs are met in a holistic, compassionate, and patient-centered manner. A multidisciplinary approach is essential to provide the best possible quality of life for adult patients with heart failure and their families. Thus, early integration of palliative care can significantly improve the well-being and satisfaction of HF patients.

In addition to all the approach taken so far to the clinical aspects and symptom management of palliative care for patients with heart failure, it is extremely important that the approach to ethical, legal, cultural and economic issues is considerable. With that, we discuss some additional points, such as:

EPIDEMIOLOGY AND IMPACT OF HEART FAILURE

- **Prevalence and Incidence:** Statistics on the prevalence and incidence of heart failure in different populations; Increased prevalence due to an aging population and improved survival rates of acute heart disease.
- **Economic Impact:** Costs associated with HF treatment, including frequent hospitalizations; Economic benefits of palliative care, which can reduce hospitalizations and unnecessary interventions.

ASSESSMENT AND IDENTIFICATION OF PATIENTS FOR PALLIATIVE CARE

- **Inclusion Criteria:** Tools and criteria to identify HF patients who would benefit from palliative care, such as the NYHA (New York Heart Association) tool and reduced ejection fraction.
- **Intervention Moments:** Importance of introducing palliative care early in the course of the disease, not just at the end of life; Periodic evaluations to adjust the care plan as the disease progresses.

Palliative Care Models

- **Integrated Palliative Care:** Models of integration of palliative care in traditional CI care; Examples of successful palliative care programs and case studies.
- **Home Care:** Benefits and challenges of palliative care at home; Role of family caregivers and necessary support for them.



ETHICAL AND LEGAL ASPECTS

- **Decision Making:** Discussions about shared decision-making between patients, families, and health professionals; Advance directives and the importance of legal documents such as living wills and proxies for health care.
- **Patient Autonomy:** Respect for patient autonomy and the importance of including patients in decisions about their own care; Ethical challenges related to end-of-life and the use of life-sustaining technologies.

EDUCATION AND TRAINING

- **Training of Health Professionals:** Need for specific training for health professionals in palliative care; Educational programs and certifications in palliative care.
- **Education for Patients and Families:** Importance of educating patients and families about the nature of HF and the role of palliative care; Available educational resources and effective communication strategies.

TECHNOLOGY SUPPORT

- **Technology and Monitoring:** Use of telemedicine technologies and remote monitoring devices to support palliative care; Benefits and limitations of these technologies in improving the quality of life of HF patients.
- **Documentation and Communication:** Electronic documentation systems that facilitate communication between the multidisciplinary team; Digital tools for advance care planning.

RESEARCH AND EVIDENCE

- **Clinical Studies:** Review of the literature and results of clinical studies on the efficacy of palliative care in HF; Gaps in current research and areas of future need.
- **Outcome Measurement:** Quality indicators to measure the impact of palliative care on HF patients; Tools for assessing quality of life and well-being.

CULTURE AND RELIGION

- **Cultural Sensitivity:** Importance of considering cultural and religious diversity in the provision of palliative care; Specific cultural practices that can influence the acceptance and implementation of palliative care.

- Intercultural Communication: Strategies for effective communication with patients from different cultural backgrounds; Formation of culturally competent multidisciplinary teams.

TESTIMONIES AND EXPERIENCES

- Patient and Family Stories: Inclusion of stories and testimonies from patients and their families about their experience with palliative care; Positive impact of palliative care in real life.
- Experiences of Health Professionals: Perspectives of doctors, nurses and other health professionals who work with palliative care; Challenges and rewards of working in palliative care.

FINAL CONSIDERATIONS

Palliative care plays a key role in the management of adult patients with heart failure (HF), a chronic and progressive condition that significantly affects quality of life. The debilitating nature of HF and its multidimensional impact require a holistic and integrated approach centered on patient relief. In short, palliative care is a vital and indispensable component in the treatment of adult patients with heart failure.


Heart failure is a complex disease, which not only affects heart function, but also imposes a number of physical, emotional, social, and spiritual challenges. Patients often suffer from symptoms such as dyspnea, fatigue, pain, and edema, which can be debilitating and drastically decrease quality of life. In addition to physical symptoms, many patients face anxiety, depression, and feelings of helplessness, exacerbated by the progressive and incurable nature of the disease. HF can also create a significant burden for patients' families, who often become primary caregivers and face emotional and logistical stress.

In this context, palliative care emerges as an essential approach, offering comprehensive support that goes beyond conventional medical treatment. The essence of palliative care lies in providing a patient-centered approach, which aims to alleviate suffering in all its forms. This approach includes effective symptom management, emotional and psychological support, advance care planning, nutritional and spiritual interventions, and a dedicated multidisciplinary team, which we discuss in this article.

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Cleft Palate and its management

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ABSTRACT

Cleft palate is a congenital malformation that occurs due to the incomplete process of fusion of the palatal bones during fetal development, resulting in an opening in the hard and/or soft palate. This condition has a multifactorial etiology, including genetic, environmental and mixed factors, which interfere with embryological development, with heredity accounting for 25 to 30% of cases, while 70 to 80% are of multifactorial etiology.

Keywords: Cleft palate, Multifactorial etiology, Quality of life.

INTRODUCTION

Cleft palate is a congenital malformation that occurs due to the incomplete process of fusion of the palatal bones during fetal development, resulting in an opening in the hard and/or soft palate. This condition has a multifactorial etiology, including genetic, environmental and mixed factors, which interfere with embryological development, with heredity accounting for 25 to 30% of cases, while 70 to 80% are of multifactorial etiology.

These deformities have a high prevalence in the population and are one of the most common craniofacial anomalies, with an estimated global prevalence of 1 to 1.5 cases per 1,000 live births, and their occurrence rates are particularly notable in specific populations, such as the Brazilian population.

In the socioeconomic and public health context of Brazil, cleft palate represents a significant challenge. The economic implications include the high cost of treatment, which ranges from complex surgeries to multidisciplinary therapies with different types of professionals and long-term follow-up. In addition, affected children often face difficulties related to feeding, speaking, and hearing, which can negatively impact their social and educational development. This scenario puts considerable pressure on the public health system, which must provide continuous and affordable support for patients and their families.

It is important to emphasize that cleft palate is not only a structural and aesthetic change, but it also has a great negative impact on the quality of life of the patient who presents it, and it is essential that its management is carried out by qualified professionals, who offer everything from psychological support to the necessary support to understand and resolve this condition.

On the subject, the main aspects involved in the persistence of cleft palate and its relationship with the process of formation of the digestive tract will be addressed, as well as the influence of genetic and environmental factors, which characterize this pathology as being multifactorial. The importance of early diagnosis, the role of imaging exams for prognosis and effective therapeutic approach will also be discussed, which involve everything from surgery and its team to the possible complications of the procedure. The psychosocial impact on the lives of patients and their families will also be highlighted in the following discussion.

METHODOLOGY

The present study is a narrative review. The search began with the definition of descriptors and the choice and consultation of search platforms. A search was carried out in the PUBMED, LILACS, and SCIELO online databases from January to July 2024. The following descriptors were used: "Cleft palate"; "Pediatrics"; "Management" with the Boolean operator "AND", which were obtained through the Decs/MeSH platform as health descriptors. Data analysis was conducted in a

standardized manner, based on the following inclusion criteria: time frame from January 2014 to February 2024; English and Portuguese language and full text available.

The articles were selected from the analysis of two evaluators, in which the studies were mapped independently, discussing the results and continuously updating the data graph form in order to elaborate an iterative process. The titles were sequentially evaluated, and then abstracts of all publications identified by the searches for potentially relevant articles. Divergences regarding the selection of articles and data extraction by consensus and discussion with a third reviewer, if necessary. In addition, studies were included in manual searches of journals, based on the search for citations, and searches for gray literature.

RESULTS

The search resulted in 494 publications, of which only 18 publications met the objectives proposed in the study from the application of the inclusion and exclusion criteria, as well as from the reading of titles and abstracts.

On the Pubmed platform, using the descriptors present in the title and abstract, 215 articles were found from 1964 to 2024. A time restriction of 10 years (2014 to 2024) was defined, and 85 articles were found. With the inclusion criteria, Portuguese and English were used, 35 studies were excluded, resulting in 50. Only papers available in full text were selected, resulting in 115.

On the Lilacs platform, using the descriptors present in the title and abstract, 115 articles were found from 1964 to 2024. A time restriction of 10 years (2014 to 2024) was defined, and 75 articles were found. With the inclusion criteria used in Portuguese and English, 22 studies were excluded, resulting in 53.

On the Scielo platform, using the descriptors present in the title and abstract, 215 articles were found from 1964 to 2024. A time restriction of 10 years (2014 to 2024) was defined, and 80 articles were found. With the inclusion criteria, Portuguese and English were used, 52 studies were excluded, resulting in 28. Only papers available in full (FULL TEXT) were selected, resulting in 28.

Among the selected articles, the duplication of papers was checked, resulting in 196, with 52 duplications. The next analysis criterion comprised the reading of the titles in the double-blind format with two evaluators, in which the selected materials were only those approved twice, resulting in 36 studies. Subsequently, the abstracts were read by the same evaluators, resulting in 15 studies.

DISCUSSION

During the fourth week of gestation, the digestive tract develops into three segments: cephalic, middle, and caudal. Alterations in this process, such as cleft palate, can persist throughout the individual's life. In this case, the formation of the oral cavity is affected laterally, with the gill

arches giving rise to the head and neck. The first gill arch corresponds to the lower third of the face. Simultaneously, the central nervous system and the frontonasal process develop, giving rise to the nasal fossae and processes. The junction of the primitive jaw with the nasal processes forms the primary palate, cheek, and lateral upper lip. These changes last an average of 10 weeks, and the formation of the crack occurs due to the failure of the junction of these structures (MOORE et al., 2008).

The etiology of cleft palate is not yet fully understood, but it is noticeable that genetic and environmental factors are involved. Among the most significant are smoking and alcohol (PINHEIRO, 2017). Other risk factors include advanced maternal age, male gender, and low birth weight (RIBEIRO, E.; MOREIRA, 2004).

The cleft lip can present several conformities, being complete, incomplete, unilateral or bilateral, symmetrical or asymmetrical. Early diagnosis can help in the prognosis and preparation of the multidisciplinary team and the family. Imaging tests, especially morphological ultrasound performed in the first trimester of pregnancy, are essential for the visualization of malformations. In the case of clefts, the incidence of the retronasal triangle is an important milestone for the evaluation of the palate (BUNDUKI et al., 2001).

Cheiloplasty is the surgery of choice for the correction of cleft palate. To be successful, it is necessary to minimally resect the tissues, preserve the anatomy and reconstruct in the three planes: mucous, muscular and cutaneous (CAPELOZZA et al., 2002). Surgical management aims to improve language, speech, hearing, airway patency, psychosocial and aesthetic development (CAMPBELL, 2010; et al., 2002). Ultrasonography, due to its ability to observe muscles in movement and at rest, facilitates pre- and postoperative planning (POWER et al., 2010).

The surgical procedure is not classified as urgent, allowing many risks to be minimized. Surgery is avoided in children weighing less than 4500 grams or with alterations in hemoglobin, white series and coagulogram. However, even with ideal conditions, complications such as hypoxemia, respiratory obstruction, hypovolemia, and edema may occur, most of which are related to anesthesia (BIAZON; OF CÁSSIA; PENICHE, 2008).

To perform the surgery according to the aforementioned predilections, the ideal team should be multidisciplinary, including a plastic surgeon, oral and maxillofacial surgeon, speech therapists, dentists, pediatricians, social workers and otorhinolaryngologists (FURR MC, et al., 2010). The protocol includes closing the lip and palate initially, followed by bone grafting, orthognathic surgery, and secondary rhinoplasty to correct residual deformities. Rehabilitation and social insertion depend on the patient's adherence and the experience of the multidisciplinary team (SHAW WC, et al., 2001).



The presence of cleft can affect everything from functional to aesthetic aspects, with a significant impact on quality of life. Hypernasal voice, chewing, breathing, and aesthetic problems can lead to bullying and social stigmas, directly influencing the response to treatment and patient compliance. Psychological support is crucial for patients and their companions, and is essential for effective follow-up, considering that patients with cleft palate have a higher risk of hospitalization for psychiatric disorders and, consequently, a high mortality rate (Guimarães et al., 2014).

CONCLUSION

It is concluded that the presence of cleft palate represents an enormous challenge for both the patient and their companions. Insecurity and physical and social challenges emphasize the importance of the surgical procedure. The success of this procedure depends directly on the therapeutic planning offered, often facilitated by early diagnosis through ultrasonography, which allows multidimensional observation of the extent and involvement of the cleft. Although ultrasound images may not accurately reflect in all planes, the identification of the cleft is crucial not only for surgery, but also for the preparation of the family nucleus and the multidisciplinary team.

The performance of a multidisciplinary team is essential for the integral development of the individual, since several professionals promote comprehensive patient care, preventing, in most cases, the increase in mortality associated with this pathology. The risks for psychiatric disorders, difficulties in breathing, swallowing and phonation are present and significantly impact the quality of life of patients with this anomaly.

Thus, the importance of studies that cover the various aspects of the life of individuals with cleft palate is demonstrated, from early diagnosis to their development as a human being inserted and active in society.


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Prevention and control of infections in the hospital environment: Occupational health and safety

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ABSTRACT

Introduction: The correct performance and expanded knowledge of health professionals are essential due to the high incidence and complications of nosocomial infections, which can delay the patient's recovery and increase the risk of nosocomial infection. This problem is one of the great challenges of public health in Brazil and must be managed competently to ensure patient safety and care in health units.

Objective: This study aims to disseminate knowledge and encourage the correct practice of hand hygiene, the proper use of Personal Protective Equipment (PPE) and hospital cleaning, reflecting on health and safety at work in the prevention and control of infections in the hospital environment.

Methodology: This is a bibliographic review, of a narrative, exploratory and descriptive nature, based on scientific articles indexed in Google Scholar and in the Virtual Health Library (VHL) platform, using the PubMed and Scientific Electronic Library Online (SciELO) databases. **Conclusion:** Nosocomial infection represents a major challenge for public health, exposing patients to possible infections caused by bacteria and microorganisms, sometimes acquired due to the patient's own low immunity and resistance or due to failures in infection control processes and biosafety measures.

Keywords: Occupational safety, Hospital infection, Infection control.

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INTRODUCTION

Hospital infection is characterized by an infection acquired after the patient's admission to a hospital environment, and can manifest itself both during the hospitalization period and after discharge (Oliveira et al., 2019; Nahum et al., 2021). These infections are worrisome for patients, as they cause complications, high costs, increase the length of stay in hospitalizations and increase the hospital mortality rate, being considered a serious public health problem.

The occurrence of nosocomial infections (HAIs) is related to the exposure of patients to a variety of infectious agents and pathogens, as well as to the performance of invasive procedures and the use of antimicrobials, which favor their development (Oliveira et al., 2018).

Globally, it is estimated that for every 10 patients, 1 acquires a hospital-acquired infection (WHO, 2020). In Brazil, the infection rate is 14% (BRASIL, 2019), where with an infection incidence of 10/1,000 patients with mechanical ventilators, 3.9/1,000 with central catheters, and 3.6/1,000 with indwelling urinary catheters (ANVISA, 2021).

Among the main measures to prevent HAIs, proper hand hygiene, sterilization of equipment, and careful procedures stand out, which are essential to reduce the incidence of these infections (Lopes *et al.*, 2020). Hand hygiene is considered the most effective, simple, and powerful measure to prevent pathogens (Silva; Pear tree; Souza, 2021).

Hospital infections represent a major challenge for health systems, highlighting the need for effective prevention measures, such as the introduction of more effective hygiene protocols, continuous training of health professionals in order to mitigate and avoid the spread of infections that can aggravate and lead to the fatal clinical evolution of patients. Thus, the present study aims to disseminate knowledge and encourage the correct practice of hand hygiene, the appropriate use of Personal Protective Equipment (PPE) and hospital cleaning, reflecting on health and safety at work in the prevention and control of infections in the hospital environment.

METHODOLOGY

This is a bibliographic review, of a narrative, exploratory and descriptive nature, which seeks to reflect on occupational health and safety in the prevention and control of infections in the hospital environment, contributing to discussions on research methods and results. Articles were searched in the national and international literature.

For data collection, consultations were carried out in the Virtual Health Library, Google Scholar, PubMed, and Scientific Electronic Library Online (SciELO) in the last 10 years, using the descriptors: "hospital infection", "hospital care" and "occupational safety".

Regarding the ethical aspects, this research used secondary data in the public domain, offering no risks to the participants. Therefore, there was no need to submit it to the Ethics



Committee, according to item III of resolution 510/2016, there was no need for the research ethics committee to consider the project.

THE IMPORTANCE OF OCCUPATIONAL SAFETY IN THE HOSPITAL ENVIRONMENT

The hospital environment is a complex place that, when well organized, includes determining factors for the occurrence and prevention of occupational accidents (WA). For its effective functioning and accident prevention, the availability of material resources and equipment, the adequate number of workers, and the behavioral aspects of health professionals and managers are essential (Fontana; Lautert, 2013; Soares et al., 2013).

The activities carried out in the hospital environment expose professionals to several risk factors, such as exposure to biological agents, including viruses, bacteria and fungi, which can occur through direct contact with blood and other body fluids or through airborne transmission. In addition, chemical substances, such as cleaning products, medications, and anesthetics, also pose risks, and can cause dermatitis, respiratory problems, and even poisoning when handled improperly. Ergonomic risks, resulting from repetitive movements and inadequate postures, can result in musculoskeletal disorders. Finally, physical risks, such as exposure to ionizing radiation, loud noise, and extreme temperatures, are common in radiographs, operating rooms, and intensive care units (Penna et al., 2010).

Occupational safety in hospital environments is an extremely relevant topic due to its complexity and inherent risks. Therefore, it is crucial that biosafety measures are strictly followed by professionals in the hospital sector, ensuring the safety of both patients and professionals (Luz; Beretta, 2016).

In this context, the need arose to create standards and regulations to ensure the safety of professionals who work in the hospital environment, mitigating the main risks to which they are exposed daily. The biosafety area was developed to address the problems caused by chemical, physical, biological, ergonomic and psychosocial agents in occupational health and laboratory environments (Costa; Costa, 2007).

With the emergence of genetic engineering in the 1970s, the concept of biosafety gained prominence, especially after the transfer and expression of the insulin gene to the bacterium *Escherichia coli*. This advance culminated in the Asilomar Conference in 1974, which discussed the risks and safety of genetic engineering (Albuquerque, 2001; Borém, 2001).

The biosafety standards of the National Institute of Health (NIH) of the USA emerged from this conference, highlighting the importance of safety in recombinant DNA technology and alerting the scientific community about the need for regulations (Almeida; Valle, 1999). In the 1980s, the World Health Organization (WHO) conceptualized biosafety as prevention practices for laboratory

work with pathogenic agents, classifying risks as biological, chemical, physical, radioactive, and ergonomic (Costa; Costa, 2002).

In Brazil, debates about the risks of carrying out scientific work, especially in laboratories, date back to the nineteenth century, but biosafety was structured in the country between the 1970s and 1980s, motivated by several reports of infections in laboratories (Almeida; Albuquerque, 2000; Shatzmayr, 2001). In 1995, the National Technical Commission on Biosafety (CTNBio) was created, linked to the Ministry of Science and Technology, to establish standards for activities involving genetically modified organisms and to promote health in the workplace (Scholze, 1999; Garcia; Zanetti-Ramos, 2004).

In addition to CTNBio, the Health Biosafety Commission (CBS) was created in 2002, linked to the Ministry of Health, with the objective of defining strategies for action, evaluation and monitoring of biosafety actions, seeking a better understanding between the Ministry of Health and the institutions that deal with the theme (Brasil, 2006).

With the advancement of debates on biosafety, there was a need to regulate occupational safety in health services, resulting in the creation of Regulatory Standard 32 (NR 32). This standard establishes guidelines for the protection of workers in health services, requiring the implementation of environmental risk prevention programs, the availability of PPE and the promotion of continuous education on safe practices (Brasil, 2011).

Forms of prevention related to biosafety include hand washing, use of personal protective equipment, cleaning and waste management, and proper disposal of materials. In situations of risk, specific protection, adequate working conditions and continuous professional training are necessary (Brasil, 2011).

Training and professional qualification are essential to ensure safety in the hospital environment, especially in the correct use of PPE, handling of chemical and biological substances, and emergency procedures. The training enables greater knowledge of protection measures, mitigating risks. In addition, it is necessary to provide professionals with adequate personal protective equipment and implement physical barriers, such as biological safety hoods and ventilation systems, to significantly reduce exposure to hazardous agents (Silva Pires et al., 2019).

Proper waste management, addressed in NR 32, is essential to prevent environmental contamination and the exposure of workers to hazardous materials. Biological, chemical and radioactive waste must be managed in accordance with specific regulations to ensure that it does not pose a risk to public health and the environment (Brasil, 2005).

In addition to NR 32, other biosecurity measures adopted by health facilities include safety protocols, equipment maintenance and calibration, and emergency plans (Silva et al., 2020). Occupational safety in the hospital environment is complex and fundamental to ensure the health and

well-being of professionals and the quality of care provided to patients. The implementation of preventive measures, following standards such as NR 32, is essential to mitigate existing risks and ensure a safe and efficient environment (Andrade; Silva; Netto, 2015). Top of the form.

INFECTION PREVENTION AND CONTROL IN HOSPITALS

Health care has been evolving over time, bringing great scientific and technological advances, as well as improvements in health actions and services, however, despite the technical-scientific growth, the persistence of nosocomial infections (HI) continues to be a significant problem (Andrade D, 2000).

Hospital-acquired infections have long been a concern among government agencies. Even with the regulation and creation of several Hospital Infection Control Committees (HICC) in Brazilian hospitals in the 1980s, they are still neglected, becoming a challenge for Brazilian public health (Mendonça et al., 2003).

HI is acquired after the patient is admitted for hospitalization, and may occur during their stay in the hospital or after discharge. It is directly associated with the hospital procedures performed or with the hospitalization itself, due to the range of invasive procedures and the use of antimicrobial therapies, which make the hospital environment conducive to the development of bacteria, some of which may be resistant, thus increasing the rates of hospital infections (BRASIL, 1998; COSTA et al., 2021).

According to the Ministry of Health, HAIs affect an average of 1.5 million patients worldwide, with 10% showing signs of infection after discharge and 15 to 50% of these cases evolving to death. In Brazil, hospital infection rates represent 5% to 14% of total hospitalizations. These infections result from the interaction between pathogenic agents (microorganisms or their toxins), the host (patient) and the hospital environment, manifesting themselves by signs and symptoms such as fever, weakness, pain in the affected site and changes in laboratory tests (SÃO PAULO, 2005; DA SILVA, 2020).

HAIs are more common in patients with weakened immune systems, who have undergone invasive procedures, who have metabolic and hematologic disorders, or who are using immunosuppressive drugs. The risk is higher in newborns and the elderly. The length of stay in the hospital unit is also related to the increased risk of NI due to immunological fragility and the need for invasive procedures (Padoveze, 2019).

Currently, the term "hospital-acquired infection" is being replaced by "healthcare-associated infections" (HAIs), which is more comprehensive. HAIs are infections acquired during the provision of health care, including outpatient procedures, home care, and infections acquired by health care workers. The main measure for the control of HAI is correct hand hygiene. Controlling infections is

essential to ensure the quality of the service and care provided (BRASIL, 1998; COSTA et al., 2021; SILVA et al., 2024; Rossi Neto, 2004; DA SILVA, 2020).

The National Health Surveillance Agency (ANVISA) treats HAI as infectious processes acquired in any health institution. In addition to being caused by care deficiencies and the patient's condition, HAI also result from operational failures in the process of cleaning, disinfecting and sterilizing medical and hospital articles, performing invasive procedures, preparing parenteral medications, irrational use of antimicrobials and inadequate hand hygiene of health professionals (Rossi Neto, 2004; DA SILVA, 2020).

Correct hand hygiene before, during, and after each care provided to the patient must be done in accordance with established sanitary criteria, such as the use of bacteriostatic detergent in running water and proper hand drying, avoiding spread or cross-contamination. This simple gesture can eliminate common bacteria, using the correct antiseptic (BOTELHO et al., 2021).

In order to more effectively instrumentalize sanitary inspection actions in the control of HAIs, ANVISA issued Resolution RDC No. 48/2000, which establishes the evaluation/inspection process of Hospital Infection Control Programs, and Ordinance No. 2,616/1998 of the Ministry of Health, which organizes and defines the competencies of the Hospital Infection Control Commission (CCIH) and the Hospital Infection Control Program (PCIH), establishing concepts, epidemiological criteria, indicators and recommendations.

Despite these measures, there is low adherence to health guidelines for infection control and biosecurity measures. Researchers point out that the implementation of these guidelines can occur in a non-uniform way, with discrepancies in the published requirements. Therefore, it is essential to carry out structural and process assessments, in addition to investing in continuing education for the prevention of infections in the hospital environment (Giroti, 2018; Stone, 2014; Couto, 2020).

Another crucial aspect is hospital cleaning, which prepares the environment for daily activities, removing organic dirt and pathogens, minimizing bacterial colonization and infections. Proper cleaning promotes safety and comfort for both patients and healthcare providers (Paina et al., 2015).

To perform hospital cleaning correctly, the responsible professionals – general service assistants – need to be properly trained. However, studies indicate that these professionals often do not receive the necessary training, are unaware of the sanitizers used and do not use the recommended personal protective equipment (PPE). An inadequately sanitized hospital environment poses a significant risk for HAI (BEZERRA, 2024).

Therefore, analyzing the importance of prevention and control of hospital infections, through the awareness of the population and health professionals about hand hygiene and hospital cleaning, is essential for the prevention of healthcare-associated infections (HAIs). This not only reduces the risk



of infections but also promotes safety and well-being in hospital facilities (Silva et al., 2023; BEZERRA, 2024).

CONCLUSION

It is concluded that nosocomial infection represents a significant challenge for public health, exposing patients to infections caused by bacteria and microorganisms. These infections can occur due to low immunity and resistance of patients or due to failures in infection control processes and biosecurity measures. It is essential to emphasize the correct use of prevention measures, such as proper hand hygiene, the rational use of antibiotics, the correct use of PPE, and the proper cleaning of the hospital environment, in order to minimize contamination rates.

The continuous approach to this theme is essential to disseminate knowledge and updates, especially among health professionals. The education and training of these professionals are crucial to reduce complications and promote safety in the hospital environment.

Additionally, implementation and strict adherence to infection control protocols are vital to creating a safer environment for patients and staff. Constant studies and monitoring are needed to identify areas for improvement and develop effective prevention strategies.

Finally, collaboration between hospital managers, healthcare professionals, and regulatory bodies is imperative to ensure that best infection control practices are adopted and maintained. Only through a joint effort will it be possible to significantly reduce the incidence of hospital infections and improve the quality of care in hospitals.

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Toxic impacts of inhalants: Diagnosis, treatment, and clinical perspectives

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ABSTRACT

Introduction: Inhalant abuse, especially among children and adolescents, is a growing public health concern due to the severe neurotoxic and systemic effects that these substances can induce. Inhalants, which are often accessible and inexpensive, carry a significant risk of acute and chronic health problems, including irreversible damage to the central nervous system. This chapter addresses the multifaceted challenges of diagnosing and treating inhalant poisoning, highlighting the importance of early detection and intervention to mitigate the long-term consequences.

Objective: To provide a comprehensive overview of the clinical presentation, diagnostic strategies, and therapeutic approaches related to inhalant abuse. In addition, it seeks to highlight the crucial role of health professionals in identifying and managing the health impacts caused by the use of inhalants, with an emphasis on preventive measures and public health strategies.

Materials and Methods: The chapter synthesizes the current literature and clinical guidelines on inhalant abuse, using a wide range of sources, including case studies, clinical trials, and toxicological reviews. Diagnostic methods such as imaging techniques (magnetic resonance imaging and computed tomography) are discussed, as well as laboratory tests that are essential in the evaluation of patients suspected of inhalant poisoning. Therapeutic interventions, both pharmacological and non-pharmacological, are explored to provide a thorough understanding of treatment options.

Results: The findings indicate that inhalant abuse is associated with a range of neurological and systemic complications, including toxic leukoencephalopathy and metabolic disorders. Imaging studies often reveal significant brain damage, especially in chronic users, with diffuse demyelination being a common finding. Therapeutic efforts are complicated by a lack of specific antidotes, necessitating supportive care and symptomatic treatment. Preventive strategies, particularly in high-risk populations, are key to reducing the incidence and severity of health problems related to inhalant use.

Final Thoughts: Inhalant abuse remains a significant challenge in clinical practice, especially due to its widespread accessibility and the severe health outcomes associated with chronic use. Early diagnosis and intervention are crucial to prevent long-term neurological damage. This chapter emphasizes the need for comprehensive public health strategies and ongoing research to better understand the mechanisms of inhalant toxicity and to develop more effective prevention and treatment protocols. The participation of multidisciplinary teams, including health professionals, educators, and policymakers, is essential to address this complex issue and improve health outcomes for affected populations.

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INTRODUCTION

Recreational inhalants, such as loló and other volatile solvents, are widely used by diverse populations, especially among adolescents and young adults. The ease of access, low cost, and immediate psychoactive effects make these products popular at parties and social gatherings. Substances such as toluene, ether, and chloroform are inhaled to elicit euphoria, relaxation, and, in some cases, hallucinations. However, the apparent "harmlessness" of these substances hides a grim reality: the damage to the central nervous system and other vital organs can be profound and irreversible. Continued exposure to these inhalants can result in severe neurotoxicity, significantly compromising users' cognitive and motor function (DIEHL et al., 2012; MACCHI et al., 2022; MACCHI; CARLISLE; FILLEY, 2022).

The popularity of inhalants among young people is driven by social and psychological factors, such as peer pressure, curiosity, and the desire to experience new sensations. In addition, the misperception that inhalants are less dangerous than other drugs, such as cocaine or heroin, contributes to their spread. This perception is extremely misleading, as even short-term use can cause dependence and irreversible damage to the body. Toxic effects include debilitating conditions like toxic leukoencephalopathy, which severely affects brain function. Young people are often unaware of the severity of the potential harm, which perpetuates the cycle of abuse of these substances (CROSSIN et al., 2019; CUREUS, 2023).

Clinically, inhalant poisonings present significant challenges for healthcare providers due to the wide variability in symptom presentation. Symptoms can range from mild headaches and dizziness to more serious conditions like seizures, cardiac arrhythmias, and respiratory collapse. In extreme cases, coma or sudden death can occur, especially when inhalation occurs indoors or for prolonged periods. The absence of specific antidotes for most inhalants aggravates the clinical management of these emergencies, requiring a multidisciplinary approach, which includes ventilatory support and intensive cardiac monitoring. Rapid intervention is crucial to minimize harm and avoid fatal outcomes (SVENSON et al., 2022; FRANKLIN & FRENCH-CONSTANT, 2008).

In addition to affecting the central nervous system, inhalants cause significant damage to other systems in the body. The respiratory system is especially vulnerable, with inhalation of volatile solvents can cause airway irritation, bronchospasm and, in severe cases, asphyxiation. The effects on the cardiovascular system are equally concerning, with reports of cardiac arrhythmias, hypertension, and myocardial infarction associated with the use of inhalants. Renal impairment is also a potential consequence, with prolonged exposure resulting in toxic nephropathy and eventually renal failure. The systemic toxicity of inhalants requires comprehensive clinical management that takes into account all affected systems to optimize treatment and improve patient prognosis (HERNANDEZ; RODRIGUES; TORRES, 2017; CROSSIN et al., 2017).



The lack of strict regulation and the misperception of the risks associated with the use of inhalants increase the ease of access to these substances and, consequently, abuse among young people. The absence of effective control over the sale of these products, combined with the lack of knowledge about their dangers, creates an environment conducive to indiscriminate use. Awareness campaigns that inform about the risks of using inhalants are essential to reduce the incidence of these poisonings. Educators, health professionals and parents have a crucial role in preventing adolescent drug use, including inhalants. The creation of healthy family and school environments, combined with solid preventive education, can be an effective strategy to mitigate the abuse of these substances (BAPTISTA; FARIA, 2022; CRUZ et al., 2021).

Controlling inhalant use is not only a local challenge, but a global one. Studies indicate that the use of these substances is prevalent in several regions, including Latin America, Asia, and Europe, with variations in the most commonly used substances and motivations for use. Factors such as poverty, social exclusion, and lack of educational and work opportunities are often associated with inhalant use. The vulnerability of young people in different contexts is exacerbated by a lack of access to health services and psychological support, perpetuating the cycle of abuse. Prevention and intervention strategies must be adapted to local realities, taking into account the cultural and social specificities of each region. International cooperation and the sharing of effective strategies between countries are essential to address this problem globally (BAPTISTA; FARIA, 2022).

LITERATURE REVIEW: MECHANISMS OF ACTION OF INHALANTS

Recreational inhalants, such as volatile solvents and anesthetic gases, exert their effects primarily through central nervous system (CNS) depression. When inhaled, these substances quickly cross the blood-brain barrier, reaching high concentrations in the brain within minutes. At the cellular level, inhalants interfere with neurotransmitter function by altering the fluidity of the neuronal membrane and modulating GABA-A receptors, which are responsible for CNS inhibition. By enhancing the action of GABA, these substances promote neuronal hyperpolarization, resulting in sedation, euphoria, and disinhibition, effects that can progress to respiratory depression, loss of consciousness, and even coma at higher doses. In addition, inhalants affect other neurotransmission systems, including the dopaminergic and glutamatergic systems, contributing to the complexity of the clinical effects observed during intoxication (FRANKLIN & FRENCH-CONSTANT, 2008; MACCHI; CARLISLE; FILLEY, 2022).

In addition to CNS effects, inhalants exert significant toxicity on the cardiovascular system, and can induce serious cardiac arrhythmias that are often fatal. The mechanism of this toxicity is related to myocardial sensitization to catecholamines, such as adrenaline. By increasing the release of catecholamines or potentiating their action on the heart's beta-adrenergic receptors, inhalants can

trigger tachycardia, hypertension and, in extreme cases, ventricular fibrillation, resulting in the so-called "sudden death by inhalation syndrome". Substances such as toluene can cause direct damage to heart tissue, leading to necrosis of muscle fibers and contributing to the development of dilated cardiomyopathy. This imbalance in the autonomic system, where the heart becomes extremely sensitive to fluctuations in catecholamine levels, is a critical factor in increasing the risk of sudden death in chronic users (MACCHI et al., 2022; CUREUS, 2023).

The neurotoxic effects of inhalants go beyond CNS depression, with studies showing that prolonged exposure can result in permanent brain damage, such as toxic leukoencephalopathy. Characterized by the destruction of myelin, this condition compromises the conduction of nerve impulses, resulting in neurological symptoms such as ataxia, dysarthria, dementia, and movement disorders. The pathogenesis involves the accumulation of lipophilic solvents in brain tissue, where they exert a direct cytotoxic effect on oligodendrocytes, leading to diffuse demyelination. Complete recovery is rare, with many patients presenting with permanent sequelae. In addition, peripheral neuropathy, particularly induced by toluene, results in pain, muscle weakness, and loss of reflexes, caused by the destruction of Schwann cells and axonal degeneration, affecting nerve conduction and leading to motor and sensory impairment (CROSSIN et al., 2017; SILVA, 2022).

Inhalants also cause significant renal toxicity, with substances such as chloroform and carbon tetrachloride being known to cause acute tubular necrosis and renal failure. The mechanism involves the biotransformation of solvents into reactive metabolites, which cause oxidative damage to kidney cells. Repeated exposure can lead to interstitial fibrosis and progressive loss of kidney function, with symptoms such as edema, hypertension, and oliguria. Progression to chronic renal failure is a real possibility, especially in chronic users. Strategies to monitor and protect renal function should be implemented in the clinical management of these patients, as renal toxicity is a critical consideration in the treatment of inhalant abuse (MACCHI et al., 2022).

Although less studied, the immune toxicity of inhalants also poses a significant risk, with evidence suggesting that chronic exposure can lead to immunosuppression and increase susceptibility to infections. The dysfunction of immune cells, such as T lymphocytes and macrophages, in addition to the production of pro-inflammatory cytokines, can contribute to the development of autoimmune diseases in chronic users. Systemic inflammation induced by inhalants exacerbates damage to other organ systems, such as the cardiovascular and central nervous systems. This immunotoxic effect is an area that requires further study to fully understand the long-term health implications for users, highlighting the need for continued research in this area (FRANKLIN & FRENCH-CONSTANT, 2008).



SYSTEMIC EFFECTS OF INHALANTS

The toxic effects of inhalants on the respiratory system are one of the first to manifest after inhaling these substances. Direct contact with the upper airways can cause irritation of the nasal mucosa and throat, resulting in symptoms such as rhinitis, pharyngitis, and persistent cough. In more severe cases, prolonged exposure to volatile solvents may lead to bronchospasm, pulmonary oedema and acute respiratory failure. The development of pulmonary fibrosis is a potential complication of chronic inhalant use, resulting in progressive loss of lung function. Repeated exposure can also compromise local immune defenses, increasing the risk of respiratory infections such as pneumonia. For patients with asthma or other pre-existing respiratory conditions, the use of inhalants can significantly exacerbate symptoms, causing severe respiratory flare-ups that require immediate medical intervention (CROSSIN et al., 2019; MACCHI et al., 2022).

The cardiovascular effects of inhalants are equally worrisome, with the induction of cardiac arrhythmias being one of the most serious complications, which can progress to ventricular fibrillation and sudden death. The cardiotoxicity of inhalants is attributed to myocardial sensitization to catecholamines, leading to exacerbated sympathetic hyperactivity. In addition to arrhythmias, inhalants can cause high blood pressure and dilated cardiomyopathy, where the heart muscle becomes unable to pump blood effectively. Chronic use can lead to early atherosclerosis, increasing the risk of myocardial infarction, especially in combination with other substances such as alcohol and stimulant drugs. The management of cardiovascular complications requires an integrated approach, including the control of arrhythmias, hemodynamic support and, in severe cases, the consideration of heart transplantation (FRANKLIN & FRENCH-CONSTANT, 2008; BAPTISTA; FARIA, 2022).

The central nervous system (CNS) is particularly vulnerable to the effects of inhalants. CNS depression, manifesting as sedation, euphoria, ataxia, and, at high doses, coma, is the most common acute effect. Chronic exposure can cause permanent damage to the brain, resulting in toxic leukoencephalopathy and dementia, attributed to the direct effect of solvents on myelin, compromising the conduction of nerve impulses. In addition, inhalants can induce behavioral and psychiatric changes, such as depression, anxiety, and psychosis, as well as significant cognitive deficits, including problems with memory, concentration, and executive function. In adolescents, who are in the phase of brain development, these effects can compromise academic and social development, with devastating long-term consequences (HERNANDEZ; RODRIGUES; TORRES, 2017; MACCHI et al., 2022).

The renal effects of inhalants, although less evident initially, can be severe with prolonged use. Substances such as carbon tetrachloride and toluene can cause acute tubular necrosis, compromising the kidneys' ability to filter waste from the blood. Toxic nephropathy can progress to chronic renal failure, a potentially fatal condition that requires dialysis or kidney transplantation. The

biotransformation of solvents into toxic metabolites, followed by their excretion by the kidneys, is the main mechanism of renal toxicity of inhalants. Initial symptoms such as edema, hypertension, and reduced urine output may go unnoticed until the damage is irreversible, highlighting the importance of regularly monitoring kidney function in chronic inhalant users (MALLOUL et al., 2018; SVENSON et al., 2022).

In addition to the direct effects on specific body systems, inhalants impact the immune system, increasing susceptibility to infections. Chronic exposure to volatile solvents can lead to immunosuppression by compromising the function of T lymphocytes, macrophages, and other immune cells. In addition, the production of pro-inflammatory cytokines, associated with the use of inhalants, can contribute to the development of autoimmune diseases. Immune dysfunction can exacerbate damage to other systems, such as cardiovascular and central nervous, complicating the overall clinical picture of users. Therefore, understanding the immune toxicity of inhalants is essential to develop appropriate prevention and treatment strategies for chronic users (BAPTISTA; FARIA, 2022; FRANKLIN & FRENCH-CONSTANT, 2008).

SPECIFIC TOXICOLOGICAL PROFILES

Toluene is one of the most common and studied inhalants due to its industrial use and the severe neurotoxic effects associated with its abuse. Found in products such as glues, paints, and thinners, toluene is easily accessible, especially for teenagers and young adults. Inhalation of toluene causes depression of the central nervous system, resulting in symptoms such as euphoria, dizziness, mental confusion, and, at higher doses, loss of consciousness and coma. Although the acute effects of toluene are usually reversible with cessation of exposure, chronic use can lead to permanent brain damage such as toxic leukoencephalopathy, characterized by diffuse demyelination of the brain, resulting in significant cognitive and motor deficits. In addition, toluene is hepatotoxic and nephrotoxic, contributing to liver and kidney dysfunction in chronic users. The potential for toluene dependence is high, and withdrawal may be accompanied by symptoms such as irritability, anxiety, and insomnia (MACCHI; CARLISLE; FILLEY, 2022; SVENSON et al., 2022).

Another significant inhalant is diethyl ether, historically used as an anesthetic, known for its potent central nervous system depressant properties. Inhalation of ether may induce euphoria and disinhibition, followed by drowsiness and confusion, and may progress to coma in cases of prolonged exposure or high doses. Although acute effects are known, chronic recreational use may lead to liver and kidney toxicity. In addition, ether is highly flammable and explosive, increasing the risks associated with its use, especially indoors. Psychological dependence on ether can develop, with withdrawal symptoms such as tremors, anxiety, and seizures. The clinical management of ether poisoning involves respiratory and cardiovascular support, as well as decontamination measures such



as the administration of activated charcoal in cases of concomitant ingestion (MACCHI et al., 2022; HERNANDEZ; RODRIGUES; TORRES, 2017).

Chloroform, an inhalant with a history of medical use, has a concerning toxicological profile due to its high toxicity and carcinogenic potential. Inhalation of chloroform rapidly depresses the central nervous system, causing dizziness, nausea, and loss of consciousness, and can lead to respiratory arrest in severe cases. Chloroform is hepatotoxic and can cause hepatic necrosis, especially with chronic exposure. In addition, chloroform can cause fatal cardiac arrhythmias and increase the risk of liver cancer due to DNA damage. Due to its risk profile, the use of chloroform as a recreational inhalant is extremely dangerous and should be avoided (SILVA, 2022; MACCHI; CARLISLE; FILLEY, 2022).

Hexane, widely used in industry, is known to cause severe peripheral neuropathy in chronic users. Inhalation of hexane may initially produce effects such as dizziness and euphoria, but prolonged use leads to significant neurotoxicity. Hexane is metabolized into toxic compounds that affect peripheral nerves, causing damage to axons and Schwann cells. Symptoms such as muscle weakness, loss of sensation, and neuropathic pain are common, and in advanced cases, neuropathy can be disabling, compromising the patient's mobility and quality of life. Recovery from hexane-induced neuropathy is slow and often incomplete, even after cessation of exposure (CUREUS, 2023; CROSSIN et al., 2019).

Nitrous oxide, known as "laughing gas," is widely used in recreational settings due to its quick euphoric effects. Although it is considered less dangerous than other inhalants, nitrous oxide is not without its risks. Prolonged or repeated exposure can lead to serious complications such as vitamin B12 deficiency, resulting from inhibition of the enzyme methionine synthase, leading to peripheral neuropathy, ataxia, and, in severe cases, degenerative myelopathy. In addition, the use of nitrous oxide can cause cerebral hypoxia, resulting in permanent neurological damage. Clinical management of nitrous oxide poisoning includes the administration of vitamin B12 supplements and respiratory support in cases of severe hypoxia (BAPTISTA; FARIA, 2022; MALLOUL et al., 2018).

DISCUSSION: CLINICAL DIAGNOSIS OF INHALANT POISONING

The clinical diagnosis of inhalant poisoning is challenging due to the diversity of substances involved and the variability of the symptoms presented. Early identification of physical signs is crucial for the effective management of these poisonings. Patients intoxicated by inhalants can present with a wide range of symptoms, ranging from mild to severe, depending on the type of substance inhaled and the amount used. The most common signs include dizziness, headache, mental confusion, nausea, and vomiting, while severe cases may involve seizures, cardiac arrhythmias, respiratory depression, and coma. Physical examination may reveal signs such as tachycardia,



hypertension, altered reflexes, and altered mental status, ranging from lethargy to extreme agitation. In addition, specific signs may be observed depending on the inhaled substance; for example, inhalation of toluene can cause hypokalemia, while chloroform can induce cardiac arrhythmias (Lubman, 2009; FERIGOLO et al., 2017).

Laboratory findings complement the initial clinical evaluation and are fundamental for diagnosis. Blood tests can detect electrolyte abnormalities, such as hypokalemia and metabolic acidosis, which are common in patients who have inhaled toluene or other solvents. Arterial blood gas analysis may reveal hypoxemia and respiratory acidosis, especially in cases of severe respiratory depression, whereas complete blood count may indicate leukocytosis, reflecting an inflammatory response to inhalant toxicity. Although specific tests to identify the presence of toxic substances in blood or urine are less common, they can be performed in specialized centers. For example, gas chromatography can detect volatile solvents in the blood, confirming the diagnosis (Cruz, 2021; THULASIRAJAH et al., 2020).

Imaging tools play a crucial role in the evaluation of patients with suspected inhalant poisoning. Computed tomography (CT) scans of the head are often used to assess brain damage in patients with significant neurological symptoms, such as seizures or coma. Toxic leukoencephalopathy, a serious complication associated with chronic use of inhalants such as toluene, can be detected on CT as areas of hypodensity in white matter. Magnetic resonance imaging (MRI) is useful for identifying more subtle changes, including diffuse demyelination, and can differentiate leukoencephalopathy from other neurological conditions, such as multiple sclerosis (CROSSIN et al., 2017; MACCHI; CARLISLE; FILLEY, 2022).

Differential diagnosis is a crucial part of the clinical evaluation process in cases of suspected inhalant poisoning. Because of the variability of symptoms, it is important to consider other conditions that may mimic the signs of intoxication, such as metabolic disorders, central nervous system infections, and co-ingestion of other drugs. Conditions such as diabetic ketoacidosis or hypoglycemia have similar symptoms, such as altered mental status and acidosis, and should be ruled out. Infections such as meningitis or encephalitis, which can manifest with fever, headache, and confusion, also require additional tests for confirmation. In patients with a history of substance use, it is essential to consider the possibility of co-ingestion of drugs, such as alcohol, benzodiazepines, or opiates, which may aggravate the clinical picture (DIEHL et al., 2012; Svenson et al., 2022).

Finally, a detailed medical history is essential for the accurate diagnosis of inhalant poisoning. Information on the type of substance inhaled, the amount, the time of exposure and previous symptoms are essential. History of drug use, including frequency and duration of inhalant use, is also relevant to assess the risk of chronic complications such as leukoencephalopathy or dilated cardiomyopathy. Occupational history can provide important clues, especially in patients working in



industrial settings with exposure to volatile solvents. Physical examination and clinical history should be complemented by questions about the intoxication environment, such as site ventilation and the presence of other chemicals, crucial information to guide clinical management and determine the need for specific interventions (MALLOUL et al., 2018; Svenson et al., 2022).

CLINICAL MANAGEMENT AND TREATMENT

Clinical management of patients with inhalant poisoning begins with initial stabilization, which includes ventilatory support and continuous monitoring of vital signs. The first measure is to remove the patient from the source of exposure, stopping the continuous absorption of the toxic substance. Then, airway patency should be ensured and, if necessary, supplemental oxygen-assisted ventilation should be initiated to correct hypoxia. In cases of severe respiratory depression, orotracheal intubation and mechanical ventilation may be required. In addition, cardiac monitoring is essential due to the risk of fatal arrhythmias, especially in patients who have inhaled substances such as toluene or chloroform. Initial treatment also includes correction of electrolyte abnormalities, such as hypokalemia, which is common in patients who abuse volatile solvents. Intravenous hydration is recommended to prevent acute renal failure and facilitate the excretion of toxins (HERNANDEZ; RODRIGUES; TORRES, 2017; Lubman, 2009).

After stabilization, treatment should focus on removing the toxic substance from the body. Although gastric decontamination is rare in cases of inhalation poisoning alone, it can be performed if there is concomitant ingestion. Administration of activated charcoal is considered if oral ingestion is suspected, as it helps to adsorb the remaining toxic in the gastrointestinal tract. However, the elimination of most inhalants occurs primarily through the lungs and, to a lesser extent, the kidneys and liver. Hemodialysis may be indicated in cases of severe renal failure or when the inhalant substance is dialyzable, such as methanol, although its effectiveness in removing volatile solvents is limited (CROSSIN et al., 2019; Lubman, 2009).

The management of cardiovascular complications is a critical aspect, with cardiac arrhythmias being a leading cause of mortality. Beta-blockers, such as propranolol, can be used to control tachycardia and prevent fatal ventricular arrhythmias. In cases of ventricular fibrillation, immediate defibrillation is indicated, and continuous electrocardiographic monitoring is essential to detect arrhythmias early. Electrical cardioversion may be required for unstable arrhythmias that do not respond to pharmacological treatment, whereas inotropic support may be required for patients with acute heart failure due to toxic cardiomyopathy. Cardiopulmonary resuscitation (CPR) should be initiated promptly in case of cardiac arrest, with intensive care focused on neurological and hemodynamic recovery post-resuscitation (RADPARVAR, 2023; HERNANDEZ; RODRIGUES; TORRES, 2017).



Neurological management requires continuous monitoring to assess brain damage and prevent neurological deterioration. Seizures should be treated with benzodiazepines, such as diazepam or lorazepam, and, if necessary, phenytoin or valproic acid as a second line. The prevention of hypoxic brain injury is fundamental, with adequate ventilatory support ensuring cerebral oxygenation. Patients with toxic leukoencephalopathy should be evaluated by imaging tests, such as MRI, to determine the extent of demyelination. Management is mainly supportive, focusing on neurological rehabilitation and control of symptoms such as spasticity and cognitive dysfunction (CRUZ; BOWEN, 2021).

Respiratory complications, such as bronchospasm, should be treated with bronchodilators, while pulmonary edema may require diuretics to reduce fluid buildup in the lungs. Noninvasive ventilation may be useful in moderate cases, but intubation and mechanical ventilation may be required in severe cases. Continuous monitoring of oxygenation and lung function is crucial to adjust respiratory support as needed. Prevention of secondary infections, such as pneumonia, is essential, and may include the use of prophylactic antibiotics in high-risk patients. Respiratory management should be integrated with the treatment of systemic complications to optimize patient recovery (MACCHI; CARLISLE; FILLEY, 2022; FERIGOLO et al., 2017).

CASE STUDY: RELEVANT CLINICAL CASES

The first case involves a 17-year-old teenager admitted to the emergency room after inhaling large amounts of toluene during a party. The patient had mental confusion, tachycardia, and severe dyspnea, as well as hypertension and hyperactive reflexes. Reports from friends indicated that he had inhaled toluene repeatedly within a few hours, seeking to intensify the euphoric effects. Laboratory tests revealed significant hypokalemia and metabolic acidosis, typical indicators of toluene poisoning. Initial management included oxygen administration, continuous cardiac monitoring, and intravenous potassium replacement. However, the patient developed ventricular arrhythmias, requiring electrical cardioversion. After 48 hours in the intensive care unit, he stabilized without neurological sequelae and was referred for psychological follow-up aimed at preventing substance abuse. This case highlights the severity of toluene-associated cardiovascular complications and the importance of rapid interventions to avoid fatal outcomes (Lubman, 2009; Svenson et al., 2022).

The second clinical case deals with a 32-year-old man found unconscious in his residence after inhaling large amounts of ether. Known to use ether recreationally, the patient exhibited erratic behavior prior to the event. On admission to the hospital, he was in a deep coma, with severe respiratory depression and hypotension, indicating severe intoxication. Computed tomography revealed diffuse cerebral edema, and laboratory tests indicated respiratory and metabolic acidosis. Management included intubation, mechanical ventilation, and aggressive fluid therapy. Despite the



interventions, the patient remained in a coma for several days, and subsequent MRI revealed toxic leukoencephalopathy, a serious complication of chronic ether use. After a week in the ICU, the patient began to show signs of improvement, but was left with significant neurological deficits, including cognitive and motor impairment, requiring prolonged neurological rehabilitation (MACCHI; CARLISLE; FILLEY, 2022; Svenson et al., 2022).

The third case refers to a 28-year-old woman who suffered cardiac arrest after inhaling volatile solvents in an enclosed space. She was found unconscious in her car, with signs of cyanosis and no pulse, prompting immediate cardiopulmonary resuscitation (CPR) by the emergency service. At the hospital, she underwent defibrillation and administration of adrenaline, being resuscitated after several minutes of CPR. The patient was transferred to the ICU, where she remained in an induced coma for brain protection. CT scans revealed diffuse cerebral edema, and cardiac monitoring indicated persistent arrhythmias, requiring intensive cardiovascular support. Recovery was prolonged and complicated by neurological deficits, including memory loss and motor difficulties, highlighting the extreme dangers of using inhalants in inappropriate settings and the importance of rapid and coordinated interventions (HERNANDEZ; RODRIGUES; TORRES, 2017; BAPTISTA; FARIA, 2022).

LESSONS LEARNED

The analysis of the clinical cases presented reveals important lessons for medical practice in inhalant poisoning. Rapid identification of signs and symptoms of intoxication, followed by immediate therapeutic interventions, such as ventilatory support and correction of electrolyte imbalances, is essential to avoid fatal outcomes. Cases demonstrate that delays in initial management, such as late identification of cardiac arrhythmias or underestimation of the severity of respiratory depression, can result in severe and permanent complications. Therefore, it is crucial that health professionals are trained to recognize the clinical patterns associated with different inhalant substances and act promptly with the necessary interventions (FERIGOLO et al., 2017; Svenson et al., 2022).

The cases also emphasize the complexity of managing neurological effects in patients intoxicated by inhalants, especially at chronic exposures. Neurological damage, such as toxic leukoencephalopathy, is often irreversible, highlighting the need for effective prevention and education strategies to prevent continued use of these substances. The difficulty in reversing the damage underlines the importance of early interventions and ongoing support, including neurological rehabilitation programs. In addition, patient and family education about the risks associated with inhalant use and the importance of long-term follow-up is critical to improving clinical outcomes and reducing recurrence (CROSSIN et al., 2019; MACCHI; CARLISLE; FILLEY, 2022).



Finally, the cases reinforce the importance of multidisciplinary approaches in the management of patients with inhalant poisoning. Collaboration across specialties such as cardiology, neurology, nephrology, and psychology is essential to address the multiple systemic complications that can arise. Integration of care allows for holistic treatment, addressing not only acute symptoms but also rehabilitation needs and long-term psychological support. The involvement of mental health professionals is crucial in dealing with the psychological aspect of substance abuse, helping to prevent relapse and promoting full recovery. Prevention and health education strategies, focused on adolescents and their communities, are key to reducing the incidence of inhalant poisoning and improving patient outcomes (CROSSIN et al., 2019; BAPTISTA; FARIA, 2022).

SUMMARY OF THE MAIN POINTS

This chapter has comprehensively explored the various aspects related to inhalant intoxication, emphasizing both the complexity and severity of this type of substance abuse. Inhalants, often underestimated, pose a significant health risk due to their toxic effects on multiple body systems, including the central nervous, cardiovascular, respiratory, and renal systems. Substances such as toluene, ether, and chloroform, each with distinct toxicological profiles, make the diagnosis and clinical management of these poisonings challenging. A detailed understanding of the mechanisms of action, systemic effects, and toxicological profiles of these substances is essential for early identification and effective treatment. In addition, this chapter highlighted the importance of clinical management strategies, which range from initial measures, such as ventilatory support, to more specific interventions, such as the use of antidotes and intensive care. These interventions are essential to stabilize patients and prevent serious complications, which can result in permanent sequelae or death (Cruz, 2021).

The chapter also addressed the importance of prevention and health education strategies, particularly in the context of adolescence, a phase vulnerable to inhalant abuse. Ongoing education and training of health workers are essential for the early detection of signs of abuse and for the implementation of effective preventive interventions. Collaboration between schools, families, and health professionals is crucial to create a supportive environment that discourages inhalant use and promotes healthy alternatives for young people. The clinical cases presented illustrated how toxicological knowledge is applied in the management of patients, demonstrating the need for a multidisciplinary and integrated approach in the treatment of these poisonings. In addition, the cases highlighted the ongoing challenges faced by healthcare professionals, from diagnosis to long-term management of complications. Rehabilitation and psychological support are critical components of treatment, helping to prevent relapses and promote the complete recovery of patients (MACCHI; CARLISLE; FILLEY, 2022).



In short, toxicological knowledge is indispensable in medical practice, especially in the management of inhalant poisoning, which remains a significant public health problem. The ability to recognize clinical signs, make accurate diagnoses, and implement appropriate therapeutic interventions can be the difference between life and death for many patients. In addition, the promotion of prevention strategies and health education can reduce the incidence of these poisonings, protecting the most vulnerable populations, such as adolescents. The practical application of the knowledge discussed in this chapter is essential to improve clinical outcomes and reinforce the importance of a proactive approach to the management of inhalant poisoning. Health professionals must continue to stay up to date on advances in toxicology and apply this knowledge in their daily practice, ensuring that they are prepared to deal with the complexities of these poisonings. The union of knowledge, clinical practice, and preventive education is key to addressing the challenges posed by inhalant abuse and to protecting the health of future generations (Svenson et al., 2022).

IMPLICATIONS FOR MEDICAL PRACTICE

Inhalant poisonings pose a significant challenge to medical practice, requiring healthcare providers to be well prepared to recognize and treat these emergencies effectively. Given the rapid evolution of symptoms and the potential severity of complications, it is imperative that emergency department physicians and other frontline professionals possess a thorough understanding of the mechanisms of action and toxic effects of these substances. The ability to quickly identify clinical signs of intoxication, such as respiratory depression, cardiac arrhythmias, and neurological changes, is crucial to implementing life-saving interventions. In addition, the management of inhalant poisonings often requires a multidisciplinary approach, involving cardiologists, neurologists, nephrologists, and intensivists to treat the various systemic complications that may arise. This need for interdisciplinary collaboration underlines the importance of effective communication between healthcare team members, ensuring that every aspect of care is addressed in a coordinated and comprehensive manner.

The implications for medical practice extend beyond the acute management of inhalant poisonings to the long-term follow-up of patients. Many survivors of severe poisoning have chronic sequelae, such as neurological dysfunctions, cardiomyopathies, and kidney failure, which require ongoing care. Clinicians should be prepared to manage these outcomes in the long term, offering appropriate support and referring patients for rehabilitation when necessary. Additionally, identifying risk factors for continued inhalant use, such as a history of substance abuse or mental health issues, is essential to prevent further poisoning. Health professionals should also play an active role in educating patients and their families, informing them about the dangers of inhalant use, and



providing resources for psychological and social support. These interventions are crucial to reduce relapse and improve patients' long-term quality of life (Lubman, 2009).

Finally, preparedness to deal with inhalant-related emergencies should include ongoing training of healthcare workers at all levels. This involves not only formal education during medical training, but also participation in refresher programs and emergency simulations that reinforce the skills necessary for the management of these critical situations. The availability of clear and accessible protocols for the treatment of inhalant poisonings is essential to ensure that care is delivered in an efficient and evidence-based manner. In addition, physicians should be aware of new substances that appear on the market that can be used as inhalants, adapting their practices as new information becomes available. This adaptability and the constant search for knowledge are fundamental to face the dynamic challenges presented by inhalant poisoning in modern medical practice (FERIGOLO et al., 2017).

SUGGESTIONS FOR FUTURE RESEARCH


Although knowledge about inhalant poisonings has advanced significantly, there are still important gaps that need to be filled through future research. A critical area that requires attention is the development of more effective treatments for the systemic complications associated with chronic inhalant use. The identification of specific antidotes that can reverse or mitigate the toxic effects of these substances represents a promising field, especially for compounds such as toluene and chloroform. In addition, further studies are needed to fully understand the mechanisms of inhalant-induced neurotoxicity and cardiotoxicity, with the goal of developing targeted therapies that can prevent permanent damage. Another area that deserves investigation is the prevention of inhalant use among vulnerable populations, such as adolescents and young adults. More comprehensive preventive strategies, including community-based interventions and evidence-based educational programs, need to be evaluated and implemented on a large scale. Research on the social and economic impacts of inhalant use can provide valuable data for effective public policy formulation and health resource allocation. Finally, international collaboration on multicenter research can help standardize treatment protocols and ensure that best practices are shared globally, improving clinical outcomes and preventing new poisonings (CROSSIN et al., 2019).

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Rule modeling for automatic verification of RDC-50 requirements in EAS

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ABSTRACT

The modeling of rules for the automatic verification of requirements of architectural programs of Health Care Establishments (EAS) represents one of the many challenges related to the adoption of the BIM methodology in the processes of the Coordination of Projects and Works of Cogic-Fiocruz. These programs need to comply with the requirements of RDC-50. With a new process of approval of most of the activities of the EASs in the city of Rio de Janeiro, by the municipal secretariat and no longer by the State Health Surveillance and, when the visa service in plan is terminated by the municipal agency, the possibility and severity of the risk of non-compliance of the EAS already built or in project increases. The objective of this research is to study how to model rules for automatic verification of RDC-50 requirements, in the Solibri Model Checker (SMC) tool, using information from the BIM model of the Germano Sinval Faria School Health Center (CSEGSF), located at the Manguinhos Campus of Fiocruz, in Rio de Janeiro. The research methods used were bibliographic and documentary reviews, as well as exploratory research. In this study, the conditions for achieving the objective are presented, the importance of the organization and the information classification system and the modeling of the rule itself in the SMC, for the automatic verification of the minimum areas of the environments of the CSEGSF BIM model, according to the requirements presented in RDC-50. It also presents a reflection on the parameterization of the requirements of RDC-50 and the construction of domain-specific ontologies for various aspects of the SUS system, with its challenges and difficulties.

Keywords: Building projects, Health Care Establishments, Rule modeling, Automatic verification of requirements, RDC-50.

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INTRODUCTION

The National Health Surveillance Agency (Anvisa) is responsible for regulating the planning, programming, preparation, evaluation and approval of physical projects of Health Care Establishments (EAS), through the Technical Regulation of Collegiate Board Resolution No. 50, of February 21, 2002 (RDC-50).

ANVISA guides state and municipal health departments in complying with and interpreting the Resolution, and they are responsible for its application and execution, and may, in addition to RDC-50, establish other supplementary or complementary rules, to adapt to local specificities.

In 2017, the State Health Surveillance of Rio de Janeiro ended the off-plan visa service for basic projects of various health care activities in the city of Rio de Janeiro. Through Joint Resolution SES/SMS/RJ No. 538 of March 1, 2018, the responsibility for the application and execution of RDC-50 and other state and municipal rules was transferred to the municipal secretariats of Rio de Janeiro. Within this new context, so far, the Municipal Health Department of Rio de Janeiro does not offer the off-plan visa service for EAS, which increases the possibility and severity of the risk of non-compliance of the hospital building already built.

Fiocruz is a health science and technology institution, linked to the Ministry of Health and which aims to produce, disseminate and share knowledge and technologies aimed at strengthening and consolidating the Unified Health System (SUS), thus contributing to the improvement of the quality of life of the Brazilian population, to the reduction of social inequalities and to the national dynamics of innovation, having as its central value the defense of the right to health and broad citizenship. (Fiocruz, 2019)

In its portfolio of services offered to the population, there are health care activities, through the various EASs of the Foundation. One of these is the Germano Sinval Faria School Health Center (CSEGSF), located on the Manguinhos Campus, in Rio de Janeiro, which offers basic health care services.

In 2018, the physical space occupied by the CSEGSF was subjected to a point cloud survey, allowing the building to be modeled according to its built form, an action integrated with the adoption of the BIM methodology in the management processes of Fiocruz's building stock, in alignment with the guidelines of Federal Decree No. 10306/2020, which establishes its use in the direct or indirect execution of engineering works and services, carried out by the agencies and entities of the federal public administration, within the scope of the BIM-BR strategy (National Strategy for the Dissemination of Building Information Modeling).

Interventions through renovations in public buildings are quite frequent, especially in EASs, as well as the standards for health spaces are dynamic, and must be aligned with advances in science

and medicine, the evolution of public policies, the demographic profile of users, epidemics and several other factors.

Even an EAS accredited and renovated less than 15 years ago can still present aspects of non-compliance, enhancing future costs with corrective works.

The automated evaluation of a space becomes feasible and advantageous from the application of resources and tools based on the BIM methodology. The possibility of a verification of the environments that simulates an inspection by the Sanitary Surveillance can minimize the risks of non-conformities pointed out by the agency, not only in the design phase, but also in the post-occupational evaluation phase, favoring the planning of future renovations. This research presents possibilities of contribution to the management of the building through the automatic verification of RDC-50 requirements, in this case, of an already built space. This could also be applicable to a project that has not yet been built.

OBJECTIVE

The objective of this article is to study how to create and model rules for automatic verification of RDC-50 and SomaSUS requirements, in the Solibri Model Checker tool, using the information from the BIM model of one of Fiocruz's EASs – the Germano Sinval Faria School Health Center (CSEGSF).

METHODOLOGY

The research methods used were bibliographic and documentary reviews, as well as exploratory research.

There are three conditions, initially verified, for the success of this proposal. The first necessary condition is to ensure the standardization of the nomenclature of the areas (spaces and activities) so that it is possible to create the rules. The second condition is the parametric construction of the rule so that automatic verification is feasible. The third condition refers to the use of verification software – the Solibri Model Checker.

In order to make automatic verification feasible, facilitating the design process and verification of requirements, it was necessary to select one of the various parameters of RDC-50 and the configurations to be used so that the schedule foreseen for the survey was met. Thus, the parameter of the minimum area required for each compartment of the EAS was used.

THE CASE STUDY: GERMANO SINVAL FARIA SCHOOL HEALTH CENTER

The Germano Sinval Faria School Health Center (CSEGSF), created in 1968, still as the Germano Sinval Faria Training Unit, is a national reference institution of the SUS for tuberculosis

and other lung diseases, standing out as a support body for national actions in public health. It is a component unit of the Sérgio Arouca National School of Public Health (ENSP), founded in 1954, and has occupied its current headquarters, the Ernani Braga Pavilion, since March 23, 1964 (OLIVEIRA, 2003, p. 151-163). It is located on the Manguinhos campus, in Rio de Janeiro, and is one of the technical-scientific units of the Oswaldo Cruz Foundation (Fiocruz), an agency linked to the Ministry of Health.

The current headquarters was designed by Floroaldo Alano and Josélio Médici who adapted an existing reinforced concrete structure, abandoned since the 1940s, with 1,251 m², possibly built to be an annex to the Torres Homem Municipal Hospital. The structure was sold by the government of Carlos Lacerda to the Ministry of Health. The project included additions, such as the auditorium and the outpatient clinic, now the health center. The work was completed in a short period of time, from 1965 to 1966 – during this period ENSP worked in an improvised way at the National Children's Department, on Avenida Rui Barbosa, in Flamengo, where the Fernandes Figueira Institute is located today. In addition to being fast, the construction was low-cost, without the use of noble materials. With the inauguration of the new building, ENSP began to offer postgraduate courses, in addition to conducting research and studies in public health. (CASTRO et al., 2004; OLIVEIRA, 2003, p. 154-155).

The Health Center occupies an annex of the so-called Ernani Braga Pavilion, with a single floor. Figure 1 shows its location. The Manguinhos campus is accessible both from Avenida Brasil and Avenida Leopoldo Bulhões, by urban bus or train, or from Rua Sizenando Nabuco, by car or on foot, with the closest access to the Health Center through the entrance of Avenida Leopoldo Bulhões, 1480.

In 2012, the CSEGSF obtained its first international accreditation certificate. The process was carried out by the Brazilian Accreditation Consortium (CBA), which applied the international method of the North American organization Joint Commission International (JCI) and granted the unit international recognition of the quality of services provided to the population. In this process, the procedures and physical infrastructure were evaluated.

Figure 1 - Location of the Ernani Braga Pavilion, at the Manguinhos Campus of Fiocruz - ENSP and Health Center.

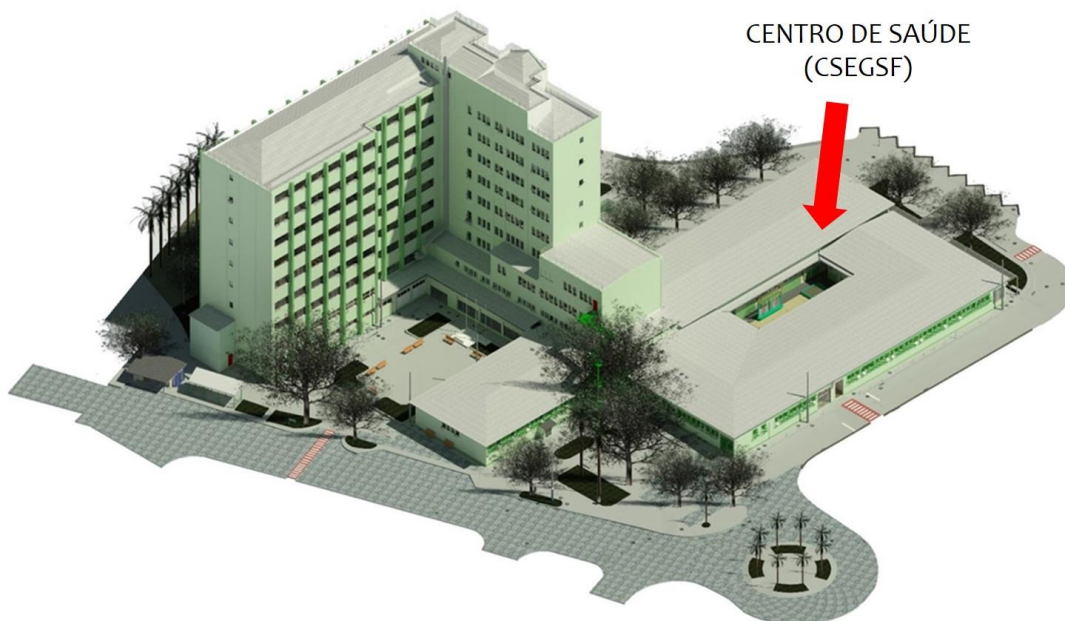


Source: Fiocruz (2024). Adapted by the authors.

CADASTRAL SURVEY IN BIM

From the hiring of the "As is" survey by point cloud of the ENSP building (Ernani Braga Pavilion), with eleven floors and 12,151.07m² of total built area, the Coordination of Projects and Works (CPO) team began the process of information management, through the cadastral update of the built park. Figure 2 presents an image of the BIM model resulting from the point cloud modeling, captured from the survey service using the laser scanner, with the indication of the location of the Health Center.

Figure 2 – BIM model of the Ernani Braga Pavilion, with the indication in red of the location of the Health Center.



Source: CPO (2018). Adapted by the authors.

It was found that BIM modeling, based on the point cloud, meets the requirements for automatic evaluation of the model, based on one of the criteria indicated in the 2017 study by Santos, Ribeiro. These authors consider that the BIM model should present a minimum level of development equivalent to a preliminary project, which in the BIM methodology corresponds to ND 300. In this way, it was possible for this building to be the object of this study.

PROGRAM OF SPACES

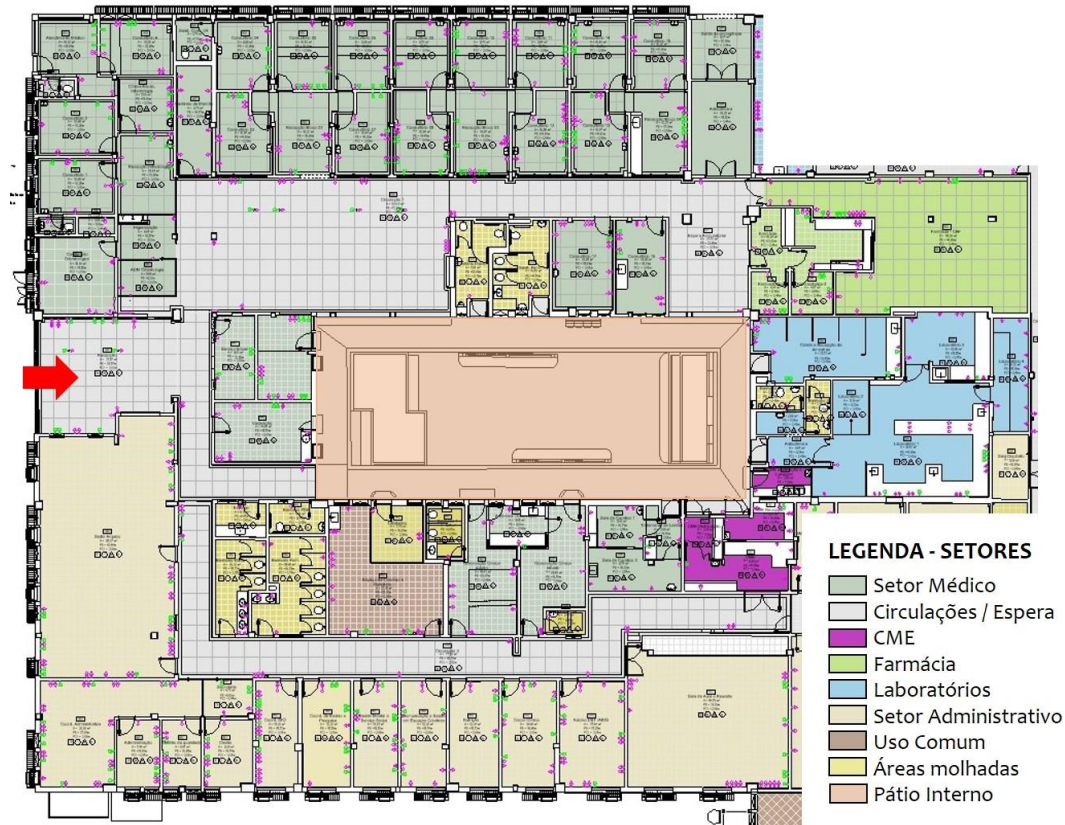
The Health Center has 1,673 m², with environments grouped as: Medical Sector, Circulations, Waiting, CME, Pharmacy, Laboratories, Administrative Sector, Common Use and Wet Area, as shown in Figure 3. The entrance (reception) is indicated by a red arrow.

The Diagnosis and Therapy Support Sector houses the Pharmacy, the Material and Sterilization Center (CME) and the Laboratories and, together with the Medical Sector, is located around the internal courtyard, which provides natural lighting and ventilation to these environments. The CME receives and sterilizes all the material used in the Health Center and the Analysis Laboratory performs Bacilloscopy and Mycobacterial Culture exams for patients in this and other units.

The areas in which patients receive care were classified as Medical Sector: reception, clinical observation, special care area, breastfeeding room, collection room, vaccination and offices. Clinical Observation is subdivided into three areas: the nursing room, separated by glass from the two rest areas (one for children and one for adults); and each of the rest areas has two beds. The Special Care area is subdivided into two areas for non-invasive lesion treatments. One of the areas is used to treat infected lesions and is equipped with an exhaust fan with an absolute filter (HEPA).

This sector has 20 offices, divided into two subareas: those for Infectious Diseases, and the other offices, divided into 4 blocks of 5 offices. Each of the blocks has an access room where an initial service is performed by nursing professionals, such as weighing and measuring blood pressure.

Figure 3 – Sectorization of the Health Center.



Source: CPO (2018). Adapted by the authors.

The Administrative Sector consists of rooms and bathrooms for the internal team. They are occupied by the head, coordination, administration, medical archive and multipurpose activities, such as classes, meetings and training.

The area classified as for common use corresponds to the Social Room and Cafeteria for employees. In the wet areas, toilets were included for the use of patients and companions.

The Health Center was built in masonry, and most of the walls were plastered and painted, with the exception of the corridors of the patient sector, which are covered at half height with tiles, however, some internal walls were made later, in *drywall*, regularized with putty and paint. As for the ceilings of the rooms, they were plastered and painted or have a modulated ceiling in plates. The floor has three types of coating: the original is in high-strength mortar; in the "clean areas" it is cemented painted with epoxy; and the most recent floors are covered with porcelain tiles.

AUTOMATIC RULE CHECKING

AUTOMATIC VERIFICATION TOOLS

According to Eastman et al. (2009), there are three ways in which the verification of rules can be carried out, with specific uses and objectives:

- 1) an application developed to work in another tool, such as a plug-in, allowing verification at any time;
- 2) as a computer software, parallel to the design software;
- 3) as a web-based application, which accepts the derivative design from various platforms.

The tool chosen by the authors of this research for automatic verification of the rules is developed by NEMETSCHEK COMPANY, a German software company, aimed at the entire life cycle of buildings and infrastructure projects.

Solibri Model Checker is a quality assurance solution for BIM validation, compliance control, design review, analysis and code verification, which allows you to adapt the Ruleset Manager for the generation of custom rules for model verification. It automatically analyzes and groups interferences according to their severity, also looking for components and materials that are missing from the model. The tool extracts the data in the form of a report, with the possibility of using Excel functions in them. Importing the model is possible in IFC, compressed IFC (IFCZip), and DWG formats. To carry out this research, three Solibri test licenses were used that were made available for 45 days.

CLASSIFICATION OF INFORMATION FOR RDC-50

For the application of RDC-50 requirements, there would be the possibility of using international classification systems, such as OmniClass. However, when observing the spaces defined in this system and their corresponding functions, it is verified that they are dissonant with the spaces provided for by Anvisa's rules, which is more detailed and comprehensive for certain disciplines, in addition to containing programmatic differences. Standards established by public agencies are linked to regional parameters and inherent to the specialization and selectivity of themes, while international systems have the objective of generalization and standardization.

In addition, RDC-50 aims at the assessment of biosafety, while OmniClass is aimed at the objectives of the construction industry. Probably the application of other classification systems would not meet the objective of normative evaluation within ANVISA's parameters. To illustrate this incompatibility, in Figure 4 extracted from OmniClass, the pediatric office (OmniClass number 13-51 11 19) is defined as a space intended for the care of patients aged 1 to 20 years; For the Brazilian health system, together with the Statute of the Child and Adolescent, a patient is considered pediatric when he or she is between 0 and 18 years old. Another noteworthy point is that the tables for classification of environments of ABNT Standard 15.965 referring to the classification of environments (4A) and Units (4U) had not yet been published at the time of the experiment, hence the OmniClass system was used.

Figure 4 - Classification and description of health care areas of the OmniClass.

1	Table 13		Spaces by Function			
2	OmniClass Number	Level 1 Title	Level 2 Title	Level 3 Title	Level 4 Title	Definition
312	13-49 23 13			Computer Server Room		Climate controlled space for servers associated with office environments
313	13-51 00 00	Healthcare Spaces				Space which is used for services directly related to the health care and medical practice. Most uses are applicable to providing medical care to humans as well as veterinarian services for animals. Size of the space may vary according to the size of the patient however the functions would be consistent as in admissions, diagnostics, surgery etc.
313	13-51 11 00		General Examination Spaces			Spaces used by multiple medical services for routine patient examinations.
314	13-51 11 11			Exam Room		Space used for routine, urgent, and emergent examination (physical inspection of a patient or parts of his body) in order to verify health or diagnose disease or injury. May also be Space used for minor procedures such as injections, wound care, and suturing.
315	13-51 11 13			Exam Room, Airborne Infection Isolation		Space used for examination of patients who are suspected to have or have a condition which could pose an airborne infection threat to other patients.
316	13-51 11 15			Exam Room, Isolation		Space used for examination of patients with suspected contagious diseases.
317	13-51 11 17			Exam Room, OB/Gyn		Space used for gynecological examination of women.
318	13-51 11 19			Exam Room, Pediatric		Space used for examination of patients who conform to institutional criteria as being children, generally 1 year old to 20 years old.
319	13-51 11 21			Exam Room, Protective Environment Isolation		Space used for examination of patients who are suspected to have or have a condition which makes them highly susceptible to infection.
320	13-51 11 23			Exam Room, Podiatry		Space used for the diagnosis and treatment of disorders of the foot, ankle and leg.
321	13-51 11 25			Exam Room, Security		Space used for examination and holding of patients who are under custodial observation due to mental infirmity or judicial restraint.
322						

Source: Omniclass.

RDC-50 is organized into themes focused on the planning of the spaces of the EAS, in chapters ordered within a hierarchy of complexity and specialization of the disciplines involved. Its form, partly structured in patterns and tables, contributes to the automation of the structuring of rules.

Within the diversity of themes to be inspected by RDC-50, the dimensioning of spaces is considered the most relevant and recurrent. From small offices of self-employed professionals to large hospitals, the dimensions associated with the correct nomenclature of the compartments are parameters that are very likely to be inspected. In addition to having a high impact on construction and urban space, the minimum areas seek to ensure quality in health care processes. The minimum areas and dimensions of the spaces are easily found in this standard, which presents this information in a column in spreadsheets grouped in a single chapter, as shown in Figure 5.

Figure 5 - Example of one of the several tables of environments related to care activities provided for in the RDC-50 standard.

UNIDADE FUNCIONAL: 1- ATENDIMENTO AMBULATORIAL				
N.º ATIV.	UNIDADE / AMBIENTE	DIMENSIONAMENTO		INSTALAÇÕES
		QUANTIFICAÇÃO (min)	DIMENSÃO (min)	
1.1 a 1.5	<i>Ações Básicas de Saúde</i>			
1.1	Sala de atendimento individualizado	1	9,0 m ²	HF
1.1, 1.3, 1.4 e 1.5	Sala de demonstração e educação em saúde	1	1,0 m ² por ouvinte	HF
1.1	Sala de imunização	1	6,0 m ²	HF
1.5	Sala de armazenagem e distribuição de alimentos de programas especiais		1,0 m ² por tonelada para empilhamentos com h= 2,0 m e com aproveitamento de 70% da m ² do ambiente	
1.2, 1.4, 1.5	Sala de relatório		1,0 m ² por funcionário	
1.11	<i>Enfermagem</i>			
1.11	Sala de preparo de paciente (consulta de enferma, triagem, biometria)		6,0 m ²	HF
1.11	Sala de serviços		8,0 m ²	HF
1.8, 1.11	Sala de curativos / sumos e coleta de material (exceto ginecológico)		9,0 m ²	HF
1.11	Sala de reidratação (oral e intravenosa)		6,0 m ² por paciente	HF,EE
1.11	Sala de inalação individual	1, obrigatório em unidades p/ tratamento de AIDS	3,2 m ²	HF,FAM,FO,E
1.11	Sala de inalação coletiva		1,6 m ² por paciente	HF,FAM,FO
1.11	Sala de aplicação de medicamentos		5,5 m ²	HF
1.7	<i>Consultórios¹</i>			
1.7, 1.8	Consultório indiferenciado	NC=(A,B):(C,D,E,F) *	7,5 m ² com dim. mínima=2,2 m	HF
1.7	Consultório de serviço social - consulta de grupo		6,0 m ² + 0,8 m ² p/ paciente	
1.7, 1.8	Consultório de ortopedia		7,5 m ² ou 6,0 m ² (+ área de exames comuns a outros consultórios com área mínima de 7,0 m ²). Dim. mínima de ambos=2,2 m	HF
1.7, 1.8	Consultório diferenciado (oftalmo, otorrino, etc.)		A depender do equipamento utilizado. Distância mínima entre cadeiras odontológicas individuais numa mesma sala = 1 m	HF
1.7, 1.8	Consultório odontológico coletivo		9,0 m ²	HF,FAM,FVC
1.7, 1.8	Consultório odontológico			
1.11	<i>Internação de Curta Duração²</i>			
1.11	Posto de enfermagem e serviços	1 a cada 12 leitos de curta duração	6,0 m ²	HF,EE
1.11	Área de prescrição médica		2,0 m ²	
1.8, 1.9, 1.10, 1.11, 1.12	Quarto individual de curta duração	1	10,0m ² = quarto de 1 leito 7,0m ² por leito = quarto de 2 leitos 6,0m ² por leito = quarto de 3 a 6 leitos N.º máximo de leitos por quarto = 6 Distância entre leitos paralelos = 1m Distância entre leito e paredes: cabeceira = inexistente; pé do leito = 1,2m; lateral = 0,5m Na pediatria e na geriatra devem ser previstos espaços para cadeira de acompanhante ao lado do leito	HF, HQ, FO, FAM, ER, ED
1.8, 1.9, 1.10, 1.11, 1.12	Quarto coletivo de curta duração			

Ver Portaria Conjunta MS/GAB n.º 1 de 02/08/00 sobre funcionamento de estabelecimentos privados de vacinação e Portaria MS/GAB n.º 44 de 10/01/01 sobre hospital-dia no âmbito do SUS.

¹ Admite-se consultórios agrupados sem ambientes de apoio, desde que funcionem de forma individual. Nesse caso os ambientes de apoio se resumem a sala(s) de espera e recepção e sanitário(s) para público e, caso haja consultórios de ginecologia, proctologia e urologia, sanitário para pacientes anexo a esses.

² Quando o EAS possuir unidade de internação, esta pode ser utilizada para manutenção de pacientes em observação pós-cirurgia ambulatorial.

Source: Anvisa (2002).

RDC-50, in addition to being organized, is comprehensive when it lists the possible spaces within an EAS. There are more than 200 different environments, each one housing specific activities - these are coded within the standard itself - with their own physical requirements, most of the time being requirements of minimum areas and/or dimensions.

To differentiate such spaces, RDC-50 establishes names that, in order not to be duplicated, sometimes become long and composed of many words, such as "storage and distribution room for food of special programs" different from "storage and distribution room for sterilized materials and clothing".

Long names in the graphic representation of the project tend to be abbreviated subjectively, subtracted, poorly written, broken down into separate words into distinct objects when developed in CAD. When one seeks to automate the verification of a long expression, this becomes a weakness, which could be circumvented if there were a standardized coding in the description of these compartments.

In 2004, the Ministry of Health presented SomaSUS, prepared by the team of the Study Group in Hospital Engineering and Architecture of the Federal University of Bahia (GEA-Hosp/UFBA), in partnership with the Institute of Biomedical Engineering of the Federal University of Santa Catarina (IEB/UFSC). Since its creation, it has been developing, updating and adding more information to the planning of EASs. Until 2023 it was publicly and interactively available on the internet. In May 2024, the system was re-edited and presented in a new version (SomaSUS).

The elaboration of SomaSUS was based on RDC-50, transposing the spaces to illustrated cards with schematic layout, proximity flowchart, installation points, lists of furniture and equipment necessary or usually applied and other information, in addition to RDC-50. One of its most significant contributions to this study is in the version prior to 2024, being the presentation of a code system for each compartment, associating, for example, code AMB04 for "storage and distribution room for food of special programs" and CME08 for "storage and distribution room for sterilized materials and clothing".

Table 2 presents an example of a list of compartments for RDC-50. In this case, the parameters for verification are the names of the compartments and their minimum areas.

Table 2 - Example of a list of RDC-50 compartments and minimum areas.

PARAMETER NAME	MINIMUM AREA PARAMETER
ADMINISTRATIVE ROOM	5,5
AREA FOR THE EXECUTION OF ADMINISTRATIVE, CLINICAL, NURSING AND TECHNICAL SERVICES	5,5
MEETING ROOM	2
INDIVIDUALIZED SERVICE ROOM	9
DEMONSTRATION ROOM AND HEALTH EDUCATION	1
IMMUNIZATION ROOM	6
STORAGE AND DISTRIBUTION ROOM FOR FOOD FROM SPECIAL PROGRAMS	
REPORT ROOM	1
PATIENT PREPARATION ROOM	6
SERVICE ROOM	8
DRESSING ROOM / SUTURES AND MATERIAL COLLECTION	9
REHYDRATION ROOM	6
INDIVIDUAL INHALATION ROOM	3,2
COLLECTIVE INHALATION ROOM	1,6
MEDICATION APPLICATION ROOM	5,5
UNDIFFERENTIATED OFFICE	7,5
SOCIAL WORK OFFICE	6
ORTHOPEDICS OFFICE	7,5
OPHTHALMOLOGY OFFICE	
OTORHINOLARYNGOLOGY OFFICE	
GYNECOLOGY OFFICE	7,5
PROCTOLOGY OFFICE	7,5
UROLOGY OFFICE	7,5
COLLECTIVE DENTAL OFFICE	
DENTAL OFFICE	9
NURSING STATION AND SERVICES	6
MEDICAL PRESCRIPTION AREA	2
SHORT TERM SINGLE ROOM	10
SHORT-TERM COLLECTIVE ROOM 2 BEDS	14

Source: Anvisa (2002). Adapted by the authors.

The codification also goes beyond the compartments established by RDC-50, differentiating, for example, a "nursing and service station" from an infirmary to that of an ICU. Chart 3 presents examples of SomaSUS coding.

Chart 3 – Example of SomaSUS codes for environments and their respective names and minimum areas.

CODE PARAMETER	PARAMETER NAME	MINIMUM AREA PARAMETER
ADM03	ADMINISTRATIVE ROOM	5,5
ADM04	AREA FOR THE EXECUTION OF ADMINISTRATIVE, CLINICAL, NURSING AND TECHNICAL SERVICES	5,5
ADM12	MEETING ROOM	2
AMB01	INDIVIDUALIZED SERVICE ROOM	9
AMB02	DEMONSTRATION ROOM AND HEALTH EDUCATION	1
AMB03	IMMUNIZATION ROOM	6
AMB04	STORAGE AND DISTRIBUTION ROOM FOR FOOD FROM SPECIAL PROGRAMS	
AMB05	REPORT ROOM	1
AMB06	PATIENT PREPARATION ROOM	6
AMB07	SERVICE ROOM	8
AMB08	DRESSING ROOM / SUTURES AND MATERIAL COLLECTION	9
AMB09	REHYDRATION ROOM	6
AMB10	INDIVIDUAL INHALATION ROOM	3,2
AMB11	COLLECTIVE INHALATION ROOM	1,6
AMB12	MEDICATION APPLICATION ROOM	5,5
AMB13	UNDIFFERENTIATED OFFICE	7,5
AMB14	SOCIAL WORK OFFICE	6
AMB15	ORTHOPEDECS OFFICE	7,5
AMB16	OPHTHALMOLOGY OFFICE	
AMB17	OTORHINOLARYNGOLOGY OFFICE	
AMB18	GYNECOLOGY OFFICE	7,5
AMB18	PROCTOLOGY OFFICE	7,5
AMB18	UROLOGY OFFICE	7,5
AMB19	COLLECTIVE DENTAL OFFICE	
AMB20	DENTAL OFFICE	9
AMB21	NURSING STATION AND SERVICES	6
AMB22	MEDICAL PRESCRIPTION AREA	2
AMB23	SHORT TERM SINGLE ROOM	10
AMB24	SHORT-TERM COLLECTIVE ROOM 2 BEDS	14

Source: SomaSUS. Adapted by the authors.

Associating these codes with spatial objects at the time of modeling, as one of its parameters, provides automation and more accurate reading of the project. Regardless of the name of the compartment presented in the project, by associating each environment with its SomaSUS code, it

will bring greater reliability to the automated evaluation process, with the security of the results. The column with the name of the compartments would be unnecessary for verification. It is important to note that the code is not necessary for the construction process or for Anvisa's evaluation process.

Thus, despite its usefulness in the automatic verification of requirements, it is not recommended to replace the names of these compartments in the project documentation with codes, which would make it difficult to read, and it is unlikely that anyone, whether layman or specialist, has in memory all the codes and their associated environments.

According to Mendonça (2020), the software to be used in the verification must "recognize" the classification system used in the model. Solibri has some systems loaded in its database, including OmniClass, and also allows the adoption of the user's own systems. In this research, the SomaSUS codes for the environments will be used and not the OmniClass classification. In the automatic verification process, the environment code parameter will be directly associated with the minimum area.

PREPARATION OF THE BIM MODEL

In Revit, there is a specific category of object called *Room*, being a unit of the subdivision of space, that is, a compartment. Room instances have fields to allocate location data, some of which are automatically generated through a specific command:

- Level
- Area
- Perimeter
- Height
- Volume
- Phase

And other data that must be filled in (optionally) by the designer:

- Workset
- Number
- Name
- Image
- Comments
- Occupation
- Department
- Base finish
- Ceiling Finish
- Wall Finishing

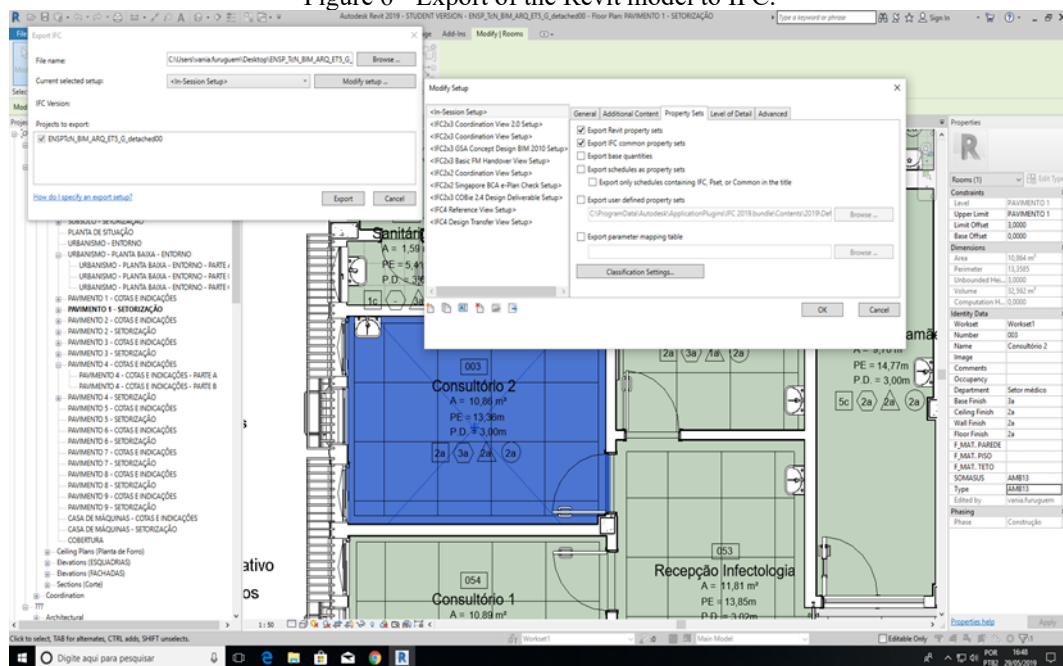
- Floor Finishing

However, there is no specific field for the insertion of codes such as those of SomaSUS. In this case, you must use one of these fields offered for manual content completion or customize the Room data grid, creating one more field. In this research, it was decided to create a new field, arbitrarily called Type.

For each Room in the Health Center model, its corresponding SomaSUS code was then filled in. As an example, Clinic 2 was coded as AMB13.

The model was then exported to IFC through the predefined settings (Figure 6).

Figure 6 - Export of the Revit model to IFC.



Source: The authors.

MODELING OF THE RULES

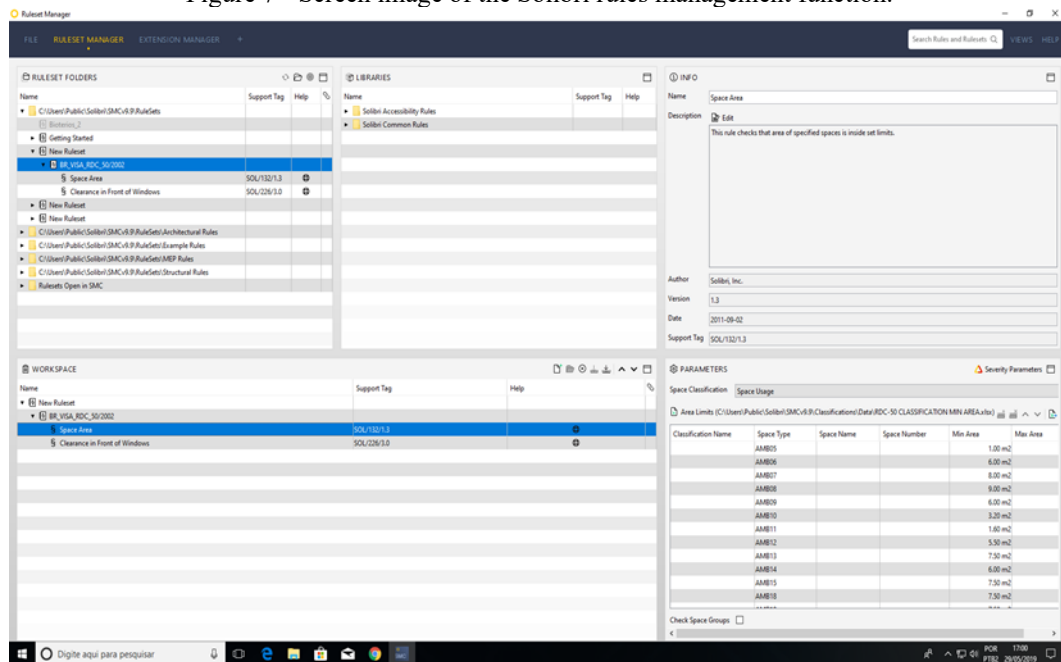
Among the rules offered by Solibri, there is the verification of areas - Space Area (Figure 7), which has the following parameters:

- Classification Name
- Space Type
- Space Name
- Space Number
- Min Area
- Max Area

For this research, the following parameters were customized for the verification of minimum areas of the RDC-50 standard: Space Type as the SomaSUS code and Min Area as the corresponding

minimum area, through the import of an Excel table containing such information extracted from the standard.

Figure 7 - Screen image of the Solibri rules management function.



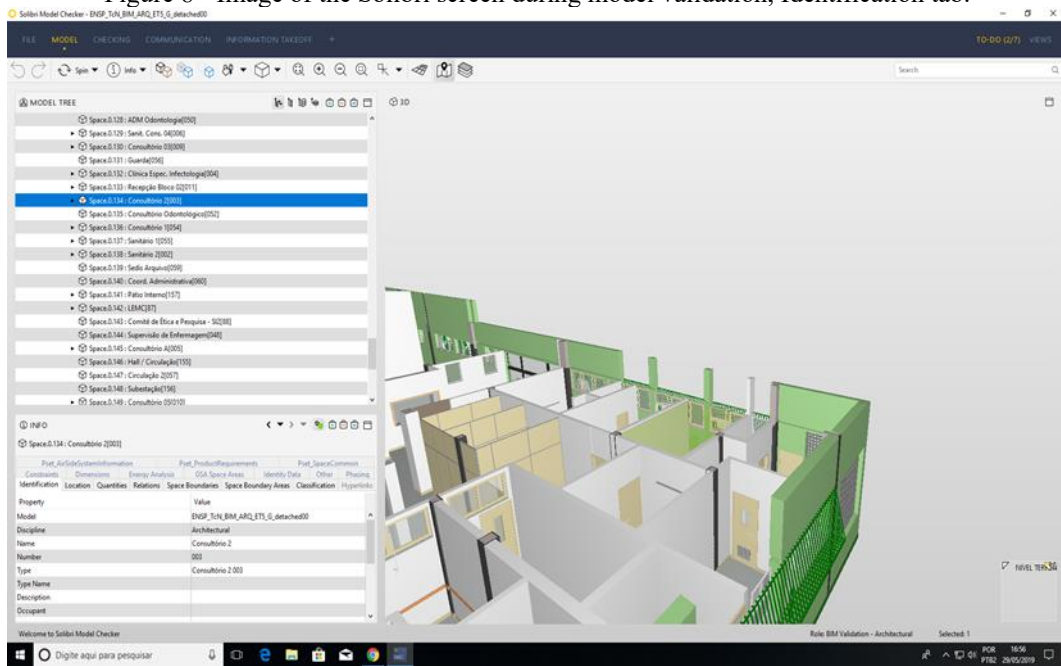
Source: The authors.

BIM MODEL VALIDATION

According to Santos (2018), there are two steps to requirements verification: model validation and requirements verification itself. When the IFC file was opened inside Solibri, it was found that not all the data contained in the Room instance in Revit was properly exported to the parameters of the rules modeled in Solibri. The Room instance has been translated as Space in Solibri. Within the Identification tab of the INFO box for the "Clinic 2" Space, there are the fields of the discipline: name and compartment number (Figure 8).

In the standardized tabs, the parameters that will be checked are also indicated. In this case, the parameters of the Identification tab are indicated.

Figure 8 - Image of the Solibri screen during model validation, Identification tab.



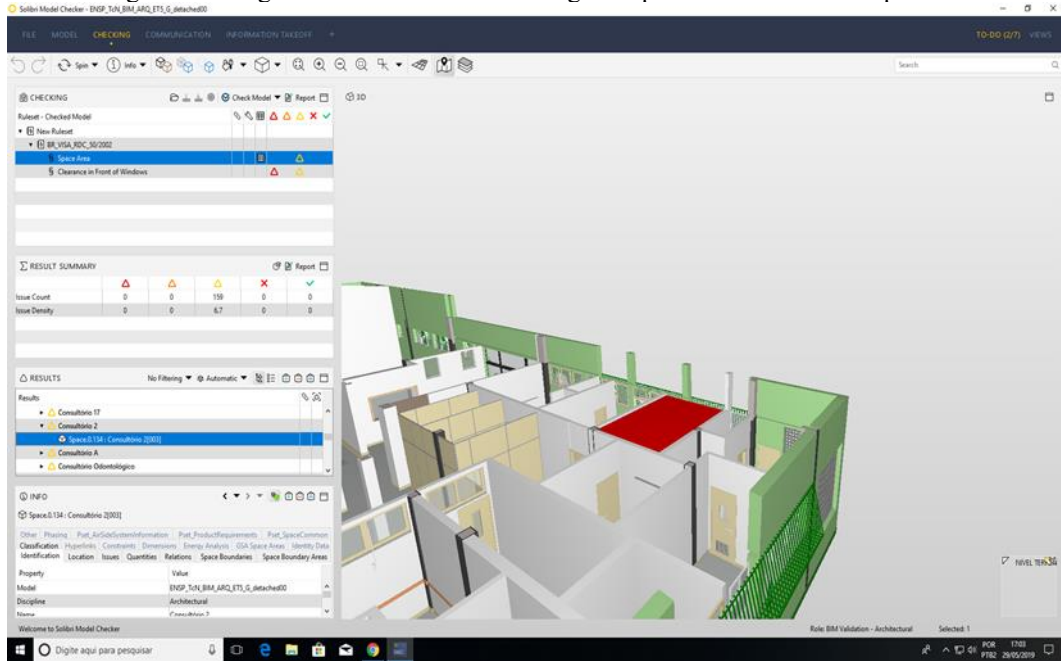
Source: The authors.

Other information from the Revit model, such as Department, Finishes and the Type field created for SomaSUS, can be found in another tab, bluish, which receives the same name used in Revit: Identity Data. Up to this point it is understood that Room information has been imported into Solibri, despite being in different tabs. And that the bluish brims are alien to Solibri's standards.

CHECKING THE MODELED RULES

When performing the Space Area rule check for RDC-50, the Type field imported from Revit is not understood as the Space Type parameter from Solibri. This means that Solibri considers as a verification parameter, for the rule used, the data contained in the Identification tab. The Revit Type parameter is found in the Identity Data tab, as mentioned.

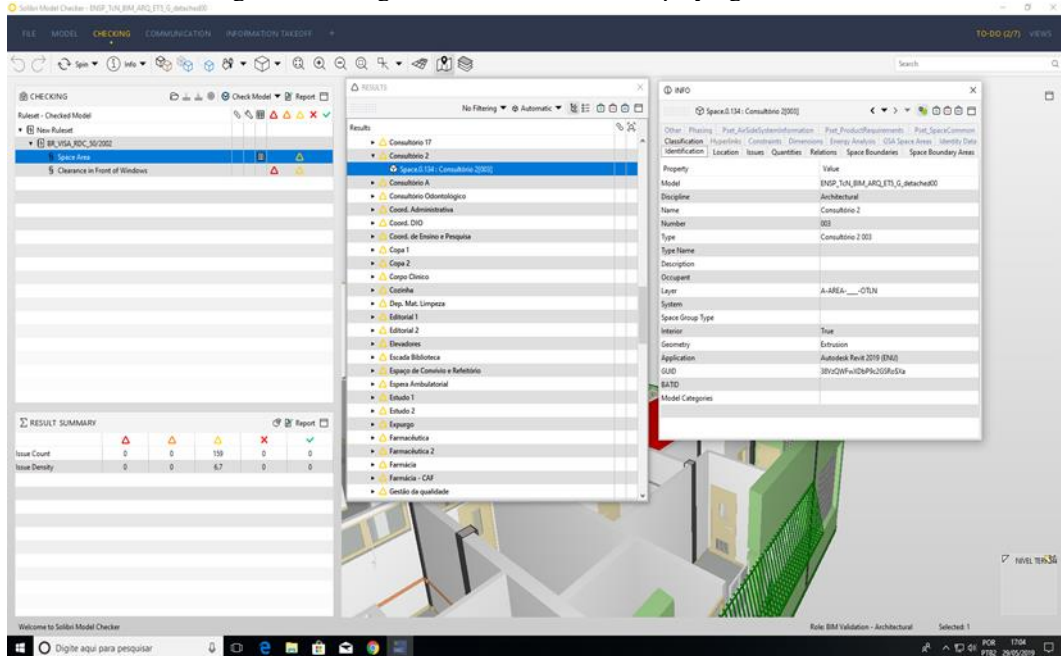
Figure 9 - Image of the Solibri screen during the Space Area verification process.



Source: The authors.

The software identifies the spaces under analysis in the color that can be previously specified. In Figure 9, the environment under analysis is highlighted in red.

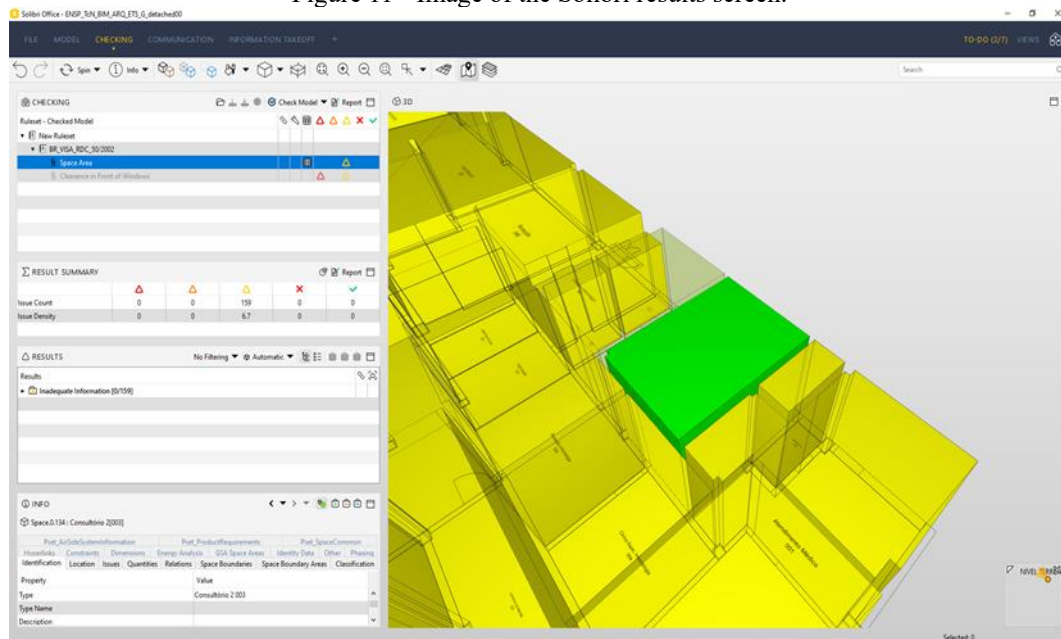
Figure 10 - Image of the Solibri screen displaying the results.



Source: The authors.

Figure 10 shows the results after the rule is checked. According to Solibri, the model studied does not present adequate information, that is, it cannot be validated for the verification of the rule, as shown in Figure 11.

Figure 11 - Image of the Solibri results screen.



Source: The authors.

In order for Solibri to recognize the SomaSUS parameter, this issue of correctly addressing parameters from Revit to Solibri must be addressed. Therefore, through the verification of the rules, it was found that the model would not yet be validated.

DISCUSSION

RDC-50 AS A DATA SOURCE FOR REQUIREMENTS

In its initial considerations, RDC-50 presents the following text:

"Considering the need for state and municipal secretariats to have an instrument for the preparation and evaluation of physical projects of health care establishments, appropriate to new technologies in the health area." (ANVISA, 2002)

Note the date of the current rule: February 21, 2002. Considering the dynamics of the technical-scientific evolution in the biomedical area, which imposes new work processes at all times, in parallel with the technological evolution of the Brazilian AEC industry, it is quickly understood when architects and engineers specialized in EAS express the need for the standard to be revised. In 2018, an ANVISA Working Group was created for this purpose, and it is expected that this review will be completed soon. It would also include SomaSUS, which would continue to be publicly available as a guidance instrument for the management of EAS spaces. According to the article published on the Ministry of Health website, Cláudia Cury, a technician at the Ministry of Health, justifies the revision with the text:

"The supply of physical structures, as well as the incorporation of technologies that require their qualification or adaptation are two very important guidelines for the Ministry of Health. As the manager of a system responsible for adapting RDC 50 to something more playful and



visually interesting, the Ministry's Qualification of Investments in Health Infrastructure team has the technical competence to point out possible deficiencies in the standard and suggest improvements. And, of course, once the new version is published, we will have to completely update the technical content available on SomaSUS". (MINISTRY OF HEALTH, 2017)

In view of his speech, it can be speculated that the general structure of the rule will still be maintained, understanding that SomaSUS would continue to act as a consultation tool accessible to the general public. It should also be noted that RDC-50 does not exhaust ANVISA's standards. There are other Resolutions of the body, specific to certain EAS, amendments, ordinances, in addition to regional codes and manuals of good practices. What can be considered is that RDC-50 is the most comprehensive and central of all standards for EAS. In any case, it is necessary to think of a structured rules verification system to receive modifications to requirements in an automated way, which allows it to be connected directly to the standards in a dynamic way, in real time, in universal web language.

REFLECTIONS ON MODEL PREPARATION

The preparation of the model in Revit, in addition to the ND 300 standards being met, addresses the qualitative review of the project, which needs to be consistent with the standards adopted in RDC-50. To enable this automatic verification, the nomenclatures of compartments, equipment and other construction elements must use the same vocabulary used in the standard. For example, "sink" and "washbasin" have very different meanings and different rules. The information on the care activities that are carried out in each compartment must be consolidated in data documentation attached or entered in the model. The standard establishes and codifies each of them, assigning a specific appropriate compartment. The number of users or certain objects also interferes with the calculation of parameters, such as calculating areas. The model must also receive data from disciplines other than architecture, for the verification of installation points, and these points are also named according to the vocabulary of RDC-50. As an example, the electrical outlet should be labeled "E". And finally, in the same way that engineering elements are introduced, it is highly recommended that architectural elements not evaluated by the standard be excluded from the model so that the verification becomes faster and safer, with less risk of errors. Furniture (except stretchers and beds), roofs, landscaping and urban planning elements (except vehicle spaces), signage, are not useful for verifying the rules, despite the need to be represented in the documentation required in the approval process.

DIFFICULTIES AND RESTRICTIONS

SOFTWARE LICENSE

Initial difficulties in viewing the model were caused by the graphics card installed in the institution's computers (Intel Graphics), which is not recommended by the developer of the tool itself, as it has problems in the operation of the software.

DATA EXPORT

The solution for the correct export of the model information in Revit to the IFC must be carefully planned so that the fields with the information are correctly transferred between the applications. This task implies that the professionals involved know all the applications used and the two information structures: those of the source programs, which can be proprietary data structures, and the neutral (IFC) for the exchange. In order to start the rule verification step more quickly, the data to be verified was entered into Solibri. Ideally, the column created to insert the SomaSUS code in the data of the Room objects of the original model would be automatically identified by Solibri as an existing parameter in its rules, in this case in Space Type.

CONCLUSIONS

From the designer's point of view, we can list some difficulties inherent to the reported process. First, the use of different tools exposes processes to the risk of losing information, due to the need to constantly adapt and change data transit between models, which can be not only to manage the flow between different formats, but also to avoid the bottlenecks caused by different versions. In addition to this problem, it is noteworthy that it would be desirable for the checks to be made in sync with the project definition stage, in which the designers make the decisions. By exchanging data between applications, the personal process of decision-making reflection is usually interrupted.

Another issue is related to the existence of several coding systems that should be harmonized and evolve in parallel with the project. It is usual for more than one code system to be involved in projects, a factor that hinders the harmonization process. In this sense, it is recommended that the structuring of traditional databases, that is, databases composed of tables that contain and relate records and fields, evolve to the structuring of "interconnected knowledge bases", common in Web-semantic environments. Knowledge bases are formatted as graphs and allocated in network environments with stable URI addressing. The graphs are composed of RDF triples, which can grow and help ensure the consistency of the information contained in the project, in addition to being able to be integrated with the current LLM (*Large Language Models*) systems used by generative AI systems, resulting in a public infrastructure of digital knowledge within the open and connected data

paradigm proposed by Tim Berners-Lee. It is believed that an infrastructure of this type results in greater levels of integration and assertiveness of BIM processes.

Experience shows that each compartment of the building, in addition to the code that typifies it as an environment, must have a unique code that identifies it as an instance, in other words, "every compartment must have its own identity guaranteed within a logical coding system that is independent of the chosen application". This ensures the independence of the project in relation to the application used. The list of *RDF triples* may grow and be enriched with new knowledge as the project progresses or during the life of the building (example in Table 4).

Table 04 – *Triples for Rooms or Spaces S01 and S02 of the model.*

SUBJECT	PREDICATE	OBJECT
S01	está_em	Floor1
S01	é_tipo_somasus	AMB20
S01	tem_nome	"Doctor's office"
S01	nome_somasus	DENTAL OFFICE
S02	está_em	Floor1
S02	é_tipo_somasus	AMB20
S02	tem_nome	"Doctor's office"
S02	nome_somasus	DENTAL OFFICE

Source: The authors.

To format the structuring of knowledge suggested in this article, one of the main elements needed is the definition of ontologies. A SomaSUS ontology needs to express how the elements of the system should "be". This allows the definition of the query pattern composed of "subjects, objects and predicates", executed thanks to filtering languages such as SPARQL. The definition of the characteristics of the properties (transitivity, reflexivity, functionality, etc.) will allow to reduce the definition of rules, as it will increase the possibility of inferences by logical calculation. Another benefit that stands out and that is related to query independence is that it allows the knowledge model to be computationally agnostic, that is, independent of the various formats usually used by the applications of the AEC industries, whether proprietary or neutral. Ontologies are usually readable by computational agents and, depending on the language used to write them (Manchester and Turtle mainly), they are also easily readable by human agents. Therefore, we highlight as a strategic need the elaboration of specific domain ontologies for all public entities that manage built assets.

The environments, compartments and equipment of the model to be analyzed must be fully with the same nomenclature used in RDC-50 and SomaSUS, since the beginning of the conception. In the case of projects prepared by outsourcing, this obligation must already be included in the Term of Reference of the contracting and the inspection of the public agency must be attentive and already verify this issue, at each delivery of the product, at each phase of the project. The automation of this process deserves to be developed.

After checking the rule in Solibri, the report indicated that the model presented inadequate information for the process, that is, that it could not yet be considered validated. In order for Solibri to recognize SomaSUS parameters, the Revit parameter addressing must be equivalent to that of the verification software parameter. In this case, it is necessary to understand which parameter of the rule corresponds to the parameter of the model to be exported, in order to form the proper links and correspondences between the information.

Another simpler verification proposal than the experiment carried out with Solibri, could be performed from Revit, using the Schedules Keys type tables with the definition proposed for each type of compartment. By activating the Location Points of the families, the range of possible checks can be expanded, such as the inclusion of equipment necessary for each type of compartment.

Following this same line, a proposal is being developed for the organization of information in BIM models, using as parameters for the environment: SomaSUS code, SomaSUS name, SomaSUS sector and the name of each environment. In addition, the definition of the appropriate location of these parameters, for later use in the automatic checking of rules, fills in the gaps to be filled, according to a necessary standardization.


Through this research it is possible to infer that, by solving the difficulties encountered throughout the process, the automatic verification of RDC-50 requirements, both in the case of a space already built and in the case of a project not yet built, can minimize the risks of non-conformities that are usually pointed out, both in inspections by Anvisa and by accreditation bodies. It was also possible to verify that the automated evaluation of the requirements declared by the rules and regulations can speed up the process in a global way, bringing benefits to the professionals who prepare the projects, to those who have the function of verifying them and to those who supervise them.

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The relationship between the socio-environmental problems of the twenty-first century and the Covid-19 pandemic

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ABSTRACT

COVID-19 is infectious, of zoonotic origin and rapid spread. Among the measures adopted to contain the advance of the disease, the interruption of human activities stood out, such as the closure of industries and transport, actions that proved to be positive for the environment and human health, reflecting in achievements such as the reduction of pollution and respiratory diseases. Several factors have been pointed out for the emergence/re-emergence, emergence and resurgence of infectious diseases, including population growth that intensifies the process of urbanization, globalization, loss of biodiversity, deforestation and land use change. This study aimed to verify the relationship between the socio-environmental problems of the twenty-first century, with a focus on deforestation and the change in land use with the emergence of the COVID-19 pandemic. This is a narrative review of the literature carried out in the databases of CAPES, SCIELO, PUBMED, GOOGLE SCHOLAR and national and international news sites and public organizations such as the World Health Organization and the Ministry of Health. The analysis of these studies allowed the creation of three categories, namely: 1) Advance of deforestation in Brazil and in the world; 2) Climate change; and 3) Human interference and COVID-19. Deforestation is a human activity associated with the emergence of zoonotic diseases, used to open and expand areas for agriculture and livestock. The practice has brought humans and domestic animals closer to wildlife, in this sense, it dialogues with another situation that is related to the theme expanded in this work, the illegal trafficking of wild animals. The highlighted conditions increase the risks of exposure to pathogens, which may favor the emergence of emerging diseases, such as COVID-19.

Keywords: Deforestation, Covid-19, Land use changes, "Zoonotic diseases", Environment, Coronavirus.

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INTRODUCTION

COVID-19 is an emerging infectious disease that emerged in the city of Wuhan, China, in late December 2019. The disease spread rapidly throughout the country and reached other continents, being recognized by the World Health Organization (WHO) as a new pandemic in March 2020 (WHO, 2020).

To contain the advance of the virus, all countries in the world, in different times, had to adopt measures that included the interruption of a set of educational, industrial, commercial, and people-moving activities. The main measure was social isolation, followed by the mandatory use of masks by the population (Spagnol et al., 2021).

Despite being strict measures adopted in an atypical situation, these actions proved to be positive for human health and also for the environment, since previously hidden landscapes reemerged clear and visually recovered. The interruption of tourism in the city of Venice, for example, resulted in an improvement in the water quality of the canals. In other cities, the shutdown of factories and the reduction of traffic powered by fossil fuels such as oil contributed to the reduction of air pollution and respiratory diseases (Souza, 2020; WHO, 2020; Carvalho, 2020; Nascimento et al., 2021).

However, even with the mobilization of national governments and international bodies, especially the World Health Organization (WHO), COVID-19 resulted in the death of about 15 million people worldwide (Grimley; Cornish; Stylianou, 2022).

In Brazil, as of May 29, 2024, 712,205 deaths from the disease had been recorded. The Southeast region ranks first in lethal victims, with 343,286 deaths. This was followed by the South (112,994), Northeast (136,849), Midwest (67,057) and, finally, the North region with 52,019 deaths (Coronavirus Panel, 2024).

In this sense, the very high number of people victimized by the virus brought an alert and a reflection to the constant human interference in nature and the consequent emergence of zoonoses, because COVID-19 is a zoonotic disease, which originated from bats and at the time of writing this work, there is no clarification about the species that acted as the intermediate hosts. It is believed, however, that the animal in question was among the wild species traded in a live animal market, in inadequate sanitary conditions, in the Chinese city of Wuhan (Nascimento et al., 2021; Morcatty, 2021; Liu et al., 2020).

It is estimated that each year an average of three new infectious diseases appear in humans and about 75% of them are of zoonotic origin. We have as an example recent diseases that threaten human health: SARS (2002); Avian Influenza or Avian Influenza (2004); H1N1 or the Swine Flu (2009); MERS (2012); Ebola (2014-2015); the Zika Virus (2015-2016); West Nile Fever (2019) and SARS-CoV-2 (2020) (UNEP, 2020).

Zoonotic diseases can be transmitted to humans by direct and indirect contact. In the direct mode, transmission occurs through secretions (saliva, blood, urine and feces) or by scratches or bites. Meanwhile, indirect contact occurs through the bite of mosquitoes, fleas, and secretions due to the consumption of food contaminated by etiological agents (Duarte et al., 2021).

Among the reasons given for the re-emergence / emergencies of infectious diseases, we highlight the population growth that intensifies the process of precarious urbanization and densification in vulnerable areas, migrations and displacements as displaced from the climate of human and non-human populations, armed conflicts that promote a situation of high unhealthiness, economic globalization, intensification of trade relations, extreme poverty, biodiversity loss, and species extinction, increasing ecological imbalance, as well as deforestation and land use change (Lima, 2020).

Studies point to the relationship between the emergence of diseases and environmental changes and human invasion of natural habitats with a low degree of anthropization or wild as a factor that increases contact between species and pathogens with domestic animals and humans (Nascimento et al., 2021; Rabello; Oliveira, 2020; Souza, 2020).

Human invasion in these areas occurs mainly through anthropogenic activities such as deforestation, logging, intensive cattle ranching, mining, and the increase of agricultural zones that encroach on forested areas, or even new urban areas (Rabello; Oliveira, 2020; Nascimento et al., 2021).

In this sense, this study aimed to verify the relationship between the socio-environmental problems of the twenty-first century, such as deforestation and land use change, with the emergence of the COVID-19 pandemic through a narrative review of the literature.

METHODOLOGICAL PATH

It is a narrative literature review research, which consists of the search and analysis of literature, publications in books, printed or electronic magazine articles. The choice of the method is justified by the possibility of individual interpretation and critical analysis of the researcher (Rother, 2007). Therefore, the following research question was elaborated: *Is there a relationship between deforestation and land use change with the emergence of the COVID-19 pandemic?*

The search for studies was carried out in national and international databases, namely: Journals of the Coordination for the Improvement of Higher Education Personnel (CAPES), Scientific Electronic Library (SCIELO), National

Library of Medicine (MEDLINE/PUBMED), GOOGLE SCHOLAR, and national and international websites with publications on the subject such as WHO, PAHO, BBC, and CNN BRASIL). The following keywords were used: "Deforestation"; "Covid-19"; "Changes in land use";

"Zoonotic diseases", "Environment" and "Coronavirus". with the combination of the Boolean operators AND and OR, without time frame.

For the screening stage, the titles and abstracts were read, and studies that did not answer the research question were excluded. In the eligibility stage, eligible studies were read in full. In the inclusion stage, the studies selected in the previous stage were data extraction and information categorization. From the analysis of the studies, the following categories were created: a) the advance of deforestation in Brazil and in the world; b) climate change; c) human interference in natural habitats and COVID-19.

INTERACTIONS BETWEEN THE ELEMENTS OF THE ENVIRONMENTAL CRISIS AND HUMAN HEALTH

THE ADVANCE OF DEFORESTATION IN BRAZIL AND IN THE WORLD

Anthropogenic changes in land use intensified in the nineteenth and twentieth centuries, especially in developing countries, where logging, deforestation, mining, the construction of hydroelectric dams, the opening of roads and highways, and the increase in agricultural production, which is linked to the agricultural-urban-industrial world system (Ahmed et al., 2019; Saccaro-Junior et al., 2015).

The uncontrolled use of the natural commons, treated from the dominant capitalist economic aspect only as natural resources, is evidenced by deforestation, mining, the reduction of biodiversity by agriculture and the construction or expansion of cities. Such situations harm and affect the existence of other living beings on the planet, taking away their living spaces (Tarazona; Ceballos; Broom, 2020).

Deforestation represents one of the greatest socio-environmental concerns today, being present in global agendas on land use. The preservation of the forest is important, as it is through them that the purification of air and water occurs, in addition to the practice of deforestation puts at risk the biodiversity of numerous animal species, leading them to extinction and unbalancing ecosystems (Ceolin, 2019); CNN Brasil, 2023).

Research shows that about 95% of deforestation is due to illegal practices. This process has been aggravated in the state of Amazonas, with the extraction of timber and activities related to agriculture (Constantino, 2023; Nassif; Raciunas, 2023; BBC, 2023). In Mato Grosso, it is estimated that 80% of the deforestation that occurred in the Cerrado biome was illegally practiced. These changes have an impact on the Pantanal biome, as the Cerrado is home to springs that supply the region's rivers, contributing to the worsening of water crises (Ghaouri, 2023). In the case of Mato Grosso, deforestation in the Amazon has also been a growing and continuous practice from the 1970s to the present.

However, if the situation is very visible in the context of the Brazilian Amazon, it also exists in other forests present in Bolivia, Indonesia, Asian countries, Peru, and the Democratic Republic of Congo (BBC News Brasil, 2021; Morens et al., 2020). Bolivia and Peru together contributed more than 5 million hectares to forest clearance (BBC News Brasil, 2021).

During the pandemic period, the deforestation rate recorded in Brazil in 2020 was considered the highest in more than a decade (BBC News Brasil, 2021). This year, deforestation jumped from 63% to 136% when compared to the previous year (2019), this increase may be related to the application of isolation measures that aimed to contain the spread of Coronavirus and that reduced monitoring and inspection actions (Branca et al., 2020).

The states with the highest deforestation rates in Brazil in 2020 are Pará with (33%) of the alerts and 26% of the deforested area, Mato Grosso with (5%) of alerts and 12.86% of deforested area, and finally the state of Maranhão with (12.08%) of deforested area in the country, and the main cause responsible for deforestation is agriculture, other causes are mining, mining, natural cause, urban expansion and others (Azevedo et al., 2020).

In addition, the pandemic also favored the approval of political actions, which aimed to weaken environmental protection policies in Brazil. These acts included environmental deregulations that weakened environmental stewardship and enforcement through less stringent standards and procedures. Although research indicates an increase in deforestation rates, there was a reduction in the application of fines (Vale et al., 2021).

CLIMATE CHANGE AND FIRES

According to the Intergovernmental Panel on Climate Change (IPCC), about 23% of the world's greenhouse gas emissions are due to human activities, including fires (Levin; Parsons, 2019). The consequences of climate change on human health can be perceived in two ways: direct, through heat waves or other events such as hurricanes and/or floods; or indirect, which occurs through environmental changes, such as modifications in ecosystems and biological cycles, which can lead to the emergence or reappearance of emerging and reemerging diseases (Barcellos et al., 2009).

Currently, the planet is facing strong heat waves, severe droughts, and forest fires in several countries around the world, such as the United States, Australia, the Siberian Arctic, and including Brazil (Silva et al., 2021). The number of fire outbreaks that occurred on Brazilian soil in 2020 in the Pantanal region broke records: 4,611 fire outbreaks were recorded, triple the rate in the previous year (2019; 1,534), considered the highest record in 22 years (Fiocruz, 2020; Bronze, 2020; Borges, 2020).

The consequences of uncontrolled fires include the loss of natural vegetation, reduced biodiversity, and damage to human health (Silva et al., 2021; Fiocruz, 2022). This practice emits

gases that are harmful to human health, causing damage to the respiratory system, reducing lung capacity, contributing to the increase in hospital admissions due to respiratory diseases, generating unnecessary expenses for public health systems (Gonçalves et al., 2012; Silva et al., 2020; Hacon et al., 2021; Fiocruz, 2022).

The effects of fires on human health can be felt even at a distance from the places where fires are located. This is due to the speed and direction of the wind, which spreads the toxic components and atmospheric particles present in the smoke (Alvin, 2020).

HUMAN INTERFERENCE IN NATURE AND COVID-19

It is estimated that the world population is currently approximately 7.8 billion inhabitants. The population increase is pointed out as an intensifying agent of the urbanization process, which occurs in most cases, in a disorderly and precarious way. In association with the high demand for food, energy, food and rapid transport of people, globalization and human activities such as deforestation, there are factors that contribute to the emergence, introduction and spread of diseases (Thoradeniaya; Jayasinghe, 2021).

In addition, it should be noted that tropical forests are natural environments that provide shelter for various species of animals. On the other hand, they are places "rich" in viruses, which can be enhancers of pandemic diseases (Vale et al., 2021; Ilacqua et al., 2021).

Wildlife spaces are getting smaller and smaller, cornering most species that may be possible hosts for zoonotic diseases (Lacy-Niebla, 2021). Therefore, the loss of biodiversity hinders the natural stability of viruses and pathogens that tend to concentrate in certain species. It is observed that this instability, in turn, can lead to the emergence of emerging and reemerging diseases (Rabelo; Oliveira, 2020).

For Silva and Aleixo (2020), the preservation of biodiversity can "protect ecosystems and minimize the occurrence of virus spread among the human species". In the meantime, we highlight the paramount role played by biodiversity in regulating natural ecosystems and the global biosphere (Junges, 2020). Likewise, Junges considers that the decrease in diversity affects the adaptations of living beings to disturbances.

Focusing on the context of the Brazilian Amazon, deforestation has resulted in several environmental and social problems such as conflicts between indigenous peoples and miners, exposing many people to contact with hosts and various pathogens (Souza, 2020; Santos, Severo, Hoefel, 2020; Vale et al., 2021).

In addition, anthropic practice is related to contact between humans and animals that host unknown diseases, and consequently, the emergence of pandemic diseases. Therefore, the pandemic of the new coronavirus alerts us to the indirect effects of deforestation (Pierro; Jacobi, 2021) and

annihilation of wild environments. The number of zoonoses increases every year, many of them are the result of the removal of wild animals from their natural habitats, as well as their commercialization (Ilacqua et al., 2021). Such removal is for food purposes, sale of species for exotic breeding, removal of skins and other animal parts for medicines and illegal research.

Illegal wildlife trafficking is considered the third most lucrative activity in the world, second only to drug and arms trafficking (Duarte et al., 2021). In this scenario, Brazil is considered one of the main suppliers of animals and it is believed that the illegal market moves around one billion euros per year (Duarte et al., 2021; Alvarenga, 2016). There is a very serious situation of environmental and ecological crimes, with enormous potential for causing human health crises.

According to Ribeiro et al. (2020) the COVID-19 pandemic has contributed to an increase in the illegal trade in animals, because when legal suppliers are unable to meet consumer demand for exotic pets, illegal traders become the most viable option.

According to Junges (2020), most viruses that can reach the respiratory tract, as well as SARS-CoV-2, have a zoonotic origin, and bats are the main carriers. This is because in the processes of agricultural and urban expansion, places inhabited by humans are increasingly closer to bat habitats. The author also points out that animal feedlot farms (cattle, pigs and poultry) that meet the demand for meat have favored the creation and spread of viruses that affect the respiratory tract.

The study by Souza (2020) also points to this relationship between animal production and management practices as a risk factor for the emergence of zoonotic diseases. For the author, livestock acts as a carrier of pathogens, since animals assume the position of vector (host) of pathogen transfers from wild animals to the human population.

FINAL CONSIDERATIONS

The results of this study indicated that deforestation and the reduction of biodiversity have contributed to the emergence and transmission of zoonoses. This occurs due to the interactions between species and the removal of forest cover, which lead to modifications in these interactions.

The studies revealed that in Brazil and other countries, the intensification of agriculture and livestock has brought humans closer to wildlife, increasing the risk of exposure to pathogens. In addition, the studies warn about the consequences of deforestation with the water crisis, since forest deforestation can compromise the supply of rivers and influence the population's shortage.

Another consequence is forest fires, practices that not only intensify the greenhouse effect, but also destroy wildlife spaces, causing the death and extinction of several species. Regarding the effects on human health, its association with an increase in respiratory diseases stands out. In addition, studies highlight the dangers of wildlife trafficking to human health. This practice exposes humans to



the risk of disease specific to the animal, which can favor the emergence of emerging diseases such as COVID-19.

When dealing with COVID-19, studies point out that the disease may have arisen from man's constant exposure to animals sold in markets that sold live and dead animals. Therefore, it is important for environmental, animal and human health to provide guidance to the population about the potential risks related to these practices, as well as to institute permanent public policies for monitoring and control. In addition, it is necessary to strengthen existing environmental legislation and carry out stricter ways of enforcement.

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Liposomes as drug delivery: A review of innovations in disease treatment and tumor therapy

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ABSTRACT

Liposomes are a drug delivery model that are studied for the treatment of various pathologies. These nanoparticles are manufactured by redirecting phospholipids with the hydrophilic inner medium surrounded by the lipophilic bilayer. As an additional advantage of this model, several changes can be made to the bilayer to implement the transport of drugs in the biological media, such as the insertion of polyethylene glycol, peptides and carbohydrates, giving more specificity to the drug delivery model, such as multifunctional liposomes and ligand-directed liposomes. These modifications help in the different mechanisms of active and passive vectorization and make the liposome system cover several areas of action, such as pain control, antibacterial action, and vaccines. In addition, these nanoparticles are also used in new strategies in tumor therapy, which use cancer symptoms to target nanoparticles more effectively, such as double-ligand liposomes, co-delivery liposomes, and sensitive to stimuli that are still under development or already used in the clinic.

Keywords: Nanoparticles, Liposome, Drug delivery, Cancer.

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INTRODUCTION

With the advances in nanotechnology, the development of new therapeutic alternatives to overcome the conventional limitations of drug transport in biological media has become more specific. Thus, nanoparticles have the potential to improve the stability and solubility of encapsulated fillers, promote transport across membranes, and extend circulation times to increase safety and efficacy (Mitchell *et al.*, 2020). Among the various nanotechnological models, liposomes are widely studied and developed for the treatment of various pathologies. These nanoparticles are manufactured from the self-assembly of phospholipids, which consist of a group of phosphate polar head and hydrophobic lipid tails, typically 100-500nm in diameter. In aqueous environments, hydrophobic tails reorient themselves, resulting in a spherical structure composed of an aqueous core surrounded by a lipophilic double-layered membrane (Almeida *et al.*, 2020).

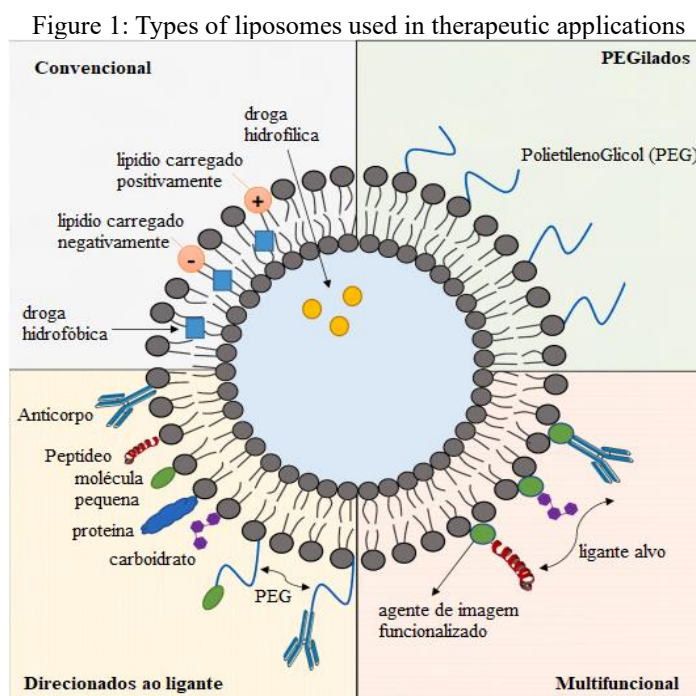
When compared to other colloidal drug delivery systems, liposomes have the advantage of enabling modifications in the structural and physicochemical characteristics of their envelope, which directs the nanoparticle to a specific target *in vivo*. Therefore, liposomes can be classified according to their composition and functionalization. In addition, other more recent changes in the literature can also be observed, such as the improvement of the design by inserting units sensitive to environmental stimuli and other functionalities (Nisini *et al.*, 2018).

COMPOSITION AND FUNCTIONALIZATION

- **Conventional liposomes:** can be composed of neutral, cationic or anionic phospholipids, usually combined with CH to stabilize the liposomal bilayer (Figure 1). However, this type of liposome is unstable in plasma, which results in a reduced half-life, being quickly captured by the reticuloendothelial system and removed from the bloodstream. This is due to the fact that they are attacked by opsonins, serum proteins that cause macrophages to recognize the nanoparticle as a foreign body susceptible to phagocytosis by the mononuclear phagocytic system (Riaz *et al.* 2018).
- **PEGylated liposomes:** Also called stealth or long-circulating liposomes, they are the second generation of liposomes. To increase the half-life of these nanoparticles, they were coated with a layer of a biocompatible hydrophilic polymer such as polyethylene glycol (PEG) or chitosan (Figure 1) to increase the repulsive forces between the liposomes and the serum proteins, and they could remain stable for up to 12 days in the body (Guimarães; Cavaco-Paulo; Nogueira, 2021). However, this exacerbated residence time can cause some adverse effects such as the cell uptake blockade phenomenon, in which the hydrophilic barrier that increases the half-life makes it difficult to interact with target cells; and the ABC phenomenon, in which repeated doses by the parenteral route

induces accelerated blood clearance (ABC) by inducing the generation of an anti-PEG IgM antibody, increasing systemic elimination from the body (Saraf *et al.*, 2020; Wang *et al.*, 2021).

- **Ligand-targeted liposomes:** To address the limitations of the previous generation, ligand-targeted liposomes have been developed for targeted distribution of compounds to target tissues, promoting greater and more selective therapeutic activity. Thus, in addition to the modification of liposomes with PEG, glycoproteins, polysaccharides, or ligands specific to receptors such as antibodies, small molecules, or peptides were inserted (Figure 1). Thus, new formulations have been developed, inserting different fragments to the liposomal surface and further increasing the specificity of the systems that respond to stimuli in the body (Nisini *et al.*, 2018; Guimarães; Cavaco-Paulo; Nogueira, 2021).
- **Multifunctional liposomes:** This class has been studied for its potential to perform a combination of multiple functions through surface modification techniques, resulting in liposomes with a wide range of functionalities (Figure 1). In the literature, several examples of multifunctional liposomes such as theranostic liposomes have been reported, in which the same agent can have a target for diagnostic imaging and therapeutic assets (Xing, Hwang, Lu, 2016).



Source: Guimarães, Cavaco-Paulo and Nogueira, 2021 (adapted)

VECTORIZATION STRATEGIES

PASSIVE VECTORIZATION

This approach has been applied mostly in the field of oncology due to its pathophysiological characteristics of cancer and the environment in which it is inserted. An example of this passive targeting occurs through distribution through the leaky tumor vasculature through fluid movement. As the endothelial space of tumor cells is larger and widely irrigated, and often without lymphatic return due to obstruction, 10-500nm liposomes are able to passively reach the site and remain in the tumor due to this effect called the enhanced retention and permeability (RPE) effect (Guimarães; Cavaco-Paulo; Nogueira, 2021).

Another example is through the stealthy liposomes with PEG and their system of not adhering to serum opsonins, increasing the circulation time, as seen previously (Saraf *et al.*, 2020; Wang *et al.*, 2021). Finally, the use of electrostatic interactions can also be performed by inserting charge properties to induce targeting in the tumor. There are certain phospholipids, proteoglycans, and other negatively charged molecules in tumor neovascular endothelial cells that can serve to guide cationic liposomes, which will accumulate in the endothelium through electrostatic interactions (Wang *et al.*, 2021).

ACTIVE VECTORIZATION

It is the active targeting of the liposome by inserting one or multiple ligands on its surface to increase the distribution of liposomal systems in the target, thus forming multi-functionalized liposomes. This chemical binding of liposomes to ligands occurs primarily through covalent and non-covalent bonds between the active groups on the surface of the liposomes and specific groups present in the ligand (Wang *et al.*, 2021).

There are several aspects that must be considered in the selection of ligands that will direct the liposome, which include: degree of relative overexposure or selective expression in the target; the capture of the target cells of the targeted formulation; and the degree of coverage of the target molecule. Furthermore, the main focus of ligand selection is to allow binding to the target while minimizing binding to healthy cells as much as possible (Guimarães; Cavaco-Paulo; Nogueira, 2021). Some examples of active vectorization are:

- **Vectorization mediated by polypeptide and protein:** in this type an example is transferrin, a protein that is normally used in the body to transport iron absorbed by the digestive tract and by erythrocytic degradation, in addition to being the largest carrier of iron ions. Because tumor tissue with rapid cell proliferation mainly requires iron as a nutrient, the transferrin receptor is overexpressed in tumor cells when compared to normal cells, which facilitates receptor-mediated endocytosis of a liposome with

transferrin (Jhaveri *et al.*, 2018). Another example is BR2, a polypeptide with 17 amino acids, is a derivative of an anticancer peptide of nonspecific cell penetration called buforin IIb. BR2 penetrates cancer cells four times faster than normal cells (Zhang *et al.*, 2017).

- **Polysaccharide-mediated vectorization:** hyaluronic acid is a mucopolysaccharide widely used in tumor treatment because of its special structural characteristics. CD44 is largely overexpressed in tissues where inflammation and tumorigenesis occur. hyaluronic acid binds to CD44 molecules, allowing the concentration of drugs in the tumor region (Wang *et al.*, 2020).
- **Aptamer-mediated vectorization:** Aptamers are small segments of a single-stranded oligonucleotide molecule (DNA or RNA) that binds tightly to the surface and specifically to the target molecule with high affinity and specificity, folding into a unique three-dimensional structure. Nucleic acid aptamers have emerged as attractive carrier molecules. It has high chemical flexibility and tissue penetration, in addition to having stability, low immunogenicity, and simple synthesis (Li *et al.*, 2019).
- **Folate-mediated vectoring:** folate is a water-soluble vitamin that induces receptor-mediated endocytosis. The high affinity of folic acid for the folate receptor has been used as a target in tumor cells due to the low level of expression in normal tissue and overexpression on the surface of cancer cells (Moghimi *et al.*, 2018).
- **Antibody-mediated vectoring (immunoliposomes):** the binding surface of antibodies to liposomes is a common approach used to produce systems with efficient targeting to match the target antigen (Eloy *et al.*, 2017).
- **Vectorization mediated by other molecules:** other molecules can also be used to improve the drug delivery capabilities of liposomes, such as carbohydrates (Chen *et al.*, 2016), and small molecules such as porphyrins (Wang *et al.*, 2018).

THERAPEUTIC USES OF LIPOSOMES

- **Pain control action:** **DepoDur** is an FDA-approved extended-release morphine sulfate-filled liposome-based injection for the treatment of severe pain. The composition of the liposome includes DOPC, DPPG, cholesterol, tricapryline, and triolein (Large *et al.*, 2021).
- **Antibacterial action:** **Arikayce**, is an inhaled liposome suspension containing amikacin, approved by the FDA for the treatment of bacterial infection in the lungs by *Mycobacterium avium* complex (MAC) that can be caused by two non-tuberculous species: *Mycobacterium avium* and *Mycobacterium intracellulare*, which typically affect

immunocompromised patients. The drug is composed of the antibiotic amikacin and the DPPC and cholesterol wrapper (Zhang *et al.*, 2018).

- **Vaccines: Inflexal V**, is a trivalent inactive influenza vaccine, composed of virosomes, liposomes whose surfaces are decorated with viral antigens (hemagglutinin and neuraminidase, in this case influenza variants A and B), 150nm unilamellar composed of 70% lecithin, 20% cephalin, and 10% phospholipids (DOPC:DOPE, 75:25 ratio) (Bulbake *et al.*, 2017). In the case of **SARS-CoV-2 vaccines**, they have fragments of mRNA from spike proteins, which enable SARS-CoV-2 to be attacked and able to enter cells, encapsulated in lipid nanoparticles whose function is to protect the genetic material from being degraded by enzymes (Pardi *et al.*, 2018).

LIPOSOMES IN CANCER TREATMENT: NEW STRATEGIES FOR TUMOR THERAPY

DOUBLE-LIGAND LIPOSOMES

Double-ligand liposomes are two ligands modified into a single liposome. This method allows the simultaneous distribution of multiple targets on the surface receptors of tumor cells, significantly improving the selectivity of liposomes in target cells, resulting in a higher absorption and ability to kill tumor cells than passive targeting techniques or single-ligand-modified liposomes. An example of this type of strategy is by making a liposome with biotin and glucose to attack the sodium-dependent multivitamin transporter (SMVT), which is a key transporter of biotin overexpression on the surface of breast cancer cells (4T1 and McF-7) as well as GLUT1, which is also overexpressed in several tumor cells (Huang *et al.*, 2020).

LIPOSSOMAS DE CO-DELIVERY

Combination chemotherapy refers to the combination of two or more antitumor drugs to improve the induction of the mechanism of drug resistance and reduce toxicity. However, different drugs with different pharmacokinetics may have uneven distribution. Therefore, with the design of liposomes that carry these drugs, they can increase the half-life in the systemic circulation and better accumulation of these in the tumor, preventing different stages of cell growth (Sen *et al.*, 2019).

STIMULUS-SENSITIVE LIPOSOMES

Stimulus response systems emerged as an emerging mode of drug delivery and delivery at specific sites. There are two different categories of approach: the first explores the differences between the tumor microenvironment and normal tissues, such as elevated temperature, low pH, elevated local enzyme activity, and elevated redox potential inside and outside cells. The second

approach to drug delivery is through external stimulation, such as ultrasound exposure and magnetic localization (Wang *et al.*, 2021).

- **PH-sensitive liposomes:** Since the pH of the tumor microenvironment is < 6 , unlike normal cells, pH-sensitive liposome formulations can be an effective way to improve the liposomes' ability to distribute and increase efficacy. However, it requires that the nanoparticle arrive intact until it reaches the tumor site (Lee *et al.*, 2017).
- **Temperature-sensitive liposomes:** Temperature-sensitive liposomes are used to improve the permeability of tumor cells by increasing local temperature, thus allowing more accumulation in the tumor. The ideal temperature to activate liposomes under internal and external influence is above 37°C (Lee *et al.*, 2017; Wang *et al.*, 2021).
- **Ultrasound-sensitive liposomes:** Ultrasound-sensitive liposomes can be activated by external stimuli to activate drug release. An example is the ultrasound-activated folic acid-linked liposome drug delivery system with oridonine as a model being activated by ultrasound device (Wang *et al.*, 2021).

MAIN LIPOSOMAL DRUGS PRESENT ON THE MARKET

Among the various mechanisms made possible by using liposomes as a drug vehicle, about 14 drugs authorized by the FDA and EMA are currently proposed (Table 1), without taking into account generics and lipid complexes. Thus, the main therapeutic focus of these drugs is in the treatment of cancer, but they also cover other functionalities such as infection, lung diseases, as well as anesthesia, vaccines and photodynamic therapy encompassing several routes of administration such as intravenous infusion, intramuscular and/or intrathecal injection, epidural, local infiltration and inhalation of the components (Liu *et al.*, 2022).

Table 1: Liposomal drugs available on the market

Name of the product	Drug	Indication	Composition and type liposome
Doxil/Caelyx	Doxorubicin chloridate (DOX-HCl)	Câncer ovariano, sarcoma de Kaposi, melanoma mieloide	HSPC, MPEG-DSPE, Colesterol Type: SUV
Mepact	MTP-PE	Osteossarcoma	POPC, OOPS Type: MLV
DaunoXome	The Writer of the	Sarcoma de Kaposi	DSPC, Chol Type: SUV
Myocet	DOX-HCl	Breast cancer	EPC, colesterol Type: MLV
Marqibo	Vincristine Sulfate	Leukaemia	SM, colesterol Type: SUV
Vyxeos	Daunorubicin, recombinant cytarabine	Leukaemia	DSPC, DSPG, Chol Type: Bilamellar
Onivyde	Hydrochloreth Trihydrate	Pancreatic adenocarcinoma	DSPC, MPEG2000-DSPE, colesterol Type: SUV


Source: Liu *et al.*, 2022 (adaptado)

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Technological advances in nanomedicine and liposomes: Promises and challenges in modern medicine

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ABSTRACT

The chapter addresses nanotechnology and its applications in medicine, focusing on nanomedicine and liposomes. Nanotechnology has transformed medical science, particularly through nanomedicine, which uses nanomaterials for more accurate and personalized diagnoses and treatments. Metallic, magnetic, carbon and quantum dot nanoparticles stand out, each with specific applications in targeted drug delivery, imaging and advanced therapies. Liposomes, discovered in 1965, are effective lipid vesicles for drug delivery, evolving over the years with preparation techniques such as thin-film hydration and sonication. Despite the advances, challenges such as liposome stability and large-scale production still need to be overcome. The future of nanomedicine and liposomes is promising, with continuous technological innovations and improvements in the safety and efficacy of treatments, promising significant advances in the diagnosis and treatment of complex diseases.

Keywords: Nanotechnology, Nanomedicine, Liposomes, Nanomaterials.

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INTRODUCTION

Nanotechnology has emerged as a revolution in the applied sciences, offering innovative solutions that are redefining the frontiers of medicine. At the heart of this transformation is nanomedicine, an area that uses nanomaterials to improve the diagnosis and treatment of diseases. With the ability to operate at nanometer scales, nanomedicine allows for a more precise and personalized approach, promoting significant advances in drug delivery and the early detection of pathological conditions. Examples such as FDA-approved liposomal formulations demonstrate how nanotechnology can minimize side effects and maximize the effectiveness of treatments. However, despite major advances, the safety and regulation of nanomaterials still pose crucial challenges, requiring a careful balance between innovation and responsibility. This chapter introduces the fundamentals of nanotechnology and nanomedicine, exploring their current applications and the challenges shaping their future.

NANOTECHNOLOGY AND NANOMEDICINE

Nanotechnology has emerged as a transformative force in several areas of science and medicine. Among its ramifications, nanomedicine stands out as an innovative tool that is shaping the future of medical care. By employing nanomaterials for the diagnosis and treatment of diseases, nanomedicine is providing a more personalized and precise approach, promising significant advances in drug delivery and the early detection of pathological conditions (Cancini et al., 2014). The application of nanomaterials in medicine has brought numerous innovations.

Targeted drug delivery is one of the most developed areas, allowing drugs to be delivered directly to target cells, thereby minimizing side effects and improving treatment effectiveness. A notable example is FDA-approved liposomal formulations such as Doxil® and Abraxane®, which have shown efficacy in treating cancer by reducing drug toxicity and improving delivery to the desired site (Wang et al., 2013).

In addition, the functionalization of the surface of the nanoparticles with specific biomolecules has allowed selective targeting to tumor tissues, further enhancing therapeutic efficacy. Nanomedicine has also been exploring new approaches to imaging and radiotherapy, including combining photodynamic therapies and other innovative strategies. However, challenges remain, such as improving sensitivity in early diagnosis, reducing the toxicity of nanomaterials, and ensuring the safety and quality of manufactured products (Wang et al., 2013). While nanomedicine represents a significant advancement, it also faces regulatory and safety challenges that cannot be ignored. It is essential to conduct rigorous checks on the properties of each batch of nanofabricated drug and implement quality control methods to ensure their efficacy and safety. The future of nanomedicine

depends not only on scientific innovations, but also on a careful and responsible approach to ensure its successful clinical application (Wang et al., 2013).

CHARACTERISTICS OF NANOMATERIALS

Nanomaterials are central to nanomedicine advancements, and their specific properties play a crucial role in their effectiveness. Below, we explore the characteristics and types of nanomaterials most relevant to biomedical applications.

- **Metallic Nanomaterials**

Metallic nanomaterials, especially gold-based ones, have stood out due to their unique optical, electronic, and catalytic properties. Surface plasmonic resonance (SPR) is a notable feature of these materials, allowing selective light absorption and enabling applications such as photothermal therapy for the selective destruction of cancer cells. Material shape modification and the formation of core-shell structures broaden their applications, making them useful in biosensors, diagnostics, and drug delivery (Jain et al., 2007).

- **Magnetic Nanoparticles**

Magnetic nanoparticles, such as magnetite and maghemite, are valuable in a variety of systems, including drug delivery and as contrast agents for MRI. These particles are also used in cancer therapies through magnetic hyperthermia, where they are heated locally to destroy tumor cells. Core-shell structures combine magnetic and optical properties, offering versatility for therapeutic and imaging applications (Martins et al., 2012).

- **Carbon Nanomaterials**

Carbon nanotubes and graphene are other examples of nanomaterials that have attracted significant attention due to their exceptional properties. These structures are used in biosensors, drug delivery, and photothermal therapies. The specific functionalization of nanotubes and graphene allows for the selective targeting of therapies, resulting in more effective treatments, especially in the fight against cancer (Liu et al., 2011).

- **Quantum Dots**

Quantum dots, known for their unique optical properties, offer great promise for molecular imaging and drug delivery. However, the toxicity of quantum dots is an important concern that must be addressed through appropriate coating techniques. Despite these challenges, its optical properties enable advanced applications in diagnostic imaging and controlled drug delivery (Probst et al., 2013).



CLINICAL APPLICATIONS AND TECHNOLOGICAL ADVANCES

The integration of nanomaterials into medicine is revolutionizing both the diagnosis and treatment of diseases. Below, we discuss some of the main applications and technological innovations in the field of nanomedicine.

- **Targeted Delivery of Medicines**

Targeted delivery is one of the most promising areas of nanomedicine. Functional nanoparticles can be designed to bind to specific biomarkers on tumor cells, allowing for precise drug delivery at the site of disease. This method not only improves the effectiveness of treatment but also reduces the side effects associated with systematic drug use (Cancini et al., 2014).

- **Diagnostic and Imaging**

Nanomaterials have contributed to the development of more sensitive and specific diagnostic techniques. The ability of nanomaterials to interact with tissues and cells at the molecular level has allowed the creation of high-resolution images and the early detection of diseases. For example, gold nanoparticles and quantum dots are used in imaging techniques to detect small changes in cell biology that indicate the presence of disease (Jain et al., 2007; Probst et al., 2013).

- **Combination and Advanced Therapies**

The combination of different types of nanomaterials in therapies may lead to new treatment strategies. For example, the combination of magnetic nanoparticles with photothermia allows treatments that use both magnetic energy and light to attack tumor cells. These combination therapies offer a multifaceted approach to the treatment of complex diseases (Martins et al., 2012).

THE LIPOSOME REVOLUTION

The journey of liposomes began in 1965, when Alec Bangham and his research team made a discovery that would forever change the field of biomedicine. They identified liposomes—small spherical vesicles composed of layers of lipids—that turned out to be highly effective vehicles for drug delivery (Bangham et al., 1965). These vehicles, formed by a double layer of phospholipids, mimic the structure of cell membranes and therefore have the ability to fuse with these membranes and release their contents directly into the target cells (Castanho et al., 2002).

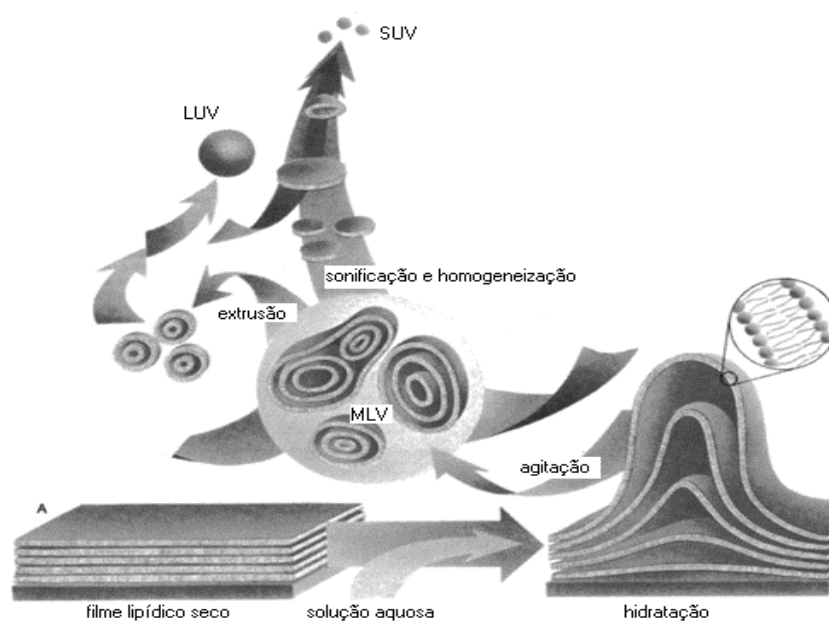
The 1980s marked a phase of expansion and refinement in liposome research. During this period, the classification of liposomes was systematized to reflect their specific structural and functional characteristics. The main categories that have emerged include multilamellar vesicles (MLV), large unilamellar vesicles (LUV), small unilamellar vesicles (SUV), giant unilamellar

vesicles (GUV), and middle unilamellar vesicles (MUV) (Castanho et al., 2002). Each of these categories has distinct properties that directly influence their therapeutic applications. For example, MLVs are often used in early studies due to their ease of preparation, while LUVs and SUVs are more common in clinical applications due to their superior ability to fuse with cell membranes (Guimarães et al., 2021). Liposome creation is a complex art that involves several preparation techniques. Key approaches include thin-film hydration, reversed-phase evaporation, and sonication, each with its advantages and disadvantages (Pattni et al., 2015).

METHODS OF PREPARATION

1. **Thin-Film Hydration:** This method begins with dissolving lipids in organic solvents, which are then evaporated to form a lipid film. The film is hydrated with an aqueous solution to form liposomes. This technique is relatively simple and was one of the first to be used (Guimarães et al., 2021).
2. **Reversed-Phase Evaporation:** In this method, lipids are dissolved in organic solvents and evaporated under controlled conditions to form liposomes. This technique is particularly useful for creating liposomes with specific sizes and can be adjusted for different applications (Pattni et al., 2015).
3. **Sonication:** Utilizes ultrasonic waves to reduce the size of vesicles and improve their homogeneity. This method is effective for producing small, uniform liposomes, which are essential for some clinical applications (Kapoor et al., 2017).

Figure 1: Schematic representation of the preparation of liposomal vesicles.



Source: Adapted from www.avantilipids.com.

CHARACTERIZATION OF LIPOSOMES

Characterization is crucial to ensure that liposomes meet the requirements for effective drug delivery. Parameters such as size, zeta potential, and encapsulation efficiency are key to evaluating the efficacy of liposomes. Encapsulation efficiency refers to the amount of drug incorporated into the liposome, while stability is related to the ability of liposomes to maintain their properties over time (Pattni et al., 2015; Kapoor et al., 2017).

CHALLENGES AND LIMITATIONS OF LIPOSOMES

Despite significant advances, liposome technology faces several challenges. Stability is a critical concern, as the lifespan and effectiveness of liposomes are directly linked to their ability to maintain structural and functional integrity (Guimarães et al., 2021). Problems such as lipid oxidation, drug leakage, and aggregate formation can compromise the effectiveness of liposomes.

Another significant challenge is large-scale production. Manufacturing liposomes in sufficient quantities for clinical applications requires efficient production methods and appropriate sterilization techniques (Guimarães et al., 2021). Identifying effective methods for the production and sterilization of liposomes is essential to ensure that they can be widely used in commercial applications.

THE FUTURE OF LIPOSOMES


The future of liposomes is promising, with new approaches and continuous improvements. Researchers are exploring ways to overcome the challenges associated with stability and production, as well as investigating new ways of modifying the properties of liposomes to improve their efficacy (Castanho et al., 2002). The integration of emerging technologies, such as nanotechnology and tissue engineering, promises to further expand the applications of liposomes in medicine (Pattni et al., 2015).

Continued innovation in the field of liposomes could lead to new ways of tackling complex diseases and improving patients' quality of life. The legacy of Alec Bangham and his team continues to inspire new discoveries, showing that even small innovations can have a colossal impact on science and medicine (Bangham et al., 1965).

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Human and environmental health at risk: An approach to the practice of urban burning

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ABSTRACT

High temperatures have provided risks to human and environmental health at various levels and scales in several countries around the globe. This work aims to contribute to a reflection on urban burning practices with a view to the impacts on human and environmental health. It presents a consistent and updated theoretical basis on the problem, having as an urban space to reflect on the problem, the city of Araguaína in Tocantins. Several countries have recorded an increase in the case of urban and rural fires and large fires with traces of devastation and deaths, as occurred in Chile, the United States, Canada and Brazil.

Keywords: Human and environmental health, Practice of burning, Environmental crimes, Society and nature.

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INTRODUCTION

The global temperature of the last 12 months (June 2023 to May 2024) were the highest consecutive highs on record. The information was released by scientists from the European Copernicus observatory and ratified by the World Meteorological Organization (WMO).

On April 22, 2024, the International Labor Organization (ILO) published a report on the impacts and consequences of climate change for long periods that affect workers exposed mainly to those who work outdoors. The result addresses the impacts of excessive heat, ultraviolet radiation, extreme weather events, air pollution, vector-borne diseases and pesticides.

The beginning of the year 2024 marked the Chilean population with records of large fires that resulted in the death of hundreds of people. The fire reached urban areas leaving trails of destruction and deaths. In Chile, on 02/11/2024, about 3 thousand houses had been destroyed by fire in the Las Pataguas sector in Viña del Mar, with 131 deaths and several missing (ESTADÃO, 2024).

In August 2023, in the USA, more precisely in Maui and Lahaina on the island of Hawaii, a large fire occurred that resulted in the death of more than 100 people. According to the non-profit research group, the National Fire Protection Association (ANPI), this fire was the most lethal in the US since 1918, when, at the time, 453 people died in Minnesota and Wisconsin⁴.

Regarding public health, the result of a study published estimated the impact of forest fires and burnings that occurred in South America between 2014 and 2019 in the journal *Environmental Research Health*. The results of the study indicate that 12 thousand premature deaths per year recorded in the period can be directly associated with pollutants released by the burning of vegetation, of which 55% of them occurred in Brazil (Bonilla, *et. al*, 2023; Silva and Santos, 2023).

As for poor air quality, people's exposure can be through skin contact, ingestion or inhalation, which is one of the most susceptible ways as pointed out by the World Health Organization (WHO) Report. Since the 1970s, studies on the effects of air pollution on health have been carried out in metropolises such as the cities of São Paulo, Rio de Janeiro and Mexico City. (Silva and Santos, 2023; Ribeiro and Assunção, 2002).

Located in the northern region of Brazil, the state of Tocantins has the cerrado as its predominant vegetation, bordered to the south by the states of Goiás; to the east with Piauí; to the Northeast with Maranhão, to the Southeast with Bahia, to the Northwest with Pará and to the Southwest with Mato Grosso.

Every year, in the urban areas of several cities in the State of Tocantins, a high percentage of fires are found, whether in backyards, abandoned lots or those that serve as garbage dumps by the population, as well as in roads and public areas, squares and areas intended for the construction of sidewalks.

⁴ 'Global boiling': Hawaii fires leave 93 dead, the worst disaster of its kind in the US in 1 century.

It is worth emphasizing that the current text does not bring a discussion based on the cultural and symbolic elements of the use of fire, to mention: rituals and religious practices for example. As a culture, fire is used for contemplation of indigenous peoples, conversation circles, dancing in circles, opening banners in areas for planting, among other forms of use (Silva and Santos, 2023).

In Geertz's (2008) view, when portraying the cultural dimension in a certain aspect, he understands culture as a "pattern of meanings transmitted historically, incorporated in symbols, a system of inherited conceptions expressed in symbolic forms through which men communicate, perpetuate and develop their knowledge and their activities in relation to life" (GEERTZ, 2008, p. 66).

In opposition to the cultural issue of the practice of burning without prior authorization, we have the Brazilian legislation, which characterizes burning as a crime, provided for in the Federal Constitution of 1988, for causing damage to health and the environment. The gases produced by the fires are harmful, causing, among other consequences, respiratory diseases in the population, asthma, rhinitis, redness of the skin, irritation of the eyes and can even contribute to cardiovascular diseases, for example. (Silva & Silva, 2006; Silva and Santos, 2023).

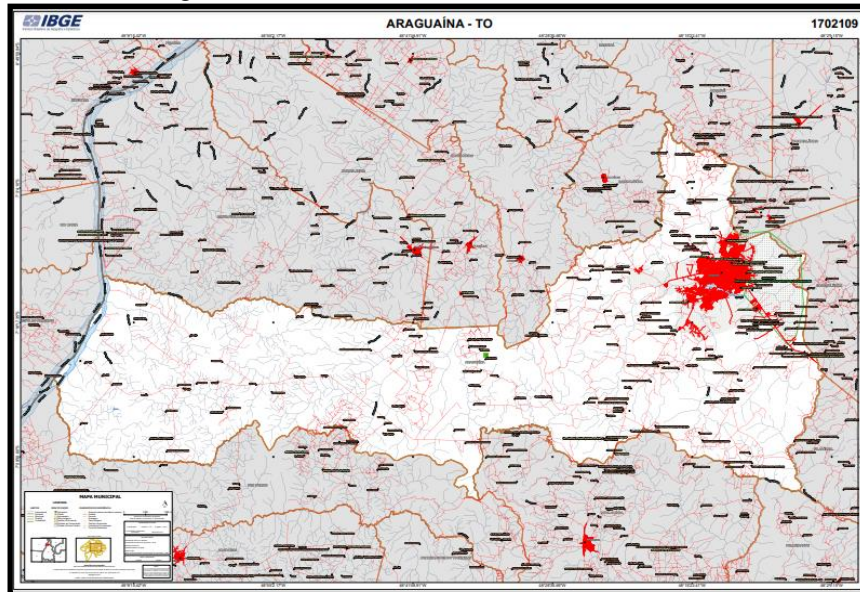
In the northern region of Brazil, fires occur in both rural and urban areas. In the city of Araguaína it is no different. It is customary to see periodic changes in the atmospheric air, due to pollution caused by smoke and soot resulting from forest fires, urban burning, and suspended particles from dust. It should be noted that burning practices also occur in the city in winter periods.

The main objective of the text is to contribute to a reflection on the risks to human and environmental health with the use of urban burning practices. The text mentions the social and environmental aggravating factors related to such recurrent practices in the city of Araguaína-TO.

The municipality of Araguaína is part of the State of Tocantins, in the northern region of Brazil. According to information available at IBGE (2022), the municipality has a population of 171,301⁵, with an area of 4,000.416 km², 42.78 inhabitants/km², latitudes 7° 11' 28" south and longitude 48° 12'26" to the west, it borders the cities of Babaçulândia, Nova Olinda, Piraquê, Santa Fé do Araguaia and Wanderlândia, see figure 1.

⁵ <https://cidades.ibge.gov.br/brasil/to/araguaina/panorama>. Accessed on 09/15/2023

Figure 1. LOCATION MAP OF ARAGUAÍNA – TO



Source:https://geoftp.ibge.gov.br/cartas_e_mapas/mapas_municipais/colecao_de_mapas_municipais/2020/TO/araguaina/1702109_MM.pdf. Accessed on 05/20/2024

METHODOLOGY

The result of the work follows the methodology adopted by Silva and Santos 2023 when they developed a study on urban fires in the morada do sol II sector and in other sectors of the city of Araguaína-TO. Other studies addressing the theme were also of paramount importance as theoretical support.

As for photographic records, they have been widely used by (Silva & Silva, 2006; Silva & Silva, 2017; Monteiro & Silva, 2018, Silva and Santos, 2023) in activities that require fieldwork.

In the research, the photographic records used serve as proof of the fires and the possibility to expand the debate since, at the moment of the "click" for the record, the captured image will contribute to the discussion. The choice of public roads is justified, since, in order to register other outbreaks, it would be necessary to enter homes to the outbreaks that are located mainly in backyards.

The text has a qualitative character and was carried out with the theoretical and methodological basis of texts published in scientific journals. Information from international, state, and local news sites was used.

RESULTS AND DISCUSSIONS

An increase in temperatures has been recorded and perceived in various parts of the globe by different populations, as illustrated in figure (2). Studies revealed by NASA point out that between the months of July 2023 and April 2024, the highest temperatures in the historical series were recorded.

In April 2022, PAHO/WHO released the update of the air quality database that presents, for the first time, ground-based measurements of average annual concentrations of nitrogen dioxide (NO₂), a common urban pollutant and precursor to particulate matter and ozone. It also includes measurements of particles with diameters of 10 µm (PM₁₀) or 2.5 µm (PM_{2.5}) in diameter (Pan American Health Organization and World Health Organization, 2022).

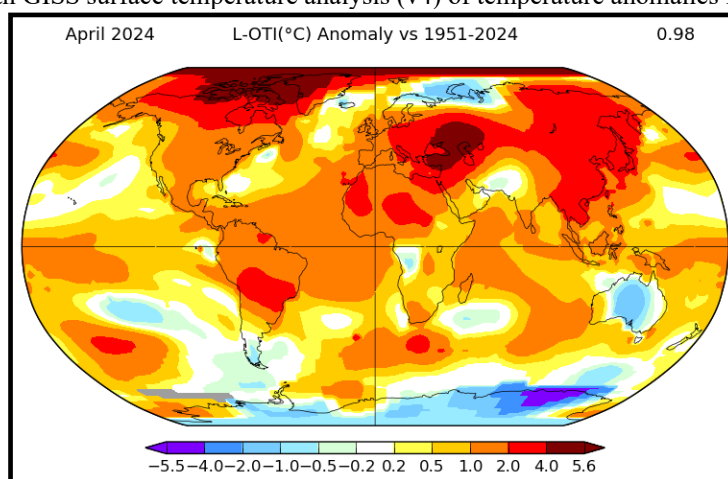
According to PAHO/WHO

Almost the entire population of the world (99%) breathes air that exceeds the quality limits recommended by the World Health Organization (WHO), which threatens their health. A record number of more than 6,000 cities in 117 countries are monitoring air quality, but people living in them still breathe unhealthy levels of fine particulate matter and nitrogen dioxide, with people in low- and middle-income countries suffering the highest exposures (PAHO/WHO, 2022).

It should be emphasized that there was a revision of the WHO Air Quality Guidelines. After the review, the WHO found that in low- and middle-income countries, air quality is in line with the limits recommended by the WHO in less than 1% of cities.

In the area studied, high temperatures, low air humidity and strong winds are also present in the city of Araguaína-TO. The local news has a series of reports on the topic under discussion. According to the news site Surgiu⁶, edition of May 31, 2017, for the first time, Araguaína joined the Fire Protocol Program, created in 2005, with the objective of developing actions to combat fire outbreaks in urban and rural areas.

Figure 2 - Global map with GISS surface temperature analysis (v4) of temperature anomalies from 1951 to April 2024



Source: <https://data.giss.nasa.gov/gistemp/maps/>. Accessed on 05/20/2024

Several actions are developed by the municipal and state public authorities in relation to the control and fighting of fire, however, it has been unable to eliminate the practice of burning in the

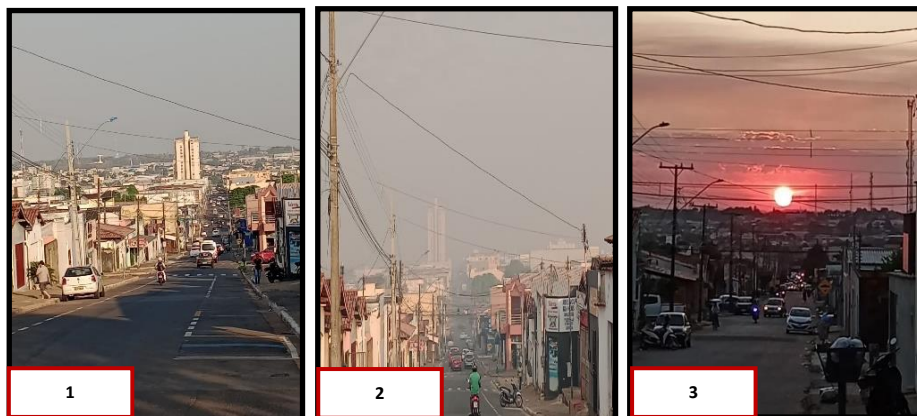
⁶ <http://surgiu.com.br/2017/05/31/araguaina-adere-ao-protocolo-fogo-para-diminuir-focos-de-incendio-na-regiao/>. Accessed on 08/24/2024

urban environment. The Municipal Protocol for the Control and Prevention of Fire Use, together with environmental agencies and organized civil society, aims to prevent and combat fires in the city and region as mentioned by (Monteiro & Silva, 2018).

The idea is to mobilize and raise awareness in society that the environment is a common good, not only the responsibility of the government. It also aims to prioritize the best quality of life and environmental and human health. The Protocol is from Naturatins, an agency belonging to the State, but from the adhesion, it became part of the municipality.

In the city of Araguaína (TO), urban fires during periods of drought are routine by the population residing in the city. Due to air pollution, cooling becomes slow, even at night, especially in periods of drought. According to AYOADE (1991), the climate of urban areas is more impacted by human action, causing changes in the chemical composition of the atmosphere, not allowing the cooling of the earth's surface, even with the decrease in insolation.

Photographs 1, 2 and 3. Panoramic view from the São João neighborhood to the city center partially covered by smoke from various fires



Source: Marivaldo Cavalcante da Silva, 2023

Taken from the top of the São João neighborhood, on 1° de Janeiro street, photographs 1 and 2 were intended to demonstrate the difference in air pollution - in order to show the changes visible to the naked eye of the "cloud" of smoke spreading the suspended particles in the city of Araguaína-TO. It is salutary to mention that the use of the cell phone to take the photographs ends up filtering a little and improving visibility. This smoke can hinder the visibility of buildings and residences early in the morning, in addition to contributing to traffic accidents, putting society at risk pedestrians, motorcyclists, drivers and the population in general.

For the theoretical framework of the risk society, the concept of "risk society" used by Giddens can be highlighted. For the author, there are strong and objective reasons to believe that we are going through an important period of historical transition. In addition, according to the author, "the changes that affect us are not confined to any area of the globe, but are understood almost everywhere" (Giddens, 2007 pg. 13).

Corroborating Giddens' idea, Fernandes points out that:

The current world is considered to be at risk, because from the social, economic, political or nature point of view, it tends to be out of human reach and escape its monitoring and protection (Fernandes, 2002 p. 185)

The authors mentioned about the society of the rich contribute directly to the understanding of the risks provided by the practices of burning both in urban and rural environments, by the way in the introduction of the text there is already relevant information about the dimension of impacts on human and environmental health, as a result of the predominant risk of setting fires.

The dispersion of the smoke cloud that covers the city depends on the winds and other elements of meteorological variables. Photograph 3 was taken at 18:12 on 08/08/23 also in the São João neighborhood on Rua Gonçalves Ledo.

The throat is dry, the odor that the fires provide is intense, the eyes burn, it causes fatigue and dizziness, it causes difficulties for better breathing among other problems, including pulmonary problems. It is salutary to mention that the situation illustrated does not come only from urban fires (Silva and Santos, 2023).

In health, with the burning of biomass and expansion of smoke particles (Bonilla, et. al 2023) states that:

Air pollution from fires is detrimental to public health. Smoke particulate matter from biomass burning in the Amazon Basin can travel great distances, affecting air quality across several countries in South America. (Bonilla, et.at. pg. 2)

With the burning of garbage and organic and inorganic materials, it expels smoke and soot into the atmosphere. In this place, it is common for nearby residents or even carters to dispose of antlers and residential garbage. The intentionality of the burning carried out to clean the area and eliminate the accumulation of discarded material is evident (Silva and Santos, 2023). The fires are seen as a quick and economical way to "get rid of" the garbage accumulated and deposited by the population itself, shown in image 1 and photograph 4.

Image 1 and photograph 4. It shows an area that was completely burned in the morada do sol II sector in Araguaína TO



Source from: Marivaldo Cavalcante Silva, 07/07/2023 at 11:37

It is possible to verify the burning of all vegetation in the allotted area without any housing as shown in photograph 4. However, this area would have a purpose for public use. There are several residences on the streets around the completely burned block.

It was possible to notice that part of some roofs of several residences were completely black with the accumulation of soot. With this, it can be inferred that smoke and soot also enter homes, commercial points, hinder the visibility of pedestrians, car drivers, motorcyclists, heavy vehicles, and can even contribute to the occurrence of accidents. This criminal practice of setting fires in urban areas also modifies the landscape and "expels" small wild animals and birds and, in some cases, nests and chicks can be burned.

In an interview given to Conexão TO,⁷ published in the August 28, 2017 edition, general practitioner Frederico Teixeira Leite says that respiratory diseases are aggravated by fires, especially in children. Asthma attacks worsen, causing patients to seek health units more frequently. The population suffers from the soot that the fires release into the air, causing allergic skin problems, rhinitis, sinusitis and eye irritation.

According to (Silva and Santos, 2023), the proximity of fires to inhabited areas causes greater damage to human and environmental health. It is normal for fire to expel smoke into the atmosphere, it is part of nature itself, and if the winds are directed to areas with a greater number of inhabitants, it can further aggravate the situation. (Ribeiro and Assunção, 2002)

⁷ [http://conexaoto.com.br/2017/08/26/apos-fogo-em-imovel-aco-es-de-prevencao-e-controle-de-queimadas-em-araguaína-sao-intensificadas#pp\[news\]/0/](http://conexaoto.com.br/2017/08/26/apos-fogo-em-imovel-aco-es-de-prevencao-e-controle-de-queimadas-em-araguaína-sao-intensificadas#pp[news]/0/). Accessed in: 08/25/2023

In this sense, Ribeiro and Assunção, 2002) argue that:

... Burning is an incomplete combustion in the open air, and depends on the type of plant matter being burned, its density, humidity, etc., as well as environmental conditions, especially wind speed. As it is an incomplete combustion, the resulting emissions initially consist of carbon monoxide (CO) and particulate matter (soot), as well as ash of varying granulometry. Simple and complex organic compounds represented by hydrocarbons (HC), among other volatile and semi-volatile organic compounds, such as polycyclic organic matter – polycyclic aromatic hydrocarbons, dioxins and furans, compounds of great interest in terms of public health, due to the high toxicity characteristics of several of them, also result from this combustion. As in fires, combustion is processed with the participation of atmospheric air, there are also emissions of nitrogen oxides (NO_x), especially nitric oxide (NO) and nitrogen dioxide (NO₂), formed by the thermal process and by the oxidation of nitrogen present in the plant (Ribeiro and Assunção, 2002 p. 128-129).

Through studies carried out, it has already been proven that exposure to pollutants of different levels, in the short term, respiratory diseases have worsened in the community (Ribeiro and Assunção, 2002; Silva and Santos, 2023). This causes effects on human and environmental health (loss of biodiversity, for example), on education, since it increases the demand for consultations and hospital admissions and mortality.

Furthermore, they are reasons for student absences from schools. In the long term, the objective of the study is to evaluate the effects by comparing mortality with mobility, due to the different levels of air pollution (Silva and Santos, 2023). It is a fact that there are several lung tests that are more effective than the X-ray evaluation, which is the most widely used, probably due to the costs. At another time, X-rays were the most commonly used (Ribeiro and Assunção, 2002).

Photographs 5 and 6 were taken on 07/0/23. Photo number 5 at 9:07 am and number 8 at 9:12 am located on street 9 in the morada do sol II sector. As seen in photograph 8, the fire at the back of the residences located on 9th street. However, this focus began on 8th Street.

The fire department was activated due to the degree of danger perceived by the population (Silva and Santos, 2023). By the time firefighters arrived, the fire had already spread between 8th and 9th streets by about 19:20. About an hour after the start of the fire. The fact occurred on 08/08/23. Once again, it is pertinent to pay attention to the concept of risk used in the text.

Photo 8 is the first record that triggered contact with the fire department. It was held at 17:57. In a way, it generated great tension on the part of some residents. The strong wind and high flames caused a lot of fear. A lot of smoke took over the residences and streets.

Image 2 and photographs 5 to 10. Fires in vacant lots on streets 8 still without asphalt and street 9 in the morada do sol II sector in Araguaína-TO



Sources: Marivaldo C da Silva; Luciana Nunes dos Santos (photos 9 and 10), 2023

For (Silva and Santos, 2023), the practices of setting fires in public areas, backyards, and vacant lots should be understood as an environmental crime subject to punishment. It can also be understood as a lack of respect for others and that causes social (economic and financial) damage and damage to the environment, putting at risk the health of the population and the environment, real estate, energy supply network, traffic accidents, among others.

For (LEITE & PEREIRA, 2017) who developed a study on urban fires: the case of the residential garden of flowers in Araguaína – TO and proved that, since 2006, the practice of burning on public roads occurs year after year in the area where the study was developed.

Another aggravating factor concerns the low humidity of the air, strong winds can also spread fire and suspended particles more quickly. The G1 News Portal⁸, in an article published about the low air humidity on September 1, 2017, the state of Tocantins had 46 cities in a "desert climate" due

⁸ <https://g1.globo.com/to/tocantins/noticia/alerta-de-baixa-umidade-e-expandido-e-46-cidades-tem-clima-de-deserto-veja-lista.ghtm>. Accessed in: 08/20/2023

to the atmospheric air humidity dropping to 12% levels. The cities of Tocantins have an alert level ranging from yellow (between 30% and 21%), orange (between 20% and 12%) and red (below 12%).

On 08/21/2023, the METEORED.tempo.com news portal⁹ released a forecast reporting intense masses of hot air that spread throughout Brazil with temperatures reaching close to 40°C in several locations in the Brazilian territory. Given this information, it is worth a little reflection on the mental health of people who set fires in urban areas usually.

It is pertinent to highlight that culture is one of the main spaces where these practices take root, in which these authoritarian powers are established, but curiously, culture is also the space where all this can be radically questioned (RICHARD, 2005). Based on the author, the proposal is not to treat the practice of setting fire as a culture, given that several justifications have already been highlighted in the text.

Thus, in addition to having defined culture as an *inherited habitus – emphasis added*, it can also be a place of response to official hegemony, a way of identifying with the established and promoting greater visibility on the powers that constitute us and that reproduce themselves socially. Thus, it is necessary to make an inference from the current environmental legislation and to demand from managers the proper inspection and application of fines when appropriate (Silva and Santos, 2023).

According to Municipal Law No. 3,100/19, the fine for anyone identified committing this type of crime within the urban perimeter of Araguaína varies between R\$45.00 and R\$85.00 for every 12 square meters of burned area, according to the type of material burned. In addition, the amount of the fine can be doubled on weekends, holidays, between 6 and 6 am, or in case of recurrence (ARAGUAÍNA, 2023).

However, the amounts may be even higher, since the municipality's inspection also uses the Federal Law on Environmental Crimes 9.605/98 as a basis, which provides for a fine of R\$ 5,000 to R\$ 50 million according to the type of fire. As stated in the law, it also prohibits any type of burning on public roads and in public or private urban properties, also including burning on the sides of highways, rivers, lakes, or forests (Silva and Santos, 2023).

Also according to (Silva and Santos, 2023) in 2022, the municipal government of Araguaína fined dozens of people for causing criminal fires in the city's urban environment. The inspection is carried out by the Department of Economic Development and Environment of Araguaína, which last year registered 73 infraction notices. To be able to monitor the entire urban perimeter of the city, the inspection team has an urban burning hotline by phone (63) 99976-7337, which works on an on-call basis until 8 pm every day.

⁹ An intense mass of hot air spreads across Brazil and temperatures are close to 40°C in several locations! (tempo.com). accessed on 09/19/23

There are several ways to make complaints. They can be made by calling the Civil Defense of Araguaína, at (63) 99973-9794 or 199; to the Fire Department, at 193, and to Naturatins (Instituto Natureza do Tocantins), at number (63) 991067787 (PREFEITURA DE ARAGUAÍNA, TO. 2023).

FINAL CONSIDERATIONS

Year after year, the same practice of setting fires in urban areas is repeated in the city of Araguaína. As a suggestion, to contribute to the collection for fires in vacant lots, is the use of geotechnologies with drones to record images and be attached to the IPTU collection system already pointed out by Silva and Santos in 2023. Alternatives also need to be discussed and implemented in an intersectoral way in municipal management to curb and inhibit criminal practice and reduce social risks in general, and seek a better interaction between society and nature.

The survey reveals that fires and the practice of urban burning are frequent in Araguaína. The impacts compromise the human and environmental health of urban areas, with a reduction in atmospheric air quality and economic and health losses to the population. It is necessary to engage the population in reporting when witnessing the fires because it is perceived that there is a risk assumed, in addition to characterizing a criminal practice.

It is necessary to think about the process of (de)culturalization of the practice of burning in urban environments. In addition, the highest incidences occur in periods with long droughts and low relative humidity of the air. Despite the fact that local, national and international media are always warning of the various types of risks that society is exposed to. It should be emphasized that hundreds of people have died in recent years due to large fires that have reached urban environments.

For months during the year, the population needs to be careful with walks and physical exercises both outdoors and indoors (gyms) since the smoke enters the establishments causing discomfort, irritation in the throat, eyes and can cause dizziness and fainting.


With this, when intense fires are occurring in the vicinity of these establishments, try to avoid breathing for a long time the toxic smoke resulting from the burning of organic and non-organic materials. On the other hand, the situation is so serious that the smoke from fires coming from large areas devastated by fire, spreading to several states and regions of the country. Sometimes, between continents.

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Stratospheric balloon platform for experiments at altitudes up to 40 km

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ABSTRACT

The Earth's atmosphere at altitudes between 20 and 40 km is relatively understudied due to the challenging access to this atmospheric layer. Airplanes rarely reach these altitudes, and sounding rockets travel too quickly to remain at this altitude for sufficiently long periods. The only effective way to study this atmospheric layer is through stratospheric balloons. This paper describes a system developed by a team of students from the Instituto Tecnológico de Aeronáutica (ITA, Brazil), consisting of a system (telemetry, onboard electronics, and data acquisition and storage subsystems) carried by stratospheric balloons to conduct scientific experiments and also serve as a testing platform for systems and components intended for use in nanosats. A balloon flight using this platform, which carried a Geiger-Müller counter, is also described.

Keywords: Ballooning, Radiosonde, Ionizing radiation.

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INTRODUCTION

Humanity has always dreamed of conquering the atmosphere. The invention and development of balloons (manned or unmanned) were the tools that allowed humans to travel at high altitudes and explore the atmosphere for the first time. The history of ballooning spans over three hundred years. In the Western world, Bartolomeu de Gusmão demonstrated in 1709, through a prototype, how a hot air balloon could achieve flight (Visoni and Canalle, 2009). The Montgolfier brothers successfully launched a hot air balloon carrying domestic animals in 1783; the first manned balloon flight occurred just 2 months after the Montgolfier brothers' flight and had 2 crew members, Rozier and François Laurent d'Arlandes (Gillispie, 2014). The first manned hydrogen balloon was also launched in 1783 by Jacques Charles and the Robert brothers (Watson, 1946). Scientific ballooning began in 1804 when Gay-Lussac reached an altitude of 8,000 m, measuring air temperature, pressure, and humidity during the flight (Yajima et al., 2009). In 1902, V. F. Hess ascended to 5,000 m and, with a simple ion chamber, measured how the number of cosmic rays varied with altitude (Riggi, 2023). Compact and autonomous systems designed to probe the atmosphere were introduced with the invention of the radiosonde in 1929 by R. Bureau. Radiosondes are typically used to measure atmospheric parameters such as temperature, humidity, and pressure as they ascend through the atmosphere. State-of-the-art radiosondes are now produced by a number of manufacturers in different countries (Ingleby, 2017)

Due to the increasing miniaturization of components, the reduction in their costs, and greater access to information, university and high school students have ventured into the activity of launching balloons for research (e.g., Voelzke and Pereira, 2022; Lee and Conklin, 2016; Coleman and Mitchell, 2014). Usually, the main interest of the students is focused on obtaining pictures of the Earth from high altitudes, to visualize the Earth's curvature, and to perform a series of environmental measurements, such as ionizing radiation and meteorological parameters. Other experiments may consist of studying the effects of ionizing radiation and low temperatures on animal and plant cells and tissues as a function of altitude.

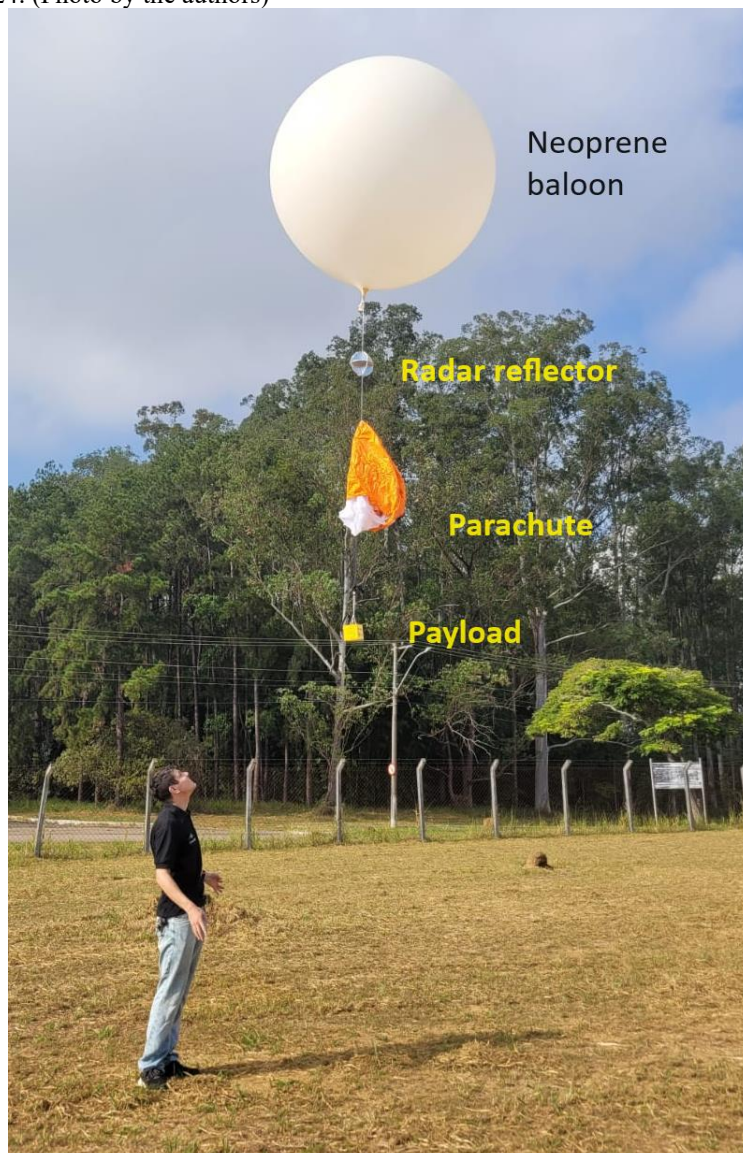
To conduct these studies, it is necessary to develop a low-cost, easy-to-assemble platform to transport these experiments. This platform should include a GPS system to track the balloon during its flight, a barometer and thermometer to measure atmospheric pressure, data acquisition and storage subsystems, as well as a telemetry system capable of communicating with a ground station at distances of up to 300 km. These balloon launches should occur preferentially during the turn-around period. On these days, the stratospheric winds are close to zero velocities and without preferred directions, causing the balloon to remain almost vertically above its launch point. During this period, the recovery of the experiment is more likely, and the measurement time is greatly increased (Redkar,

1981). In this study, such a system was built, and the results of a flight to measure and record the variation of ionizing radiation in the atmosphere with respect to altitude are presented.

MATERIALS AND METHODS

The platform used, as seen in Fig. 1, is called CurieSat V2, named in honor of Nobel Prize-winning physicist Marie Curie. It was developed in 2023 by the ITACube team, an extracurricular group of ITA students focused on the development of nanosatellites and affiliated with the ITA Space Center (CEI). The system was designed to be a useful, low-cost platform accessible to anyone interested, containing only components available in the Brazilian market. It consists of a 1-kg latex/neoprene TX balloon from Kaymont Consolidate, a radar reflector, a parachute, and a payload containing the electronics and a Geiger-Müller counter. The balloon was filled with approximately 2.5 m³ of helium. The total mass of the payload was about 1 kg.

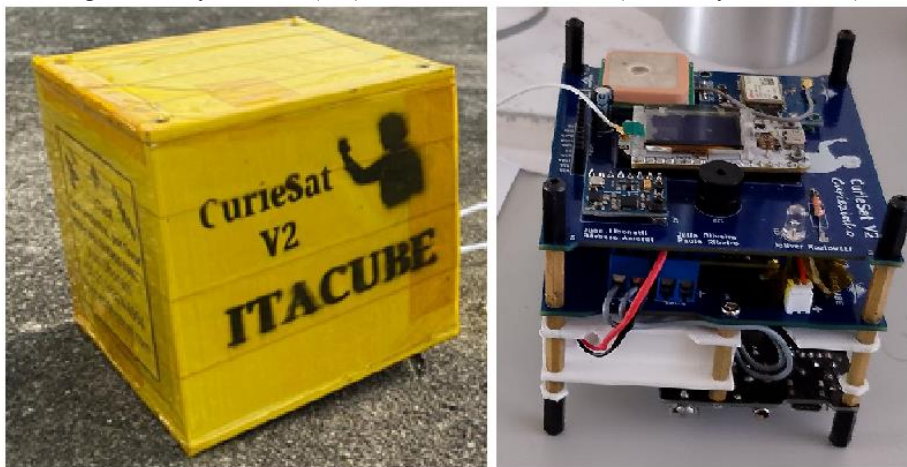
Figure 1. Sounding platform just after its release. Its initial vertical velocity was approximately 5 m/s. This launch occurred on April 29, 2024. (Photo by the authors)



In Fig.2 is shown a detail of the payload container and its interior, with some of the electronics visible.

The payload is equipped with an inertial sensor system consisting of an MPU6050 and a QMC5883L magnetometer, a Neo-6m GPS locator, and a BMP280 barometer. Additionally, the system carries a payload consisting of a circuit and a Geiger counter operating a J305 tube, of Chinese origin. The data from these sensors are collected and processed by a Heltec LoRa Wifi v2 board, which contains an ESP32 microcontroller. The system has the capability to record data on an SD card and transmit it directly via a 915 MHz LoRa radio link with a transmission power of 100mW.

Figure 2. Payload box (left) and electronics boards (Photos by the authors)



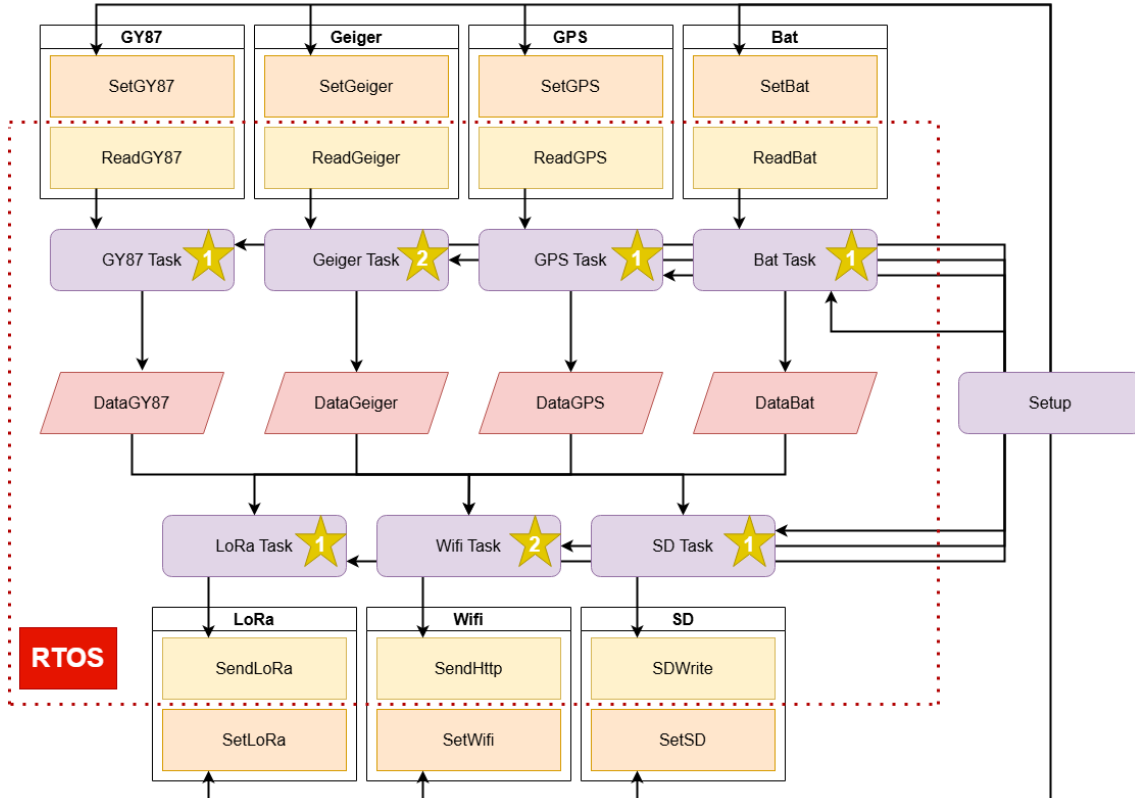
The payload box is made of polylactic acid plastic (PLA), with internal insulation made of extruded polystyrene (XPS) and externally coated with Kapton. A 1000 mAh lithium polymer battery provides 6 hours of autonomy to the satellite and is stored in a separate compartment from the satellite, also made of PLA with additional XPS insulation. It is important to note that the structure completely protects the J305 Geiger tube in the payload from sunlight, preventing potential interference with the measurements.

The embedded software in the system uses the ESP-IDF framework, leveraging the functionalities of FreeRTOS. The system is based on two sets of tasks, as shown in Figure 3: data collection tasks and data consumption tasks. The first group contains tasks that read data from the sensors and store it in shared memory between processes. The second group reads the shared memory and either transmits the data to the ground station or stores it on an SD card. The software also implements error checking at startup and a system watchdog to enhance robustness.

The ground station used for tracking the balloon consisted of a Yagi antenna with a 915 MHz transmitter, a Heltec LoRa Wifi v2 radio, and a personal computer. Using the GPS data received via radio from the platform, the ground station calculates the azimuth and elevation of the balloon for

manual adjustment of the directional antenna. The platform also included, as a redundant measure, a Sinotrack car tracker for location via GSM network to assist in recovering the experiment on the ground.

Figure 3. Diagram of the system's instruments and associated electronics

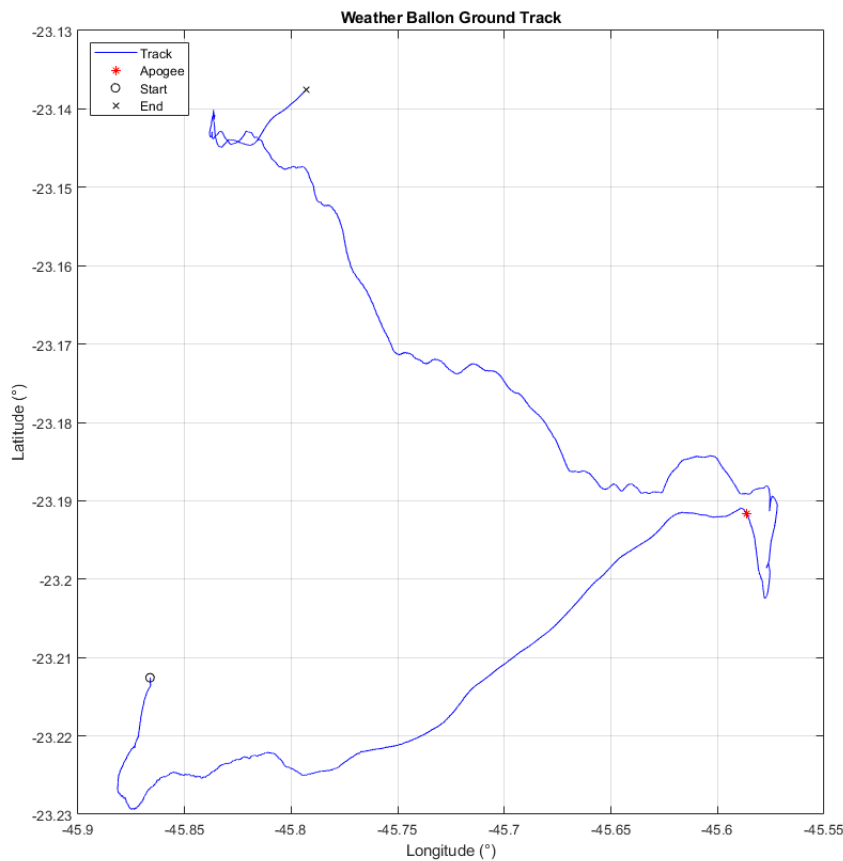


RESULTS AND DISCUSSION

Figure 4 shows the projection on the Earth's surface of the path traveled by the balloon over time. This graph is determined by the GPS signal and the pressure sensor located on the balloon. Figure 5 plots the pulse count values measured by the Geiger counter as a function of altitude relative to the ground. This profile of ionizing radiation intensity with respect to altitude and location provides information about the radiation dose at the flight point, which is an important parameter that should be known across Brazil. The measurements of the ionizing radiation profile with respect to altitude and time could help verify the presence of external agents, such as nuclear experiments, that may introduce this type of radiation into the environment. Additionally, large solar explosions can produce extensive secondary nuclear radiation in the Earth's stratosphere, resulting in an increase in the ionizing radiation

in Earth's atmosphere. In Fig. 5, it is clearly visible the Regener-Pfotzer Maximum at an altitude of approximately 16 km (Regener and Pfotzer, 1935).

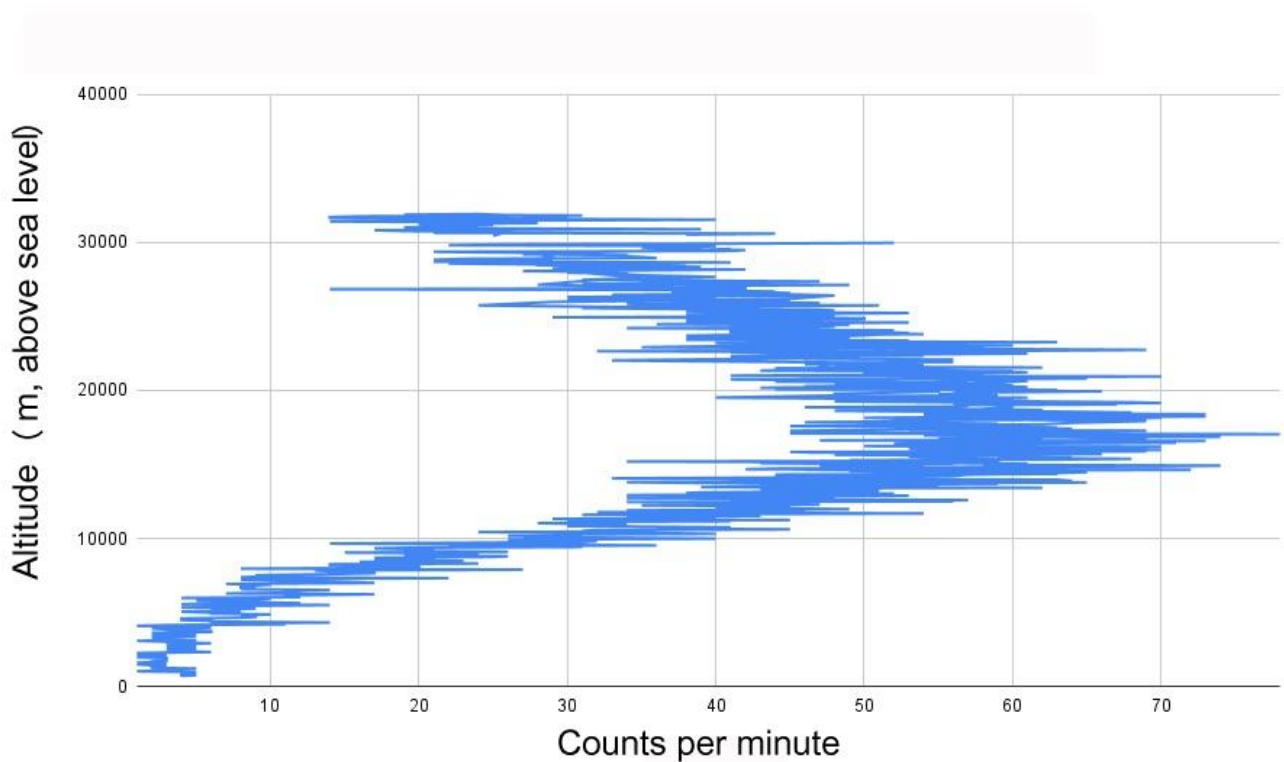
Figure 4. Track of the balloon projected on Earth’s surface. The empty circle, the red circle and the “x” mark, respectively the launch site, the position of the highest altitude reached by the balloon and the fall site.



CONCLUSION

This work, carried out by ITA students from various fields, demonstrates a simple yet important system for other groups in Brazil to use for conducting various types of measurements between the ground and 40 km altitude. For such measurements, a reliable telemetry system is essential to maintain a continuous ground-balloon-ground link, even at horizontal distances of up to 300 km. A good GPS receiver and atmospheric pressure sensor onboard the balloon enabled the determination of the balloon’s altitude, latitude, and longitude, as well as its recovery on the ground. This successfully tested balloon-ground telemetry system allows interested parties to conduct intriguing experiments in the lower atmosphere of the Earth. Our ITA team utilized this opportunity to determine the ionizing radiation profile between the ground and 40 km altitude in the São José dos Campos region, SP, Brazil, as shown in Figure 5.

Figure 5. Counts per minute of ionizing radiation as a function of altitude measured by the Geiger-Müller counter. The Regener-Pfotzer Maximum is observed at an altitude of approximately 16000 m. The total flight time was about 2 h and 30 min.



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Reencanto: An integrative review of music therapy and young children

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ABSTRACT

Context: the work carried out in Music Therapy has been conquering new spaces in recent years and, from there, it started to be carried out in the school environment. Therefore, this study seeks to address the music therapy process with preschool children in the context of early childhood education. Methodology: an integrative review was carried out using the combination of the terms "music therapy in a school context", "social and community music therapy" and "preschool children", searched for research published in the PubMed, LILACS, in addition to Google Scholar databases and in the magazines *Incantare* and *Revista Brasileira de Musicoterapia*, characterized as gray literature, between the years 2013 and 2023. Results: 1,811 studies were found and, based on the inclusion criteria, three studies were selected, one published in Latin America and two in Europe. Conclusion: theoretical possibilities, possibilities of action, evaluation and eligible audiences that the research included in the study allowed to identify were listed. The need for future studies in the field of Music Therapy in an Educational Context is also highlighted.

Keywords: Music Therapy, Preschool Children, Early Childhood Education, Social and Community Music Therapy, Music Therapy in the Educational Context.

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INTRODUCTION

Music Therapy has become a vast field of knowledge, with several possibilities of action, advancing and directing itself to different environments in relation to the usual *setting* (Arndt; Wedge; Volpi, 2016). Of these new investments, the practice of music therapy in the school environment presents itself as a promising area of professional activity.

The perspective of Social and Community Music Therapy is the theoretical path, in dialogue with Music Therapy in an Educational Context, by which the author of this work is oriented, thinking of the daycare environment as a welcoming field, which goes beyond the process of introduction to school life. Gomes (2011), through complex thinking, understands the role of the school as that of "seeking to transform the instrumental approach of knowledge into a humanistic approach, serving as a subsidy for the strengthening of self-esteem" (p. 26).

By making use of music to welcome groups of individuals, the music therapist is faced with what Zampronha (2007) describes as an affective scheme, which is awakened by music and stimulates bodily activities, allowing the listener to reveal himself. Gomes (2011) also adds that musical language, with regard to meaning and signifier, is purely structural, however, through listening, emotions and drives that escape the logical regime are accessed.

From the social and community perspective of Music Therapy, Cunha (2016) thinks of this practice as "an action based on the encounter between people who are willing to exercise solidarity, survival, resistance, confrontation, permission and welcoming" (p. 112). This is in line with the reflections of Moraes (2003 *apud* Gomes, 2011) about education needing a "re-enchantment" in the search to make the school environment "a place of enchantment and beauty, a place where creativity prevails and joy and new values are cultivated" (p.43). The author highlights that "it is in this perspective that we believe in the contribution that the music therapist can bring to the educational area through his or her sensitive look and performance" (Gomes, 2011, p. 43).

By basing this work on bringing to dialogue authors from the Social and Community perspective of Music Therapy, it seeks to understand the individual as a member of a group, who has the possibility of experiencing encounters that increase, decrease or do not interfere with their potentiality. Reflection in this perspective is deposited in people and in the plot of their daily lives, their feeling, acting, thinking and relating. The work of the music therapist, then, is to - through musical making - to become a mediator of good encounters, promoting the "possible space for sharing, exchange of knowledge, and increase of the power of action through creative actions" (Arndt, Cunha and Volpi, 2016, p. 391).

Here, 'potency' or 'potentiality' is understood from the perspective of Spinoza (1663/2013) and the interpretation of the author's writings given by Arndt, Cunha and Volpi (2016). In this system of thought, the author understands "potency" as an expression of the nature of each being, which is

revealed in its existence and in the way it relates to the environment. Thus, potency is inherent in each being, reflecting its essence and its interconnectedness with the world around it.

Starting from this meeting of people willing to welcome and solidarity, it is believed that, in the preschool environment, the music therapist can bring re-enchantment, permission to be creative, and increase their potential through musical making.

Gomes (2011) also mentions changes in the way of thinking within schools, describing a perspective that seeks to value the person as a creative and emotional being. At the same time, the thought of Paulo Freire (2021) is articulated, who understands that the human being has become more than a being in the world, he has become a presence in the world, with the world and with others. Thus, recognizing the other as "not me" and recognizing oneself as "oneself" – a transforming agent, who intervenes, who speaks of what he does and what he dreams, who breaks.

Considering the Brazilian educational environment in current times, it is worth mentioning the presence and growth of Inclusive Education, which is guaranteed by Law No. 12,796/2013, which establishes "free specialized educational service to students with disabilities [...] at all levels, stages and modalities, preferably in the regular education network" (Brasil, 2013).

Gomes (2011), in line with what Ferreira (2007) postulates, writes that "it is necessary to stop thinking about education from a simplistic and reductionist perspective", defending "a more humanitarian and fairer education" incorporating concepts such as "interdisciplinarity, individualization, collaboration, awareness and sensitization" (p. 10). Accordingly, the Salamanca Declaration states that:

those with special educational needs should have access to regular schooling, which should accommodate them within a child-centered pedagogy, capable of satisfying such needs (UNESCO, 1994, p.1).

Paulo Freire (2021) states that - in true learning - students become subjects of construction and reconstruction of knowledge, each one being - including the educator - subjects of the process. In this process, the work of inclusion must be brought into schools, which "must recognize and respond to the diverse needs of their students, [...] ensuring quality education for all through an appropriate curriculum [...]" (UNESCO, 1994, p. 5).

Freire (2021) brings in his reflection the understanding that "we are conditioned beings, but not determined" (p.20). With this, we can "recognize that history is a time of possibility and not of determinism, that the future [...] it is problematic and not inexorable" (Freire, 2021, p.20). This excerpt allows the author to get closer to what Arndt, Cunha and Volpi (2016) understand in Social and Community music therapy practice, since space is opened for the group to recognize its history at the same time as the experience and construct it.

In her writings, the author Araceli Onório (2012) warns of a manifestation of new

subjectivities whose dimensions have brought to light people who act in a refractory way to the word. She understands that this manifestation comes in the impossibility of asking for help, since there is no message directed to the other. This "other" is understood as the "source of all evil", "someone to tolerate it because the discourse of diversity is fashionable" (Onório, 2012, p. 23). Thus, and in line with the thought of Zamprona (2007), it is sought through musical making to access affections that go beyond the word and allow the listener to reveal himself.

Aiming at Freire's (2021) writings on the Pedagogy of Autonomy, reflections on music therapy practices in the school environment, as well as the Social and Community perspective of Music Therapy, the following guiding question arises: **What possibilities⁴ are presented in the music therapy process with preschool children in the context of early childhood education?**

The proposal is justified through the need to find readings on the subject and audience during the internship practice. And through this, the observation - also reached by Gomes (2011), that, in Brazil, "there are few researches in the area of Music Therapy in Education" (p. 13). According to the author and Nascimento and Domingues (2009), Music Therapy in the school context is a field to be explored, triggering new investigations in the area, opening new possibilities of work and a new paradigm. Gomes (2011) also points out that this area of activity is seen as "a possibility for the advancement of music therapy practices, favoring the construction of knowledge in various actions in this field [...]" (p. 48).

Finally, in this work, we seek to understand the performance of the music therapist professional in the school context as a member of the system that corroborates the acceptance of creativity and the being that is inserted in the group, seeking to promote encounters that increase the power of these human beings. Thinking with Gomes (2011), the student inserted in the school context will be seen as an integral part of the whole, which suffers diverse influences, being the source of the sound that is heard and welcomed, understood as being active in the group and belonging to it, worthy of the choice about oneself and the human gaze.

METHODOLOGY

It is an Integrative Literature Review, based on what Souza and Carvalho (2010) propose, with data collection carried out from secondary sources, which allows the survey and analysis of research published in journals indexed in virtual databases.

The following steps were carried out for the development of the Integrative Review: definition of the research question, establishment of inclusion and exclusion criteria with the literature search, definition of the information to be extracted from the included articles, critical

⁴ Here, the meaning of the word is understood by something that is possible (Possibility, 2024) that can happen (Possibility, 2024)

analysis of the results presented in the included articles, and synthesis of the data.

1ST STEP: GUIDING QUESTION

The guiding question of this Integrative Review was defined : **What possibilities are presented in the music therapy process with preschool children in the context of early childhood education?**

2ND STAGE: LITERATURE SEARCH

Terms and combinations of the descriptors music therapy; children and early childhood education; were prepared for search in the PubMed/MEDLINE, Latin American and Caribbean Health Sciences Literature (LILACS) search databases. In addition, searches were carried out in the gray literature through *Google Scholar* and in specific journals in the area, such as the Brazilian Journal of Music Therapy and Revista Incantare.

The following inclusion criteria were established:

- Original articles, available for free in full format, published in Portuguese or English, between 2013 and 2023
- Articles published by music therapists or where one of the authors is a music therapist.
- Articles in which the researched audience has been preschool children.

The following exclusion criteria were established:

- Reviews, conference proceedings, opinion articles, reflection articles and editorials.

STEP 3: DATA COLLECTION

After searching the search databases, the articles were managed using the *EndNote Web software* (Thomson Reuters, Toronto – Canada).

Initially, the studies were selected based on the reading of the titles and abstracts. In a second moment, the full reading was done and they were selected according to compliance with the inclusion and exclusion criteria established in this review.

The search protocol for the searches in the databases is as follows:

Chart 1 - Search protocol in the databases

	SEARCH BASES
PubMED	1. (“music therapy” [MeSh] OR “music therapy” OR “music” [MeSh] OR “music” OR “social and community music therapy”) AND 2. (“preschool children” [MeSh] OR “preschool children” OR “preschool child” [MeSh] OR “preschool child” OR “preschool” [MeSh] OR “preschool” OR “child” [MeSh] OR “child” OR “children” [MeSh] OR “children” OR “toddler”)
LILACS	("music therapy" OR "musicoterapia" OR "terapia musical" OR "social and community music therapy" OR "musicoterapia social e comunitária" OR "musicoterapia social y comunitaria") AND ("preeschool children" OR "preschool girls" OR "preschool girls" OR "preschool children" OR "preschool child" OR "preschool girl" OR "preschool girl" OR "preschool children" OR "children" OR "crianças" OR "girls" OR "boy" OR "child" OR "criança" OR "girl" OR "boy" OR "toddler" OR "toddler" OR "little girl" OR "little girl" OR "little boy")
CONSCIENTIOUS LITERATURE Brazilian Journal of Music Therapy and InCantare magazine	("music therapy" OR "musicoterapia" OR "terapia musical" OR "social and community music therapy" OR "musicoterapia social e comunitária" OR "musicoterapia social y comunitaria") AND ("preeschool children" OR "preschool girls" OR "preschool girls" OR "preschool children" OR "preschool child" OR "preschool girl" OR "preschool girl" OR "preschool children" OR "children" OR "crianças" OR "girls" OR "boy" OR "child" OR "criança" OR "girl" OR "boy" OR "toddler" OR "toddler" OR "little girl" OR "little girl" OR "little boy")
GOOGLE SCHOLAR	“social and community music therapy in preschool”

Source: The authors (2023).

4TH STEP: EXTRACTION OF DATA FROM THE INCLUDED STUDIES

The data extraction protocol has a title, author, date, country of origin, research objective, sample, music therapy procedure applied, data collection instruments used, variables analyzed, results and conclusions.

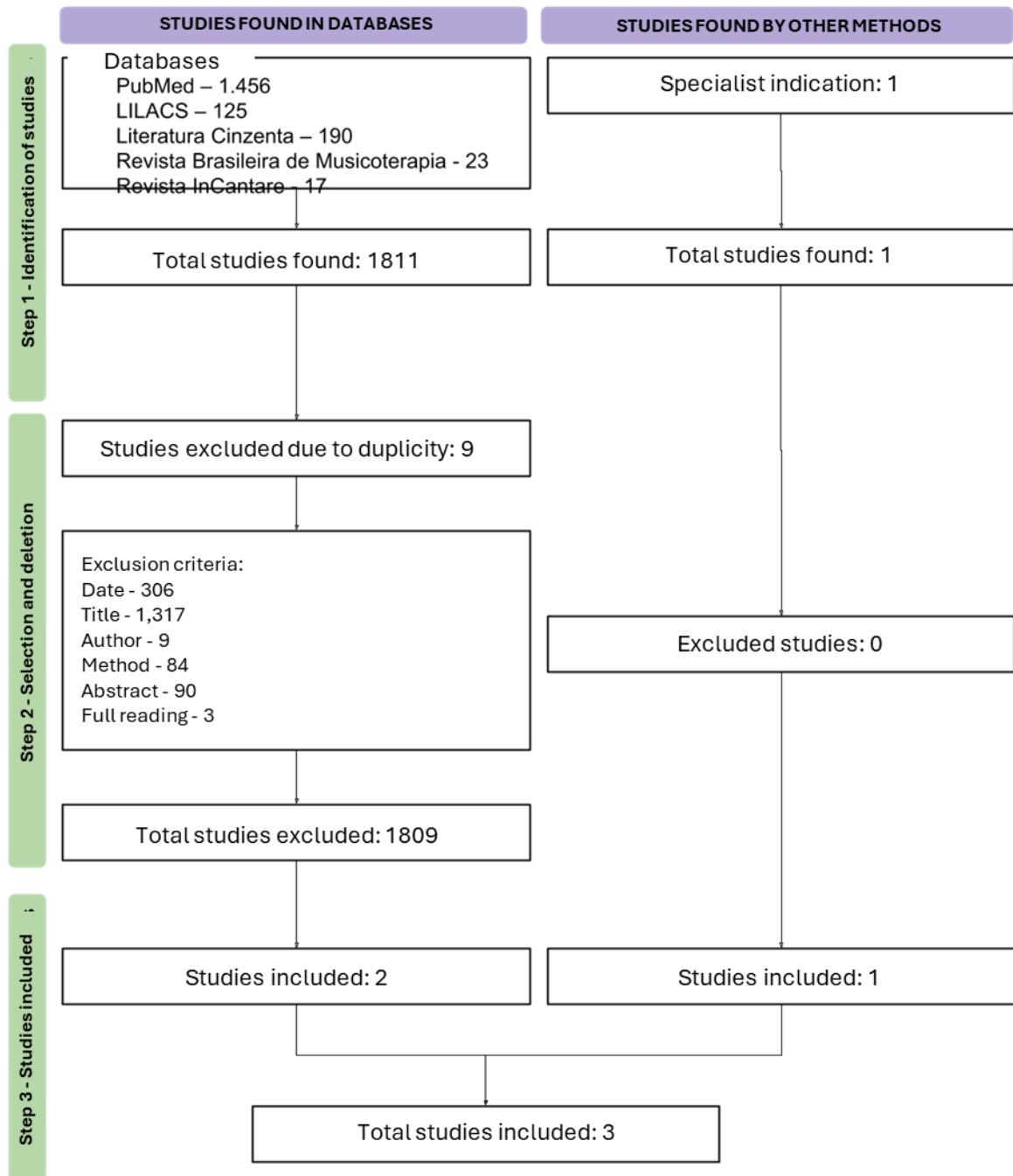
5th Stage: critical analysis of the data and discussion of the results.

RESULTS

Based on the research protocol presented, 1,456 studies were found in the PubMed/Medline database, 125 studies in the Latin American and Caribbean Health Sciences Literature (LILACS), the search in the gray literature resulted in 190 studies in *Google Scholar*, 23 in the Brazilian Journal of Music Therapy and 17 in the InCantare Journal, generating a total of $n = 1,811$. In addition to the studies provided by the research in the bibliography, a study suggested by a specialist was also considered.

During the selection stage, 1,809 studies were excluded, 306 of which were based on the date of publication; 1,317 for reading the title; nine that were not published by at least one music therapist; 84 non-original studies; 90 excluded by reading the abstract and three by reading it in full. Two studies found through the research protocol and one study indicated by the specialist were chosen for this review, totaling $n = 3$.

Figure 1 - Flowchart of the selection of studies



Source: The authors (2023).

Table 2: Result of the extraction of materials

No	AUTHOR	DATE	COUNTRY	STUDY DESIGN	OBJECTIVE	PARTICIPANTS	METHODOLOGY	RESULTS
1	BLANKY-VORONOV; GILBOA, 2022	2022	Switzerland	Quantitative analysis based on observations of recordings and semi-structured interviews	Initially examine the "Ensemble" treatment and determine if it has the potential to improve children's social skills	24 children between 5 and 6 years old, 24 mothers and 23 teachers	Qualitative quantitative mixed study, using video analysis and counting of key behaviors (quantitative) and semi-structured interviews (qualitative)	The "Ensemble" treatment improved the children's social skills both within the group and in other social contexts. The results were positive regardless of the diverse composition of the group, which indicates the potential of the "Ensemble" treatment with various clinical populations.
2	CUNHA; MAYNARDES, 2020	2020	Brazil	Description of the use of sound properties in music therapy sessions.	Describe ways in which the properties of sound have been used in Music Therapy meetings to facilitate communication with a group of infants and young children	Young children and infants, age not given	Description of the meetings through field notes after the end of the activities with weekly supervisions. And case reports of each service performed.	Changes were observed in the way participants relate to music, to each other and to the therapists
3	CARVALHO, 2022.	2022	Portugal	Report of the curricular internship of the Master's Degree in Music Therapy carried out in an inclusive school.	To present case studies based on the music therapy work carried out in an inclusive school.	Preschool children attending inclusive school.	Analysis of the music therapy process, presenting results of research tools.	There were improvements in most of the IMTAP domains evaluated, and the articulation and integration of the music therapist in the multidisciplinary team that intervenes directly with the children, whether during teaching or non-teaching activities, is crucial.

Source: The authors (2023).

From the table presented, it can be seen that the qualitative studies were mostly in relation to the quantitative ones, and the one that considers the quantitative analysis is of mixed character. Each

selected study was represented by a country of origin, namely Switzerland, Brazil, and Portugal, the first two being published in English and the last in Portuguese, all between the years 2020 and 2022.

The results presented by the studies showed improvements in social skills, in the relationship of participants with music, therapists and each other, and an improvement was also found in the assessment of the domains of the Individualized *Music Therapy Assessment Profile* – IMTAP (Baxter *et al.*, 2007). The authors of articles 1 and 2 highlighted the need for future studies, whether for the validation of music therapy treatment – as is the case of the study of the "*Ensemble*" treatment – or with the aim of exposing the limitation of the literature on the population and the theme researched.

The theme 'social relations' was present in all the studies analyzed, having been presented in different ways. In the study by Blanky-Voronov and Gilboa (2022), participants' social skills were directly surveyed and key behaviors were quantified for survey data collection. In the study by Cunha and Maynardes (2020), social relationships were addressed as one of the results of the music therapy intervention, considering that at the end of the meetings the authors noticed changes in the children's relationship with the people around them. The exploratory study in the social and community context conducted by Carvalho (2022) allows us to understand that the intervention of music therapy in a community context has the potential to have a positive impact "at the level of the emotional area, allowing the promotion of the expression of feelings and emotions, and the social area, facilitating and improving social interaction and awareness of the other" (p. 93-94).

DISCUSSION

The objective of the present study was, through an integrative literature review, to present the possibilities presented in the music therapy process with preschool children in the context of early childhood education.

The results of the search show that the volume of publications on the subject and, especially, on the surveyed public is scarce. During the literature search process, 1,811 publications were surveyed, of which only two studies met all the inclusion criteria. In addition to these publications, the article suggested by the specialist was included, which totaled the three studies analyzed in this research. With this number of publications, it is not possible to envision a generalized panorama of music therapy in the school context with the public that includes preschool children.

Therefore, as a first reflection, there is the need for scientific studies in the field of Music Therapy in the School Context and applied to the preschool public. Cunha and Maynardes (2021) bring the same mishap in their reflection, highlighting:

Music therapy studies that focus on infants without health problems are quite limited in the Brazilian literature. More research is needed to support music therapy practices with this population. Studies on the subject can consider the increase in empirical knowledge about

each of the sound properties and their impacts on music therapy interactions with infants and young children (p. 230).

It is also worth noting that the music therapist's own performance in the school context is recent and when it comes to working with "normative individuals" - that is, individuals without mental, sensory or physical disabilities and psychiatric conditions - the limitations are even more prominent (Nascimento; Gomes; Brazil, 2009; Gomes, 2011). Professor Sandra Rocha Nascimento *et al.*, who conducted a study group on Music Therapy in Education (NEPAM/EMAC/UFG) in 2006, write in their article "Applicability of Music Therapy in Education: challenges and possibilities":

We realize that some difficulties manifested by professionals and parents of students, regarding the understanding of the real applicability of Music Therapy and its effectiveness within the educational context, as well as its differentiation from the musical practice promoted by other areas of knowledge, may be associated with the existence of few studies related to the theme [...] (Nascimento; Gomes; Brasil, 2009, p. 389).

With this, it can be understood that the need for research in the educational area within the field of Music Therapy comes together with the pioneering of professional performance within schools and educational institutions.

Within the public policies for education, Nascimento, Gomes and Brasil (2009) think of the practice of the music therapist in school as a factor that provides the generation of an environment without judgment, observing the individual from other angles, in addition to his difficulty. This thought is in line with what is thought in social and community music therapy practice, a theoretical line that guided one of the articles analyzed in this research. In it, the authors Cunha and Maynardes (2021) understand that this perspective of work goes beyond the *setting* to reach its audience, the work happens where the community lives and relates to each other (Stige; Aaro, 2012 *apud* Cunha and Maynardes, 2021).

It is possible to make a comparison between the studies located in this research, in order to identify their differences. The first study (article 1) is based on quantitative-qualitative analysis, using behavior counting to generate quantitative information and interviews for qualitative information, while the other two (articles 2 and 3) are based on qualitative analysis, using reports and case studies. In addition, during the analysis of the publications, different lines of thought can be perceived.

Article 1 of Table 2 is based on behavioral foundations, while article 2 is based on authors of Social and Community Music Therapy such as Even Ruud. In the aforementioned research, the concern with mutual care and the humanization of institutions and communities is evident. Thus, the authors affirm that the concept of disease adopted by the biomedical model is challenged, and the understanding that "poor health and deficiencies have to be seen as a whole" (Ruud, 2004, p.11) is put on the agenda. Article 3 of the table, on the other hand, is based on multiple theories, understanding that work in the area differs from clinical work due to the non-pathological approach and the opening

of greater possibilities for learning and cognitive and social development with the objective of expanding musical experiences beyond formal learning. The author points out that "musical experience, from this perspective, can stimulate the student to deal with their realities of autonomy and dependence, facilitating the construction of a more complete being with a better quality of life" (Cunha and Volpi, 2008 *apud* Carvalho, 2022, p. 22). The cultural distance of the published studies is also evident, considering that the countries that each one represents belong to Latin America (Brazil) and Europe (Portugal and Switzerland), this indicates that choices such as methodology, theoretical foundation, among others may have been influenced by the cultural environment from which the authors originate.

From the theoretical framework of the articles found, it is possible to understand an approximation of thought by the authors Cunha and Maynardes (2021) and Carvalho (2022), who start from authors with social and community perspectives. On the other hand, the work of Blanky-Voronov and Gilboa (2022), is based on studies that consider participants' behaviors and social skills. The authors bring research that found that music therapy increased receptivity to positive social behaviors and encouraged interactions with aggressive peer groups. From this point of view, the authors developed the "*Ensemble*" tool, which aims to "develop and improve children's social skills, unfolding into 6 sub-goals and 12 measurable behaviors" (Blanky-Voronov; Gilboa, 2022 p.3).

Regarding the target audience, article 3 of the table presented describes the research participants as children enrolled in inclusive schools who were diagnosed with Autism Spectrum Disorder - ASD, Emotional and Behavioral Disorders and Intellectual and Motor Development Disorders. The author sheds light on the understanding that the literature points out that most interventions in the school context are related to disorders - whether of behavioral, social origin and emotional regulation - and to special educational needs, with emphasis on the ASD public (Carr; Wigram, 2009; Gattino; Reis, 2019 *apud* Carvalho, 2022). In article 2, the target audience of the study was children who did not have health problems, which allowed the authors to analyze the effects of sound properties during the music therapy process in children in typical development for their age. Article 1 included children who had not undergone a medical diagnosis process, but presented difficulties in the classroom and in daily life related to the social skills that were expected to be developed at the age in which they were.

Finally, some of the possibilities in the music therapy process found by the authors of the analyzed studies can be outlined. Starting from theoretical possibilities, where each author found in literature a starting point that proved to be different from the others; moving on to possibilities of professional action, which mostly covered work with groups and individual work. Music therapy assessment scales were also presented, such as the *Individualized Music Therapy Assessment Profile* – IMTAP (Baxteer *et al.*, 2007), also scales *Music in Everyday Life* – MEL (Gottfried; Thompson;

Elefant; Gold, 2018), in addition to Rolando Benenzon's Music Therapy File (1985). In addition, the researchers studied chose to reach different audiences, even though they all had the age group in common, which denotes possibilities for varied audiences with different needs.

CONCLUSION

Music Therapy in an Educational Context is constantly expanding, especially in the context of inclusive education. In addition, music therapy interventions were also possible in this context from the Social and Community perspective, under which it is understood that professional performance can cross the walls of the *setting* and go where the participant is.

By outlining the objectives of this research, we sought to identify possibilities in the music therapy process of the studies analyzed. Thus, theoretical possibilities, action, evaluation and eligible audiences that the research included in the study allowed to identify were listed. This shows that the music therapy process in the school context with preschool children is a field with clear possibilities, which can be explored and deserves to be explored.


In view of the points presented in this research, it is possible to perceive the relevance of producing studies that encompass Music Therapy in the Educational Context, especially with preschool children, whether they are public of inclusive education or not. With this, it is expected that in the future the literature will allow a diversity of scientific productions that give rise to a consolidated development of professional performance in the area.

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Use of medicinal plants in the prevention and treatment of COVID-19 by the population of Carolina, Maranhão, Brazil

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ABSTRACT

The objective of this research was to carry out the ethnobotanical study of the medicinal plants used by the population of Carolina, MA in the prevention and treatment therapies of COVID-19, their justifications and influencing sources. The study consisted of a qualitative-quantitative, exploratory research carried out along the lines of a case study, carried out in the city of Carolina, MA, where two questionnaires were applied to 120 residents of the city. The results showed 56.63% of the research participants stated that they used medicinal plants only for prevention, 12.05% used them only in treatment and 31.32% of the participants used it both in the prevention and treatment of COVID-19. The species with the highest percentages of citations, used in the prevention, treatment and in both cases of COVID-19, were *Peumus boldus* (boldo), *Citrus limon* (lemon), *Allium sativum* (garlic), *Curcuma longa* (turmeric). These results show that the population made use of several medicinal species with emphasis on *Lippia alba* and *Peumus boldus*, for different diseases, with emphasis on preventing and treating the symptoms of COVID-19. It is important to note that so far there are no studies that prove the therapeutic action of these plants against COVID-19, but the literature reports several properties regarding the symptoms caused by it.

Keywords: *Allium sativum*, Popular knowledge, *Lippia alba*, Maranhão.

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INTRODUCTION

Brazil is considered the country with the greatest plant biodiversity, which allows the population to make use of its resources, especially for therapeutic purposes (NASCIMENTO, 2016). In addition to the vast biodiversity of flora, Brazil also stands out for having a rich cultural diversity, with different principles, opinions, knowledge, practices and techniques, resulting in a collection of traditional knowledge, habits and customs, passed down from generation to generation (ARNOUS; SAINTS; BEINNER, 2005). Historically, the Indians were the first to make use of medicinal plants, which used various herbs mainly in healing and worship rituals, this knowledge was associated with the information brought by Europeans and African slaves, thus allowing the construction of a comprehensive tradition throughout the country. (BRANDELLI et al., 2017).

The custom of using different plants for therapeutic purposes is quite strong, especially in the Northeast region of the country (SOUZA et al., 2019), which due to its vast territorial extension, remains rich in several traditions, with emphasis on the forms of knowledge and use and management of medicinal plants in the treatment and/or prevention of various diseases, the use and knowledge about medicinal species by the majority of the population of the northeast region, they originated in family tradition, becoming a very common practice in their daily lives (DINIZ et al., 2020).

The use of herbal practices began in an artisanal way, without much research and scientific support, however, based on popular knowledge and practices, it was possible to discover important medicines used in traditional medicine (ARNOUS; SAINTS; BEINNER, 2005). With the development of Science and technology, there has been a deepening of research on the subject, resulting in new knowledge about techniques and methods for a better use of medicinal species, in addition to the increase in their recommended use by health professionals (BRAGA, 2011).

Some factors contribute to the use of medicinal plants in alternative medicine, one of them is the need that exists in many communities, making it a more accessible option for the treatment and prevention of some diseases (CARNEIRO et al., 2014). The high cost of industrialized medicines, the population's difficult access to medical care and the growing use of natural products are some of these factors for the use of medicinal plants (BRASILEIRO et al., 2008).

With the pandemic of the new coronavirus and the uncertainties about the treatments to follow, many people have adhered to the use of medicinal plants. It is important to note that COVID-19 is an infectious disease, caused by the SARS-CoV-2 virus, which initially presents flu-like symptoms in people, but is characterized by an acute, potentially serious respiratory infection. It has a high degree of transmissibility, which caused and was quickly decreed in early 2020 as a pandemic (BRASIL, 2022).

Infected people manifest symptoms between the second and fourteenth day after exposure to the virus, and may have mild and moderate flu-like symptoms, treatment depends on the severity, in which case resting at home and taking medicine to reduce fever could often be enough. However, others developed a more serious condition and needed hospitalized care, intensive care, intravenous medications, oxygen and other support measures, with cases of respiratory failure and even death. The infected individual becomes contagious to others for up to two days before symptoms appear, remaining contagious for 10 to 20 days, depending on their immune system and the severity of the illness. People over the age of 65 or with a medical condition are at higher risk of severe disease (FRANÇA et al., 2021).

Knowing that a good immune system would be a primary factor in not contracting the virus, several people resorted to the use of medicinal plants, a habit already practiced in the daily lives of many Brazilians, as an attempt to get through the disease unscathed (DINIZ et al., 2020). Thus, research focused on the field of Ethnobotany makes it possible to identify and bring communities closer to the use of plants, in relation to the level of knowledge they have and what treatments are carried out with the use of these species (CAVALCANTE; SILVA, 2014; SILVA, 2020).

OBJECTIVES

The general objective of the research was to carry out the ethnobotanical study of the medicinal plants used by the population of Carolina, MA in the prevention and treatment therapies of COVID-19; the specific objectives were: 1) To know the species of medicinal plants and their forms of preparation used in the prevention and treatment therapies of COVID-19; 2) To determine which factors interfere in the sampled population regarding the decision to use medicinal plants either in the prevention or treatment of COVID-19 and 3) To define and quantify the influencing agents in the interviewee's choice regarding the use of "home remedies" made with medicinal plants for the prevention and treatment of COVID-19 symptoms.

MATERIAL AND METHODS

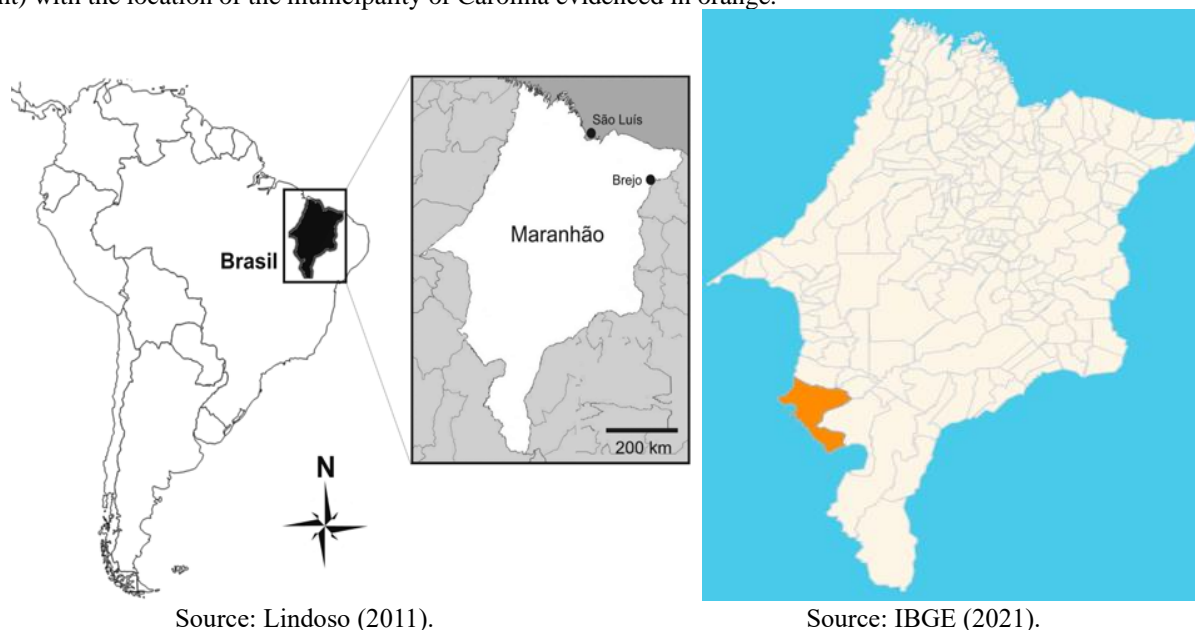
The work was carried out in the city of Carolina, located in the southern region of the State of Maranhão (Fig. 1); which is located on the right bank of the Tocantins River, with the following geographic coordinates: Latitude: 7° 20' 16" South and Longitude of 47° 28' 04" West (CIDADE BRASIL, 2022) and with a population of 23,959 inhabitants (IBGE, 2010). According to data from the last epidemiological bulletin on November 23, 2022, the municipality had 2565 confirmed cases of the Coronavirus and 47 deaths (CAROLINA, 2022).

The methodology used consisted of a qualitative-quantitative, exploratory research, carried out along the lines of a case study in which the study requires the deepening of the understanding of

a social group, more details about the type of research used is presented in the work of Godoy (1995).

The research project was approved by the Human Research Ethics Committee (CEP) of the Federal University of Tocantins, under code number 47603221.1.0000.5519, thus respecting the ethical and legal precepts required by the current Resolutions.

Figure 1. Map of Brazil (image on the left), with emphasis on the state of Maranhão. Detail of the state of Maranhão (right) with the location of the municipality of Carolina evidenced in orange.



Source: Lindoso (2011).

Source: IBGE (2021).

The methodology used was based on Silva; Roriz and Scareli-Santos (2018), using the simple random sampling method, in which 30 streets in the city and four houses per street were drawn, totaling 120 residences, of which one resident of each house, aged 18 years or older, was invited to participate in the research. The research proposal and the consent form were read, then, without any doubt, the delivery for signature. The interviewees participated in the research by answering a questionnaire, whose elaboration was based on the publication of Mafra; Lasmar and Rivas (2020); it presented questions on the following aspects: A) Occurrence of COVID-19 symptoms; After obtaining the answer no, the other questions were directed to the use of medicinal plants in the prevention of the disease; B) Use of home remedies for prevention; C) Which plants were used in prevention; D) What are the forms of consumption in prevention (part of the plant, method of preparation and form of acquisition); E) Reasons that led them to use the plant in prevention; F) Indication of medicinal plants to prevent symptoms of COVID-19. The same questions were directed to respondents who reported having symptoms of COVID-19, who said they used the plants during the treatment of the disease; B) Use of home remedies for treatment; C) Which plants were used in the treatment; D) What are the forms of consumption in the treatment (part of the plant, method of

preparation and form of acquisition); E) Reasons that led them to use the plant in the treatment; F) Indication of medicinal plants to treat the symptoms of COVID-19.

Respondents who have used preventive use and were later diagnosed with COVID-19 were asked questions aimed at both prevention and treatment.

RESULTS AND DISCUSSION

USE OF MEDICINAL PLANTS IN THE PREVENTION AND TREATMENT OF COVID-19 BY THE POPULATION OF CAROLINA, MA

The results obtained showed that of the 120 interviewees in the city of Carolina, Maranhão, 36.67% stated that they had symptoms of COVID-19. This percentage was higher than that shown in Mafra's work; Lasmar and Rivas (2020) in the city of Manaus in Amazonas, in which 23% of the participants reported having presented symptoms of the disease, however it is low compared to those who stated that they did not have symptoms of COVID-19.

It was observed that 56.63% of the participants declared that they use medicinal plants only for the prevention of COVID-19, which is in line with the results of Scareli-Santos; Ferreira and Monteiro (2021), in which 51.56% of respondents stated that they use medicinal plants to prevent COVID-19. Similar to this result was also observed in the work of Mafra; Lasmar and Rivas (2020), where 64% of respondents, a little more, stated that they resorted to home remedies even though they did not have symptoms of COVID-19, that is, in prevention.

The interviewees mentioned 24 species of medicinal plants distributed in 16 botanical families in prevention. For the treatment, 19 species distributed in 15 botanical families were cited, and for both cases 26 species distributed in 18 botanical families (Table 1).

It is important to highlight that the consumption of home remedies grew during the COVID-19 pandemic, as verified by Braga and Silva (2021) who showed that during the pandemic 27.0% of people increased the consumption of medicinal plants, according to the authors, this increase may be related to the need to keep the immune system healthy, in order to avoid contamination by the virus. According to Mafra; Lasmar and Rivas (2020) found that medicinal plants, traditionally known for their curative properties used for respiratory problems, began to be sought after both for the prevention and treatment of suspected COVID-19, within the family environment, and even for the consequences of social isolation such as anxiety and depression.

Table 1. Medicinal species used in the prevention, treatment and both cases of COVID-19 by the population of Carolina, MA. Abbreviations used: Pr: prevention; Tr: treatment; Am: Both; Plant part: F: leaf; C: whole stem; Fr: fruit; CF: fruit peel; Fl: flower; S: seed; T: whole plant. Preparation: Ch: tea, infusion, decoction; S: juice; I: inhalation; G: garrafada; LB: licker; X: syrup; Ol: oil; SM: juice; ML: molasses. Acquisition: PC: planted at home; Q: Neighbors' or relatives' yard; CF: bought at fairs or market.

Botanical Family	Species Name	Popular name	Prevention, Treatment and Both	Part of the plant	Preparation	Method of acquisition
Amaranthaceae	<i>Chenopodium ambrosioides</i> L.	Mastruz	Pr, Tr, Am	F	Ch	Q
				F	SM	Q
				F	SM	PC
				F	Ch	PC
Amaranthaceae	<i>Alternanthera brasiliana</i> (L.) Kuntze	Meracillin	On the	F	Ch	PC
Amaranthaceae	<i>Gomphrena globosa</i> L.	Life	Pr	F	Ch	PC
Amaryllidaceae	<i>Allium sativum</i> L.	Garlic	Pr, Tr, Am	C	Ch	PC
				C	Ch	CF
				C	ML	CF
				C	X	PC
Amaryllidaceae	<i>Allium cepa</i> L.	Onion	Pr, Am	C	Ch	CF
Arecaceae	<i>Mauritia flexuosa</i> L. f.	Moriche palm	Tr, Am	Fri	Ol	CF
Arecaceae	<i>Cocos nucifera</i> L.	Coco	On the	Fri	S	CF
Asteraceae	<i>Matricaria chamomilla</i> L.	Camomile	Pr	Fl	Ch	CF
Bixaceae	<i>Bixa orellana</i> L.	Annatto	On the	S	Ch	PC
Caricaceae	<i>Carica papaya</i> L.	Papaya	Pr, Tr	F	Ch	PC
				F	Ch	Q
Botanical Family	Species Name	Popular name	Prevention, Treatment and Both	Part of the plant	Preparation	Method of acquisition
Clusiaceae	<i>Platonia insignis</i> Mart.	Bacuri	On the	Fri	Ol	CF
Cucurbitaceae	<i>Momordica charantia</i> L.	Melon of São Caetano	Pr, Tr, Am	F	Ch	PC
				T	SM	PC
Dioscoreaceae	<i>Dioscorea trifida</i> L. f.	Yam	On the	Fri	S	PC

Fabaceae	<i>Senna macranthera</i> (DC. ex Collad.) H. S. Irwin & Barneby	Fed	Pr	F	Ch	PC
Fabaceae	<i>Chenna Alexandrina</i> Mill.	Year	On the	F	Ch	Q
Fabaceae	<i>Pterodon pubescens</i> (Benth.) Benth.	Fava de Sucupira	Tr	S	Ch	Q
				S	Ch	PC
Lamiaceae	<i>Plectranthus barbatus</i> Andrews	Seven Pain	Pr	F	Ch	PC
Lamiaceae	<i>Rosmarinus officinalis</i> L.	Rosemary	Pr	F	Ch	PC
Lamiaceae	<i>Ocimum gratissimum</i> L.	Alfavaca	Tr, Am	F	Ch	PC
				F	Ch	Q
Lamiaceae	<i>Mentha spicata</i> L.	Mint	Pr, Tr	F	Ch	Q
				F	ML	Q
Lauraceae	<i>Licaria puchury-major</i> (Mart.) Kosterm	Pens	Tr	S	Ch	CF
Malvaceae	<i>Gossypium herbaceum</i> L.	Cotton	Pr, Am	F	SM	Q
				F	SM	PC
Malvaceae	<i>Malva sylvestris</i> L.	Mallows	Pr, Tr, Am	F	Ch	PC
				F	I	PC
				F	Ch	Q
Meliaceae	<i>Azadirachta indicata</i> A. Juss.	Before	Pr, Tr, Am	F	Ch	PC
				F	Ch	Q
Monimiaceae	<i>Peumus boldus</i> Molina	Boldo	Pr, Tr, Am	F	Ch	Q
				F	SM	Q
				F	Ch	PC
				F	G	PC
				F	SM	PC
				F	ML	PC
Phyllanthaceae	<i>Phyllanthus niruri</i> L.	Quebra Pedra	Pr, Tr	F	Ch	PC
Botanical Family	Species Name	Popular name	Prevention, Treatment and Both	Part of the plant	Preparation	Method of acquisition
Poaceae	<i>Cymbopogon citratus</i> (DC.) Stapf	Sweet Grass	On the	F	Ch	PC
Rosacea	<i>Pirus malus</i> L.	Apple	On the	Fri	S	CF
Rubiaceae	<i>Coffea sp</i> L.	Coffee	Tr	Dust	Ch	CF
Rubiaceae	<i>Cinchona</i> L.	What	Pr, Tr	F	Ch	Q
Rutaceae	<i>Citrus aurantium</i> L.	Orange	Pr, Tr, Am	F	Ch	PC
				Fri	Ch	CF
				Fri	X	CF

Rutaceae	<i>Citrus aurantifolia</i> Swingle	File	On the	F	Ch	PC
Rutaceae	<i>Citrus limom</i> (L.) Osbeck	Lemon	Pr, Tr, Am	CF	X	CF
				CF	Ch	CF
				F	Ch	CF
				Fri	Ch	CF
				Fri	Ch	Q
				Fri	Ch	PC
				Fri	ML	CF
				Fri	S	Q
				Fri	S	PC
				Fri	X	CF
				Fri	ML	PC
Verbenaceae	<i>Lippia alba</i> (Mill.) N.E. Br. ex Britton & Wilson, P.	Lemon Balm	Pr, Am	F	Ch	PC
Verbenaceae	<i>Stachytarpheta</i> <i>cayennensis</i> (Rich.) Vahl	Gervão	Pr, Am	F	Ch	PC
Asphodelaceae	<i>Aloe</i> <i>barbadensis</i> Mill.	Slug	Pr, Am	F	Ch	PC
Zingiberaceae	<i>Curcuma longa</i> L.	Saffron	Pr, Tr, Am	C	X	Q
				C	Ch	Q
				C	Ch	PC
				C	ML	PC
				C	Ch	CF
				C	X	CF
				F	Ch	CF
Zingiberaceae	<i>Zingiber</i> <i>officinale</i> Roscoe	Ginger	Pr, Tr, Am	C	Ch	PC
				C	Ch	CF
				C	ML	CF

Source: Prepared by the author.

SPECIES WITH THE HIGHEST CITATIONS, PART OF THE PLANT, METHOD OF PREPARATION AND FORM OF ACQUISITION OF THE SPECIES USED FOR THE PREVENTION AND/OR TREATMENT OF COVID-19

The species *Peumus boldus* (boldo), *Citrus limon* (lemon), *Allium sativum* (garlic) and *Curcuma longa* (turmeric) were the most cited by the interviewees, when asked about which medicinal plants they used for prevention, treatment or both cases of COVID-19, as shown in Table 2.

Table 2. Species with the highest percentages of citations by respondents, used in the prevention, treatment of COVID-19 and in both cases, in Carolina, MA.

		Prevention	Treatment	Both
<i>Peumus boldus</i>		25,23%	19,05%	26,14%
<i>Citrus limon</i>		23,42%	14,29%	15,90%
<i>Allium sativum</i>		21,62%	11,90%	12,50%
<i>Curcuma longa</i>		6,31%	9,52%	7,95%

Source: Prepared by the author.

Peumus boldus (boldo) was cited by respondents to combat the symptoms emitted by the virus. In addition, they mentioned using it for other purposes, such as anti-inflammatory, flu, malaise, anemia, fever, hangover, diabetes, pain in general and diseases of the digestive system. According to Ruiz et al. (2008), this species has antioxidant, anti-inflammatory, antibacterial and antifungal activities, suggesting that, even though the interviewees rely on popular knowledge, there are scientific bases that prove the efficacy of the home remedy. This species was also mentioned in the research carried out by Oliveira; Dias and Santos (2022), on medicinal plants used during the COVID-19 pandemic in the southern region of Pará, where according to the volunteers who responded to the questionnaire, boldo was the main medicinal plant used for the prevention or treatment of COVID-19. The authors point out that homemade tea can relieve mild symptoms of the disease, but does not have any therapeutic effect against the virus.

Citrus limon (lemon) was mentioned by participants for COVID-19, flu, shortness of breath, and digestion. Some of the proven properties of *Citrus limon* are anticancer, antioxidant, anti-inflammatory, antimicrobial, antiparasitic, antiallergic activity and effects on the digestive system (KLIMEK-SZCZYKUTOWICZ; SZOPA; EKIERT, 2020).

Allium sativum (garlic) has been described for COVID-19, influenza, lung clearance, colic, and diarrhea. According to Apolinário et al. (2008), this species may have healing activity, antioxidant effects, digestive activity, antiviral and antibacterial properties, in addition to stimulating the immune system. In addition, Oliveira et al. (2020), analyzing phytotherapeutic candidates to combat COVID-19 symptoms, demonstrated that *Allium sativum* had a possible effect against the virus, emphasizing that its extract can be seen as an option to enhance the immune response. Studies carried out by Thuy et al. (2020), state that the compounds in *Allium sativum* essential oil inhibit the ACE2 protein, causing the virus to lose the host receptor and attacking the PDB6LU7 protein, the main protease of SARS-CoV-2, while preventing the maturation of the virus protein from occurring. The authors point out that the use of garlic essential oil can help prevent the disease.

Curcuma longa (turmeric) has been prescribed for COVID-19, flu, sore throat, infection, back pain, anti-inflammatory, boosting immunity, and for fever. Some of its scientifically proven activities are anti-inflammatory, antioxidant, antiprotozoal, nematocidal, antibacterial and antiviral (ARAÚJO; LEON, 2001).

When asked about the part of the plant, mode of preparation and form of acquisition of plant species, a similarity was observed in the results when compared to the answers about the cases of prevention, treatment and both cases of COVID-19, as shown in Table 3.

Table 3. Percentage values referring to the part of the plant, form of acquisition and mode of preparation of the plant species mentioned by the interviewees in Carolina, MA for prevention, treatment and both.

Part of the Plant			Prevention	Treatment	Both
Leaf			55,56%	45,16%	54,76%
Stem			19,44%	25,81%	21,43%
Fruit			13,89%	19,35%	21,43%
Fruit Peel			5,56%	0,00%	0,00%
Flower			2,78%	0,00%	0,00%
The whole plant			2,78%	0,00%	0,00%
Seeds			0,00%	9,68%	2,38%
Acquisition					
Planted at Home			55,56%	35,48%	47,62%
Neighbors/Relatives' Backyard			19,44%	29,03%	19,05%
Bought at Fairs/Markets			25,00%	35,48%	33,33%
Preparation					
Tea			75,22%	70,97%	66,67%
Sumo			13,89%	6,45%	7,14%
Syrup			5,56%	9,68%	0,00%
Honey			5,56%	3,23%	11,90%
Juice			2,78%	3,23%	7,14%
Olive oil			0,00%	3,23%	4,76%
Inhalation			0,00%	3,23%	0,00%
Garrafada			0,00%	0,00%	2,38%

Source: Prepared by the author.

Leaves are the most used plant parts mentioned by the participants (Table 1), a fact also evidenced in other studies on ethnobotany, where leaves are the most used parts, such as in the work of Battisti et al. (2013) on the medicinal plants used in the municipality of Palmeira das Missões in Rio Grande do Sul, where the leaves obtained 52%. The authors also point out that the probable explanation for this is the fact that they are easy to collect and are available throughout the year. The work by Gonçalves et al. (2018) carried out in the city of Santa Luzia, Maranhão, also showed that the leaf was the most used vegetable part in the preparations of home remedies, with 35% of the citations, followed by sapwood with 20% and root with 13%. The study by Scareli-Santos; Ferreira and Monteiro (2021), also pointed out that the leaf comprised the part of the plant most used in COVID-19 phytotherapy by the population of Riachinho, in Tocantins (55.56%), followed by the stem (27.78%) and the fruit (16.67%).

Most of the medicinal plant species were acquired in their own backyards, in line with the research of Badke et al. (2012), about the knowledge and popular practices of health care with the use of medicinal plants, where the participants were asked about how they obtained the plants, all of them stated that they cultivated some of them in their own homes, They point out that the preferred

way to obtain vegetables is the one that comes from their own cultivation due to the importance of knowing the origin, because according to them, the conditions of planting, the form of harvesting and the way of storing them interfere with their medicinal properties.

The form of tea preparation was the most prevalent, corroborating the results of the work by Silva et al. (2021), who analyzed the importance of the use of medicinal plants in the pandemic scenario, concluded that the form of tea was predominant in relation to the other forms, comprising 92.2% of the citations. In Lira's study; Sousa and Lins the form of preparation obtained 78% for infusion and 28% decoction.

MOTIVATIONS AND INFLUENCING SOURCES REGARDING THE USE OF MEDICINAL PLANTS IN THE PREVENTION AND TREATMENT OF COVID-19

When the participants were asked about the reasons that led them to use medicinal plants in the prevention of COVID-19, we obtained (40.37%) that they stated that it was a natural remedy, followed by internet advertising (18.35%), influence of friends (18.35%), recommendation of colleagues (11.01%), TV advertising (5.50%), low cost (3.67%) and medical indication with (2.75%). The reasons that led them to use medicinal plants in the treatment of the disease were because it is a natural remedy (46.81%), influence of friends (21.28%), advertising on the internet (12.77%), medical indication (6.38%), recommendation of colleagues (6.38%), advertising on TV (4.26%) and low cost (2.13%).

These results are in line with the data obtained by Braga and Silva (2021), who analyzed the consumption of medicinal plants and herbal medicines in Brazil in the face of the COVID-19 pandemic, concluded that the indication of the use of medicinal plants by friends and family also obtained a significant mention of 47.0%. The authors highlight that 14.6% were based on evidence and 12.6% used it by medical indication and 2.0% answered that they use it by internet indications, they point out that these data demonstrate that people are looking for proven information, in order to use it correctly and avoid fake news.

When asked about the sources that indicated home remedies with medicinal plants for the prevention of COVID-19, the interviewees mentioned family members (41.13%), friends (26.95%), internet advertising (16.31%), co-workers (4.96%), nurse referral (3.55%), TV advertisement (3.55%), doctor referral (2.13%), pharmacist referral (0.71%), pharmacy clerk referral (0.71%) and radio advertisement (0%). Regarding the sources that indicated home remedies with medicinal plants for the treatment of the disease, it was found that the interviewees stated that they had received indications from family members (41.54%), friends (29.23%), internet advertising (12.31%), nurse indication (6.15%), doctor indication (4.62%), co-workers (4.62%) and TV advertising (1.54%), the

categories radio advertising, indication of pharmacist and indication of pharmacy clerk were not mentioned by the research participants.

Similar results were found in the work of Scareli-Santos; Ferreira and Monteiro (2021), where the main source of indication for the use of medicinal plants was family members with (41.94%) for prevention and (50%) in the treatment of COVID-19, followed by friends with (35.48%) and (37.50%).

INTERACTIONS BETWEEN SPECIES INDICATED FOR COVID-19 VERSUS SCIENTIFIC PROPERTIES DESCRIBED IN THE LITERATURE

The indications mentioned by the interviewees regarding the use of medicinal plants in the prevention and/or treatment of COVID-19 in Carolina, MA versus the therapeutic indications described in the scientific literature are presented in Table 4. It is important to note that there are still no studies that prove the therapeutic action of these plants, referring to the therapy of COVID-19. The effects of most medicinal plants showed promising inhibitory activities, which made the population seek to combat the symptoms caused by the coronavirus, in this case the literature reports several properties of the species mentioned, regarding the symptoms caused by COVID, but this does not mean that they are effective in fighting the virus.

We cannot rule out that the results from the use of medicinal species both in prevention and in positive treatment can also be a placebo effect, which according to Soares (2002) is defined as "any treatment that does not have a specific action on the patient's symptoms or disease, but that generally causes an effect". This concern about the use of medicinal plants and the occurrence of the placebo effect is also presented by Baracho et al. (2006), who state in their work on the use of medicinal plants as an alternative treatment, that the responses attributed as optimal may, in addition to coming from the properties of the species, also be the result of the placebo effect, that sick people believed and trusted in the cure was enough to achieve it.

In view of this, it is necessary to reaffirm that the only form of prevention against COVID-19 is vaccination and the necessary care, following all the rules and guidance protocols made available by the World Health Organization.

Table 4. Medicinal plants cited by the population of Carolina, MA, in the prevention and treatment of COVID-19 and their therapeutic indications described in the scientific literature. Legend: nc: not mentioned by the interviewee; Ok: quoted by the interviewee; NL: not found in the literature.

Species Name	Popular name	Prevention	Treatment	Therapeutic indications	Bibliographic reference
<i>Allium cepa L.</i>	Onion	OK	OK	Effective in the treatment of gastrointestinal tract disorders; aiding in the control of diabetes and as a hypoglycemic agent; reducing the risk of developing esophageal, gastric and breast cancer.	Teixeira (2011)
<i>Allium sativum L.</i>	Garlic	OK	OK	Antibacterial property; antiviral; Antifungal; antiprotozoa; antiparasitic; cicatrization; antidiabetic; antihypertensive; antitumor effects; liver protectors/detoxifiers; antioxidants and radioprotectants; diuretic activity; Digestive; COVID-19	Alam; Hoc; Uddin (2016) Thuy et al. (2020)
<i>Aloe barbadensis Mill.</i>	Aloe	OK	OK	Antimicrobial action; topical treatment of burns and superficial wounds as a healing agent; inflamed hemorrhoids; bruises, sprains and rheumatic pain; Used in the cosmetics and pharmaceutical industry with laxative properties.	Lorenzi; Matos (2008)
Species Name	Popular name	Prevention	Treatment	Therapeutic indications	Bibliographic reference
<i>Alternanthera brasiliiana (L.) Kuntze</i>	Meracillin	Ok	Ok	Anti-inflammatory, analgesic action and also the inhibiting activity of the herpes simplex virus.	Delaporte et al. (2002)

<i>Azadirachta indica</i> A. Juss.	Before	Ok	Ok	Antidermal; antifungal; antihelminth; antituberculosis; antitumor; antiseptic; contraceptive; cosmetics; ear pain; burns; diabetes; catapora; smallpox; warts; Dandruff and galdular tumors.	Brazil (2013)
<i>Bixa orellana</i> L.	Annatto	Ok	Ok	Antifungal activity; antibacterial and antimalarial.	Vilar et al. (2014)
<i>Carica papaya</i> L.	Papaya	Ok	Ok	Digestive action; diuretic; laxative; asthma; diabetes; vermifuge; emmenagogue; antipyretic; stomach; sedative and calming; respiratory tract disorders; Antibacterial and anthelmintic properties	Lorenzi; Matos (2008)
<i>Chenopodium ambrosioides</i> L.	Mastruz	Ok	Ok	Anti-parasitic, anti-fungal, antitumor, anti-inflammatory, analgesic, insecticidal and repellent activity.	Matos (2011)
<i>Cinchona</i> L.	What	Ok	Ok	Action against malaria; Fevers; indigestion; ailments of the mouth and throat; cancer; cardiac action - against arrhythmia and other problems; stomatic, tonic; febrifuge; treatment of physical weakness; anaemia; dyspepsia; appetite stimulant; gastrointestinal disturbances and general fatigue.	Lorenzi; Matos (2008)
Species Name	Popular name	Prevention	Treatment	Therapeutic indications	Bibliographic reference
<i>Citrus aurantifolia</i> Swingle	File	Ok	Ok	Antibacterial activity; Antifungal; antiaflatoxicogenic; anticancer/cytotoxic; antioxidant; immunomodulatory; anti-obesity; antifertility; cardiovascular activity; effects on bone; anthelmintic; It prevents the formation of kidney stones and facilitates their dissolution.	Enejoh et al. (2015)

<i>Citrus aurantium</i> L.	Orange	Ok	Ok	Activity in the respiratory system; on the central nervous system; antiedematogenic; anorectic action; antispasmodic and antitumor.	Areas; Moura (2012)
<i>Citrus limom (L.)</i> Osbeck	Lemon	Ok	Ok	Anticancer activity; antioxidant; Inflammatory; Antimicrobial; antiparasitic; anti-allergic; hepatoregenerating; antidiabetic; anti-obesity; effects on the digestive system; cardiovascular system; influence on the nervous system and skeletal system.	Klimek-Szczykutowicz; Shed; Ekiert (2020)
<i>Cocus nucifera</i> L.	Coco	Ok	Ok	Anthelmintic activity; Antimicrobial; antiviral; assist in the treatment of gastric ulcer; against the genital herpes virus; energy and in the treatment of constipation; rehydrating and diuretic.	Lorenzi; Matos (2008)
<i>Coffea sp</i> L.	Coffee	Nc	Ok	Clean the blood; hypoglycemic; curative action on eye conditions; influence on blood fat levels; protective effect against arteriosclerosis; stimulates reasoning; decreases drowsiness and fatigue; effect on digestion; cases of hypotonia; cold and migraine associated with analgesics.	Lorenzi; Matos (2008)
Species Name	Popular name	Prevention	Treatment	Therapeutic indications	Bibliographic reference
<i>Curcuma longa</i> L.	Saffron	Ok	Ok	Anti-inflammatory activity; antioxidant; antiprotozoa; nematode; Antibacterial; antivenin; Anti-HIV - with antiviral and antitumor activity.	Araújo; Lion (2001)
<i>Cymbopogon citratus</i> (DC.) Stapf	Sweet Grass	Ok	Ok	Gentle soothing and spasmolytic action; antimicrobial activity; Analgesic; used for the relief of uterine and intestinal colic; treatment of nervousness and states of restlessness.	Lorenzi; Matos (2008)

<i>Dioscorea Trifida</i> L. f.	Yam	Ok	Ok	Anti-inflammatory drugs are used in the treatment of food allergies.	Mollica et al. (2013)
<i>Gomphrena globosa</i> L.	Life	Ok	nc	Antithemic activity; antidiarrhea; febrifuge; eupeptic and emmenagogue; used against dyspepsia and various poisonings; cases of colitis and enteritis; general weakness and intermittent fevers.	Lorenzi; Matos (2008)
<i>Gossypium herbaceum</i> L.	Cotton	Ok	Ok	antibacterial tivity; diuretics; anti-ulcer; antioxidant; scarring; antiepileptic; antidiabetic; anti-fertility; Anti-helminthic and anti-urolithic.	Chikkula; Monty; Kottumukkula (2018)
<i>Licaria puchury-major</i> (Mart.) Kosterm	Pens	nc	Ok	Antimicrobial and antioxidant.	Grace (2015)
<i>Lippia alba</i> (Mill.) N.E. Br. ex Britton & Wilson, P.	Lemon Balm	Ok	Ok	Gentle soothing and spasmolytic action; analgesic activity; sedative; anxiolytic; mucolytic activity facilitating expectoration; effective in relieving uterine and intestinal cramps; treatment of nervousness and states of restlessness.	Lorenzi; Matos (2008)
Species Name	Popular name	Prevention	Treatment	Therapeutic indications	Bibliographic reference
<i>Malva sylvestris</i> L.	Mallows	Ok	Ok	Antiepileptic action; anti-inflammatory and antiseptic.	Lorenzi; Matos (2008)
<i>Matricaria chamomilla</i> L.	Camomile	Ok	Nc	Emmenagogue action; Digestive; sedative; facilitate the elimination of gases; cramps and stimulate appetite; immunostimulant property; spasmolytic; bacteriostatic action; trichomonicides; anxiolytic property; skin healing; inflammation of the gums and as an antiviral.	Lorenzi; Matos (2008)
<i>Mauritia flexuosa</i> L. f.	Moriche palm	Ok	Ok	Healing activity.	Barros et al. (2014)

<i>Mentha spicata</i> L.	Mint	Ok	Ok	Expectorant action; bronchodilator; fatigue; indigestion; flatulence; diarrhoea; poisoning of gastrointestinal origin; liver disorders; nervous vomiting; External use in scabies and dental neuralgia.	Macedo (2016)
<i>Momordica charantia</i> L.	Melon of São Caetano	Ok	Ok	Treatment of worms; inflamed hemorrhoids and diarrhea; anti-diabetic properties; antitumor and antiviral.	Lorenzi; Matos (2008)
<i>Ocimum gratissimum</i> L.	Alfavaca	Ok	Ok	It has antimicrobial properties; hypoglycemic; antioxidants and anti-inflammatories.	Santos et al. (2021)
<i>Peumus boldus</i> Molina	Boldo	Ok	Ok	Antioxidant; anti-inflammatory; antibacterial and antifungal.	Ruiz et al. (2008)
<i>Phyllanthus niruri</i> L.	Quebra Pedra	Ok	Ok	Treatment of renal and hepatic disorders and antispasmodic activity.	Oliveira et al. (2019)
<i>Pyrus malus</i> L.	Apple	Ok	Ok	NL	NL
<i>Platonia insignis</i> Mart.	Bacuri	Ok	Ok	Leishmanicidal activity; antioxidant; Antimicrobial; genotoxic effect; anticonvulsant and anti-inflammatory.	Lorenzi; Matos (2008)
Species Name	Popular name	Prevention	Treatment	Therapeutic indications	Bibliographic reference
<i>Plectranthus barbatus</i> Andrews	Seven sorrows	Ok	nc	Treatment of liver ailments and digestion problems; gastric hyposecretory action; gastritis control; dyspepsia; heartburn; gastric malaise; hangover; stimulant of digestion and appetite.	Lorenzi; Matos (2008)
<i>Pterodon pubescens</i> (Benth.) Benth	Fava de Sucupira	nc	Ok	Antiarthritic effect; anti-inflammatories; antinociceptive and antiparasitic.	Hansen; Haraguchi; Alonso (2010)

<i>Rosmarinus officinalis</i> L.	Rosemary	Ok	nc	Headache; dysmenorrhoea; weakness; poor memory; hypertension; digestive problems; loss of appetite; rheumatism; spasmolytic properties; liver protective; antitumor; Healing; Antimicrobial; scalp stimulant; diuretic; cholagogue; choleric; carminative and anti-inflammatory bowel drugs.	Lorenzi; Matos (2008)
<i>Senna spectabilis</i> (Schrad.) H. S. Irwin & Barneby	Year	Ok	Ok	Diuretic action and febrifuge activity; used to treat liver and dropsy disorders, anemia, flatulent dyspepsia and other menstrual disorders; emmenagogue and purgative effect; antimicrobial activity and wound healing and combat impingement and white cloth.	Lorenzi; Matos (2008).
<i>Senna obtusifolia</i>	Fed	OK	Nc	Laxative; insomnia; headache; intestinal constipation; cough; blurred vision; double vision; hypertension; Beneficial action against psoriasis and dermatoses caused by fungi and bacteria.	Lorenzi; Matos (2008)
Species Name	Popular name	Prevention	Treatment	Therapeutic indications	Bibliographic reference
<i>Stachytarpheta cayennensis</i> (Rich.) Vahl	Gervão	OK	OK	Anti-inflammatory effect; anti-ulcerogenic; antinociceptive; leishmanicidal; antibacterial and antioxidant properties.	Souza et al. (2010)
<i>Zingiber officinale</i> Roscoe	Ginger	OK	OK	Anti-ulcer activity; Inflammatory; cardiovascular and antioxidant effect.	Moghaddasi; Kasani (2012)

Source: Prepared by the author.

CONCLUSIONS

From the results obtained, it can be concluded that the interviewees used it in the prevention, treatment of COVID-19 and both cases. The species with the highest citation was *Peumus boldus*

(boldo), also using the leaves and tea at the time of preparation, planted in its own backyard. The reasons that led them to use it would be because it is a natural remedy and the family members would be the influencing agents regarding their indication.

Regarding the effects of medicinal plants, most may have shown positive activity related to the infection, but this does not mean that they are effective in fighting the Coronavirus. Many species were used for prevention and treatment, showing a cultural behavior, which sought ways to combat mainly the symptoms caused by COVID-19.

The low participation of home remedies containing active therapeutic properties by health professionals indicates the need to qualify these professionals so that they are able to provide guidance on their use, since the health system has become saturated and the population has found it difficult to obtain medical care. This made people consume home remedies on their own. Several of the species mentioned have properties consistent with those mentioned by the population, but self-medication is dangerous and requires care in the preparation of home remedies.

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Mountain microorganisms in bocashi production and their effect on lettuce development (*Lactuca sativa* L.)

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ABSTRACT

In the present research, the effect of the incorporation (inoculation) with Mountain Microorganisms (MM) from Tequexquínahuac, Texcoco, State of Mexico, on the nutritional quality of bocashi, and its agronomic behavior in lettuce was evaluated.

To evaluate the effect of bocashis inoculated with Mountain Microorganisms with respect to the presence of mycorrhizae, the spores of mycorrhizae-forming fungi were quantified in samples of bocashi, and Mountain Microorganisms (solid phase and liquid phase).

The bocashi substrate (with and without MM)-vermiculite-peat moss ratio 1:1:1 was used to evaluate its effect on leaf area, root and aerial biomass, and mycorrhizal colonization in lettuce.

Mountain microorganisms (solid phase + liquid phase) favorably influenced parameters evaluated in bocashi such as electrical conductivity and pH, as well as the presence of mycorrhizae-forming fungi in bocashi.

On the other hand, bocashi inoculated with Mountain Microorganisms (solid phase + liquid phase) + vermiculite + peat moss increased the percentage of mycorrhizal colonization in the lettuce crop evaluated at 40 days, favored the dry weight of the roots and leaves, although it was not positively reflected in the leaf area. Therefore, it is necessary to continue researching the agroecological technique of Mountain Microorganisms.

Keywords: Native microorganisms, Endogenous microorganisms, Consortium of microorganisms, Mycorrhizae-forming fungi, Agroecology.

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INTRODUCTION

Mountain Microorganisms (MM) are a low-cost artisanal product, which does not require sophisticated growth means for scaling and aims to take advantage of the microbial diversity, both taxonomic and functional, of the communities of native microorganisms in forested areas, to then incorporate them into agroecosystems (Castro Barquero *et al.*, 2015, Torres *et al.*, 2022).

This agroecological technology has as its principle the reproduction of endogenous microorganisms, including photosynthetic bacteria, lactic acid bacteria, fungi, yeasts and actinomycetes (Campo *et al.*, 2014; Ramírez *et al.*, 2016; Medina *et al.*, 2021).

Mountain microorganisms are useful in agriculture since they have the ability to increase both the growth and productivity of the crop, through the production of useful substances (amino acids, nucleic acids, bioactive substances and sugars) (Parra-Cota *et al.*, 2018), likewise, they allow improving the physical, chemical and biological properties of soils (Ramírez Marrache, 2019; Torres *et al.*, 2022).

Sindhu *et al.*, (2016) indicate that Mountain Microorganisms favor the rooting of plants, due to the ability to produce changes in the phytohormonal balance, mainly in the production of indoleacetic acid, as well as in the ability to solubilize soil minerals such as phosphates, making them more available and helping to generate plant leaves and strengthening existing ones.

Cóndor *et al.*, (2007) point out that microorganisms, when developing in adequate conditions of organic matter, have the ability to secrete substances that can inhibit or control the growth of populations of pathogenic microorganisms. According to Ramos (2016), it is a biofertilizer that represents an alternative for the natural regeneration of soil life, and that promotes the recycling of nutrients (Suchini, 2012).

The benefits of the use of organic amendments such as bocashi are widely known worldwide, although the scientific literature is not very precise about their nutritional content and little reference is made to the microbial load existing in these materials (Ramos *et al.*, 2014).

In this sense, it was proposed to evaluate the effect that Mountain Microorganisms have as an inoculant in bocashi in order to study and assess the innovations made by farmers in the field. In this way, it was verified that the bocashis complied with the quality parameters under the NMX-FF-109-SCFI-2008 standard. On the other hand, mycorrhizal spores were counted both in the MM (solid and liquid phase) and in the bocashi; likewise, an agronomic evaluation was carried out, to measure the response of the lettuce crop to the different treatments of bocashi inoculated with MM.

METHODOLOGY

The experimental phase was developed at the Training Center for Agroecological Techniques: Jurassic module, at the Autonomous University of Chapingo, Texcoco de Mora, State of Mexico, located at 19°49'LN and 98° 89'LO; at an average altitude of 2200 meters above sea level.

For the elaboration of the solid phase of Mountain Microorganisms (MM), the methodology suggested by Gómez and Gómez (2017) was followed. The inoculum was collected in a forest area in Tequexquináhuac, Texcoco, State of Mexico.

4 bocashis were made: (B) bocashi testigo, whose composition consists of sheep manure, bushland, oat straw, coal, bread yeast, molasses, MM ferment, rock flour and phosphites; (BMMS) materials included in the control bocashi + 8% MM solid phase; (BMML) core bocashi materials + 95 µL of MM liquid phase; (BMMSL) materials of the bocashi control + 8% of MM solid phase and 95 l of MM in liquid phase.

A composite sample of each bocashi was obtained for analysis as compost. The variables evaluated were total nitrogen, organic matter, C/N ratio, humidity, pH, electrical conductivity, cation exchange capacity and bulk density.

An experiment was established where each bocashi was used as a substrate in the lettuce crop, combined with vermiculite and peat moss in a ratio of 1:1:1. Each experimental unit was randomly distributed. 20 replicates were placed per treatment, each lettuce plant represented an experimental unit.

Mycorrhizae-forming fungal spore counts were performed in the solid phase of MM and in bocashis, using the wet sieving technique (Gerdemann and Nicolson, 1963).

After 40 days, the 7 unfolded leaves of each experimental unit were harvested, and the leaf area was obtained, using the WinFOLIA program, subsequently, to obtain the dry weight, they were introduced in the drying oven for 72 hours at 45 °C; The same procedure was performed to obtain the dry weight of the roots.

For the observation of mycorrhizal colonization, the technique of thinning and staining of roots was used (Sánchez de P., 2010).

To evaluate mycorrhizal colonization, the quadrant intersection technique was used (Sánchez de P., 2010).

Statistical differences between treatments were calculated through one-factor ANOVA analysis of variance, using Tukey's multiple comparison tests. For the variable percentage of mycorrhizal colonization, a non-parametric test was used, since the data did not fit the assumptions of the ANOVA, in this way the Kruskal-Wallis test was used; all data were analyzed using the SAS statistical package, with a P value < 0.05.

RESULTS AND DISCUSSION

QUALITY PARAMETERS

Regarding the percentage of nitrogen, none of the bocashis meets the requirement of the NMX-FF-109-SCFI-2008 vermicompost standard that indicates at least 1% nitrogen (table 1). This data coincides with what was studied by Kleber (2019), when evaluating bocashis with different doses of endogenous and commercial microorganisms, obtaining a maximum of 0.70% of total nitrogen with the bocashi treatment inoculated with endogenous microorganisms, at a dose of 0.5 l/m³.

The percentage of organic matter present in bocashi except that containing the liquid phase exceeds the recommended levels (Table 1); this is because bocashi is a fermented organic fertilizer, whose decomposition process was only maintained for up to 21 days. These values of organic matter agree with the values reported by Delgado *et al.*, (2019) at 21 days, since the 4 compost piles they evaluated presented organic matter (%) between 49 and 56%.

Regarding the C/N ratio, none of the bocashi samples complies with what is recommended by the standard (Table 1), although it is observed that the bocashis inoculated with Mountain Microorganisms presented a C/N ratio closer to what is recommended, this may be due to the fact that Mountain Microorganisms favored the increase of the microbial load, and, consequently, there was a better degradation of the materials.

BMMSL, BMMS and B bocashis showed adequate humidity (Table 1), however, bocashi with liquid phase (BMML) is below the accepted range.

Regarding pH, bocashis did not meet the criterion required by the standard (Table 1). It is important to note that the decomposition process of the bocashis was maintained until 21 days, so only the thermophilic stage was reached (which led to the pasteurization of the fertilizer), and due to the microbial activity, the pH obtained was greater than 8. This justifies that the pH values are higher than the value recommended by the NMX-FF-109-SCFI-2008 standard. However, the use of Mountain Microorganisms in the process of making a bocashi suggests that the fermentation process of bocashi can be improved.

With regard to electrical conductivity (EC), the bocashis do not comply with the requirements of the standard (Table 1). This is due to the quality of the manure used, which suggests a high salt content, which is related to the feeding and age of the animals, as expressed by Román and Rosas (2010). However, the use of both phases of MM in bocashi suggests that optimal EC can be achieved.

All bocashis meet the bulk density criterion required by the standard (Table 1).

Bocashis inoculated with MM solid phase and liquid phase (BMMS and BMML) have a higher cation exchange capacity than bocashi without MM (Table 1), so it is concluded that bocashis

inoculated with MM have the ability to make a greater amount of nutrients accessible to both plants and microorganisms.

Table 1. Quality parameters of bocashis (inoculated with and without Mountain Microorganisms) in comparison with the Mexican Standard NMX-FF-109-SCFI-2008.

Parameter	Allowed limits		BMMS	BMML	B
Total Nitrogen	1-4% (SECA base)	0.70	0.77	0.84	0.70
Organic matter	20-50% (SECA base)	52.0	54.0	50.0	52.0
C/N ratio	≤20	43.1	40.7	34.5	43.1
Humidity	20-40%	22.1	23.0	18.6	23.2
pH	5,5 a 8,5	8.66	8.56	8.65	8.74
Electrical conductivity	≤ 4 dS m ⁻¹	5.82	6.87	7.55	7.22
Cation exchange capacity	> 40 cmol kg ⁻¹	59.3	88.9	76.4	68.6
Bulk density over dry matter (volumetric weight)	0,40 a 0,90 g mL ⁻¹	0.58	0.52	0.58	0.54
BMMSL: Bocashi inoculated with Mountain Microorganisms (solid and liquid phase); BMMS: Bocashi inoculated with Mountain Microorganisms (solid phase); BMML: Bocashi inoculated with Mountain Microorganisms (liquid phase); B: Bocashi without the addition of Mountain Microorganisms. Source: Authors, 2021.					

MYCORRHIZAE-FORMING FUNGAL SPORES IN MM

The spore content of mycorrhizal fungi in 50 grams of solid-phase mountain microorganisms (20.33 spores) is statistically different from the spore content in 100 ml of liquid-phase mountain microorganisms (0.33 spores) (Table 2). This is far from

reported by Reyes (2019), finding 40 spores per 100 ml of MM liquid phase, and adds that the density of spores can vary depending on the site from which the propagules of microorganisms are collected to make the MM in solid phase.

FORMING FUNGAL SPORES IN BOCASHI

The mean number of spores present in 50 g of bocashi inoculated with both MM phases is statistically different from bocashi without the addition of MM (Table 3).

The research suggests that, by inoculating an organic fertilizer with endogenous microorganisms, a higher microbial load is obtained, in this case, it favors the presence of mycorrhizae-forming spores. On the other hand, a greater number of viable spores can be found in a bocashi inoculated with both MM phases.

There are no research reports that have studied the presence of mycorrhizae in a bocashi inoculated with different applications of mountain microorganisms (liquid phase and solid phase), this being an important contribution to the research of agroecological techniques, in this case, bocashi and mountain microorganisms.

Table 2. Tukey Studentized Range (HSD) Test for the Presence of Mycorrhizae-Forming Fungal Spores in Mountain Microorganisms (MM) Solid Phase and Liquid Phase from Tequexquináhuac, Texcoco, State of Mexico

Treatment	Media
Mountain microorganisms liquid phase	0.33 a
Mountain microorganisms solid phase	20.33 b
The average number of mycorrhizae-forming fungal spores with different letters is statistically significant according to Tukey's test ($\alpha=0.05$)	

Table 3. Tukey's estudentized range test for spores present in bocashi with and without Mountain Microorganisms (MM)

Treatment	Stocking
Bocashi + MM Solid and Liquid Phase (BMMSL)	70.66 to
Bocashi + MM fase sólida (BMMS)	50.00 ab
Bocashi + MM fase líquida (BMML)	45.66 AB
Bocashi sin MM (B)	30.33 b
The average number of mycorrhizae-forming fungal spores with different letters is statistically significant according to Tukey's test ($\alpha=0.05$)	

PERCENTAGE OF MYCORRHIZAL COLONIZATION IN LETTUCE

The lettuce roots of the treatment that used as a bocashi substrate inoculated with MM liquid phase presented a low percentage of mycorrhizal colonization (Table 4) compared to the bocashis inoculated with MM (both phases and with solid phase), and this may be related to the final moisture content of the fertilizer (since it was below what was recommended by the standard, minimum 20%), considering that microbiological activity depends largely on it.

However, all bocashis have a low percentage of mycorrhizal colonization, contrasting with the work of Ley-Rivas et al., (2016) who evaluated the effectiveness of four strains of arbuscular mycorrhizal fungi (*Glomus* sp. 1, *Glomus* sp. 2, *Rhizoglosum clarum* and *Rhizoglosum intraradices*) in lettuce culture, reporting percentages of mycorrhizal colonization (86.6, 87.1, 77 and 96.5% respectively).

Table 4. Kruskal-Wallis test for the percentage of mycorrhizal colonization in lettuce roots grown on substrates with and without Mountain Microorganisms (MM)

Treatment	Stocking
Bocashi + MM Solid and Liquid Phase (BMMSL)	55.10 to
Bocashi + MM fase sólida (BMMS)	43.52 a
Bocashi + MM fase líquida (BMML)	37.52 from
Bocashi sin MM (B)	25.85 b
The percentage of mycorrhizal colonization with different letters is statistically significant according to the Kruskal-Wallis Test ($\alpha=0.05$).	

LEAF AREA

The treatment inoculated with both phases of mountain microorganisms (380.75 cm²/g) did not present significant differences (Table 5) compared to the treatment inoculated with mountain microorganisms solid phase (371.30 cm²/g), nor against bocashi with MM liquid phase (347.05 cm²/g), or bocashi without MM (341.65 cm²/g).

Table 5. Tukey's Studentized Range (HSD) Test for the Leaf Area of Lettuce Established in Bocashi Substrate with and without Mountain Microorganisms (MM)

Treatment	Media
Bocashi + MM Solid and Liquid Phase (BMMSL)	380.75 a
Bocashi + MM fase sólida (BMMS)	371.30 a
Bocashi + MM fase líquida (BMML)	347.05 a
Bocashi sin MM (B)	341.65 a
The average number of leaf area of lettuce with equal letters is statistically non-significant according to tukey's test ($\alpha=0.05$)	

DRY WEIGHT OF SHEETS

The treatment inoculated with both phases of MM (11.45 g) was not statistically different from the bocashi treatment with MM solid phase (11.40 g), but it is statistically different from the treatment inoculated with MM liquid phase (9.33 g), as well as with respect to the treatment with bocashi without MM (7.27 g).

The combination of bocashi + MM solid phase favors dry weight gain in lettuce leaves harvested at 40 days (Table 6).

Table 6. Tukey Studentized Range (HSD) test for dry weight of lettuce leaves established in bocashi substrate with and without Mountain Microorganisms (MM).

Treatment	Media
Bocashi + MM Solid and Liquid Phase (BMMSL)	11.45 a
Bocashi + MM fase sólida (BMMS)	11.40 am
Bocashi + MM fase líquida (BMML)	9.33 b
Bocashi sin MM (B)	7.27 c
The average number of dried weight of lettuce with different letters is statistically significant according to the tukey test ($\alpha=0.05$)	

DRY WEIGHT OF ROOTS

Treatment inoculated with both phases of MM was not statistically different from treatment with bocashi without MM (Tukey; $p < 0.034$). On the other hand, it was statistically different from the bocashi treatment with MM solid phase and the treatment inoculated with MM liquid phase (Table 7).

Mycorrhizal colonization did not favorably influence the dry weight of the lettuce root of the treatments, in this sense, it differs with Puebla (2012) who concluded that the use of mycorrhizae (*Glomus intraradices*) led to higher root dry weight in relation to the non-application of inoculum, although this was not reflected in the lettuce crop yield. In turn, Kohler *et. al.*, (n.d.), in their research on the effect of mycorrhizal fungal inoculation on the growth of lettuce plants, reported that there was no significant effect of root dry weight with respect to the control. On the other hand, Loarte (2018) reported statistically significant results for the variable of root weight of lettuce with the bocashi inoculated with endogenous microorganisms liquid solution and fermented for 45 days.

Table 7. Tukey's Studentized Range (HSD) Test for the Dry Weight of Lettuce Roots Established in Bocashi with and without Mountain Microorganisms (MM)

Treatment	Stocking
Bocashi + MM Solid and Liquid Phase (BMMSL)	1.70 to
Bocashi + MM fase sólida (BMMS)	0.67 b
Bocashi + MM fase líquida (BMML)	0.99 b
Bocashi sin MM (B)	1.72 to
The average dry weight number of lettuce roots with different letters is statistically significant according to tukey's test ($\alpha=0.05$)	

CONCLUSIONS

Bocashis (with and without MM) have a different level of maturity than organic fertilizers such as compost or vermicompost (which form humic and fulvic acids). In this sense, the values of quality parameters presented by the bocashis according to the chemical analysis are outside the recommended ranges.

However, the characterization of bocashi according to the quality criteria of the NMX-FF-109-SCFI-2008 standard, suggests continuing to study what happens to fertilizers that do not finish their decomposition and mineralization process, which will provide guidelines to establish quality parameters for bocashi. It is necessary to improve the fermentation process of bocashi, and, therefore, to affect its chemical, physical and biological properties, so a viable alternative is to use inoculation with Mountain Microorganisms, both phases (solid and liquid).

This research shows that mycorrhizae-forming spores persist during the bocashi fermentation process, in this case, the inoculation of bocashi with mountain microorganisms (liquid phase and solid phase together) considerably favors the presence of mycorrhizae-forming fungal spores, unlike bocashi inoculated with MM phases separately. Therefore, if you want to promote the presence of these spores in the bocashi, it is recommended to do so with both MM phases, and it is advisable to increase the doses, solid phase (greater than 8%) and liquid phase (greater than 5%).

The bocashi substrate inoculated with mountain microorganisms (solid and liquid phases) + vermiculite + peat moss favors mycorrhizal colonization in lettuce crops, however, to increase the percentage of colonization, at least 80%, as the results obtained by Ley-Rivas et al., (2016) it is suggested to increase the amount of the solid phase (greater than 8%), and the liquid phase (greater than 5%).

Regarding the agronomic variables, the dry weight of the lettuce leaves presented statistically significant differences, where the best results were obtained when using as substrate the bocashi inoculated with both phases of MM + vermiculite + peat moss. Regarding the dry weight of the root, there were statistically significant differences between the treatments inoculated with MM, favoring the bocashi treatment inoculated with both phases of MM, however, it was not with respect to the treatment established in the substrate where the control bocashi was used.

Regarding the leaf area of lettuce, there were no statistically significant differences. It is necessary to continue with the evaluations in the lettuce crop in the recommended time for its harvest (this evaluation was carried out after 40 days), in the same way, it is suggested to evaluate the performance in both lettuce and long-cycle crops.


Finally, it is important to develop research that revolves around agroecological practices, in this case, organic fertilizers and biofertilizers (Mountain Microorganisms respectively) to improve ecological forms of production.

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Abnormal uterine sangation, cervical pólipo, adenomyosis, uterine myomatosis and endometriose: Case report

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ABSTRACT

Abnormal uterine bleeding is defined as excessive menstrual loss that has relevant physical, emotional, and social repercussions. It is a common condition that affects about 1/3 of women of all ages and negatively affects the quality of life of patients. There are 4 main structural causes of this condition and this study reports the case of a 40-year-old woman who, after careful investigation, was diagnosed with three of them: adenomyosis, cervical polyp and uterine myomatosis. In addition, the patient was also diagnosed with endometriosis. A successful invasive surgical approach of total abdominal hysterectomy was suggested.

Keywords: Bleeding, Quality of life, Hysterectomy.

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INTRODUCTION

To conceptualize abnormal uterine bleeding – AUB – it is first necessary to establish what is considered normal menstrual bleeding. With an average duration of 3 to 8 days and with a blood loss of 30 to 80 ml, we have a menstrual flow considered normal. The average cycle varies between 24 and 34 days. Therefore, abnormal uterine bleeding is that which presents alterations in one or more of these three parameters, being, therefore, a clinical manifestation that should be investigated in search of a definitive diagnosis.

There are many possible causes for this condition, being first divided into structural and non-structural causes. Structural causes include polyps that can be cervical or endometrial, adenomyosis, leiomyoma, and malignancies. Non-structural causes, on the other hand, include coagulopathies, ovulatory disorders, endometrial disorders, and iatrogenesis. Therefore, there are numerous hypotheses that can be questioned and should be excluded with the help of diagnostic methods, so that only after all the investigation can we safely propose the invasive surgical resolution that also has consequences, especially in the case of a young patient who does not yet have complete offspring.

Dysfunctional or endocrine uterine bleeding is a frequent disorder that can occur at any time of a woman's reproductive period, but it is mainly concentrated in its extremes, that is, right after menarche and in the perimenopausal period.

These bleedings can cause several repercussions in the patient's life. The most common of them is anemia responsible for worsening quality of life, in addition to 83% of patients consider that AUB impacts their daily activities, professional activities and many of them avoid social activities because of this. A careful analysis, detailed anamnesis and careful investigation of cases like this are necessary.

CASE REPORT

Patient A.G.S.F., female, 40 years old, primiparous with no history of miscarriage, menarche at 11 years of age, reports that she had irregular cycles, lasting 3 days and moderate flow, associated with intense menstrual cramps since menarche. In recent years, the patient sought medical attention, was requested and performed a pelvic ultrasound via transvaginal, being informed that there was no change and oriented about the normality of her cramps and menstrual flows and, therefore, never used any contraceptive method to control symptoms. However, since February 2022, she has reported an alteration in the menstrual cycle, with an increase in flow, becoming of strong intensity, lasting about 7 to 8 days, associated with an increase in menstrual cramps that have become disabling, as well as intense dyspareunia. As the only improvement factor, she reported the use of ketoprofen 150mg 3 times a day associated with mefenamic acid throughout her menstrual period, in which she was limited in performing her daily activities. In October 2022, the condition worsened, with

increased bleeding and cramps during the menstrual period, with intense pain during period intervals. On this occasion, a transvaginal and abdominal ultrasound with bowel preparation was requested to search for foci of deep endometriosis, whose examination presented the following conclusion:

- Deep endometriosis in the lateral and posterior compartments, with endometriomas in the left ovary, with involvement of uterosacral ligaments, especially the left one, and the rectosigmoid bowel loop
- Fibroadherent changes between ovaries and uterine serosa
- Uterine echotextural and volumetric changes suggestive of adenomyosis
- Umbilical hernia
- Diastasis rectus abdominis

In association with transvaginal pelvic ultrasound, an MRI exam was requested, the conclusion of which was the following report:

- Enlarged ovaries with bilateral cystic images, mostly with spontaneous hyposignal on T1-weighted and intermediate signal on T2-weighted sequences consistent with endometriomas
- Small focus of endometriosis in the uterine body region posteriorly, with no signs of invasion of the uterus or sigmoid

Through the patient's clinical practice, which presented complaints of abnormal uterine bleeding and pain that prevented her from performing her usual daily activities, associated with complementary imaging tests that showed multiple structural and non-structural causes of abnormal uterine bleeding such as polyp, adenomyosis, leiomyoma, deep endometriosis associated with adhesions, in addition to failure of clinical treatment, Surgical resolution of the condition was chosen.

In February 2023, total abdominal hysterectomy surgery was performed, with a Fanestil incision. After dissection of the planes, it was possible to visualize foci of endometriosis, the fibroid located in the uterine fundus region (Figure 1), in addition to the positioning of the ovaries posterior to the uterus, called *Kissing ovaries*, which, in most cases, occurs due to the displacement that the adhesions themselves can cause (Figure 2).

The ligaments were dissected, as well as the uterine artery was ligated and the adhesions were removed, until the removal of the organ was possible. The body and cervix, fallopian tube, right and left ovary were removed. Only then was it possible to visualize the cervical polyp (Figure 3). There was no heavy bleeding during surgery or other complications. The procedure was completed after suturing of planes and skin.

The patient was under observation for 48 hours in the hospital after surgery, evolved with overall improvement of symptoms, was discharged in good clinical condition and was prescribed medication in case of pain.

A few days after surgery, the anatomopathological examination showed a polypoid lesion in the uterine body measuring about 1.1 cm, sinuous fallopian tubes bilaterally and a left ovary containing a binocular cyst with serous content measuring 3.3 cm. A microscopic examination was performed that showed a uterine body with endometrial polyp without atypia and a focus of adenomyosis without atypia, uterine cervix with mild chronic cervicitis and squamous metaplasia of the endocervical epithelium without atypia. Right ovary showing foci of endometriosis without atypia, follicular cysts without atypia, epithelial inclusion cysts without atypia and corpus albicans without atypia and left ovary showing hemorrhagic corpus luteum cyst without atypia and foci of endometriosis without atypia, as well as follicular cysts without atypia, epithelial inclusion cysts without atypia and corpus albicans without atypia. Fallopian tubes bilaterally lined with typical ciliated columnar epithelium.

Figure 1 – Uterine fibroid in the fundic region



Figure 2 – Kissing ovaries

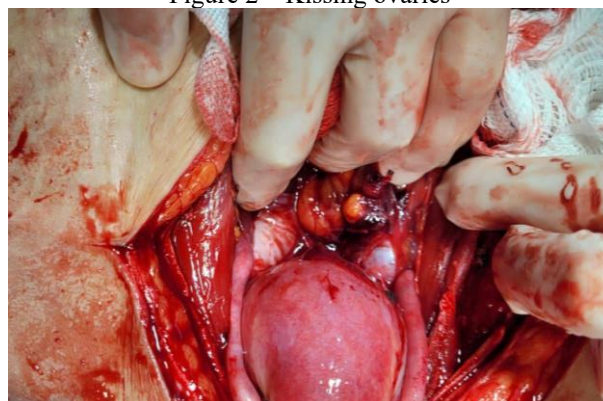


Figure 3 – Pólipo cervical



DISCUSSION

Abnormal uterine bleeding is a common problem of women, it occurs most commonly in the beginning and end of childbearing age. The most common non-structural cause is ovulatory dysfunction, when there is no ovulation or when this process occurs in a Symptoms depend on the cause of bleeding, and may or may not be associated with menstruation, negatively affecting physical, emotional, professional, and sexual aspects of patients' lives.

Suspicion of AUB occurs when there is irregularity or excessive volume in the menstrual cycle. Detailed anamnesis is essential and the first step towards a correct diagnosis. Anemias, coagulation disorders, abnormal hormone concentrations of the menstrual cycle itself, thyroid hormones and prolactin should always be measured and considered in the investigation of possible causes and consequences associated with abnormal uterine bleeding.

The conduct depends on the condition of each patient, and the physician may opt for definitive surgery or require hemodynamic stabilization with volume replacement. In the case of acute bleeding, we must stabilize the patient and if there is no response, the conduct is urgent surgery.

The use of high-dose contraceptives alone, high-dose progestins alone or tranexamic acid is indicated in case of attempted oral treatment, since, among other variables to be evaluated, the reproductive desire of each woman must be considered. Surgical treatment can be performed in many ways depending on the alteration presented by each patient, and only one myomectomy or a total hysterectomy can be performed. Endometrial ablation with uterine artery embolization is also an option to consider.

CONCLUSION

Therefore, we conclude that AUB affects the patient's life globally, brings not only relevant clinical repercussions, but also social consequences that affect the patient's quality of life. Research and a possible diagnosis become fundamental in ensuring social well-being and resumption of usual daily activities.



CONFLICTS OF INTEREST

The authors have no conflicts of interest in disclosing it.

ACKNOWLEDGMENT

The data collected will lead to the expansion and deepening of knowledge about the symptoms, possible causes, and outcomes in cases of abnormal uterine bleeding. In addition, this study aims to broaden the view that it is possible to have more than one associated cause for the same diagnosis.

APPROVAL BY ETHICS COMMITTEE


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Community health education as a strategy for the prevention of maternal mortality in health centers in the city of Nampula

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ABSTRACT

The study focuses on community health education as a strategy for preventing maternal mortality. Its general objective is to understand the course of community health education as a strategy for the prevention of maternal mortality in health centers in the city of Nampula. Specifically, the demographic characteristics of the pregnant women were described; the strategies and contents of education for the prevention of maternal mortality in health centers were identified; The attitudes and behaviors manifested by the women during the prenatal period were characterized, following community health education on the prevention of maternal mortality in the health centers of the city of Nampula; Factors that influence community education for the prevention of maternal mortality in health centers in the city of Nampula were also identified. The research question that guided the study sought to understand how community health education activities on the prevention of maternal mortality in the city centers of Nampula take place. This was a qualitative-quantitative, descriptive, exploratory study carried out in the city of Nampula, at Health Centers Y, Z and General Hospital X. A total of 391 people participated in the study, 18 nurses and 373 pregnant women. To collect the data, a questionnaire, semi-structured interviews and observation were used. The results show that community health education on the prevention of maternal mortality in the Health Units of the city of Nampula takes place through three methods: Individual Counseling/Person-Centered Education, disease-centered clinical method/clinical consultation and collective lectures. The strategy that nurses use most often in antenatal consultations is Person-Centered Education/person-centered clinical method.

Keywords: Education, Health, Maternal Death, Strategy.

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INTRODUCTION

The prevention of maternal mortality in the context of community education is directly linked to the strategy designed and organized to guide this process. Thus, this work has as its theme "Community health education as a strategy for the prevention of maternal mortality in health centers in the city of Nampula".

All education is a policy of values that configure a certain vision of a certain area of knowledge, in order to support the various aspects, whether economic, social, scientific or technological, imposed by a globalized world.

Within the scope of the 2025 Agenda, the strategic vision, with regard to the development of human capital, is oriented towards an integral formation of the Mozambican man based on four pillars: Knowing how to Be, Knowing how to know, Knowing how to do, Knowing how to live together and with others (Agenda, 2025).

The strategic options, in relation to education, highlight the massification of basic education, the strengthening of secondary education, the expansion of adult literacy and education, technical-professional training, education focused on science and technology and the introduction of patriotic, moral, ethical and civic education, scientific research, and innovation, at all levels of the education system.

For Andrade (2016), health is a basic and major objective of education and is fundamental for the present and future of the nation. And nothing is more important and nothing should interfere with the time that the teacher should dedicate to health. The same author also states that developing countries depend on the educational performance of schools and colleges, in this field, to have a healthy way of life and survive with economic prosperity, political stability and a higher standard of living.

It is clear that health education should be considered as one of the aspects of the global educational process – of which it is part – and although it has specific objectives, it is in no way detached from it, nor is it a watertight department.

In this perspective, the study aims to understand the course of community health education as a strategy for the prevention of maternal mortality, carried out by health centers in the city of Nampula, taking into account education and health as fields of greater human, social and economic value.

The relationship between education and health has many affinities in the field of public policies and favors greater proximity to the habits and customs of the community, with regard to the acceptance of public health programs (Alves, 2017).

In this order of ideas, the main focus of Health Education (EpS) is the attitudes, behaviors, patterns or habits observable in the community related to health (Alves, 2017).

Health prevention strategy is the name given to health promotion and prevention of risks and diseases. Nogueira et al. (2015) They say that health promotion and protection actions are fundamental for the reorientation of care models, being a strategy of transversal articulation that aims to improve the quality of life and reduce health risks, through the construction of healthy public policies, which provide improvements in the community's way of life.

Health promotion and risk and disease prevention supplement access to community empowerment to act to improve their quality of life and health, including greater participation in disease control, to achieve a state of complete physical, mental, social and spiritual well-being.

Prevention is oriented towards actions to detect, control and weaken disease risk factors, focusing on disturbance and mechanisms to attack it (Nogueira et al., 2015).

Conformable Moreira (2013), prenatal care is the process of monitoring the pregnant woman from conception to the beginning of labor. The main objective of prenatal care is the monitoring of pregnancy, in order to reduce the risks that contribute to maternal and perinatal morbidity and mortality.

The gestation process is complex, dynamic and multidimensional for the woman and her family, due to clinical, social and cultural characteristics. The transformations that occur during pregnancy can expose women more frequently to serious consequences, which are the specific causes of maternal morbidity and mortality.

OBJECTIVES OF THE STUDY

The general objective: "To understand the course of community health education as a strategy for the prevention of maternal mortality in the health centers of the city of Nampula", and for its implementation the following specific objectives were outlined:

- To describe the demographic characteristics of pregnant women in health centers in the city of Nampula.
- Identify the strategies and contents of education for the prevention of maternal mortality in the health centers of the city of Nampula.
- To characterize the attitudes and behaviors manifested by women during the prenatal period, following community health education on the prevention of maternal mortality in health centers in the city of Nampula.
- To verify whether Community Health Education is a strategy for the prevention of maternal mortality in HCs in the city of Nampula.

In order to better understand the reality, a series of questions that operationalize this problem are listed as follows, for which we seek to build knowledge about the problem under study:

- What are the counseling strategies developed by maternal and child health nurses in the community health education procedure on the prevention of maternal mortality in the Health Units of the city of Nampula?
- What content is developed by ESMI in the community health education procedure on the prevention of maternal mortality in the Health Units of the city of Nampula?
- What Attitudes/Behavior do women manifest during prenatal care following community health education on the prevention of maternal mortality in Health Units in the city of Nampula?
- How is Community Health Education a strategy for the prevention of maternal mortality in HCs in the city of Nampula?

REASONS THAT JUSTIFY THE STUDY

The reason for carrying out this research is related to the fact that Education and Health are fields of great human, social and economic value, areas that most need investment and in which technological innovation can bring significant and still unexpected benefits.

The interest in the theme, Community health education as a strategy for the prevention of maternal mortality in the HCs of the city of Nampula, arises from the fact that the researcher is an Obstetrician Gynecologist, following the concerns about the behaviors of the female population, specifically pregnant women, parturients and mothers, as a result of the poor monitoring of the prenatal process.

The relevance of the study lies in the fact that pregnant women need to have knowledge and access to better information about the prenatal period, in order to better face the various difficulties, obstacles, limitations and frustrations that arise during pregnancy.

Concerns regarding maternal mortality arise as a result of the follow-up and beginning of the prenatal process and the observation of difficulties faced by health professionals in attending to and resolving complications, culminating in the death of pregnant and parturient women.

It is a relevant research because it is expected to collect valuable information about the experiences and perceptions of pregnant women and maternal and child health nurses, about the importance of complying with prenatal care.

METHODOLOGY TYPE OF STUDY

The present study (Interpretative) was developed in a dual perspective – using qualitative and quantitative techniques.

UNIVERSE OF THE STUDY

In this research, the study population is pregnant women and maternal and child health nurses.

The universe of the quantitative research was obtained by the sum of women who had prenatal consultations (ANCs) and consultations for healthy children (CCS) in the last three months in the health centers under study.

According to the analysis of data from the CPN and CCS (December 2021, January and February 2022) carried out by the Provincial Directorate of Health of Nampula (DPS, 2022), 2,145 women made an antenatal appointment at Health Center Y, 2,578 at Health Center Z, 810 at General Hospital X, and 18 maternal and child health nurses. The sum corresponds to 5,551 participants, constituting the universe of this research.

SAMPLE

Second Santos (2003), the sample is a representative subset of the study population, which must have the same general characteristics as the population from which it was extracted. When this sample is rigorously selected, the results obtained tend to be very close to those obtained if all the elements of the universe were surveyed (Oliveira, 2001). However, the representativeness of the sample depends on its size and the way it is collected, aiming to obtain a significant sample that actually represents the entire population (Gil, 1999). Quantitative sampling of this study will be applied to pregnant women in the universe.

Second Estanislau and Sanches (2017), in the research in which the universe is very large, as is the case of this study with 5,533 pregnant women, It is necessary to calculate the first approximation of the sample first. The researcher decided to use a sample confidence interval of 95% so that the margin of error Estimate high (E0) or 0.05%.

Equation1 – first approximation of the sample:

$$n_0 = \frac{1}{E_0^2}$$

Source: Estanislau e Sanches (2017, p. 41).

Where:

n_0 - First approach to the show

E_0 -Error Maximum Estimation

Therefore, the first approximation of the sample was calculated as follows:

$$n_0 = \frac{1}{E^2} \frac{1}{0,05^2} = \frac{1}{0,0025} = 400 \text{ pregnant women}$$

Equation 2 - Sample calculation:

$$n = \frac{N \cdot n_0}{N + n_0}$$

Source: Estanislau e Sanches (2017, p. 41).

Where:

N - Universe

n – Sample size

n₀– First approximation of the sample

$$n = \frac{N \cdot n_0}{N + n_0} = \frac{5533 \times 400}{5533 + 400} = \frac{2213200}{5933} = 373 \text{ Pregnant woman (sample)}$$

In this study, probabilistic sampling was chosen because it confers greater reliability to the results obtained, as each element of the population has the same probability, previously known and different from zero, of being included in the sample.

Stratified sampling consists of specifying how many elements of the sample will be taken in each extract. In this case, the extracts of this research are Health Centers Z with 2,578 pregnant women who scheduled a prenatal appointment in the last three months, health center Y with 2,145 pregnant women and General Hospital X with 810 pregnant women.

The proportional determination of the pregnant women to be interviewed in each Health Centre (extract) was calculated using the following expression:

Equation 3 - Total number of pregnant women to be interviewed in each health centre (extract)

$$\frac{nh}{Nh} = \frac{n}{N}$$

Source: Estanislau e Sanches (2017, p.41).

Where:

nh: Total number of pregnant women to be interviewed in each health center.

Nh: Stratum population (Health Center: Y (2,145), Z (2,578) and General Hospital X (810))

n: Sample size = 373

N: Total population = 5,533

Therefore, the number of pregnant women to be interviewed in each Health Center is:

- Health Center Z $\frac{nh}{Nh} = \frac{n}{N} \rightarrow \frac{nh}{2578} = \frac{373}{5533} = 173$ pregnant women
- Health Center and $\frac{nh}{Nh} = \frac{n}{N} \rightarrow \frac{nh}{2145} = \frac{373}{5533} = 145$ pregnant women
- Hospital Geral X $\frac{nh}{Nh} = \frac{n}{N} \rightarrow \frac{nh}{810} = \frac{373}{5533} = 55$ pregnant women

The selection of the elements in each extract was simple random. To carry out a simple random selection, it is recommended to make a list of the elements of the sample, randomly assigning a number to each of these elements, not knowing to whom this number in the sample belongs.

However, the researcher randomly drew numbers from the pregnant women, through the distribution of duly numbered informed consent forms (ICTs), not knowing to whom these numbers belong, that is, to which name of the pregnant woman this number is associated. In this process, the pregnant women were told to memorize their numbers, which gave them the possibility to be selected to participate in the study. Remembering that the calculated sample corresponds to 373 pregnant women, each pregnant woman was selected according to the position of her drawn number.

DATA COLLECTION TECHNIQUES

For this study, questionnaires, interviews and observation were used as data collection techniques.

Questionnaire surveys are often used in large-scale studies, as they allow data to be obtained from a significant number of subjects in relation to a given social phenomenon. The quantification of the data obtained allows inferences and generalizations.

On the other hand, the interview survey is commonly associated with interpretative studies and qualitative research, due to its descriptive and detailed character. This technique provides a more in-depth analysis of the data and information collected.

Data collection techniques are defined as rigorous and well-defined procedures, adapted to the type of problem and the phenomena under study. They aim to make the investigation viable, enabling the empirical verification of the methodological options adopted.

FORMS OF PRESENTATION AND ANALYSIS OF DATA AND DISCUSSION OF RESULTS

The data were analyzed based on descriptive statistical analysis, which is a set of techniques aimed at summarizing data that help to describe characteristics of interest in a given study

According to Piana (2009), descriptive statistics is a set of techniques that allows, in a systematic way, to organize, describe, analyze and interpret data from studies or experiences, carried out in any area of knowledge.

Descriptive statistics are the set of techniques and rules that summarize the information collected about a sample or a population without distortion or loss of information.

Therefore, in this study, through the SPSS Software, a database was created with the variables of interest, in order to obtain descriptive statistical data (frequencies).

The data were presented in a summary of texts and tables processed in Microsoft Word. Finally, all data were compared with the literature, that is, with other studies with a similar theme carried out in other regions of the world or within the country.

Inclusion Criteria:

- Pregnant women treated at Health Centers Y and Z, and at General Hospital X in the city of Nampula;
- Pregnant women who agreed to participate in the study;
- Lucid pregnant women;
- Maternal and child health nurse questioned during activities at health centres Y and Z, and General Hospital X.

Exclusion Criteria:

Pregnant women who did not agree to participate in the study;

- Pregnant women who had some inability to establish a conversation (Deaf, Dumb or Drunk);
- Nurses who were unavailable to participate in the research.

ETHICAL CONSIDERATIONS

The work took all due considerations and formalities regarding ethical issues, as stipulated in the Declaration of Helsinki (2013) of the World Medical Association. It began with the request for permission to carry out the study through a credential and the presentation of the respective protocol to the directors of the institutions in which the study took place. With regard to the protection of the participants, their identity was safeguarded by keeping it confidential and the information that was provided by them was used only for academic purposes.

It should be noted that this is an academic work, in such a way that the preservation of fidelity and confidentiality in relation to the results was strictly observed. He respected all the principles of bioethics, namely: the principle of autonomy, beneficence, non-maleficence and the principle of justice. Participation was voluntary by signing the ICF with the possibility of the participant leaving at any time without any consequence on the part of any participant in the study (Silva & Menezes, 2005). Anonymity and confidentiality were guaranteed in the context of data collection, omitting information on the personal identification data of the participants. The questionnaires were kept in a closed place and will be destroyed after five years, because in addition to ensuring that any doubt about the study data that arises in this period can be used to respond to the interviews, it also guarantees the participant knowledge about how long the data will be kept.

The participants' data were coded using the letter G to designate pregnant women. To differentiate one participant from another, an Arabic numerical index per participant was added to



each letter , such as (G1, G2, G3, ... Gn). However, the numerical order of the index will not mean the order of the interview, but rather differences between participants.

The risks of this research were minimal since there were no invasive procedures during the study. Participants, for example, answered sensitive questions such as pregnancy management issues.

In addition, aspects related to the interviews may take some time, in which you could be resting or practicing another more important activity in your life, or remind you of some past event that may cause you some fear, threat or shame during pregnancy. This may cause you some psychological tension to participate in this study or to remember some past episode that may cause you to cry.

PRESENTATION OF DATA

Table 1: Main Categories studied

Category	Subcategory
Demographic characteristics of the population	Age
	Marital status
	Education level
	Number of children
Counseling strategies used by ESMI in the community health education procedure on the prevention of maternal mortality in the Health Units of the city of Nampula	Disease-centered clinical method/clinical consultation
	Individual Counseling/ Person-Centered Education
	Collective lectures
Contents developed by the ESMI in the procedure of community health education on the prevention of maternal mortality in the Health Units of the city of Nampula	Always Do Family Planning and Start the ANC before 1 month
	Vaccinating with the baby and preventing STIs
	Deliver and have abortions in the hospital, do not consume drugs and alcohol
Attitudes/Behavior manifested by the population during prenatal care following community health education on the prevention of maternal mortality in the Health Units of the city of Nampula	Using the Family Planning Method
	Start of ABC
	Number of consultations made in this pregnancy
	Vaccinate with the baby
To verify whether Community Health Education is a strategy applied for the prevention of maternal mortality in HCs in the city of Nampula.	Consumption of alcohol, cigarettes, or other drugs in the previous day
	Form of tendency, advice and lecture of ESMI at the BC

Cast Iron: Biombe, 2023

Woman's age versus No children

Table 1: Woman's age versus Number of children

		How many children do they have				Total
		Primigesta	1 child	2-3 children	4-8 children	
Woman's age	< 18 years old	12	10	42	0	64
		3,2%	2,7%	11,3%	0,0%	17,2%
	19- 35 years old	9	59	109	51	228
		2,4%	15,8%	29,2%	13,7%	61,1%
	36 years or older	2	27	47	5	81
		0,5%	7,2%	12,6%	1,3%	21,7%
Total		23	93	198	56	373
		6,2%	25,7%	53,1%	15%	100,0%

Cast Iron: Biombe, 2023

Table 2 shows primiparous pregnant women 23 (6.2%), pregnant women with 1 child 93 (24.9%), pregnant women with 2-3 children 198 (53.1%) and pregnant women with 4-8 children 59 (15.8%).

Observations of 64 pregnant women under 18 years of age are highlighted, corresponding to 17.2%: primiparous pregnant women 12 (3.2%), pregnant women with 1 child 10 (2.7%); and Pregnant women with 2-3 children 42 (11.3%).

Among the participants over 18 years of age, those in the age group of 19-25 years stand out, pregnant women in a total of 228 (61.1%), of which: 9 (2.4%) are primiparous, 59 (15.8%) have a 1 child, 109 (29.2%) have 2-3 children and 51 (13.7%) have 4-8 children.

Marital status and level of education

Table 2: Marital status and level of education

Marital status		Total	Education level			Total
Married woman	Single		Primary level	Secondary level	Higher level	
304(81%)	69(19%)	373(100%)	241(64,6%)	121 (32,4%)	11 (2,9%)	373(100%)

Cast Iron: Biombe, 2023

In general, the world literature has considered adolescent pregnancy a public health problem and social challenge, however, the discussion about its repercussions on the Education and Health System has still been occurring in an incipient way and disconnected from institutionalized actions (Molina & Romero, 1985; Duarte, 1998).

In Mozambique, girls married early face a wide variety of social and health consequences, including high maternal mortality rates, complications during pregnancy and childbirth, and an increased risk of HIV infection and obstetric fistula.

Of the 373 women who participated in the study, corresponding to 100% of the study, 304, corresponding to 81%, are married and 69, corresponding to 19%, are single.

As can be seen in Table 3, about 19% of the women who participated in the study are single, which can influence adherence to the ABC.

Contents and counseling strategies used by ESMI in the procedure of community health education on the prevention of maternal mortality in the Health Units of the city of Nampula.

ANSWERS TO THE QUESTIONNAIRE ON EDUCATION CONTENT AND STRATEGIES

Table 3 Contents and counseling strategies used by the ESMI in the community health education procedure on the prevention of maternal mortality in the Health Units of the city of Nampula

		Which of the following ways do ESMI use to provide counselling to pregnant women and mothers?			Total
		Disease-centered clinical method/clinical consultation	Individual Counselling/Person-Centred Education	Collective lectures	
What advice do ESMI give to prevent your health and that of your baby?	Always Do Family Planning and Start the ANC before 3 months	78 20,9%	107 28,7%	21 5,6%	206 55,2%
	Vaccinating with the baby and preventing STIs	26 7,0%	32 8,6%	11 2,9%	69 18,5%
	Have childbirth and abortion in the hospital, do not consume drugs and alcohol.	22 5,9%	58 15,5%	18 4,8%	98 26,3%
	Total	126 33,8%	197 52,8%	50 13,4%	373 100,0%

Cast Iron: Biombe, 2023

Table 3 shows that the strategies used for counseling/educating pregnant women are, namely: Collective lectures, 50 (13.4%), Person-Centered Education, 197 (52.8%) and Clinical method centered on the disease, 126 (33.8%).

Based on the data from the questionnaire carried out with the pregnant women on the contents and educational strategies used by the Maternal and Child Health Nurses in the Health Units of the city of Nampula, the following could be observed:

Regarding counseling/education strategies, three approaches were mentioned by the participants. The most mentioned strategy was Person-Centered Education, chosen by 197 participants (52.8%). This approach emphasizes the importance of understanding the individual needs of pregnant women, tailoring counseling according to their specific circumstances. The second strategy mentioned was the disease-centered clinical method, with 126 participants (33.8%). This approach focuses primarily on identifying and treating diseases and health conditions. Finally, the Collective Lectures were mentioned by 50 participants (13.4%), suggesting the holding of information sessions for groups of pregnant women.

Regarding the contents addressed in the counseling/education sessions, a diversity of responses was observed among the participants. The most mentioned content was family planning and the importance of starting Prenatal Care (ANC) before one month, with 206 participants

(52.2%). This highlights the relevance of educating pregnant women about the importance of seeking early care during pregnancy and planning the family according to their needs and desires. Other content mentioned includes the importance of vaccinating the baby and preventing Sexually Transmitted Infections (STIs), mentioned by 69 participants (18.5%). In addition, the guidance on childbirth and abortion in a hospital environment was highlighted, as well as the importance of not consuming drugs and alcohol during pregnancy, mentioned by 98 participants (26.3%).

These results indicate that ESMI are adopting education strategies focused on the individual needs of pregnant women, focusing on aspects such as family planning, early initiation of ANC, prevention of STIs, safety of childbirth and the importance of avoiding the consumption of substances that are harmful to health. These approaches are fundamental for the prevention of maternal mortality and contribute to the promotion of maternal and child health in the city of Nampula.

Regarding the contents, as can be seen, the participants' answers were diverse, among which the following stand out: family planning and starting the ABC before three months 206 (52.2%), vaccinating the baby and preventing STIs, 69 (18.5%), giving birth and abortion in the hospital, not consuming drugs and alcohol, 98 (26.3%), as shown in table 4.

ANSWERS TO THE INTERVIEWS ABOUT CONTENT AND EDUCATION STRATEGIES CARRIED OUT WITH THE NURSES

The nurses mentioned the contents and strategies they use to counsel pregnant women.

*[...] We advise mothers to start prenatal consultation before 1 month [...] Always Do Family Planning [...] Prevent Sexually Transmitted Infections [...]; [...] This advice has been by way of Collective lectures [...]; [...] Individual counseling [...]; [...] counseling according to the patient's illness [...]. **And 1***

*[...] Through collective and individual lectures [...] we advise pregnant women to start the consultation very early to avoid various situations that may happen during pregnancy [...]; [...] Also during prenatal care, we give a lecture on the main symptoms of childbirth to avoid giving birth at home. [...]; **E2***

*[...] In the prenatal consultation, we give lectures on the importance of vaccinating the baby [...], the importance of giving birth or having an abortion in the hospital [...]; [...] effects of alcohol on pregnancy and several other aspects [...]. There are also aspects that we advise ourselves individually and according to the disease [...]; **E3***

[...] Hee.....during the prenatal consultation, through lectures, we explained several aspects to pregnant women, as well as mothers of babies, such as the importance of breast milk [...]; [...] period

necessary to breastfeed the baby[...],[...] explain to mothers the importance of Family Planning [...]; [...] Importance of vaccinating the baby and delivering the baby in the hospital[...]**E4**

[...] To prevent maternal mortality, we advise pregnant women and mothers to give birth and have an abortion in the hospital [...]; [...]make the prenatal consultation as soon as possible [...] not to consume alcoholic beverages during pregnancy and breastfeeding [...]; we give lectures on the importance of family planning [...]; [...]; In some situations we advise you individually [...]**E5**

[...]We often advise mothers to adhere to family planning [...]; [...] prevent sexually transmitted diseases [...]; [...]vaccinate the baby together[...]**E6**

[...]The main strategies we develop to advise patients are: Collective lectures[...];[...]**E1**

lectures[...];[...]**E1**
By judging the testimonies presented by the nurses, it is observed that in prenatal consultations, women, in fact, are educated to prevent various diseases that may endanger their health.

Based on the interviews conducted with the nurses, we can observe that they mentioned the contents and strategies they use to advise pregnant women.

Attitudes/Behavior manifested by pregnant women during prenatal care following community health education on the prevention of maternal mortality in the Health Units of the city of Nampula

QUESTIONIOMARIO ANSWERS WITH PREGNANT WOMEN ABOUT ATTITUDES/BEHAVIOR

Table 4: Behavior/Attitudes of the Participants during prenatal care

Content	Answers	Frequency	Percentage
Start of ABC	Before 3 months	67	18,0
	At 3 months	93	24,9
	After 3 months	213	57,1
No appointments have already been done in this pregnancy	1-3 Consultations	278	74,5
	4 or more queries	95	25,5
Vaccinated	Yes	254	68,1
	No	119	31,9
Do family planning	Yes	268	71,8
	No	105	28,2
Experience of having a birth or abortion at home	Yes	105	28,2
	No	268	71,8
Has consumed alcohol or another drug in the current month	Yes, alcohol	82	22,0
	Yes, cigarette	13	3,5
	No	278	74,5

Cast Iron: Biombe, 2023

Regarding the BC, 67 (18%) said that they started before 3 months, 93 (24.9%) stated that they started after 3 months, and 213 (57.1%), who constitute the majority, started after 3 months.



Table 5 shows the data of pregnant women on different attitudes and behaviors in relation to prenatal care (ANC).

Initiation of the ABC before 3 months: About 18% of the participants reported having started the BC before completing three months of pregnancy. These women demonstrated a positive behavior when seeking prenatal care early, which is important for the proper monitoring of maternal and child health from the early stages of pregnancy.

Onset of the ABC at 3 months: Approximately 24.9% of the pregnant women stated that they started the BC exactly at three months of gestation. Although they have met the minimum recommended deadline, it is important to note that the sooner the ANC is started, the better the opportunities for early detection of problems and implementation of preventive measures.

Beginning of the ABC after 3 months: Most of the participants, corresponding to 57.1% of the group, reported having started the BC after completing three months of pregnancy. This delay in the start of prenatal care can have several reasons, such as lack of access to health services, lack of knowledge about the importance of the ANC or other socioeconomic barriers.

Regarding the number of consultations made during the current pregnancy, 278 (74.5%), which constitute the majority, made 1-3 consultations and 95 (25.5%) made 4 or more consultations.

Consultations from 1 to 3: The majority of participants, representing 74.5%, had 1 to 3 consultations during the current pregnancy. This number of visits is below that recommended by health guidelines, which generally indicate a minimum of 4 prenatal visits for a healthy pregnancy. This proportion suggests a possible lack of adherence to adequate prenatal care, which can negatively impact maternal and child health.

Visits of 4 or more: Approximately 25.5% of pregnant women had 4 or more visits during the current pregnancy. These women demonstrated a positive behavior when seeking a greater number of prenatal consultations, which may indicate a greater awareness of the importance of prenatal care and better health monitoring during pregnancy.

It is important to note that regular prenatal care is crucial to monitor fetal development, identify potential complications, and receive appropriate guidance on health care during pregnancy.

Table 4 also shows that 264 (68.1%) participants were vaccinated and 119 (31.9%) were not vaccinated; 268 (71.8%) were family planners and 105 (28.2%) were not; 105 (28.2%) had experience of giving birth or abortion at home and 268 (71.8%) were not; 82 (22%) consumed alcohol, 13 (3.5%) were smokers and 278 (74.5%) were not smokers or drinkers.

The interpretation of the data presented reveals information on behaviors related to family planning, home birth or abortion practices, alcohol consumption and smoking.



ANSWERS TO INTERVIEWS CONDUCTED WITH NURSES ABOUT ATTITUDES/BEHAVIOR

The nurses reported the attitudes of the pregnant women during prenatal care, as shown in the following statements:

*[...]Most pregnant women start prenatal care after 3 months [...] heee..... Some pregnant women do not complete the number of appointments planned [...] abandon family planning claiming that it is bad for them [...] **And 1***

*[...] we have had pregnant women even after being advised do not complete the number of planned consultations [...]; [...] give birth at home [...] **And 2***

*[...] Regarding the behaviors of pregnant women and mothers, I see that some do not follow our recommendations, they appear with leisure indication that the day before they consumed alcohol [...]; [...] others are irresponsible, they start prenatal consultations late [...] **E3**[...]*

*[...] in fact, we have had patients with a delay of 2 to 3 months [...]; [...] sometimes they don't know how many months it is [...]; [...] Just make an appointment, although late, she doesn't come back anymore because she's afraid of being reprimanded, which compromises the quality of our work [...] **And 4***

*[...]We have noticed several negative aspects in pregnant women and mothers [...]; [...] although there are few cases [...]; [...] there are primiparous women who have abortions at home, they only come to the hospital after everything is complicated [...]; [...] others consume alcohol during pregnancy [...]; [...] Despite everything, on the contrary, there are women who comply with all the guidelines [...] **E5***

*[...] I, as an ESMI, according to what I have witnessed on a daily basis, can say that during prenatal consultations women behave well, although some women do not comply with the recommendations, such as, for example, they do not complete the number of planned consultations [...]; [...] abandon family planning [...] **E6***

The interviews conducted with the nurses reveal information about the attitudes and behaviors of pregnant women during prenatal care, where the following was found:

Late start of prenatal consultations: According to the nurses interviewed, there is a tendency for many pregnant women to start prenatal consultations after the first three months of pregnancy. This indicates a delay in access to antenatal care, which may result in less medical supervision during this critical time.

Lack of adherence to the number of planned visits: The nurses reported that some pregnant women do not complete the number of recommended prenatal visits. This can be worrisome, as regular appointments are important for monitoring the health of the pregnant woman and the fetus, as well as providing appropriate guidance and care.

Risk behaviors: Some nurses mentioned cases in which pregnant women reported consuming alcohol during pregnancy, as well as the practice of home birth, which can pose risks to maternal and child health. These behaviors can be harmful and require appropriate intervention and guidance.

Misinformation and lack of commitment: Some nurses observed that some pregnant women demonstrate a lack of knowledge about the duration of pregnancy and do not follow the guidelines provided during prenatal consultations. In addition, they mentioned that some women are afraid of being reprimanded and, out of fear, end up not returning to subsequent appointments, thus compromising the continuity of care and the quality of care.

Variation in behaviors: Although negative behaviors were observed, the nurses also highlighted that there are women who comply with all the guidelines and demonstrate commitment to prenatal care. These positive cases show that some pregnant women are following the recommendations and actively engaging in prenatal care.

In general, the data from the interviews with the nurses indicate the existence of challenges and worrying behaviors on the part of some pregnant women and mothers during prenatal care. These challenges include late start of consultations, lack of adherence to the number of recommended consultations, and risky practices. These results highlight the importance of intensifying education and awareness efforts during prenatal consultations, aiming to promote better adherence to care and healthy behaviors, thus ensuring maternal and child health.

As can be seen, 57.1% of the participants stated that they started after 3 months. According to E1 [...] *most pregnant women start prenatal consultations after 3 months [...]*. This Attitudes/Behavior undermines the rules of organization of the CPN to avoid possible complications.

Verification of Community Health Education as a Strategy Applied for the Prevention of Maternal Mortality in HCs in the City of Nampula.

RESPONSES TO INTERVIEWS CONDUCTED WITH PREGNANT WOMEN AND MOTHERS ABOUT COMMUNITY HEALTH EDUCATION AS A STRATEGY APPLIED TO THE PREVENTION OF MATERNAL MORTALITY IN HC IN THE CITY OF NAMPULA.

Table 5: Application of community education for the prevention of maternal mortality in health centers in the city of Nampula

Content	Answers	Frequency	Percentage
How do you consider the ESMI Service at the BC	I consider that there is a lack of reception, the service is slow, slow, lack of material for the service	99	26,5%
	I consider it good service	131	35,1%
	I am very afraid of ESMI because of their bad attitudes, poor sensitivity and affection towards pregnant and parturient women	143	38,3%

Cast Iron: Biombe, 2023

As can be seen in table 5, 99 participants, corresponding to 26.5%, consider that there is a lack of receptiveness, the service is slow and slow. In addition, 131 participants, corresponding to 35.1%, affirm that there is good care and 143 participants, corresponding to 38.3%, said that they are very afraid of ESMI due to bad attitudes, poor sensitivity and affection with pregnant and parturient women.

The data from the study carried out with pregnant women on community health education as a strategy for preventing maternal mortality in health centers in Nampula reveals the following:

Influence of moral, ethical, and deontological factors: Participants highlighted that these factors have a significant influence on the process of community education for the prevention of maternal mortality. This indicates the importance of addressing these aspects when developing education strategies and improving the quality of health care provided to pregnant and parturient women.

Perception of care: A significant part of the participants (26.5%) reported that there is a lack of reception in health centers, with slow and slow care. This can have a negative impact on the experience of pregnant and parturient women, affecting the effectiveness of community health education.

ESMI attitudes: A considerable proportion of participants (38.3%) expressed fear towards ESMI (Traditional Nurses and Midwives), citing poor attitudes, lack of sensitivity and affectivity. These negative perceptions can create barriers in the communication and engagement of pregnant and parturient women, hindering the effectiveness of community health education.

Perception of good care: On the other hand, 35.1% of the participants reported that they receive good care in health centers. This positive perception may indicate that some pregnant women and mothers have a satisfactory experience in the process of community health education, which can contribute to the prevention of maternal mortality.

In summary, the data reveal a variety of perceptions about community health education in Nampula health centers. The presence of moral, ethical, and deontological factors, as well as the reception and care offered by the ESMI, play an important role in the effectiveness of this strategy for preventing maternal mortality. It is essential to address the concerns raised by the participants, seeking to improve the reception, care and sensitivity of health teams to promote a positive and effective experience of community health education.



ANSWERS TO INTERVIEWS CONDUCTED WITH NURSES ABOUT COMMUNITY HEALTH EDUCATION AS A STRATEGY APPLIED TO PREVENT MATERNAL MORTALITY IN HC IN THE CITY OF NAMPULA

Regarding the application of the Community Health Education strategy for the prevention of maternal mortality in the HCs of the city of Nampula, the nurses' answers were diverse, as can be seen in the statements presented below:

[...] there are several factors [...]; [...] in fact the center is without sonar to auscultate the baby's BCF to hear the fetus [...] We went more than a month without brown paper, which rolls the material to be sterilized. [...] ; [...] Our work is impaired, several times we cancel a patient's procedure for another day waiting for the material [...]. [...] Often the patient is embarrassed by the lack of material [...] in addition to the lack of work material such as posters, vaccines and syphilis tests [...]; [...] There are problems of ignorance of women in the guidelines we give [...]E1

[...] during the counseling of women, I face difficulties such as insufficient vaccines against tetanus, hepatitis [...]; [...] although there are women who refuse to vaccinate with the baby [...]; [...] insufficiency of medicines ...; [...] There are problems of ignorance of women in the guidelines we give [...]E2

[...] Although there are women who refuse to vaccinate with the baby during my activities, I face difficulties such as insufficient vaccines against tetanus, hepatitis [...]; [...] insufficiency of medicines ...; [...] There are problems of ignorance of women in the guidelines we give [...]E3

[...] I have had a lot of difficulty [...]; [...] mainly due to lack of work material, such as insufficient pre-eclampsia posters, sepsis posters and syphilis tests [...]E4

[...] we have faced several problems [...]; [...] the most frequent are related to women's own culture [...]; There are pregnant women who have a lot of difficulty following our guidelines[...] due to their schooling and the habits of the community itself[...] E5

[...] we have faced problems related to family matters [...]; [...] negative influences of the spouse who does not accept the woman to do family planning [...]; [...] making women disobey the instructions on planning[...] as a result we have had cases of calving intervals shorter than 2 years [...]E6

Interviews with nurses about community health education as a strategy applied to the prevention of maternal mortality in the Health Centers of Nampula reveal the following:

Limitations of resources and materials: The nurses pointed out several difficulties related to the lack of essential resources and materials for their work. This includes the absence of equipment such as sonars to auscultate fetal heartbeats, lack of materials for sterilization, and insufficient posters, vaccines, and tests to carry out proper health guidelines. These limitations negatively affect the quality of care and can hinder the effectiveness of the community health education strategy.



Difficulties in the application of the guidelines: The nurses mentioned the occurrence of problems related to the lack of adherence and understanding on the part of the women in relation to the orientations given. These include refusal to vaccinate babies, lack of knowledge about the necessary care, and difficulties in following instructions due to cultural issues, education, and spousal influence. These obstacles can compromise the results of community health education and the prevention of maternal mortality.

Need for more educational resources: Nurses reported a shortage of educational materials, such as information posters on preeclampsia and sepsis, which are essential for disseminating important information to pregnant women and mothers. The lack of these resources can make it difficult to understand and adopt healthy practices.

Challenges related to family problems and external influences: Some nurses mentioned challenges associated with family issues and negative influences, such as spouses' resistance to family planning. This can lead women to disobey medical advice, resulting in shorter than recommended delivery intervals, which can increase maternal health risks.

The interviews reveal a series of challenges faced by nurses in the implementation of community health education as a strategy to prevent maternal mortality. Resource limitations, lack of buy-in and understanding on the part of women, scarcity of educational materials, and negative external influences are obstacles that need to be addressed to improve the effectiveness of this strategy and ensure quality care for pregnant women and mothers in the city of Nampula.

DATA FROM THE RESEARCHER'S OBSERVATION

In this investigation, some materials necessary in the community education procedure for the prevention of maternal mortality were observed. However, it was found that in all health units where data collection took place, there are no Hemorrhage Flowcharts, Preeclampsia Flowcharts, and Sepsis Flowcharts. In addition, until the moment of data collection there were no syphilis tests, HIV tests, tetanus and hepatitis vaccines.

It was observed that the pregnant woman was present at the ABC, vaccination cards of the baby's mothers, and several irregularities were found, such as: late start of the ABC 2 to 3 months after conception, incomplete vaccinations with the baby, mothers without a family planning card, short birth intervals, pregnant women under 18 years of age, mothers under 18 years of age with 2 to 3 children.

There are several strategies that can help prevent bleeding or even reduce its complications. This can start in prenatal care.

It is important to properly treat anemia in pregnant women and use a flowchart.

CONCLUSIONS

Thus, it concludes that:

1. Regarding the general objective "To understand the course of community health education as a strategy for the prevention of maternal mortality in the health centers of the city of Nampula", that the main counseling strategy developed by the ESMI in the procedure of community health education on the prevention of maternal mortality in the Health Units of the city of Nampula is the method of Person-Centered Education/person-centered clinical method, as most maternal and child health nurses use this method.

It is an efficient strategy, as it helps maternal and child health nurses to understand pregnant women and not just limit themselves to the disease. This strategy also includes the characteristics related to the contents of the consultations, including attention to the orientations provided to the mothers, in addition to the uniqueness of each patient, with the reception, satisfaction and maintenance of the professional-patient bond.

Similarly, it is concluded that there are maternal and child health nurses who resort to the clinical method centered on the disease/clinical consultation and collective lectures focusing only on biological aspects. Although they are prevention and health care actions aimed at advising, correcting behavior in a socio-sanitary, inclusive and solidary dimension to improve the quality of life, it does not achieve the desired goals.

2. Regarding the specific objective "To describe the demographic characteristics of pregnant women in the health centers (HC) of the city of Nampula.":

It is concluded that single women have a three-fold higher risk of not having prenatal consultations when compared to married women. One hypothesis for this finding may be related to the partner's support during pregnancy, which favors adherence to prenatal consultations and, conversely, the lack of contact with the baby's father contributes both to the lack of care and to the fewer consultations during pregnancy.

In order for the pregnant woman to feel more confident and secure during the gestation period, there is a need for the father figure to be accompanying the entire process.

3. Regarding the specific objective "To identify the strategies and contents of education for the prevention of maternal mortality in the health centers (HC) of the city of Nampula":

It is concluded that the purpose of Person-Centered Education/person-centered clinical method is the formation of healthy habits and attitudes/behaviors, which is the principle of value creation. Values represent basic convictions, a specific mode of conduct that contains an element of judgment, based on what the individual believes to be right, good, or desirable. Values are important in the study of community behavior because they lay the foundation for understanding attitudes and motivation, as well as influencing perceptions.

4. Regarding the specific objective "To characterize the attitudes and behaviors manifested by women during the prenatal period, following community health education on the prevention of maternal mortality in health centers in the city of Nampula":

These pregnant women show attitudes that constitute relevant prenatal problems, with greater emphasis on early and late gestational age, multiparity, and short spaces between births.

The following are problems that contribute to maternal mortality: Late start of prenatal consultation; Number of consultations less than 3; Not doing family planning; Do not vaccinate with the baby; Giving birth or having an abortion at home; and Consumption of alcohol or other drugs during pregnancy.

5. Regarding the specific objective "To verify if Community Health Education is a strategy for the prevention of maternal mortality in HCs in the city of Nampula": it is concluded that in order to correct this problem, importance should be given to educational actions during prenatal care, believing that the purpose of community health education on the prevention of maternal mortality, which occurs in the Health Units of the city of Nampula is the formation of habits, and attitudes/behaviors that is the principle of value creation.

SUGGESTIONS

After concluding the study, some questions emerged, which may constitute the development of future research and the implication in interventions in the field of community health education.

Regarding health education, it is suggested that:

- There should be an effort on the part of maternal and child health nurses so that health education is a tool to promote healthy behaviors, prevent diseases and promote well-being in communities and become a constant. Pregnant women need monitoring and guidance.
- It is urgent to develop reflections among maternal and child health nurses and pregnant women on the relationship between education and behavior change. The social and family environment in which it takes place are fundamental, if we want pregnant women to become aware and internalize important aspects for a healthy existence and the benefits it brings, they will have to use the main counseling strategy in the procedure of community health education on the prevention of maternal mortality in the Health Units of the city of Nampula, which is the Person-Centered Education method /person-centered clinical method.
- It is essential that the methodology and strategies used by maternal and child health nurses be clarified and shared with pregnant women and the community because it is important and indispensable that they favor the active participation of pregnant women in



the construction of their knowledge and promote constant reflection on practices, reflection on the realities lived and witnessed and reflection on the mobilization of their knowledge. Reflective practice is essential.

It is suggested that a study be carried out that would replicate this one, more comprehensive and carried out in more health centers, that is, that could be extended to more participants and that would allow comparisons to be made. Perhaps interesting aspects would be revealed, which could be generalized, as well as future research that focuses only on the motivation in community health education and its application in the reduction of maternal mortality.


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Skin care in the elderly: Systematic review of the literature

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ABSTRACT

The skin is a vital organ in humans that suffers from the impact of intrinsic aging and, in this process, physiological changes occur that are responsible for the thinning of the epidermis, dermis and hypodermis, transforming it into rough, whitish skin, without elasticity, with wrinkles and without freshness. This study aimed to conduct a systematic review on dehydrated skin in older people and to promote effective care strategies. Data collection was carried out from November 2023 to February 2024, and articles published between 2018 and 2023, in Portuguese, Spanish, and English, were included. In the PubMed Portal, 129 articles were found; in the Virtual Health Library (VHL), 47; on the CAPES Portal, 22; and on the EBSCO Platform, 317. Six articles were selected that met the study objective. The need for care for dehydrated skin in the elderly was highlighted, due to the impacts caused by intrinsic aging. Different skin types have been identified, so care should be individualized. Self-care, treatments such as skin cleansing and hydration help preserve the integrity of the skin, and a good diet, drinking water and using topical and oral products are important tools to attenuate wrinkles, reduce flaking and avoid itching and lesions.

Keywords: Care, Skin Aging, Aged.

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INTRODUCTION

Intrinsic skin aging, also known as natural aging, is an inevitable process of the skin, which occurs with advancing age, and is influenced by genetic and biological factors, independent of external factors such as sun exposure, smoking, and poor diet. Aging skin has characteristics such as loss of elasticity, decreased production of collagen and elastin, formation of wrinkles and expression lines, as well as dryness and thinning of the epidermis. These skin changes can be noticed from the age of 30, but become more evident from the age of 50, due to the reduction in cell activity and skin renewal (Cruz *et al.*, 2019). Chronological skin aging can present itself in different forms and intensities, which will depend on the socioeconomic level in which the elderly person is inserted and even if they are an independent and autonomous individual, they can present skin changes (Santos *et al.*, 2021).

Other characteristics of intrinsic aging include the loss of volume, density, and elasticity of the skin, which favors the appearance of age spots and changes in skin texture caused by dryness and peeling of the skin. This aging process is its own and is part of the continuous cycle of life, and it is important to take care of the skin and adopt healthy habits to delay the signs of aging and control the skin's water imbalance. (Cross *et al.*, 2020; Sousa *et al.*, 2019).

Skin hydration is essential for preventing and treating the signs of aging, as aging skin tends to lose its natural water-holding capacity. Maintaining good hydration is key to minimizing the appearance of wrinkles and fine lines, as well as promoting skin health and vitality. It is important to choose products that are suitable for each skin type and age, that provide hydration and essential nutrients for aging skin, which includes gentle cleansing and nourishment. The search for healthy and beautiful skin must be continuous throughout life, to ensure the vitality and beauty of the skin even in old age (Gomes *et al.*, 2016).

In addition to hydration, it is important to adopt specific care habits for aging skin, which include gentle skin cleansing, the use of products with antioxidant ingredients, and the practice of an appropriate skin care routine (Gomes *et al.*, 2016). The search for healthy skin and the prevention of signs of aging must be maintained throughout life, to maintain the vitality and beauty of the skin even in old age.

In view of the above, this study aims to conduct a systematic review on dehydrated skin in the elderly and to promote effective care strategies. Knowing this care will help and support professionals and family members seeking a permanent education in skin care (Cruz *et al.*, 2020).

METHOD

A systematic review of the literature was conducted with the objective of better understanding skin care related to intrinsic aging. The research was carried out on the PubMed, Virtual Health

Library (VHL), Capes Portal and EBSCO Intuitive Platform portals, between October 2023 and February 2024. The selection of descriptors and the search strategy followed the guidelines of the PICO format (population; intervention; comparison; outcome). Health Sciences Descriptors (DeCS) were used: "Elderly" as population, "Care" as intervention/comparison, and "Skin aging" as outcome, combined with the Boolean logical operator *AND* to associate the relevant terms. In the databases used, which recommend the English language, the associations of three descriptors were used: "*skin aging AND aged AND care*". The languages selected for this research were English, Portuguese and Spanish.

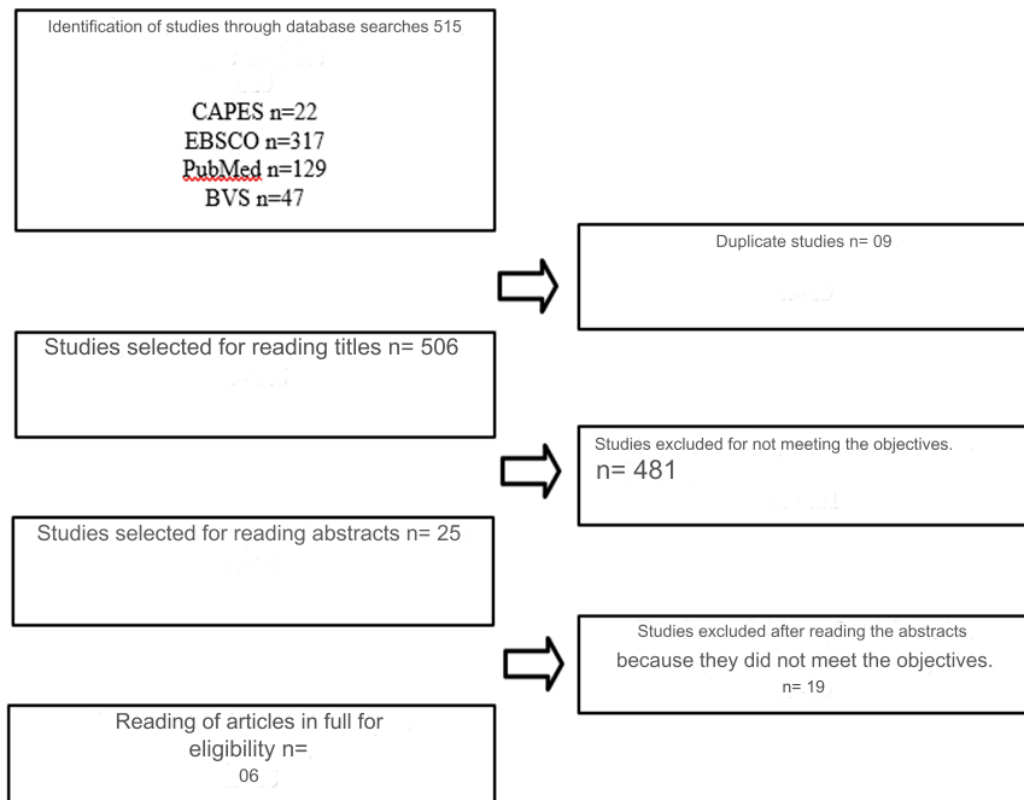
The inclusion criteria for the articles were titles and subjects related to skin care for the elderly; publications of articles in indexed journals, considering the period between 2016 and 2023. The exclusion criteria were duplicate publications in more than one database, dissertations and studies that do not fit the theme.

First, the articles were read and selected based on their titles. Then, the abstracts were analyzed to verify eligibility for inclusion. For the selected articles, the complete reading was done. The information extracted from each study included: authors' names, year of publication, objectives, methodology, instruments used, and main results.

RESULTS

The initial consultation resulted in 515 articles and, after applying the inclusion and exclusion criteria, six publications remained. Figure 1 describes the stages of article selection.

Figure 1. Flow chart of the selection of articles



Source: based on survey data (2024).

Data extraction from the six articles was conducted by collecting information: authors' names, year of publication, country where the study was conducted, research objective, description of the methods used, and main results. These data were organized in Chart 1 for later analysis.

Chart 1 – Data of the selected articles

Author	Year	Objectives	Method	Main results
Cruz <i>et al.</i>	2021	To analyze the care of cutaneous xerosis in the elderly.	Integrative review	Dehydrated skin is a senile complication that contributes to worsening quality of life and increasing the incidence of severe skin lesions. Interventions such as oral and skin hydration, self-care education and product use.
Santos <i>et al.</i>	2021	To identify factors associated with the development of lesions and/or skin changes in elderly people in perioperative care.	Descriptive study	The main skin changes were hematoma/ecchymosis and erythema. Older adults over 71.92 developed more lesions compared to younger people.
Cruz <i>et al.</i>	2020	To construct and validate an instrument to assess, prevent, and treat cutaneous xerosis.	Methodological study of content validation	The instrument's construction is valid and reliable, allowing and optimizing the work of professionals.
Cruz <i>et al.</i>	2019	Identify nursing care to assess, prevent and treat cutaneous xerosis.	Descriptive and quantitative study	There is a need to observe the importance of continuing education with the purpose of optimizing the quality of care and to address the lack of instruments and protocols aimed at skin dryness in the elderly.
Sousa <i>et al.</i>	2019	Prevent skin lesions (LP).	Integrative review study	In addition to changing the decubitus position every two hours, it is essential to hydrate the skin to avoid injuries.
Gomes <i>et al.</i>	2016	Identify the best interventions to prevent friction injuries.	Integrative review study	Maintain skin homeostasis, food and nutrition, hydration, protection and avoid skin accidents, through a safe environment.

Source: based on survey data (2024).

DISCUSSION

The absence of symptoms such as itching in older adults does not imply that skin care can be neglected, underlining the importance of specialized knowledge of healthcare professionals (Cruz *et al.*, 2019). It is important to optimize visual assessment to contribute to more accurate diagnoses, using instruments and protocols that help obtain essential information for preventive care and maintenance of skin quality. The knowledge of professionals should be continuously strengthened in relation to the skin care of the elderly, promoting health in institutionalized environments. Sousa *et al.* (2019) indicated that the use of moisturizers can have a significant positive impact in these contexts. Adequate frequency of this care is crucial to prevent skin dehydration and itching, which can lead to scratches and injuries (Gomes *et al.*, 2016).

Dehydrated skin in older adults is a common and serious problem, which can have a significant impact on quality of life and overall health. The descriptive results mentioned confirm this situation, showing that even autonomous elderly people end up developing skin changes due to dehydration. Dehydration of the skin can lead to complications, such as the appearance of serious lesions, which can become a major problem for the elderly. Therefore, it is essential that effective

interventions are carried out to prevent and treat skin dehydration (Cruz *et al.*, 2021; Santos *et al.*, 2021).

Among the suggested interventions, the importance of oral and skin hydration stands out, which are simple and effective measures to keep the skin healthy and prevent complications. In addition, self-care education is essential, as many seniors may not be aware of the importance of taking care of their skin properly. The use of specific dermatological products can also be an excellent option to prevent and treat skin dehydration in the elderly, thus ensuring an improvement in quality of life and skin health. To maintain and recover their integrity, there is an increase in the use of increasingly personalized instruments and products to provide care and prevent serious injuries, ensuring a better quality of life for these individuals (Cruz *et al.*, 2021; Santos *et al.*, 2021).

Guidance on skin care and personal cleanliness should cover both homes and institutions, evidencing the control and assiduity of this conduct, in order to obtain control of cases of skin dehydration. Investigate resources as routine and prevention measures, avoiding discomfort and compromising the quality of life of these individuals. (Sousa *et al.*, 2018).

Therefore, it is necessary for health professionals to be aware of this issue and offer appropriate guidance and interventions to prevent and treat skin dehydration in the elderly, thus ensuring a better quality of life and well-being for this population (Cruz *et al.*, 2021; Santos *et al.*, 2021). Finally, the need for courses for skin care is perceived, since the urgency in optimizing education and knowledge of professionals who have the purpose of improving the quality of this care is clear. Another relevant issue is the scarcity of recognized instruments and/or protocols for the process and management of dehydrated skin in older people (Cruz *et al.*, 2019).

All studies, in common, reinforce the importance of paying attention to the skin, fragile and vulnerable during handling and the daily need for care, since prevention can avoid elementary injuries and discomfort in patients. The use of planned and punctual strategies allows for comprehensive and safe action.

FINAL CONSIDERATIONS


In view of the aspects presented, instructions with adequate skin care and hygiene are determinant for the integrity of the skin of the elderly, it is perceived that skin dehydration has been considered a universalized complication that harms populations over 60 years of age.

The physical wear and tear that skin aging presents stands out, favored by mechanical trauma, making it a challenge for family members and professionals, requiring greater interest and commitment from everyone. In view of the above, it is necessary to think about educational policies that guarantee professionals knowledge and the right to treatment in a humanized and effective way.

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Stretch marks, causes and treatments used today – Scoping review

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ABSTRACT

Introduction: As it is the largest organ in the body, the skin is more exposed to solar radiation, body changes as well as genetics. The skin covers the body and acts as a physical barrier between the body and the outside environment and represents about 16% of body weight. Because the skin is an organ with numerous functions, it is exposed to structural changes that are easily perceived by the naked eye, including stretch marks. For a better understanding, we need to understand that the elastic fibers of the skin are the starting point for the formation of stretch marks. **Methodology:** This is a scoping review where descriptors in Health Sciences - DeCS were used. The descriptors of interest and Boolean operators were: "Therapeutic AND "Skin Lesions (stretch marks)". The search was carried out in the PubMed, Scielo and Bireme databases by these databases provide a broad search combining information from other platforms, using 19 relevant articles. **Results:** There are treatments that can treat and reduce this problem and include micropuncture, microdermabrasion, microneedling, carboxytherapy as well as the combination of treatments, which must be performed by trained professionals due to their specificities. **Final considerations:** Stretch marks are acquired integumentary lesions and, like any scar, can be considered a difficult treatment. However, with the current advancement of techniques, there are several aesthetic treatments that are performed, however, there is no scientific proof of their effectiveness for the total disappearance of stretch marks and, as it is a genetic predisposition, prevention includes both the maintenance of the ideal weight and good skin hydration.

Keywords: Stretch marks, Skin, Treatment, Microneedling.

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INTRODUCTION

The second half of the 20th century was a milestone in the development of new body image, public concern for body image, and a growing sense of community identity, resulting in a variety of beauty treatments that will be pursued to achieve this goal. the perfection of the skin (Bohjanen, 2017).

As it is the largest organ in the body, the skin is more exposed to solar radiation, body changes as well as genetics. The skin covers the body and acts as a physical barrier between the body and the outside environment and represents about 16% of body weight. Formed by an outermost epithelial portion, the epidermis and conjunctiva, below the epidermis, called the dermis. The epidermis acts as the main barrier between the body and the external environment due to the keratinized layer that covers the entire surface of the skin. However, this barrier is not enough to stop nervous stimuli that allow the skin to identify the information that the environment transmits to the body and are interpreted by the central nervous system (CNS) (Bohjanen, 2017); (De Camargo, 2018).

The skin contributes to the body's thermoregulation with the help of blood vessels, adipose tissue and sweat glands, protecting the body against the action of ultraviolet rays, through the melanin produced by melanocytes, which uses ultraviolet (UV) radiation to form vitamin D3 (Alves et al, 2019).

Our body has places where the skin can be thin or thick, depending on its location. Hands and feet have a thicker epidermis due to a larger keratin layer on the outer portion of the skin, and the face, chest, and neck skin is thinner and more fragile (Alves et al, 2019); (De Camargo, 2018).

Because the skin is an organ with numerous functions, it is exposed to structural changes that are easily perceived by the naked eye, including stretch marks. For a better understanding, we need to understand that the elastic fibers of the skin are the starting point for the formation of stretch marks, where the process of mast cell granulation and macrophyc activation begins, increasing elastolysis in the epithelial tissue (Cosme, 2015).

Stretch marks are considered an acquired tegumentary atrophy, with a linear and sinuous aspect that presents itself in two aspects: in the initial red phase, it has this color, because it has adequate vascularization, so that it can try to recover the skin, being easier to treat, later those that were not treated or that continued to be distended, will be found in white, They not only change color, but over time they become deeper, with the appearance of aged skin, and consequently wider and longer. In the case of obese people, or pregnant women, or individuals with accelerated growth, the structures that withstand pressure generate a weakening in the thickness of the connective tissue with great tensions on the skin, thus causing the rupture of elastic fibers and the formation of stretch marks (Cosme, 2015).

However, there is no precise explanation for the causes of the appearance of stretch marks, studies point to multifactorial causes, endocrinological and mechanical factors, genetic and family factors. Such factors have led to the emergence of three theories of its etiology: mechanical, endocrinological, and infectious (De Souza et al, 2016).

For the treatment of lesions, several techniques have been used so far to reduce or, if possible, eliminate undesirable stretch marks. Thus, this study will describe, through a scoping review, the therapeutic resources used in the treatment of stretch marks, discussing the benefits of these procedures and the more selective methods.

METHOD

The scoping study or scoping review is a study that aims to explore the main concepts of the topic addressed in the study, as well as to verify the size, scope and nature of the study, in a clear and concise way in the publication of the data found, allowing an analysis of the results of published studies (Ferraz et al, 2020).

Scoping review is a form of literature review, also called *scoping review* - directed by a research protocol that aims to evaluate current evidence, clarify concepts or definitions (Jesus, 2023 et al)

Scoping review can be used to assist in the collection of broad and focused information, without distinction between types of studies and methods used.

In the first stage of this study, the descriptor was established based on the Health Sciences Descriptors - DeCS. The descriptors of interest and Boolean operators were: "Therapeutic AND "Skin Lesions (stretch marks)".

The search was carried out in the PubMed, Scielo and Bireme databases by these databases provide a broad search combining information from other platforms. The following question was used: how is the scientific production about the therapeutic resources used in the treatment of skin lesions, particularly stretch marks, presented?

The inclusion criteria were: (a) original articles in Portuguese and English; (b) contain the keyword; (c) studies in the last 15 years; and (d) time frame between the years 2008 and 2023. The exclusion criteria were: (a) studies undertaken outside the period delimited for the search for production in scientific literature; (b) publications referring to reports of experiences and opinion articles; (d) texts not related to the themes addressed in the work – skin lions – stretch marks. The analysis focused essentially on the scoping review, with a descriptive approach. A total of 132 articles were found on the subject, but only 19 were used in this study, due to their relevance.

RESULTS

To understand the process of formation of stretch marks, it is necessary to understand the layers of the skin and their functions that will be important factors in the formation of stretch marks.

The layers of the skin are composed of the Epidermis, which is formed by:

- Basal or germ layer: the deepest and responsible for the constant renewal of the epidermis, in this process the cells leave the basal layer and move to the layer, in a period of 21 to 28 days.
- Spinous layer: the cells in this layer have a spiny appearance and play a role in maintaining the cohesion of the cells of the epidermis and in the resistance to friction.
- Lucid Layer: prominent in areas of thicker skin and may be absent in other places. When visualized, it looks like a clear, bright and homogeneous line. Composed of flattened cells of keratinocytes.
- Corneal Layer: consists of several planes of dead and closely linked cells, being the most superficial layer of the epidermis. When their cytoplasm is replaced by keratin, the dead cells are referred to as cornified cells that not only protect the body from external invaders but also help restrict water loss. These cells are eliminated as a result of abrasion and friction.
- Granulosa Layer: its cytoplasm is characterized by having keratohyaline granules. As the granules increase in size, the nucleus disintegrates resulting in the death of the outermost cells of the granulosa layer.

The second layer of the skin is the Dermis, formed by:

- Papillary Layer: made up of loose connective tissue and some authors admit that the function of the papillae is to increase the dermal-epidermis contact zone, giving greater resistance to the skin. Some papillae contain capillary wings and other specialized sensory receptors that react to external stimuli.
- Reticular layer: made up of dense connective tissue, it is the thickest and the bundles of collagen fibers that make it up intertwine in an arrangement similar to a network, hence its name. It contains many elastic fibers, responsible, in part, for the elastic characteristics of the skin (Guirro, 2004).

Skin integrity occurs when physiological homeostasis is present and can be impaired when for some reason there is injury to the skin, mucosal, and corneal tissue, and has as established characteristics the destruction of the continuity of the skin and its layers, as well as the invasion of body structures (Costa, 2021).

Atrophic scars, also called stretch marks, are visible and protruding linear scars, arranged parallel to each other, their cause is a rupture of elastic fibers, collagen and loss of skin color. It is diagnosed as a skin lesion, as it presents as a localized elastic imbalance (Machado, 2014).

Tissue stretching is very important for a person in several organs, including the skin, which responds to a series of physiological and pathological applications throughout their life, mainly due to the presence of stretch marks in the muscle. (Elsais et al, 2009)

The fiber can be determined by the shape of the slit lines or by the Langer lines, the lines that determine the shape of the threads in the fabric. The strength of elasticity varies according to the region of the body, and this is due to the variation in the normal direction of collagen and elastic fibers in the dermis. (Shu et al, 2023)

Collagen fibers provide tissue formation and elastin fibers provide flexibility, these are closely linked to the dermis, which is one of the main supporting tissues of the skin. Elastin, a high molecular weight fibrillar protein, is composed of a series of rare amino acids, such as desmosine and isodesmosine, responsible for its properties (Un-Din; McGeorge; Bayat, 2016).

The main component of extension fibers is protein elastin, a fiber capable of resisting acids and acids, easily allowing even the smallest substances, but resumes its original state as soon as the decomposition energy is exhausted. They are composed of various cells, such as fibroblasts, chondrocytes, and smooth muscle cells (Maia, 2009).

Changes in structures that support strong resistance create connective tissue stiffness, which, combined with severe skin tension, such as obesity, produces skin stiffness (Ud. Din; Macgeorge; Bayat, 2016).

Expandable fibers with lateral lesions, for example, are prone to, and older lesions, disintegrate and concentrate in isolated areas and therefore suffer less stress in the captivity of the skin called stretch marks (Ud. Din; Macgeorge; Bayat, 2016).

Stretch marks are defined as the process of fine-tuning the skin, characterized by atrophic lesions in a straight line, varying in color according to the stage of evolution. Atrophy of the skin, in rows, with immediate, straight, curvilinear or sinuous stretching, there is atrophy of the epidermis, with a modified dermal-epidermal border (Liu et al, 2014).

Stretch marks are called atrophic because of their symptoms, as atrophy is the decrease in the firmness of the skin, caused by a decrease in the number and volume of its components. They have a two-state character, that is, there is a tendency for stretch marks to be evenly distributed (Maia, 2014).

They have a two-state character, that is, there is a tendency for the stretch marks to be evenly distributed.



According to studies, three theories seek to justify the etiology of stretch marks, they are, mechanical theory; endocrinological theory and contagious theory;

Mechanical theory: It occurs when the skin is affected by stretching, breaking, or loss of skin stretch marks, for no apparent reason, as in the case of obesity, it is believed that there is overexposure to adipose tissue, especially this fat. What happens next is the main pattern of simple marker appearance, pregnancy, puberty, vigorous exercise, and growth. They are considered fundamental factors at the origin of extensible symptoms (Cenedese, 2018).

Endocrinological Theory: With the advent of cortical adrenal hormone therapy or through the indiscriminate use of anabolic steroids, chemical disorders of the diet, hormonal disorders, latrogens are associated with the appearance of stretch marks whose effect is found only in other regions.

Infectious Theory: Infectious processes have been reported to cause damage to the extensor fibers that cause stretch marks due to the appearance of stretch marks in adolescents after typhoid, rheumatic fever and other chronic liver diseases, chronic hepatitis, Marfan syndrome, elastic pdeuxantoma and buscheke-Ollendorf syndrome.

In addition to these factors, there is a genetic and familial tendency. The gene expression that determines the formation of collagen, elastin, and fibronectin is reduced in (Cenedese, 2018).

Symptoms of dilation can be classified as: pink (primary), atrophic and pearlescent: pink or primary, with inflammatory and pink coloration due to excessive stretching and rupture of some blood capillaries and clinical signs of itching and pain in others. cases, flat papular rash and mild edema (Cenedese, 2018).

Atrophic presents with a scarring aspect, flaccid central line, and hypochromia, with twisted and ruptured fibers, with irregular collagen and preserved cutaneous appendages (Maatta, 2022).

The pearly crop, on the other hand, has moderate flaccidity, covered by leafy epithelium, devoid of adhesive material, with torn stretch marks and fibrosis-transforming lesions (Maatta, 2022).

Stretch marks are a major cosmetic concern in a large number of people. They are red and swollen in the early stage and white and irregular in texture in the later stage. Both men and women suffer from low self-esteem caused by stretch marks.

There are treatments that can treat and reduce this problem and include micropuncture, microdermabrasion, microneedling, and chemical peels, as well as the combination of treatments (Maatta, 2022).

Medical stretch mark tattooing, also known as microneedling, can correct the color of skin pigmentation in the normal direction, but not the actual textural change. The abnormal texture can be modified by microneedling, by non-ablative laser treatment or by microdermabrasion. Treatments can also be combined, for example, initial use of a method to flatten the skin, followed by tattooing aimed at color correction (Maatta, 2022).

Micropuncture is an effective technique in the treatment of stretch marks, with the reduction of its size, in millimeters, it provides an improvement in the condition of this dysfunction. Growth factors help in the collagen formation process, rebuilding broken fibers, promoting skin filling, changing its appearance. According to the classification of skin phototypes, the higher the phototype, the greater the risk of hyperpigmentation, so the technique does not provide a significant improvement in cases of phototype VI, even though it is reversible, the de-skinning process is slow and not always the first option of choice according to Cosme (2015).

Some time ago, stretch marks were considered irreversible lesions, but with the evolution of therapeutic resources, a range of techniques have been created in order to improve the appearance of the skin, stimulating the synthesis of new collagen.

Among these techniques, microneedling should be highlighted, which produces significant results in the appearance of scars, as well as in the improvement of recent and old stretch marks. The equipment used for this technique is a formed roller covered with fine needles, made of surgical stainless steel with a length between 0.25 mm and 2.5 mm in diameter. In the application of the percutaneous collagen induction technique, it is recommended to clean the site with 70% alcohol, and the use of anesthetic may be necessary, which will be determined according to the length of the needle and individual sensitivity. The device has a roller (dermaroller) and pen (dermapen) version. If the amount to be treated is wide, it is recommended to use the dermaroller, while the dermapen is more used in smaller and specific areas such as facial wrinkles. The roller is composed of an average of 190 to 1,080 microneedles, with lengths ranging from 0.20 to 3.0 mm and with a diameter of 0.1 mm to 0.12 mm. The appliance should be handled with vertical, horizontal and diagonal movements to the right and left 10 to 15 times in each direction with adequate pressure. There is no consensus on the ideal number of rolls, so it is suggested to change direction when heavy bleeding, petechiae, or hyperemia is observed. The therapeutic system of microneedles opens microchannels from the layer to the dermis, without harming the epidermis, promoting an inflammatory stimulus which triggers the release of growth factors, where damaged collagen is removed and the development of neocholanogenesis and neoangiogenesis occurs, resulting in increased skin quality. Tissue remodeling persists for months after the procedure, until the skin improves (Queiroz et al, 2021); (Silva et al, 2016); (Costa, et al, 2020).

The last treatment to be mentioned in this study, which also demonstrates effective results in stretch marks, is carboxytherapy, which provides an attractive aesthetic option in skin rejuvenation, atrophic scars, stretch marks distensae (stretch marks), cellulite-fibrolipodystrophy adhesions after liposuction, and certain types of alopecia. It is an aesthetic procedure of a non-surgical interventionist nature based on the application of gas injections into the skin in order to eliminate problems such as

stretch marks, cellulite, sagging skin and localized fat. It is a simple and effective form of intervention aimed at stimulating cell metabolism, without harming it (Bagherani, 2023).

The therapeutic use of medical carbon dioxide (99.9% purity) is administered subcutaneously, promoting peripheral vasodilation improving tissue oxygenation, causing an inflammatory process, where the skin responds with hyperemia and edema whose purpose is to increase fibroblast replication and elastin and collagen production, concomitantly increasing local nutrition. This technique causes a small aggression in the epidermis on the stretch marks. However, it is a painful treatment that should be used by trained professionals and with caution (Ahramiyanpour et al, 2023); (Kroumpouzou, 2022).

Thus, this study sought to present, through a scoping review, the most current treatments regarding skin lesions, especially stretch marks, which can bring aesthetic discomfort and acceptance of body image in individuals of different ages and genders.

FINAL CONSIDERATIONS


Stretch marks are acquired integumentary lesions and, like any scar, can be considered a difficult treatment. However, with the current advancement of techniques, there are several aesthetic treatments that are performed, however, there is no scientific proof of their effectiveness for the total disappearance of stretch marks and, as it is a genetic predisposition, prevention includes both the maintenance of the ideal weight and good skin hydration. Improvement in appearance with a decrease in thickness/width and color is achieved through micropuncture, microdermabrasion, microneedling, carboxytherapy, among others associated with the use of cosmeceuticals, which also prevent the appearance of new stretch marks. These techniques can be used both together and alone, according to the classifications of stretch marks. Where the appearance may vary in different situations, the lesion may be depressed or elevated in relation to the level of the skin and/or with different coloration, and it is up to the professional to correctly evaluate and apply the most appropriate treatment.

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Humanization of maternal care: A new perspective on prenatal and childbirth protocols with clinical case resolution

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ABSTRACT

Prenatal care is a fundamental stage in the pregnancy-puerperal cycle, aimed at monitoring the health of the mother and fetus, identifying risk conditions early and promoting interventions that ensure a healthy and safe pregnancy. The objective of the narrative review is to present the state of the art on the main components of prenatal care, including care protocols, specific care for low-risk pregnant women, and strategies for managing complications at the time of delivery. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used for the search, selection, and extraction of data from the LILACS, BDENF, PubMed, Cochrane Library, CINAHL, Embase, SciVerse Scopus, TopCited, and Web of Science databases. A total of 261 articles were identified, after selection 15 were analyzed. Detailed knowledge about prenatal care, each stage of labor, and the hormonal factors that influence this process is essential for safe and effective care, ensuring maternal and fetal well-being. The nursing team's performance should always be based on respect for women's rights from the prenatal period, avoiding practices considered as obstetric violence, and ensuring a humanized approach that prioritizes the safety and comfort of the parturient. Understanding these practices is key to improving maternal and neonatal outcomes, providing a positive and safe antepartum and delivery experience.

Keywords: Prenatal, Childbirth, Humanization, Pregnancy.

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INTRODUCTION

Adequate prenatal care is essential for the promotion of maternal and fetal health. According to the World Health Organization (WHO), prenatal care aims to identify and treat early risk factors that may compromise pregnancy, as well as to promote the health and well-being of pregnant women (WHO, 2016). Studies demonstrate that regular prenatal care is associated with improved maternal and neonatal outcomes, including lower rates of perinatal mortality and obstetric complications (Dowswell et al., 2015).

Prenatal care also plays a crucial role in health education, providing information on nutrition, physical activity, warning signs, and newborn care. In addition, it is an opportunity to build a bond between the pregnant woman and the health professional, based on trust and respect, which is fundamental for a positive and safe birth experience. In this context, this review aims to present the state of the art on the main components of prenatal care, including care protocols, specific care for low-risk pregnant women, and strategies for managing complications at the time of delivery.

METHODOLOGY

It is a narrative review of the literature, promoted with a qualitative approach, understood as an appropriate study to describe and discuss the "state of the art" of a given theme, establishing theoretical and contextual understandings. The search for articles took place in June 2024 in the following databases: Latin American and Caribbean Literature on Health Sciences (LILACS); Virtual Library in Health Nursing (BDENF); Cumulative Index to Nursing & Allied Health (CINAHL); National Library of Medicine (PubMed); Cochrane Library (Cochrane); Excerpta Medica dataBASE (Embase); SciVerse Scopus TopCited (Scopus); and Web of Science described. The crossing occurred through the controlled descriptors "**Prenatal**", "Childbirth", "Humanization", "Pregnancy", belonging to the Medical Subject Headings (MeSH) and the Health Sciences Descriptors (DeCS). Articles, protocols, guidelines and guidelines, published in Portuguese, English or Spanish, without delimitation of the time of publication related to the theme, were included. Duplicate articles, editorials, dissertations, theses, works in other languages and that did not cover the topic addressed were excluded.

RESULTS AND DISCUSSION

CARE PROTOCOLS AND GUIDANCE DURING PRENATAL CARE

Low-risk pregnant women are those who, during the initial evaluation and prenatal follow-up, do not have preexisting medical conditions or risk factors that could complicate pregnancy. According to the Ministry of Health, a low-risk pregnancy is characterized by the absence of chronic diseases, such as hypertension and diabetes, and by the lack of obstetric complications in previous

pregnancies, such as recurrent miscarriages or premature births (Ministry of Health, 2020). These pregnant women have a reduced risk of developing complications during pregnancy and usually require a smaller number of consultations and interventions.

Comprehensive care for low-risk pregnant women should include, in addition to supplementation and vaccination, guidance on healthy eating, safe physical activity, and mental health care. Ongoing support and empowerment of pregnant women to make informed decisions about their care is critical to a positive pregnancy experience and to promoting favorable perinatal outcomes (Renfrew et al., 2014).

Laboratory Tests by Quarter

The Ministry of Health's prenatal care protocol recommends a series of laboratory tests distributed throughout the three trimesters of pregnancy. These tests are essential infectious tests that can affect the health of the pregnant woman or baby for monitoring maternal and fetal health, allowing the early detection of conditions such as anemia, infections, gestational diabetes, and diseases

Quarter	Recommended Tests	Frequency
First Quarter	Complete blood count, blood typing and Rh factor, fasting blood glucose, HIV serology, syphilis (VDRL), hepatitis B (HBsAg), toxoplasmosis (IgM and IgG), rubella (IgM and IgG), urine type I, urine culture	First appointment and repeat as needed
Second Quarter	CBC, fasting blood glucose, oral glucose tolerance test (OGTT) between 24-28 weeks, HIV and syphilis serology (VDRL), urine culture	Between 24-28 weeks
Third Trimester	Complete blood count, fasting blood glucose, HIV and syphilis serology (VDRL), urine culture, group B streptococcus	Between 35-37 weeks

Source: adapted from Brazil, 2012.

Laboratory tests in the first trimester are essential to establish a baseline of the pregnant woman's health and identify conditions that may require specific management.

- **Complete blood count:** Assess the general health status of the pregnant woman, including the detection of anemia, which is common in early pregnancy due to increased blood volume. It also helps identify infections and other hematological changes that can affect pregnancy.
- **Blood Typing and Rh Factor:** Determine the blood group and Rh factor of the pregnant woman. Identify if there is Rh incompatibility between mother and fetus, which can cause hemolytic disease in the newborn if not properly managed with the administration of anti-D immunoglobulin.



- **Fasting Glucose:** Assess blood glucose levels to detect preexisting diabetes mellitus or increased risk of developing gestational diabetes. Uncontrolled diabetes increases the risk of birth defects, miscarriage, and complications during childbirth.
- **Oral Glucose Tolerance Test (OGTT):** Performed between 24 and 28 weeks to diagnose gestational diabetes. Untreated gestational diabetes can lead to complications such as fetal macrosomia (large for gestational age baby), need for cesarean section, and increased risk of developing type 2 diabetes after pregnancy.
- **HIV serology:** Identify HIV infection to start antiretroviral treatment as soon as possible, reduce viral load, and prevent mother-to-child transmission of HIV from mother to fetus.
- **Syphilis Serology (VDRL):** Detecting syphilis, an infection that can be transmitted to the fetus during pregnancy, resulting in congenital syphilis, which can cause miscarriage, fetal death, or serious health problems in the newborn.
- **Hepatitis B (HBsAg):** Detect hepatitis B infection in the mother to prevent vertical transmission to the newborn, who has a high risk of developing chronic hepatitis B and its complications.
- **Toxoplasmosis (IgM and IgG):** Assess maternal immunity against toxoplasmosis and detect acute infection. Toxoplasmosis in pregnancy can lead to serious fetal complications, including congenital malformations and miscarriage.
- **Rubella (IgM and IgG):** Determine if the pregnant woman is immune to rubella. Rubella infection during pregnancy can cause congenital rubella syndrome, leading to heart defects, deafness, and blindness.
- **Urine Type I and Urine Culture:** Diagnosing urinary tract infections (UTIs), which are common in pregnancy due to anatomical and hormonal changes. Untreated infections can progress to pyelonephritis and are associated with a risk of complications such as preterm labor and low birth weight.
- **Group B Streptococcus Test:** Performed between 35-37 weeks to detect the presence of group B streptococcus. If positive, antibiotics are recommended during labor to prevent serious neonatal infections such as sepsis, pneumonia, and meningitis (Schrag et al., 2016).

Ultrasonography in Prenatal Care

Ultrasonography is a fundamental tool in prenatal care, used to monitor fetal development and identify structural anomalies and conditions that may affect pregnancy. The Ministry of Health recommends different types of ultrasound at specific times of pregnancy to optimize the monitoring and management of pregnancy.

Table 1 – Types of Ultrasonography

Type of Ultrasound	Right Time	Objective
Transvaginal or Obstetric Ultrasound	6-10 weeks	Confirm pregnancy, determine gestational age, check for fetal heartbeats
2nd trimester morphological ultrasound	18-22 weeks	Evaluate fetal anatomy, detect congenital malformations, evaluate amniotic fluid and placenta
3rd trimester morphological ultrasound or Doppler	28-32 weeks	Monitor fetal growth, assess amniotic fluid, check fetal position and placenta

When to Perform Each Type of Ultrasound

Initial obstetric ultrasound, performed between 6 and 10 weeks, is crucial to confirm intrauterine pregnancy, determine gestational age accurately, and verify embryo viability by identifying fetal heartbeats. This initial assessment helps predict the likely date of delivery and identify multiple pregnancies early (Salomon et al., 2019).

Morphological ultrasound, performed between 18 and 22 weeks, is recommended for a detailed evaluation of fetal anatomy. This test is essential for the detection of congenital malformations, such as heart defects and spina bifida, and allows the evaluation of the placenta and amniotic fluid, essential factors for fetal health (Reddy et al., 2015).

Growth ultrasound, performed between 28 and 32 weeks, is indicated to monitor fetal development in the third trimester, assess the growth and well-being of the fetus, check the amount of amniotic fluid and fetal position, important information for delivery planning (Papageorghiou et al., 2014).

Regular monitoring of maternal and fetal health is essential for the early detection of complications and for the implementation of preventive interventions. In addition to laboratory tests and ultrasounds, blood pressure measurement and monitoring for signs of preeclampsia are critical for the prevention of serious complications, such as eclampsia and HELLP syndrome (American College of Obstetricians and Gynecologists, 2020).

SUPPLEMENTATION DURING PREGNANCY: DOSES AND ADMINISTRATION

Supplementation during pregnancy is essential to prevent nutritional deficiencies that can affect the mother's health and fetal development. The Ministry of Health recommends folic acid and iron supplementation for all pregnant women, considering the following details:

- **Folic Acid:** Folic acid supplementation is recommended to prevent neural tube defects in the fetus. The indicated dose is **400 mcg per day**, starting at least one month before conception and continuing until the end of the first trimester (12 weeks) (Ministry of Health, 2012). Administration should be done orally, preferably in the fasting state, to optimize absorption.



- **Iron:** Iron supplementation is important for preventing iron deficiency anemia, a common condition during pregnancy due to increased iron demand. The recommended dose is **40-60 mg of elemental iron per day** from the 20th week of gestation until the end of pregnancy (Ministry of Health, 2012). Administration should be done after a meal to minimize gastrointestinal side effects such as nausea and constipation.

Benefits of Iron and Folic Acid Supplementation

Iron supplementation is vital for preventing iron deficiency anemia, which is one of the most common conditions during pregnancy due to increased iron demand. Anemia during pregnancy is associated with a higher risk of preterm birth, low birth weight, and postpartum hemorrhage. Supplementing with iron from the second trimester can prevent these complications and improve maternal and fetal health (Petry et al., 2019).

Folic acid supplementation is recommended before conception and during the first trimester of pregnancy to prevent neural tube defects in the fetus, such as spina bifida and anencephaly. Folic acid is an essential nutrient for fetal development, and its deficiency during the first weeks of gestation is directly associated with severe birth defects (Ministry of Health, 2020).

IMPORTANCE OF VACCINATION DURING PREGNANCY

Vaccination during pregnancy is crucial to protect both mother and baby against infectious diseases that can cause serious complications. Brazil's PNI includes specific recommendations for the vaccination of pregnant women, aiming to immunize against diseases that can be transmitted vertically (from mother to fetus) or that can have a significant impact on maternal and neonatal health. Vaccination helps create antibodies that are transferred to the fetus, providing passive immunity to the fetus.

The vaccines recommended for low-risk pregnant women by the PNI do Brasil include detailed information on the route of administration, type of needle and dose to ensure safe and effective vaccination.

Table 2 - Vaccination during pregnancy

Vaccine	Dose	Indicated Period	Observations
Diphtheria, tetanus and coqueluche (dTpa)	1 serving each pregnancy	From the 20th week of gestation and up to 45 days after delivery	It protects against diphtheria, tetanus and pertussis, essential to prevent transmission to the newborn. Apply to the deltoid muscle.
Diphtheria and Tethane (dT)	Start or complete 3 doses, according to vaccination history	Start or complete 3 doses, according to vaccination history	It protects against diphtheria and tetanus, essential to prevent transmission to the newborn. Apply to the deltoid muscle.
Influenza (gripe)	1 annual dose	During any period of gestation	Seasonal vaccination, important to protect against severe respiratory complications. Apply to the deltoid muscle.
Hepatitis B	3 servings (0, 1 and 6 months)	Start the scheme as soon as possible	Complete the vaccination schedule if the pregnant woman has not been previously vaccinated or has an incomplete schedule. Apply to the deltoid muscle.
COVID-19	2 doses (initial schedule) + booster dose	During any period of gestation	Vaccine recommended for all pregnant women, especially due to the increased risk of complications associated with COVID-19 infection. Apply to the deltoid muscle.

Source: Brazil - PNI, 2023.

Detailed Information for Each Vaccine:

1. **dTpa (diphtheria, tethane and coqueluche):**

- **Route of Administration:** Intramuscular (IM), preferably in the deltoid muscle.
- **Recommended Needle:** 25 x 6 mm (1 inch) for intramuscular injections.
- **Dose:** 1 single dose each pregnancy, given from the 20th week to maximize antibody transfer to the fetus.

2. **dT (difteria):**

- **Route of Administration:** Intramuscular (IM), preferably in the deltoid muscle.
- **Recommended Needle:** 25 x 6 mm (1 inch) for intramuscular injections.
- **Dose:** administer according to vaccination history, a booster should be administered every 10 years, to maximize the transfer of antibodies to the fetus.

3. **Influenza (gripe):**

- **Route of Administration:** Intramuscular (IM), preferably in the deltoid muscle.
- **Recommended Needle:** 25 x 6 mm (1 inch).
- **Dose:** 1 annual dose, recommended for any trimester of pregnancy to protect against flu and severe respiratory complications.



4. **Hepatitis B:**

- **Route of Administration:** Intramuscular (IM), preferably in the deltoid muscle.
- **Recommended Needle:** 25 x 6 mm (1 inch).
- **Dose:** Schedule of 3 doses (0, 1 and 6 months). Start the schedule as soon as possible if the pregnant woman has not been previously vaccinated or has an incomplete schedule.

5. **COVID-19:**

- **Route of Administration:** Intramuscular (IM), preferably in the deltoid muscle.
- **Recommended Needle:** 25 x 6 mm (1 inch).
- **Dose:** 2 doses for the initial schedule plus booster dose. Recommended for all pregnant women, in any trimester of pregnancy, to protect against serious complications associated with COVID-19.

Proper administration of the recommended vaccines during pregnancy is essential to protect both the health of the pregnant woman and the fetus. Following vaccination guidelines, including the correct choice of route of administration, needle, and dose, is critical to ensure the safety and efficacy of immunization.

MONITORING AND MANAGEMENT OF RISK CONDITIONS IN PREGNANCY.

Importance of Vaccination during Pregnancy and Strategies to Improve Vaccination Coverage

Vaccination is a key strategy to prevent serious infectious diseases that can have a negative impact on maternal and fetal health. Vaccination directly protects the pregnant woman and, indirectly, the fetus, through the transfer of maternal antibodies, providing passive immunity to the newborn until it can be vaccinated directly (ACOG, 2017).

Vaccines such as Tdap (diphtheria, tetanus, and pertussis) and influenza are particularly important during pregnancy. Vaccination against pertussis is recommended from the 20th week of gestation to protect the newborn against the disease in the first months of life, a period in which it is more vulnerable and cannot yet be vaccinated directly. Influenza vaccination is recommended to protect pregnant women against serious respiratory complications, such as pneumonia, which are more common and severe during pregnancy (CDC, 2020).

Vaccination also has an indirect role in preventing premature births. For example, preventing serious respiratory infections, such as the flu, reduces the risk of complications that can lead to premature birth. Studies have shown that severe influenza infection during pregnancy is associated with an increased risk of preterm birth and low birth weight, justifying annual influenza vaccination (Gale et al., 2021).

To maximize the benefits of vaccination and supplementation, it is critical that health professionals promote adherence to these recommendations among pregnant women. This can be



achieved through health education, reminders for antenatal visits, and integration of vaccination and supplementation services during routine antenatal visits. (WHO, 2020).

Impact of Vaccination and Supplementation on Gestational Outcome

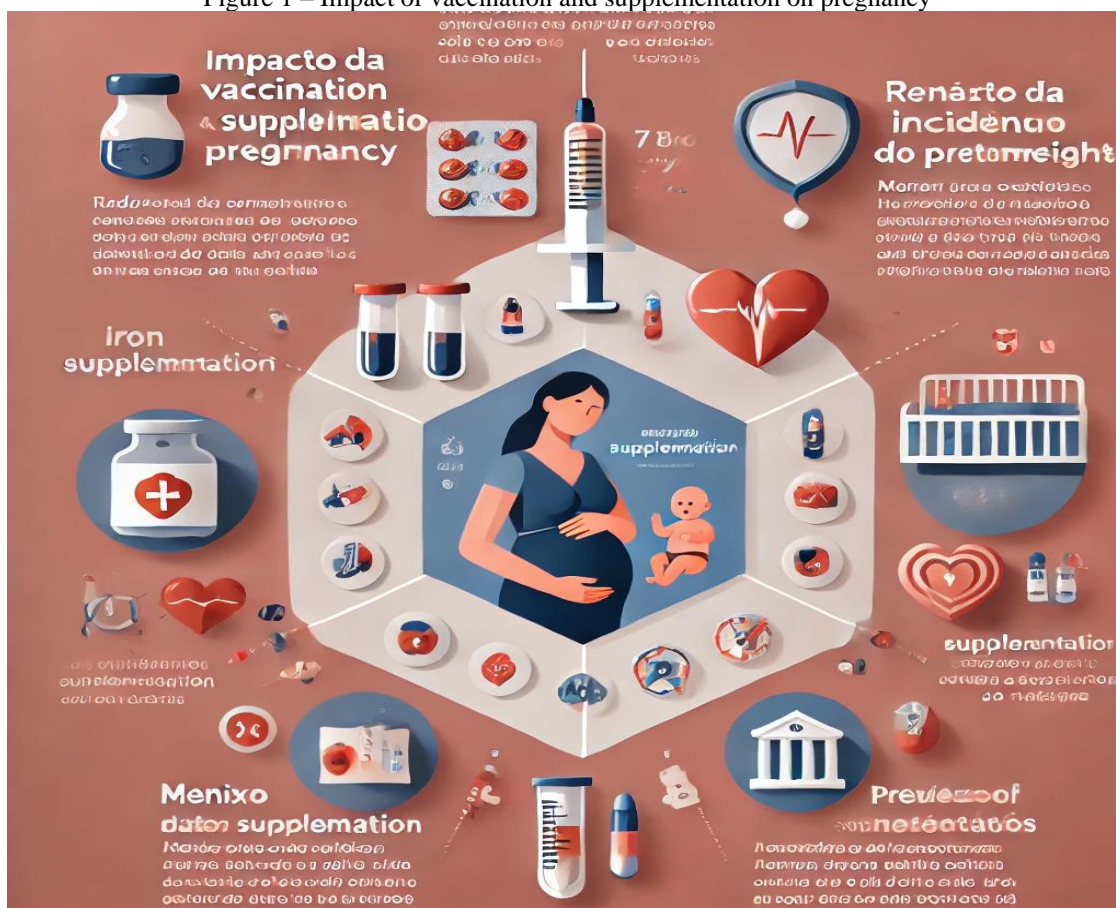
Vaccination and nutritional supplementation during pregnancy play a crucial role in promoting maternal health and preventing complications that may affect the fetus and newborn. Studies have shown that following vaccination and supplementation recommendations results in better outcomes for mother and baby, such as reduced preterm births, lower risk of low birth weight, and prevention of neonatal infections (Petry et al., 2019).

Compliance with vaccination and supplementation recommendations has a direct positive impact on maternal and neonatal outcomes. Studies have shown that women who receive adequate micronutrient supplementation and follow the recommended vaccination schedules have lower rates of obstetric complications, such as preeclampsia, gestational diabetes, and cesarean deliveries, improving the quality of obstetric care (McIntyre et al., 2019).

Vaccination of pregnant women against diseases such as hepatitis B and group B streptococcus is crucial for the prevention of neonatal infections. Vaccination against hepatitis B during pregnancy or the administration of immunoglobulin at birth prevents vertical transmission of the virus, protecting the newborn from developing chronic hepatitis. Similarly, screening and treatment of group B streptococcus prior to delivery prevents serious neonatal infections such as sepsis, pneumonia, and meningitis (Schrag et al., 2016).

Pregnant women who follow vaccination and nutritional supplementation guidelines are less likely to have babies with low birth weight (Figure 1)

Figure 1 – Impact of vaccination and supplementation on pregnancy



Source: prepared by the author.

Low birth weight is associated with several neonatal complications, such as breathing difficulties, jaundice, and a higher risk of infections. Adequate supplementation of micronutrients, such as iron and folic acid, contributes to healthy fetal growth and reduces the risk of intrauterine growth restriction (WHO, 2016).

PHYSIOLOGY OF CHILDBIRTH AND NURSING CARE

Labor is a complex physiological process that involves coordinated, adaptive changes in a woman's body to allow for the birth of the baby. Labor is divided into three main phases: the dilation period, the expulsive period, and the dequitation period. Each phase is characterized by specific events and the action of different hormones that facilitate the birth process.

The normal length of labor varies widely and depends on several factors, including whether it is the first delivery (primiparous) or whether the woman has had previous births (multiparous). Labor is diagnosed based on regular and progressive uterine contractions, accompanied by changes in the cervix (dilation and effacement) and fetal descent.

For primiparous women, labor can last from 12 to 18 hours. For multiparous women, labor tends to be shorter, lasting about 8 to 12 hours. The first stage of labor (dilation) is the longest,

especially the latent phase. The active phase of labor, which is faster, usually lasts about 4 to 8 hours for primiparous women and 2 to 5 hours for multiparous women.

The diagnosis is made when there are regular and painful uterine contractions that lead to changes in the cervix, such as dilation (opening) and effacement (thinning). Other signs include the presence of bloody show (bloody mucus), rupture of membranes (ruptured sac), and increase in the frequency and intensity of contractions.

Dilation Period

The dilation period is the initial and longest phase of labor. During this phase, the cervix undergoes significant changes that prepare it for the birth of the baby. The dilation period is divided into two subphases: the latent phase and the active phase.

- **Latent Phase:** Characterized by mild, irregular uterine contractions that result in the onset of cervical dilation (up to about 3-4 cm). This phase can be relatively long, especially in primiparous women, lasting several hours or even days. During the latent phase, the cervix begins to soften, shorten (erace), and gradually dilate.
- **Active Phase:** It begins when the cervix is dilated between 4 and 6 cm. During this phase, uterine contractions become more intense, regular and frequent, accelerating cervical dilation from 4 cm to complete dilation at 10 cm. The active phase is shorter than the latent phase, usually lasting 4 to 8 hours in primiparous women and less in multiparous women. The progression of labor during the active phase is closely monitored to ensure the safety of the mother and baby.

Hormones play a crucial role in regulating labor, particularly during the dilation period:

- **Oxytocin:** Oxytocin is the main hormone responsible for inducing and maintaining uterine contractions during labor. Released by the posterior pituitary, oxytocin is secreted in response to stretching of the cervix and stimulation of the nipples. Oxytocin promotes rhythmic and coordinated uterine contractions, which help dilate the cervix and move the baby through the birth canal. This hormone is often used in obstetric practices to induce labor or increase the strength and frequency of contractions (induction and increase of labor).
- **Prostaglandins:** Prostaglandins are lipid hormones that play an important role in preparing the cervix for labor. They promote softening (maturation) and cervical dilation, facilitating the passage of the baby through the birth canal. In addition, prostaglandins increase the sensitivity of the uterus to oxytocin, amplifying uterine contractions and accelerating the dilation process. Prostaglandin preparations are sometimes used

clinically to induce labor in women who are close to or beyond their expected delivery date.

- **Estrogen and Progesterone:** During pregnancy, estrogen and progesterone play opposite roles in regulating labor. Estrogen prepares the uterus for labor by increasing the expression of oxytocin and prostaglandin receptors, while progesterone helps maintain pregnancy until labor begins by inhibiting premature uterine contractions. During the final stage of pregnancy, there is a change in the ratio of estrogen and progesterone, favoring the onset of labor.

Assistance during Dilation

During the dilation period of labor, adequate assistance is essential to monitor the safety and well-being of the mother and baby. We will detail the performance of exams such as the vaginal examination and the evaluation of the amniotic sac, addressing its indications, procedures and clinical implications.

Vaginal Touch

Vaginal **examination** is an essential technique used to assess the progress of labor. However, it must be carried out with clear criteria and respecting the comfort and dignity of women.

Vaginal examination is indicated at various times during labor to assess cervical dilation, cervical effacement, position of fetal presentation (e.g., baby's head), and height of presentation. In a normal labour, vaginal examination may be performed every 4 hours during the active phase to monitor progress (ACOG, 2020). Other times to perform the vaginal examination include before administering anaesthesia, after membranes rupture, if there is a significant change in the frequency or intensity of contractions, or if there are signs of foetal distress (WHO, 2018).

The vaginal examination should always be performed with the consent of the pregnant woman. When performed without consent, repeatedly and unnecessarily, or in a way that causes pain and embarrassment, vaginal examination can be considered a form of obstetric violence. Obstetric violence refers to any action or omission that causes physical, psychological, or emotional harm to the woman during childbirth (WHO, 2018). Respect for women's autonomy and clear communication about the need for the examination are essential to avoid the characterization of obstetric violence.

Steps to perform the Vaginal Touch

1. **Preparation:**



- **Hygiene:** The professional must sanitize their hands properly and use gloves in full-term pregnancies to prevent infections.
 - **Informed Consent:** Explain the procedure to the pregnant woman, the reasons for performing it, and obtain her consent. The woman must be comfortable and understand what will be done.
 - **Positioning of the Pregnant Woman:** The woman should be comfortably positioned in the supine position (lying on her back) with the knees bent and the legs slightly open. Privacy must be ensured during the exam.
2. **Exam:**
- **Lubrication:** Use a sterile lubricant to reduce discomfort during the examination.
 - **Fingers:** Gently insert your index finger and, if necessary, your middle finger into your vagina. The hand performing the exam should be relaxed, and the fingers should be introduced towards the cervix.
 - **Assessment of Cervical Dilation:** Dilation is measured in centimeters, ranging from 0 cm (no dilation) to 10 cm (complete dilation). The measure is based on the opening of the cervix.
 - **Erasure:** Erasure is the thinning of the cervix, measured as a percentage from 0% (no erasure) to 100% (fully erased).
 - **Evaluation of the Position and Height of the Fetal Presentation:** Evaluate the part of the fetal presentation (usually the head) in relation to the ischial spines of the maternal pelvis, classifying it in De Lee planes, from -5 to +5.
 - **Finger Removal:** Remove your fingers carefully, avoiding sudden movements that may cause discomfort.
 - **Documentation:** Document findings in the patient's chart, including dilation, deletion, time of presentation, and any other relevant details.

Amniotic sac

The **amniotic sac** plays an important role during pregnancy and labor, providing a safe and cushioned environment for the fetus. During labor, assessment of the integrity of the amniotic sac and the characteristics of the amniotic fluid are crucial.

Amniotic sac rupture (also known as ruptured pouch) is usually characterized by a sudden sensation of a jet of fluid or a continuous flow of amniotic fluid through the vagina (Ministry of Health, 2012). Pain associated with rupture of the amniotic sac is usually minimal or nonexistent; However, if the rupture is accompanied by severe pain, it may indicate a complication, such as placental abruption. The normal odor of amniotic fluid is mild and slightly sweet. A foul odor may



indicate the presence of intrauterine infection, such as chorioamnionitis, and requires immediate intervention (ACOG, 2020).

Amniotic fluid is usually clear or slightly cloudy. The presence of meconium (fetal feces) in the amniotic fluid may indicate fetal distress and may be described as "meconium" amniotic fluid. The green or brown coloration of the amniotic fluid suggests meconium and requires careful monitoring of fetal well-being (WHO, 2018).

When the sac ruptures, the length of time the amniotic fluid remains exposed to the vaginal environment is an important factor. If the sac remains torn for more than 18 hours before active labor begins, this is called prolonged rupture of membranes. Prolonged rupture of membranes increases the risk of infection, both for the mother and the baby. In this case, the prophylactic use of antibiotics is recommended to prevent ascending infection, especially if delivery is not imminent (ACOG, 2020).

The use of antibiotics is indicated in cases of prolonged rupture of membranes (>18 hours) or if there are signs of maternal infection (fever, leukocytosis, abdominal pain). Antibiotic prophylaxis is also recommended in pregnant women with GBS-positive group B streptococcus to prevent serious neonatal infections such as sepsis, pneumonia, and meningitis. Antibiotic treatment is usually started as soon as the ruptured sac is confirmed and prophylaxis is indicated (ACOG, 2020).

Amniotomy

Amniotomy is a useful obstetric intervention that can speed up labor when used appropriately.

Amniotomy should be performed only when clinically indicated and never without the woman's informed consent. Performing amniotomy without adequate indication or consent can be considered obstetric violence (WHO, 2018). Be aware of the risks associated with amniotomy, such as umbilical cord prolapse, infection, or hemorrhage. Take precautions to minimize these risks, including performing the procedure under sterile conditions and continuously monitoring fetal well-being.

STEP BY STEP TO PERFORM AMNIOTOMY

Preparation for the Procedure

- Before performing the amniotomy, confirm the clinical indications for the procedure. Common indications include slow or stagnant labor (progression dystocia), the need to improve fetal monitoring (internal monitoring), or increase the intensity of contractions in cases of prolonged labor (ACOG, 2020).
- Explain the procedure to the pregnant woman, including the benefits, risks, and possible alternatives. Obtain informed consent from the patient before proceeding. It is essential



to ensure that the pregnant woman is aware of what will be done and agrees to the procedure.

- Place the pregnant woman in a lithotomy or supine position with her knees bent and feet supported. Make sure it's comfortable and covered properly to maintain privacy.

Procedure

Perform a vaginal examination to determine the position of the cervix, fetal presentation, and to confirm cervical dilation. The cervix must be dilated by at least 3-4 cm for the procedure to be performed safely.

- **Amniotomy:** Use a sterile amniotomy hook. This instrument is thin and has a slightly sharp end to gently break through the amniotic membrane.
- **Hook Insertion:** With one hand protecting the perineum and fingers of the other hand inserted into the vagina to guide, carefully introduce the amniotomy hook along the fingers to the cervix.
- **Break the Membrane:** Once the hook is in contact with the amniotic membrane, make a gentle motion to break through the membrane. The goal is to make a small perforation that allows the controlled release of amniotic fluid.
- **Control of Fluid Release:** After rupture, the amniotic fluid will begin to flow. Allow the fluid to flow slowly to avoid a sudden discharge that could cause umbilical cord prolapse or other complications.

Care after Amniotomy

- **Amniotic Fluid Evaluation:** Observe the color, odor, and amount of amniotic fluid. The liquid should be clear or slightly cloudy. The presence of meconium or a foul odor may indicate fetal distress or infection and requires immediate attention (WHO, 2018).
- **Fetal Monitoring:** After amniotomy, monitor fetal heart rate for any signs of fetal distress, such as variable or delayed slowdowns. Use a transducer for continuous monitoring if necessary.
- **Maternal Monitoring:** Continue to monitor the mother's vital signs and watch for any changes in labor, such as an increase in the intensity of contractions.
- **Documentation:** Record the procedure in the patient's chart, including the indication for amniotomy, amniotic fluid findings, and any change in maternal or fetal status after the procedure.



Cardiofetal Monitoring

Cardiofetal **monitoring** is an essential practice to assess the well-being of the fetus during labor. It can be performed through intermittent auscultation with a fetal sonar or continuous electronic monitoring (cardiotocography).

- **Cardiofetal Beat Reference Values:** The normal fetal heart rate (FHR) range during labor is **110 to 160 beats per minute (bpm)** (ACOG, 2020). Values outside this range may indicate abnormalities that require further evaluation.

Bradycardia and Tachycardia:

- **Bradycardia:** Bradycardia is defined as a persistent fetal heart rate below 110 bpm for more than 10 minutes. This may indicate fetal involvement and requires prompt evaluation and appropriate intervention. Potential causes of bradycardia include umbilical cord compression, maternal hypotension, uterine hyperactivity, or placental abruption. In case of bradycardia, immediate interventions include changing the mother's position to improve placental perfusion (e.g., left lateral position), administering oxygen to the mother, assessing the possibility of umbilical cord compression, and, if necessary, considering intravenous fluids or tocolytics to reduce uterine contractions. If bradycardia persists, an emergency cesarean section may be required (WHO, 2018).
- **Tachycardia:** Tachycardia is defined as a persistent fetal heart rate above 160 bpm for more than 10 minutes. It may be a sign of maternal fever, intrauterine infection (chorioamnionitis), fetal hypoxemia, or use of certain medications. In case of fetal tachycardia, it is important to assess for the presence of maternal fever, administer antipyretics as needed, and consider antibiotics if infection is suspected. Maternal hydration and adjusting the mother's position can also be helpful. If tachycardia persists or there are signs of fetal involvement, obstetric intervention may be required (ACOG, 2020).

Step by step to perform Fetal Cardiofetal Monitoring with Fetal Sonar

The use of fetal sonar to auscultate fetal heart rate is a common practice in low-risk births. Here is a step-by-step guide to accomplish this procedure:

1. **Equipment and Patient Preparation:**
 - **Equipment:** Check that the fetal sonar is in good working order and that conductive gel is available.
 - **Explanation of the Procedure:** Explain the procedure to the pregnant woman and obtain her consent. Make sure she's comfortable and relaxed.



2. **Gel Application and Transducer Positioning:**

- **Use of Conductive Gel:** Apply an appropriate amount of conductive gel to the sonar transducer to improve the transmission of sound waves. This helps to capture the fetal heartbeat more clearly.
- **Location of the Point of Maximum Audibility:** Position the sonar transducer over the pregnant woman's abdomen, usually below the navel for a cephalic presentation, and move it slowly until you locate the point where the fetal heartbeat is most audible.

3. **Auscultation and Monitoring:**

- **Auscultation:** Once the fetal heartbeat is located, listen for at least 60 seconds to assess the average fetal heart rate. Normal fetal heart rate is 110 to 160 bpm.
- **Regular monitoring:** During the active phase of labor, the fetal heartbeat should be auscultated every 15-30 minutes. During the expulsive phase, auscultation should be performed every 5 minutes or after each contraction (RCOG, 2019).

4. **Actions in Case of Heart Abnormalities:**

- **Bradycardia (<110 bpm):** If fetal bradycardia is detected, reposition the mother (e.g., to the left side), administer oxygen, and assess the need for additional interventions, such as intravenous fluid administration or an emergency cesarean section.
- **Tachycardia (>160 bpm):** If you detect fetal tachycardia, check for signs of maternal fever or infection. Administer antipyretics and consider the use of antibiotics if necessary. If tachycardia persists, assess the need for obstetric intervention.

CHILDBIRTH AND BIRTH

Childbirth is a complex and multifaceted physiological process that can occur in many ways, depending on the conditions of the mother and baby. There are three main types of delivery: normal (vaginal) delivery, cesarean delivery, and assisted deliveries such as forceps or vacuum-extractor. Each type of delivery has its specific indications, benefits, and risks, and the management of complications is crucial to ensure the safety and well-being of the mother and baby **【WHO, 2018】** .

Types of Delivery: Normal (Vaginal) Delivery

Normal delivery, also known as vaginal delivery, is the most natural and preferred method for birth, when there are no complications that prevent this type of delivery. During vaginal delivery, the baby passes through the mother's birth canal, involving three main stages: dilation, expulsion, and dequitation of the placenta. This type of delivery is associated with a faster recovery for the mother and a lower risk of respiratory complications for the newborn **【ACOG, 2020】** .



Dilation is the first stage of normal delivery, where the cervix gradually dilates to about 10 centimeters to allow the baby to pass through. This stage can last from a few hours to more than a day, depending on various factors, such as whether it is the mother's first delivery or whether there are ongoing medical interventions 【WHO, 2018】 . Proper assistance during this phase is crucial to ensure that the dilation process takes place safely and efficiently.

The second stage, the expulsive stage, is when the baby descends through the vaginal canal and is born. This stage requires pushing force on the part of the mother, and the baby's position is a critical factor. The cephalic position (head down) is ideal for vaginal delivery, while other positions, such as the breech position (buttocks down), can complicate labor and often require additional medical assistance or even a caesarean section 【RCOG, 2017】 .

During vaginal delivery, there may be a need for an episiotomy, which is an incision in the perineum to widen the birth canal and prevent serious lacerations. However, episiotomy is no longer routinely performed, and is recommended only in specific cases to prevent extensive lacerations or major complications 【NICE, 2014】

The practice of episiotomy has been widely debated and is currently recommended only in specific situations, such as imminent fetal distress or assisted operative delivery (use of forceps or vacuum-extractor), where rapid expulsion of the baby is necessary to avoid complications. We will detail the process of performing an episiotomy, who can perform it, and the care needed during the procedure.

Episiotomy

It should be performed by trained health professionals, such as obstetricians, obstetric nurses, and physicians with experience in childbirth. These professionals must have adequate anatomical knowledge, surgical skills, and training in obstetric procedures to perform episiotomy safely and effectively 【ACOG, 2020】 .

Episiotomy is not routinely performed and should only be considered in specific circumstances, such as:

- Fetal suffering, where there is a need to accelerate labor.
- Assisted operative delivery (forceps or vacuum-extractor).
- Risk of severe perineal lacerations or complications that can impair the delivery process 【NICE, 2014】 .

Step by Step on How to Perform Episiotomy

The instruments needed to perform an episiotomy include:

- **Episiotomy scissors** (curved or straight blunt tip scissors).



- **Anatomical forceps.**
- **Gaze estéril.**
- **Antiseptic solution** (e.g., chlorhexidine).
- **Local anesthetic** (e.g., 1% lidocaine).
- **Absorbable suture** (usually 3-0 or 4-0 polyglycolic acid thread) for perineum repair 【ACOG, 2020】 .

Local anesthesia is necessary to minimize pain and discomfort during the procedure. 1% lidocaine is a commonly used local anesthetic. Before the incision, the anesthetic is injected into the perineum, specifically at the site where the episiotomy will be performed. A "V"-shaped injection is administered to numb the subcutaneous tissue and bulbocavernosus muscle, blocking local sensory nerve endings 【WHO, 2018】 .

There are two main types of episiotomy based on the direction of the incision:

1. **Median episiotomy:** The incision is made in the midline of the perineum, towards the anus. This type is less painful and heals faster, but carries a higher risk of extension to the anal sphincter and rectum.
2. **Mid-lateral episiotomy:** The incision is performed at the midline and then deflects laterally at a 45-degree angle toward the buttock, avoiding the anal sphincter. This type is preferred to minimize the risk of anal or rectal sphincter laceration and is the most recommended technique in current practice 【NICE, 2014】 .

Technique to Perform Episiotomy

1. **Preparation:** Check that all instruments and materials are sterilized and ready for use. Position the patient appropriately on the delivery table.
2. **Antisepsis:** Clean the perineal area with antiseptic solution (such as chlorhexidine) to reduce the risk of infection.
3. **Anesthesia:** Administer 1% lidocaine to the perineum area. Wait a few minutes for the anesthetic to take effect, ensuring that the patient does not feel pain during the incision.
4. **Incision:** Using episiotomy scissors, make a 2-3 cm incision in the perineum, towards the chosen side (median or mediolateral). Make sure the incision is sufficient to facilitate delivery, but avoid an excessively long incision to minimize tissue damage.
5. **Monitoring:** Continue to monitor the progress of the birth. Once the baby is being born, check that there is no need for episiotomy extension.
6. **Episiotomy Repair:** After birth and placenta delivery, inspect the episiotomy area. Suture the muscle and skin layers using an absorbable suture, such as 3-0 or 4-0

polyglycolic acid thread. Ensure adequate hemostasis to prevent post-procedure bleeding
【ACOG, 2020】 .

Although episiotomy was previously a routine practice, its use is now more restricted to specific situations to avoid unnecessary risks and promote a faster and more comfortable recovery for the patient. The decision to perform an episiotomy should be based on solid clinical evidence and the individual needs of the patient, always prioritizing maternal and newborn safety and well-being
【NICE, 2014; ACOG, 2020】 .

Normal (vaginal) delivery positions play a key role in the parturient's comfort, labor efficiency, and delivery success. Different positions can be adopted throughout the different stages of labor, and the choice of the ideal position depends on several factors, including the woman's preference, the stage of labor, the clinical condition of the mother and baby, and the guidance of health professionals. Below, I present an expanded discussion about the various positions for vaginal delivery, their advantages, disadvantages and indications.

POSITIONS FOR VAGINAL DELIVERY

Lithotomy Position

The lithotomy position is the most common in many hospitals. In this position, the woman is lying on her back, with her legs raised and supported by supports (leggings).

Advantages:

- It facilitates the health professional's access to the perineum, which is useful for procedures such as episiotomy or the use of forceps and vacuum extractor.
- It allows for easy fetal monitoring and emergency interventions.

Cons:

- It can reduce the diameter of the pelvis and limit the space available for the baby to descend.
- It can lead to a higher risk of perineal lacerations and greater discomfort for the mother due to the pressure on the lumbar and sacral region.
- The horizontal position can lower maternal blood pressure, affecting uteroplacental blood flow **【ACOG, 2020】** .

Squatting position (crouching)

In the squatting position, the woman squats with her knees bent and her feet flat on the floor or in support. This position can be facilitated by a whelping stool or squatting supports.

Advantages:

- Maximizes the diameter of the pelvis, making it easier for the baby to descend and rotate.

- Gravity helps push the baby down.
- Reduces the risk of perineal lacerations and may decrease push time during childbirth 【Gupta et al., 2017】 .

Cons:

- It can be physically demanding for a woman to maintain for long periods, especially without physical preparation.
- It can be difficult to monitor the baby or perform interventions quickly if necessary.

Lateral Lying Position (Lateral Decubitus)

The woman lies on her side, usually with a pillow or support between her knees.

Advantages:

- Comfortable and easy to maintain for long periods, especially for women who want to avoid back pressure.
- It maintains good uteroplacental blood flow and can help prevent hypotension.
- It can be helpful in delaying a very fast delivery, giving time for the perineal tissue to stretch gradually, reducing the risk of lacerations 【ACOG, 2020】 .

Cons:

- Gravity does not directly help the baby's descent.
- It may be more difficult for the healthcare professional to access the perineum or perform interventions.

Sitting Position

Description: The woman is sitting in a birthing chair, birthing ball, or on an adjusted bed, with her feet resting on the floor or on supports.

Advantages:

- Gravity helps the baby to descend, facilitating labor.
- More comfortable and easier to support than the squatting position.
- It allows the woman to actively participate in the birthing process, pushing more effectively.

Cons:

- The position can also put some pressure on the sacral region.
- It may not be ideal for all situations, such as in cases of complicated births or where quick medical intervention is required 【WHO, 2018】 .

Bathtub or Water Position

The woman works in a bathtub or birthing pool with warm water, which provides a relaxing environment.

Advantages:

- Warm water helps relax muscles and relieve pain during labor.
- It may reduce the need for anesthesia and pain medications.
- It facilitates freedom of movement, allowing the woman to adopt various comfortable positions during labor 【Cluett & Burns, 2012】 .

Cons:

- It can be difficult to perform medical interventions or continuous fetal monitoring.
- It is not appropriate for all women, especially those with medical complications or high-risk pregnancies.

Gaskin Position (On All Fours)

The Gaskin position, also known as the "on all fours" position, is where a woman gets on her knees and rests her hands or forearms on the floor, on a bed, or on a flat surface. This position allows the weight of the belly to be supported by the knees and arms, taking the pressure off the lower back and sacrum. The name "Gaskin's position" is a tribute to the American midwife Ina May Gaskin, who popularized the use of this position in her obstetric practices in the 70s. She promoted this position as an effective way to relieve pain during labor and facilitate the descent of the baby, especially in situations of shoulder dystocia 【Gaskin, 2003】 .

Advantages of Gaskin's Position:

- **Back Pain Relief:** This position is often recommended for women who experience severe back pain during labor, as it helps to relieve pressure on the lower back and sacral region.
- **Facilitating Fetal Rotation:** The Gaskin position can help facilitate the baby's rotation from an occipito-posterior position (where the baby is "looking up") to an occipito-anterior position (where the baby is "looking down"), which is more favorable for vaginal delivery.
- **Reduced Risk of Perineal Lacerations:** Because the weight of the upper body is distributed across the knees and hands, there is less pressure on the perineum, which may reduce the risk of severe perineal lacerations 【Gupta et al., 2017】 .
- **Gravity Assists in Descent:** Although gravity is not directly pulling the baby down as it does in an upright position, being on all fours creates an angle that can help the baby descend more easily through the birth canal.

- **Facilitates Childbirth in Cases of Shoulder Dystocia:** The Gaskin position is especially useful in cases of shoulder dystocia, an obstetric emergency where the baby's shoulders are trapped after the head has been born. By turning the woman into this position, the pelvic diameters can expand, making it easier to release the trapped shoulder 【Gaskin, 2003】 .

Disadvantages of Gaskin's Position:

- **For** some women, holding this position for an extended period can be physically taxing, especially if there is no adequate support for the arms and knees.
- **Fetal Monitoring and Medical Interventions:** It may be more difficult to perform continuous fetal monitoring or rapid interventions in emergencies when a woman is on all fours. The position can limit the health professional's access to the perineum and birth canal.
- **Need for Adequate Support:** The position requires the woman to have support on her knees and hands, and not all birthing surfaces are suitable for maintaining this position comfortably for long periods 【ACOG, 2020】 .

Indications for the Use of Gaskin Position:

- Prolonged labor or a halt in labor progression due to unfavorable fetal position.
- Severe back pain during labor, suggesting that the baby may be in an occipitoposterior position.
- Shoulder dystocia diagnosed after the birth of the baby's head.
- Parturient's desire for pain relief and greater comfort, especially if other positions are not working 【RCOG, 2017】 .

The choice of position for normal delivery is highly individualized and must consider the safety and comfort of the woman, in addition to the specific clinical needs of each case. Health professionals should be prepared to support women in their choices, offering evidence-based guidance and facilitating positions that maximize comfort and safety during labor 【ACOG, 2020; WHO, 2018】 . In all situations, effective communication and ongoing support are key to a positive and safe birth experience.

TYPES OF DELIVERY - CESAREAN DELIVERY

Cesarean delivery is a surgical intervention used for the birth of the baby when vaginal delivery is not safe or possible. This surgery involves an incision in the mother's abdomen and uterus to extract the baby. Indications for a caesarean section may include placental abruption, placenta previa, fetal distress, anomalous position of the fetus, among other complications 【WHO, 2018】 .

While cesarean delivery is a life-saving intervention, especially in emergency situations, it is also associated with higher risks of complications for both mother and baby compared to vaginal delivery. Among the risks for the mother are infections, hemorrhages, anesthetic complications and prolonged postoperative recovery. For the baby, the risks include breathing difficulties, especially when delivery is carried out before 39 weeks of gestation without clear indication 【ACOG, 2020】 .

Rising caesarean section rates in many countries have been a cause for global concern, as many of these surgeries are performed without clear medical need, exposing mothers and babies to preventable risks. The World Health Organization recommends that the rate of caesarean sections should not exceed 10-15% of births, as above this percentage there is no evidence of benefits for maternal and neonatal mortality 【WHO, 2015】 .

Types of Childbirth - Assisted Births

Assisted births involve the use of instruments, such as forceps or vacuum puller, to help extract the baby during vaginal delivery. These procedures are indicated in cases where there is difficulty in expelling the baby, such as in situations of maternal exhaustion, detected fetal distress or when the baby is in an anomalous position that prevents the natural progression of labor 【RCOG, 2011】 .

The use of forceps or vacuum-extractor requires specific skills from the health professional to minimize the risks of trauma to the mother and baby. Possible complications include vaginal lacerations, severe perineal injuries, hemorrhages, and fetal injuries such as bruising or nerve damage. However, when used correctly, these instruments can be safe and effective in preventing more serious complications that could occur with prolonged delivery or an emergency caesarean section 【(Johanson, R., Menon, V., 2000).

Forceps-assisted or vacuum-extractor deliveries should be performed by qualified health professionals trained in obstetrics, such as obstetricians, physicians with specialized training in childbirth.

Difference Between Forceps and Vacuum-Extractor

1. Forceps:

- **Description:** The forceps is a metallic instrument that resembles a large forceps with two curved blades that fit around the baby's head. There are different types of forceps, such as the Simpson, the Kjelland and the Piper, each designed for different obstetric situations.
- **Indication:** The use of forceps is indicated when there is a need for help during delivery, such as in cases of maternal exhaustion, lack of progress in the second stage of labor, fetal suffering that requires rapid completion of labor, and some fetal presentations that



do not progress easily in the birth canal. It can also be used when there are contraindications to the use of the vacuum-extractor, such as in cases of extreme prematurity or when there is a need to control the rotation of the baby's head.

- **Advantages:** The forceps allow greater control over the rotation and traction of the baby's head, which can be especially useful in cases of shoulder dystocia or poorly positioned fetal presentations.
- **Disadvantages:** The use of forceps is associated with a higher risk of maternal injuries, such as vaginal and perineal lacerations, and fetal injuries, such as forceps marks, cephalohematomas, and, rarely, facial or cranial nerve injuries.

2. **Vacuum-Extractor (Suction Cup):**

- **Description:** The vacuum-extractor is a device that uses a suction cup (usually silicone or metal) that is attached to the baby's scalp. The suction cup is connected to a vacuum pump that creates suction, allowing the healthcare provider to apply traction to the baby's head to facilitate delivery.
- **Indication:** The vacuum-extractor is indicated in situations similar to those of the use of forceps, such as maternal exhaustion, lack of progress in the second stage of labor and fetal distress. It is often preferred to forceps in cases where minor manipulation is needed and to avoid injury to the mother and baby. However, it is not recommended in situations of extreme prematurity, cephalopelvic disproportion, or if the exact position of the baby's head cannot be determined.
- **Advantages:** The vacuum-extractor is less invasive than forceps and is generally associated with a lower risk of severe lacerations and maternal trauma. It also allows for faster assisted delivery, with less need for deep anesthesia.
- **Disadvantages:** The use of the vacuum extractor can cause bruising on the baby's scalp (cephalo-hematomas) and, in rare cases, intracranial hemorrhage. It should not be used if the baby is in an anomalous position that requires rotation, as the vacuum-extractor does not allow rotational control like forceps.

Indications for the Use of Forceps or Vacuum-Extractor

The use of forceps or vacuum-extractor should be carefully considered based on the conditions of the mother and baby, the progression of labor, and the experience of the health care provider. Key indications include:

1. **Maternal Exhaustion:** When the parturient is exhausted and unable to continue pushing effectively, especially after prolonged labor.



2. **Absence of Progress in the Second Stage of Labor:** When the baby's head does not descend properly into the birth canal after an adequate time of pushing attempts.
3. **Fetal distress:** When there are signs of fetal distress, such as persistent slowing of fetal heart rate, that require rapid completion of labor to prevent serious fetal complications.
4. **Specific Maternal Conditions:** In cases where the mother has medical conditions that contraindicate prolonged or intense pushing, such as certain heart diseases or severe respiratory diseases.
5. **Anomalous Fetal Presentation:** When the baby is in a position that does not allow natural progression through the birth canal, and there is a need for instrumental manipulation to facilitate safe delivery.

CONCLUSION

Despite the challenges, there are many opportunities for growth in the field of obstetric nursing. The increased demand for humanized, woman-centered obstetric care provides opportunities for the development of innovative, evidence-based practices. Studies show that the implementation of continuous care models, where obstetric nurses accompany women throughout pregnancy, results in better maternal and neonatal health outcomes.

CLINICAL CASE SOLVING

Clinical case 1 - Carla is a 28-year-old pregnant woman, in the second trimester of her first pregnancy. During the prenatal visit, she expresses concerns about the frequency of the recommended appointments and tests, as she feels that she is already healthy. She asks the obstetric nurse if all these visits and exams are really necessary. Why is regular prenatal care essential, even for pregnant women who feel healthy?

- A) To increase the anxiety of the pregnant woman in relation to pregnancy.
- B) To monitor the health of the mother and fetus, identify risk conditions early and promote preventive interventions.
- C) To ensure that the pregnant woman undergoes all available medical examinations, regardless of their need.
- D) To comply only with the administrative requirements of the health system.

Clinical case 2 - Marta, a 30-year-old pregnant woman in the second trimester, was advised to start iron supplementation. She questions the need for this supplementation, as she does not have symptoms of anemia and believes that iron can cause unpleasant side effects, such as constipation. What is the main reason for recommending iron supplementation from the second trimester of pregnancy, even for pregnant women without symptoms of anemia?



- A) To prevent iron deficiency and iron deficiency anemia, which are common due to increased iron demand during pregnancy.
- B) To improve the quality of sleep during pregnancy.
- C) Because it is a recommended practice only in some countries, without global consensus.
- D) To increase the energy of the pregnant woman to perform more physical activities.

Clinical case 3 - Maria, a 28-year-old primiparous pregnant woman, arrived at the hospital with regular contractions every 5 minutes, lasting 60 seconds. On initial examination, the vaginal examination revealed a dilation of 4 cm, with 50% effacement. The amniotic fluid was clear, and the fetal heart rate was 140 bpm. Maria is in the active phase of labor. During continuous monitoring, after 4 hours, dilation did not progress beyond 5 cm, and contractions began to space out every 7 minutes. The doctor decided to perform an amniotomy to try to speed up labor. Maria and her family were informed of the risks and benefits, and consent was obtained. After the amniotomy, Maria's contractions intensified, and the dilation progressed to 7 cm over the next two hours.

In view of the scenario presented, what would be the most appropriate conduct to be adopted by the health team to ensure the safety and well-being of Maria and the baby?

- A) Continue to monitor Maria without additional intervention, as labor is now progressing.
- B) Administer oxytocin to increase the frequency and intensity of contractions.
- C) Consider a cesarean section due to the initial lack of progression of labor.
- D) Perform continuous fetal monitoring and regular evaluation of labor progress, maintaining minimal interventions until there is a clear indication for further actions.

Clinical case 4 - Joana, a 35-year-old multiparous woman, arrives at the hospital in spontaneous labor. She is 39 weeks pregnant and had a previous vaginal delivery without complications. During the initial examination, it is found that Joana is 8 cm dilated and 100% effaced. The contractions are regular, occurring every 2 minutes, lasting 60 seconds. The health team decides not to intervene at the moment, allowing labor to proceed naturally. However, after 45 minutes, monitoring reveals a persistent fetal heart rate of 105 bpm for more than 10 minutes, suggesting fetal bradycardia. The medical team discusses possible interventions with Joana and decides to carry out an additional evaluation.

What is the most appropriate intervention to be taken by the health team to ensure the safety of the fetus and the mother?

- A) continue fetal monitoring and wait another 30 minutes to see if the fetal heart rate returns to normal.



- B) Position Joana in the left lateral decubitus position, administer supplemental oxygen and infuse intravenous fluids to improve uteroplacental perfusion.
- C) perform a cesarean section immediately to avoid the risk of prolonged fetal distress.
- D) apply an oxytocin infusion to intensify contractions and accelerate labor.

CORRECT ANSWERS

Clinical case 1 - Letter: (A). To prevent iron deficiency and iron deficiency anemia, which are common due to increased iron demand during pregnancy. **Rationale:** A because iron supplementation is recommended from the second trimester onwards to prevent iron deficiency and iron deficiency anemia, common conditions during pregnancy due to the increased demand for iron to support fetal growth and increased maternal blood volume. Anemia during pregnancy is associated with risks such as premature birth, low birth weight, and maternal complications, such as postpartum hemorrhage (Ministry of Health, 2012; Petry et al., 2019).

Clinical case 2 - Letter (C). To diagnose gestational diabetes, which can occur even in pregnant women with no previous history of blood glucose problems. **Rationale:** The Oral Glucose Tolerance Test (OGTT) is performed between 24 and 28 weeks to diagnose gestational diabetes, a condition that can develop during pregnancy even in women with no history of diabetes or blood glucose problems. Therefore, testing is an important preventive measure to ensure the health of the mother and baby (Ministry of Health, 2020).

Clinical case 3 – letter (D). perform continuous fetal monitoring and regular evaluation of labor progress, maintaining minimal interventions until there is a clear indication for new actions. Rationale: The most appropriate conduct according to current guidelines on the management of active labor. After the amniotomy, there was progress in Maria's cervical dilation, which indicates that labor is progressing. Additional interventions, such as administering oxytocin or performing a cesarean section, should only be considered if there are signs of fetal distress or failure to progress properly, as recommended by the American College of Obstetricians and Gynecologists (ACOG, 2020) and the World Health Organization (WHO, 2018).

Clinical case 4 – letter (B). Position Joana in the left lateral decubitus position, administer supplemental oxygen, and infuse intravenous fluids to improve uteroplacental perfusion. Rationale: When persistent fetal bradycardia is detected, the priority is to improve uteroplacental perfusion and oxygenate the fetus. Positioning the mother in the left lateral decubitus position can help relieve compression of the inferior vena cava, increasing venous return and improving blood flow to the uterus. Administration of supplemental oxygen and intravenous fluids may also help increase fetal oxygenation and perfusion. This approach is consistent with the




American College of Obstetricians and Gynecologists (ACOG, 2020) and World Health Organization (WHO, 2018) guidelines on the management of obstetric emergencies.



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Clinical-epidemiological profile and outcome of snakebite accidents in the State of Pará: A portrait of the last two decades

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ABSTRACT

Objective: The study seeks to address snakebites from venomous snakebites, focusing on the state of Pará, Brazil, over the last two decades (2003-2022). **Methods:** retrospective research methods were used, using data from the Notification and Notifiable Diseases System (SINAN) and the National Institute of Meteorology (INMET). **Results:** A total of 98,979 cases were recorded, with a predominance of men (75.5%) in the age group of 20 to 39 years (38.9%). Most cases resulted in cure (82.4%), with the brown ethnicity being most affected (78.8%). Santarém was the city with the most notifications (4,212 cases), and the snake of the genus *Bothrops* was the most prevalent (87.3%). **Conclusion:** The results highlight clinical, demographic and environmental aspects of accidents, providing insights for the efficient allocation of resources in coping with these events in Pará and for the education of the population.

Keywords: Snakebite, Brazil, Snake Envenomation, Epidemiological Profile.

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INTRODUCTION

The problem of snakebites, resulting from venomous snakebites, is a global public health issue, with a significant impact, especially in tropical regions such as Brazil. The World Health Organization (WHO) estimates that millions of people are bitten by snakes each year, with a considerable number resulting in death or permanent disability.¹ In Brazil, venomous snakes, mainly of the genus *Bothrops*, are responsible for the majority of cases.²

Despite advances in treating and understanding these accidents, they continue to pose a significant challenge to health systems, especially in remote or under-resourced areas.¹ Correct identification of the snake involved is crucial for proper treatment, but it is not always possible. In addition, symptoms and complications vary depending on the species of snake involved and the composition of its venom.³

Thus, existing publications on the subject provide valuable information on the epidemiology, clinical picture, diagnosis, and treatment of snakebites. However, there are gaps in specific knowledge about the clinical-epidemiological profile of these accidents in certain regions, such as the state of Pará.

Therefore, the main objective of this study is to fill this gap, retrospectively analyzing the cases of snakebite accidents that occurred in the state of Pará over the last two decades. This will provide a more comprehensive understanding of the problem in this specific region, allowing for improvements in prevention, diagnosis, and treatment strategies.

METHODOLOGY

This is a retrospective, cross-sectional, descriptive study with a quantitative approach, based on secondary data on the incidence rate of snakebites in the state of Pará, collected in SINAN, from the Department of Informatics of the Unified Health System (DATASUS), at the electronic address (<https://datasus.saude.gov.br/>).

Access to DATASUS data followed the following search order: health information, epidemiological information and morbidity, diseases and notifiable conditions – 2007 onwards (SINAN), in which the notification of snakebites and the state of Pará were selected. Data from INMET (National Institute of Meteorology) were also used.

The data collection date took place in September 2023, and the established period corresponded to the years 2003 to 2022, considering as variables the number of confirmed cases per year of notification, incidence of cases in each month, evolution of cases, gender, ethnicity, age group, and type of snake.

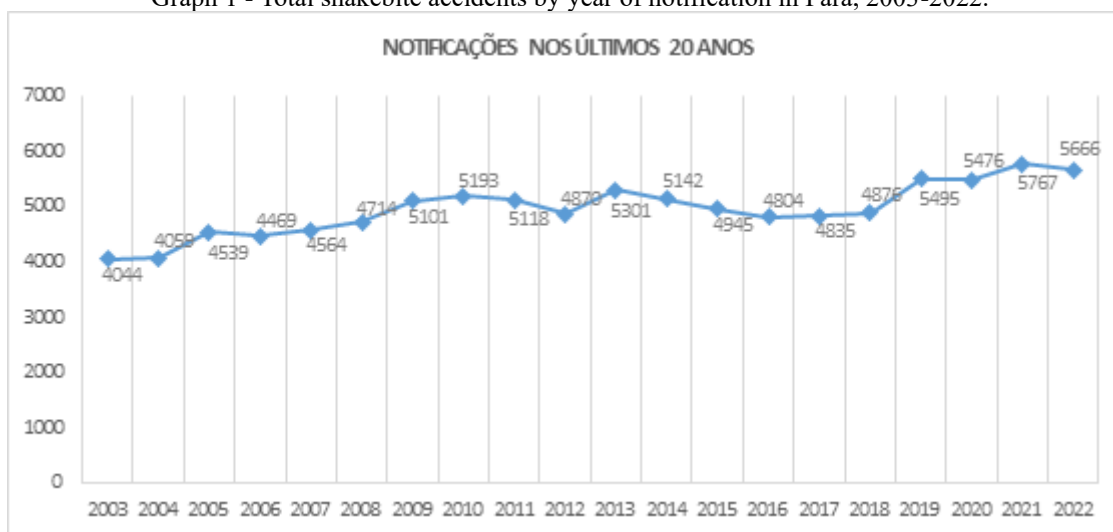
Descriptive statistical analyses of relative and absolute frequency were performed. The incidence (number of new cases/number of people at risk x per 100 thousand inhabitants) of snakebite accidents was calculated according to the annual case notification.

The data were tabulated in Microsoft Office Excel® 2020 spreadsheets and later analyzed. As these data are in the public domain, there was no identification of the people, in compliance with the ethical principles of resolution 466/2012 of the National Health Council, justifying the absence of the opinion of the Research Ethics Committee.

RESULTS

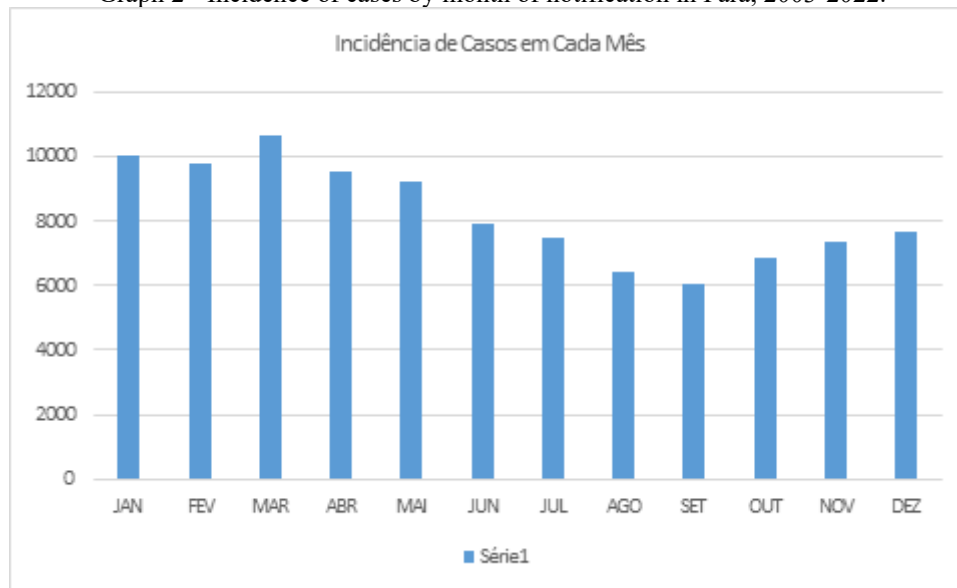
The study analyzed DATASUS data on snakebite accidents in Brazil, showing a 40.1% growth in notifications, from 4,044 cases in 2003 to 5,666 in 2022. This increase is indicative of a higher incidence or better registration of cases over the years. The data show that accidents occur mainly in the period from January to June, but there are specific increases in July 2009 and 2015, in November 2003, 2008, 2017, 2019 and 2020, and in December 2010, 2011, 2014 and from 2018 to 2022, as shown in graphs 1 and 2.

Graph 1 - Total snakebite accidents by year of notification in Pará, 2003-2022.



Source: Prepared by the authors.

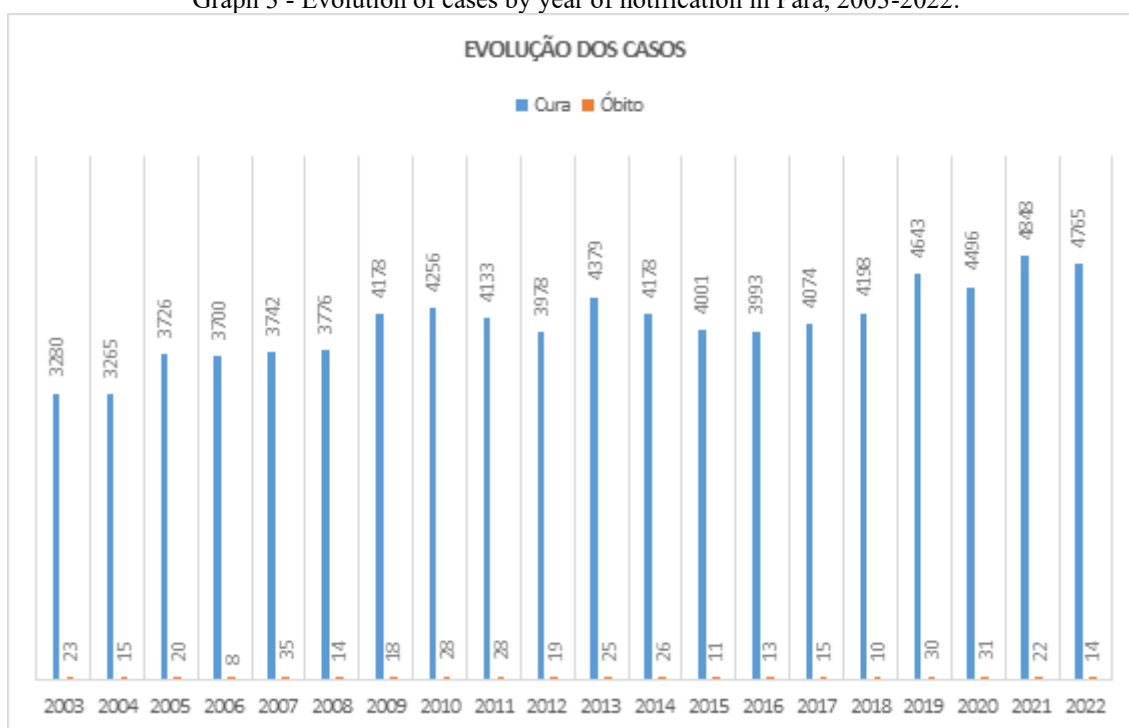
Graph 2 - Incidence of cases by month of notification in Pará, 2003-2022.



Source: Prepared by the authors.

The evolution of the cases revealed that the majority (82.4%) resulted in cure, which demonstrates the great effectiveness of the treatment and the efficiency of health professionals in the management of cases. However, there was a significant number of cases (17.1%) where the "case evolution" field was not filled in, which points to a need for improvement in the documentation of care. Deaths were relatively rare, accounting for only 0.4% of cases. Mortality has not shown a clear pattern over the years, with an average of 20 deaths per year, ranging from a low of 8 in 2006 to a high of 35 in 2007. This fluctuation suggests that, despite the increase in cure cases, the number of deaths did not decrease proportionally, possibly due to the increase in the total number of reported cases, as shown in graph 3.

Graph 3 - Evolution of cases by year of notification in Pará, 2003-2022.



Source: Prepared by the authors.

When analyzing the demographic profile of the victims, it was observed that men were the most affected, representing 75.5% of the cases. The most affected age group was 20 to 39 years, with 38,509 cases (38.9%) in the last 20 years, followed by individuals between 40 and 59 years, with 23,081 cases (23.3%). Children under 1 year of age to 9 years of age accounted for 8,483 cases (8.6%), which is worrisome, since this age group has more fragile health aspects when compared to healthy adults. Adolescents aged 10 to 19 years totaled 21,595 cases (21.8%) and elderly people over 60 years of age suffered 7,298 accidents (7.3%).

Regarding racial distribution, in 2003, most victims were brown, followed by records with "unknown field" and white people. From 2004 onwards, brown people continued to be the majority, followed by black and white people, except in 2012, when the "ignored field" surpassed the number of white victims. At the end of the period, the brown victims totaled 78,056 cases (78.8%), data shown in table 1.

Table 1 - Epidemiological characterization of snakebite accidents in Pará, 2003-2022.

Variables		Absolute Frequency	Relative Frequency (%)
Gender			
	Male	79377	80,19%
	Female	19594	19,79%
Ethnicity			
	white	6357	6,42%
	therefore	8103	8,18%
	brown	78056	78,86%
	indigenous	1099	1,11%
	yellow	835	0,84%
	Ign/Branco	4529	4,57%
Age group			
	<1 year	1164	1,17%
	1 a 4	1664	1,68%
	5 a 9	5655	5,00%
	10 a 14	9921	5,71%
	15 a 19	11674	11,79%
	20 a 39	38509	38,90%
	40 a 59	23081	23,31%
	60 a 64	3129	3,16%
	65 a 69	1992	2,01%
	70 a 79	1776	1,79%
	80+	401	0,40%

Source: Prepared by the authors.

Regarding the time needed to seek help, most of the injured people needed 0 to 6 hours to obtain care, with a predominance of the interval of 1-3 hours. Mortality increased proportionally to the waiting time for help; People who took between 1-3 hours to get assistance had a 0.31% chance of dying, while those who waited 12 or more hours had a probability of 1.09%.

In the state of Pará, all 144 municipalities have reported cases of snakebite accidents in the last 20 years. The municipality of Santarém, except for the years 2007, 2008 and from 2016 to 2018, led in the number of reported cases, with an average of 210 cases per year, totaling 4,212 cases. Belém, the capital, had just over half the cases of Santarém, totaling 2,964. The ten municipalities with the most cases were, in ascending order: Castanhal (1,953), Tomé-Açu (1,972), Thailand (2,078), Capanema (2,462), Portel (2,484), Marabá (2,825), Belém (2,964), Cametá (3,061), Breves (3,202) and Santarém (4,212), together representing 27,213 cases (28% of the records).

In relation to the municipality where the accident occurred, except for the years 2016 to 2018, the municipality of Santarém, again, ranked first in relation to the number of occurrences, totaling 3,998 (4%) cases. The 10 municipalities with the highest number of occurrences, in ascending order are: Barcarena (1,874), Moju (1,931), Tomé-açu (2,052), Acará (2,054), Afuá (2,188), Marabá

(2,434), Portel (2,567), Cametá (3,016), Breves (3,118) and Santarém (3,998). Together, they represent 25,232 cases, 25.49%.

Finally, in relation to the municipality where the accident was notified, Santarém was again in first place, except for the years between 2003 to 2008 and 2016 to 2018, with 4,239 cases in the period surveyed, representing 4.38% of the cases. The complete list of the 10 municipalities that reported the most cases is: Tomé-Açu (1,975), Thailand (2,058), Castanhal (2,348), Portel (2,479), Capanema (2,705), Marabá (2,902), Cametá (3,105), Breves (3,244), Belém (4,158) and Santarém (4,239). Together, they represent 29,213 cases, 30.19% of notifications.

Accidents were more frequent in the period between January and June, with March standing out as the month with the most occurrences in 8 of the 20 years analyzed, totaling 10,636 cases (10.74%). September had the lowest number of accidents, with 6,047 cases (6.1%).

The *Bothrops* species was the most involved in accidents, with 86,392 cases (87.28%), of which 71,569 resulted in cure (82.84%). *Lachesis* was responsible for 4,475 cases (4.52%), with a cure rate of 79.70%. The species *Crotalus* was the most lethal, with a lethality rate of 1.42%, data presented in table 2.

Table 2 – Types of species evidenced in snakebite accidents in Pará, 2003-2022.

Variables	Absolute Frequency	Relative Frequency (%)
Type of serpentine		
<i>Bothrops</i>	86392	87,28%
<i>Crotalus</i>	1067	1,07%
<i>Micrurus</i>	135	0,13%
<i>Lβachesis</i>	4475	4,52%
ign/branco	5924	5,98%

Source: Prepared by the authors.

DISCUSSION

For a state of large proportions such as Pará, the trend of cases reveals an increase in the number of cases at the end of the period, with several oscillations, but always remaining above 4 thousand cases per year. This may corroborate the hypothesis that accidents occur due to the advance of urbanization over the natural habitat of snakes, which increases the number of annual cases. Also from this perspective, it is highlighted in other studies that there was an increase in the number of cases of snakebite accidents in the period of 10 years, but that this increase did not follow the population increase recorded.¹⁰

Unlike other surveys, it was noticed that the accidents recorded over the last 20 years were concentrated in the first half of each year.^{9,12} There is an explanation for this, which points out that these periods are the rainiest in the Amazon region, also contributing to the change in temperature in the region.¹⁰ Regarding climate data, INMET recorded, in the first half of each year, among the 20

years surveyed, an average rainfall of 394.5 mm and an average temperature of 26.3°C, demonstrating that the highest accident rates occurred in the months with higher rainfall and a slightly lower temperature than the second half of the years surveyed. This data also corroborates the hypothesis that the cases happened in a way that repeated the patterns each year, making it possible to predict periods of increase in cases.

According to another study, the municipality of Santarém - PA had a predominance of accidents by the genus *Bothrops sp.* in relation to the other species.³ This scenario was repeated when the state of Pará as a whole was analyzed, since cases of this genus represented, at the end of the period, more than 87% of the reported cases, followed by the genus *Lachesis sp.*, as the study pointed out.

In addition, it is important to point out the gap left by the lack of completion of the "snake type" field, since almost 6 thousand cases did not have the species specified. Thus, as presented by another research, it is essential to identify the species precisely to provide the patient with the most appropriate treatment, since some treatments vary depending on the snake.¹⁴ In addition, the author also postulates that the symptoms presented by the patient, together with the description of the snake, can help the professional to determine the appropriate type of treatment.

There is a manual that gathers information on snakebites and their treatment, which points out that the time between the occurrence of the bite and the treatment offered is an important risk factor for a worse outcome of the case, especially when it exceeds six (6) hours.⁸ In this sense, most of the individuals affected by these accidents took between 0 and 6 hours to get medical help. This information may explain why there were few deaths during these 20 years, when compared to the number of cases that evolved to cure. However, it should be noted that the "evolution" field was not filled in in more than 17% of the cases, making it difficult to reliably determine whether the treatment provided is as effective as it appears and in which cases it is not.

The timely arrival of medical care also depends on the location where the patient lives, since the city closest to him often does not have medical and hospital resources to treat the case, making it necessary to go to neighboring municipalities. This statement, reported in several studies,^{3,5} is proven by the data obtained, since, for example, Breves is the second municipality with the highest number of occurrences, but it is the third with the highest number of notifications. This may be due to the lack of resources to care for the entire affected population, as well as the severity of the patient's case. Another example of this is the municipality of Belém, which appears as the second with the most reported cases, but does not even appear in the list of the 10 municipalities in which these cases occurred the most.

After arrival at medical care, the prescription of antivenom would probably be the most effective measure in cases, except, of course, in accidents caused by non-venomous snakes, but what

was observed in many cases is that the serum was not administered even when venomous snakes were the cause of the accidents. Therefore, as discussed in other studies,^{5,9} this fact can be justified by medical malpractice or even by the lack of serum, justifying the need for planning both to increase the transfer of funds in periods of increased occurrences of snakebite accidents, and to better manage the resources received by hospitals.

Finally, in relation to the epidemiological profile itself, as reported by other researchers, the most affected were men, between 20 and 39 years of age, who live in rural areas, predominantly brown.³ In addition, when we talk about the clinical profile of these patients, the predominant type of snake is of the genus *Bothrops sp.*, with the bite located mainly on the feet and legs, with a time between bite and care of 1 to 3 hours, with serum therapy being the treatment of choice in most cases and the main outcome being cure.

CONCLUSION

This study revealed important clinical and epidemiological aspects of snakebite accidents that occurred in Pará, highlighting clinical, environmental and demographic characteristics, in order to build the profile of the injured and the evolution of their condition. It was noticed that male individuals, of economically active age, were the most affected, indicating that, in rainy seasons, the economic aspect of the society in which individuals are inserted can be affected.

In addition, the data that show the predominant species in these accidents are of paramount importance, since hospitals can thus better allocate resources and avoid waste of material. Also with this data, governments can create education campaigns, in order to alert the population identified as the most at risk, about forms of protection and how to proceed in the event of such an event.

Governments can also look at smaller municipalities, but with a high number of cases, and send resources to assist this population, since the time until the care of these victims is paramount for their recovery. This is especially important, because many times, long distances are traveled in search of help in larger cities or in the capital.


In summary, the present study reinforces the need for multidisciplinary care for snakebites, a topic with little importance in current debates, but which needs better epidemiological surveillance, health education, and access to quality medical care. Finally, it is suggested that future studies on the subject seek to study individual cases, in order to understand the determining variables and the effectiveness of the treatment given to these victims. Continuing these investigations will be important to reduce the social impact of snakebites, as well as to assist the administrative sector of regional medical centers.

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Benefits and harms of using a tourniquet in total knee arthroplasty

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ABSTRACT

The use of a tourniquet is important to combat bleeding during total knee arthroplasty (TKA). The initial equipment, invented in 1817 by Petit and improved in 1904 by Cushing, consists of a device that compresses blood vessels, controlling the flow of blood to one extremity, while the 1904 technique consists of a pneumatic compression monitored by the microcontroller and the inflatable cuff of the device.

Keywords: Hemorrhage Control, Prosthesis, Surgery.

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INTRODUCTION

The use of a tourniquet is important to combat bleeding during total knee arthroplasty (TKA). The initial equipment, invented in 1817 by Petit and improved in 1904 by Cushing, consists of a device that compresses blood vessels, controlling the flow of blood to one extremity, while the 1904 technique consists of a pneumatic compression monitored by the microcontroller and the inflatable cuff of the device. The objective of this study is to identify advantages and disadvantages of the use of tourniquets during TKA. The method consisted of using the descriptors "*total knee arthroplasty*", "*tourniquets*", "*knee arthroplasty*" and "*tourniquets*" in the PubMed and VHL databases, using the Boolean operator *AND*, selecting 34 articles published in the last 5 years. The results showed that the use of the tourniquet in TKA showed an increase in stability and durability of the prosthesis after the procedure and less blood loss. However, its application resulted in greater postoperative pain, reduced range of motion, significant edema, and a higher probability of thromboembolic events. In the use of pneumatic tourniquets, pressures between 75-120 mmHg demonstrated milder complications, although they were less efficient in controlling bleeding compared to pressures of 150 mmHg. It is concluded that the tourniquet's hemorrhage control benefit is not sufficient to inhibit its harmfulness in relation to the patient's prognosis. However, in cases of exacerbated bleeding, the pneumatic tourniquet can be an effective alternative, since it appeared to be more advantageous due to its ability to control the pressure more efficiently during the procedure.

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Mathematics in the arab world: A journey through the golden age of knowledge

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ABSTRACT

The history of Arabic mathematics is crucial to the development of mathematics. During the Islamic Golden Age (8th-14th centuries), Arab mathematicians made important contributions in algebra, geometry, trigonometry, and arithmetic, applying their knowledge in astronomy, navigation, and engineering. A significant advance was the introduction of the Hindu-Arabic numeral system, which facilitated arithmetic operations.

Prominent mathematicians such as Al-Khwarizmi, who developed methods for solving equations and wrote about algebra, and Omar Khayyam, known for his work in algebraic calculus, made fundamental contributions. Thabit ibn Qurra also contributed to geometry and number theory. In addition, Arabic mathematics preserved and translated works of ancient civilizations, which allowed the transmission of this knowledge to Europe and its influence on the Renaissance.

Keywords: Arabic Mathematics, Golden Age, Algebra, Numerical System, Renaissance.

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INTRODUCTION

Ancient Greece, the cradle of Western civilization, stood out for its flourishing in various disciplines, especially mathematics. During this golden age, Greek mathematicians developed fundamental concepts in logic, geometry, arithmetic, and number theory, laying the foundation for a rigorous and systematic discipline. This breakthrough was driven by a spirit of inquiry and critical reasoning, which enabled thinkers to understand the world through reason and observation.

The legacy of this period influenced not only science, but also philosophy and physics, laying the foundations for logical and deductive thinking in the Western intellectual tradition.

This paper explores the achievements and contributions of Greek mathematicians and advances in various branches of mathematics during this era, highlighting the importance of their role in preserving and transmitting the knowledge of the era. It is hoped that this research will spark interest in mathematics in ancient Greece.

CONCEPTUAL ELEMENTS

THE LIBRARIANS OF ALEXANDRIA AND THEIR ROLE IN THE PRESERVATION AND TRANSMISSION OF KNOWLEDGE

The librarians of Alexandria played a pivotal role in the preservation and transmission of knowledge in the famous Library of Alexandria. These scholars and custodians of knowledge were responsible for organizing, preserving, and disseminating the vast collection of works that made up the library. (Van der Waerden, 1983).

The librarians of Alexandria were carefully selected for their knowledge and skills in different disciplines. They were scholars versed in a wide range of subjects, ranging from literature and philosophy to astronomy and medicine. Their academic training and passion for knowledge made them the guardians of the library's cultural and scientific legacy. (Encyclopedia Britannica, n.d.).

One of the main roles of librarians was to organize and catalog the collection of works. It is believed that a classification system based on different topics and areas of knowledge was used. This allowed for easy location and retrieval of texts, thus facilitating research and study.

In addition to their organizational work, librarians were responsible for the conservation and restoration of papyrus scrolls, the main means of writing at the time. Because of their delicacy and susceptibility to deterioration, librarians were required to take steps to preserve texts and prevent their loss. This involved the use of preservation techniques, such as proper storage, moisture protection, and pest control. (Heath, 1999).

Librarians also played a crucial role in the transmission of knowledge. They were not only limited to the mere preservation of works, but were also dedicated to the dissemination and exchange



of ideas. The library of Alexandria was a meeting place for scholars and philosophers, and librarians facilitated intellectual dialogue and promoted collaboration among scholars.

Another important aspect of the work of librarians was the translation of works into different languages, mainly Greek. This task allowed works from different cultures and civilizations to be accessible to a wider audience. The librarians were expert linguists and worked closely with translators to ensure the quality and accuracy of the translations. (Heath, 1999).

CONTRIBUTIONS OF MATHEMATICIANS IN THE ALEXANDRIAN PERIOD

During the Alexandrian period, known as the Golden Age of mathematics, outstanding mathematicians emerged who made significant contributions to this discipline. Among them, Euclid is one of the most recognized figures, famous for his work "Elements", a treatise that laid the foundations of Euclidean geometry and established an axiomatic approach to the proof of theorems, using deductive logic.

Euclid defined fundamental concepts in plane geometry, such as points, lines, and planes, and formulated postulates and axioms that are still used today. He also made important contributions to arithmetic, exploring properties of prime numbers and developing methods to find the greatest common divisor and the least common multiple. Its rigorous and clear methodology has influenced the teaching of mathematics over the centuries and continues to be essential in mathematics education today.

Euclid and flat bodies

In addition to his work in plane geometry and arithmetic, Euclid was also interested in the study of space and plane bodies. In "Elements", Euclid explored the properties of regular polygons and convex polyhedra. He defined and studied Platonic solids, which are regular convex polyhedra composed of congruent faces, edges, and vertices. (Euclides, Xirau, 2013).

Euclid established fundamental properties of polyhedra, such as the number of faces, edges, and vertices that compose them. In addition, he showed that only five regular convex polyhedra exist: the tetrahedron, the cube, the octahedron, the dodecahedron, and the icosahedron. This classification of regular polyhedra has been a lasting contribution and has influenced the study of geometry and three-dimensional bodies. (Netz, 2003).

Euclid played a pivotal role in the Alexandrian period, leaving important contributions in the fields of plane geometry and arithmetic. His work "Elements" laid the foundation for Euclidean geometry and provided a rigorous method of mathematical demonstration. In addition, Euclid explored the study of regular polyhedra, establishing a classification of them. His legacy lives on

today and his influence extends beyond mathematics, impacting many other areas of knowledge. (Euclides, Xirau, 2013).

Archimedes

Archimedes was a Greek scientist, mathematician, and inventor born in Syracuse, Sicily, around 287 BC. His contributions in mathematics, physics, and technology are widely recognized as precursors to many modern ideas. In mathematics, Archimedes developed methods for calculating areas and volumes of geometric figures, formulating fundamental principles that laid the foundation for integral calculus. His achievements include the precise determination of pi using geometric approximations, and the creation of a system of large numbers called "Archimedes numbers".

In addition, in physics, Archimedes formulated the principles of lever and the principle of flotation, establishing mathematical relationships between the density, volume, and weight of objects submerged in liquids. His contributions in various disciplines demonstrated a unique combination of mathematical ingenuity and scientific vision. (Dijksterhuis, 1987).

Spirals, conoids and spheroids

Archimedes also studied the properties of spirals and conoids. In his work "On Spirals", he examined the characteristics of Archimedean spirals, which are curves generated by a point moving at a constant speed along a straight line while this line rotates around a fixed point. (Arquímedes, García, 2007).

In addition, Archimedes investigated conoids and spheroids. A conoid is a surface that is generated by rotating a line around a fixed axis while traveling along another fixed line. A spheroid is a surface similar to a sphere, but deformed in a certain direction. Archimedes studied the geometric and mathematical properties of these surfaces, establishing important results and laying the groundwork for future developments in geometry and physics. (Thomas, 2012).

Apolonio

Apollonius of Pergamum, also known as "The Great Geometer", was a Greek mathematician born in Pyrgamon, around 262 BC. He is credited with significant advances in geometry and, in particular, in conical sections. His most important work, "The Conics", consists of eight books and addresses the geometric properties of conic sections: circles, ellipses, parabolas and hyperbolas. Apollonius introduced crucial concepts such as foci and the guidelines of conics, allowing for an accurate description of their mathematical properties. In addition, he developed methods for the construction and analysis of these curves, which had a profound impact on ancient mathematics and



the subsequent evolution of geometry. His systematic and rigorous approach influenced mathematical methodology for centuries. (Durán, 2013).

Tangencies or contacts and the theory of epicycles

Apollonius was interested in the study of tangencies or contacts, which are points of contact between two geometric figures. In his work "The Tangents", Apollonius investigated the properties of tangents to a curve and their relationship with the geometric properties of the curve itself. His work laid the foundations for the systematic study of tangencies and their application in various fields of geometry and physics. (Thomas, 2012).

In addition, Apollonius developed a theory of epicycles to explain the apparent motions of the planets in the sky. Epicycles are small circles whose center moves along another larger circle, and were used to model planetary orbits in Ptolemy's geocentric system. Apollonius' theory of epicycles provided an accurate mathematical description of planetary motions and was widely accepted until the heliocentric theories of Copernicus and Kepler gained acceptance. (Thomas, 2012).

DESCRIPTION

This research project is carried out as part of the requirements to obtain the degree of Bachelor of Science in Mathematics at the National University of Panama. It has been carried out with the collaboration of professors Alcibiades Medina, Elicer Cedeño, Narciso Galástica and Abdiel Cosme, who are professors at this institution. The work is structured in chapters that examine the most relevant aspects of the Greek legacy in the development of mathematics, covering its historical evolution, as well as the analysis of the mathematical contributions of the Greeks. In addition, the important scientific and cultural contribution that these civilizations have made to our society is highlighted.

FINAL THOUGHTS

The legacy of mathematical flourishing in Alexandria invites us to recognize the monumental human capacity to seek and understand the universe. This golden period not only represents a significant stage in the history of mathematics, but also symbolizes the connection between ideas and curiosity that have shaped our civilization. As we look at how the contributions of those mathematicians still reverberate in our current era, it becomes apparent that the teachings and discoveries that emerged from Alexandria have provided the foundation upon which contemporary knowledge is built.

The impact of the Library of Alexandria, though physical in its existence, is present in every advance in scientific and mathematical exploration today. This brilliant era reminds us of the



importance of the exchange of ideas and intellectual collaboration across cultures and generations. The thirst for knowledge that characterized that time continues to be a beacon that guides our aspirations towards a future where curiosity and research are essential.


As we pay tribute to the pioneers of ancient scholarship, we acknowledge our debt to them and the need to continue to cultivate understanding and wisdom. Alexandria's mathematical legacy, though faded into its physical form, continues to light the way for further exploration of the unknown, urging us to transform our questions into answers, and our theories into realities. Thus, the spirit of Alexandria's flourishing lives in each of us, encouraging us to continue investigating, learning and dreaming.



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Leprosy cases in Pernambuco between 2013 and 2022: An epidemiological study

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ABSTRACT

Introduction: Leprosy is an infectious disease caused by the bacterium *Mycobacterium leprae*. *This condition persists as a relevant public health problem, occupying the second place in the world ranking of morbidity, being one of the most important neglected diseases for study.* **Objective:** To analyze the epidemiological profile of leprosy cases reported in the state of Pernambuco from 2013 to 2022. **Methods:** This is a cross-sectional epidemiological study conducted in Pernambuco, Brazil, using data from the SINAN and IBGE databases. The annual detection rate, absolute (n) and relative (%) frequencies of the variables sex, race/color, age group, education, clinical form of notification, assessment of inability to cure and sputum smear microscopy were calculated, with a statistical significance level of 5% ($p < 0.05$). The data were analyzed using Microsoft Excel 2019® and the R 4.0.2 software. **Results:** A total of 28,109 cases were reported, with a detection rate of 28.65 cases/100,000 inhabitants. Most cases occurred in males (51.71%); brown race/color (58.22%); age group 40-59 years (37.59%); and incomplete elementary school (34.99%). The predominant clinical form was dimorphic (38.84%). In the assessment of inability to cure, the category "unknown/blank" was the most prevalent (45.27%), followed by Grade Zero (37.16%); Sputum smear microscopy was not

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performed in 34.91%. Conclusion: The results of this study are important, because although there is a trend of decrease in leprosy cases in the period, some years there were peaks of increase. This highlights the need to strengthen health surveillance actions and implement effective public policies to combat this disease.

Keywords: Leprosy, Public Health, Epidemiology.

INTRODUCTION

Leprosy is characterized by being an infectious disease, caused by the bacterium *Mycobacterium leprae*, manifesting itself in the skin mucosa and peripheral nerves, resulting in physical disabilities and deformities (Silva et al., 2023). Despite the reduction of the disease after the introduction of multidrug therapy (MDT), this condition still persists as a relevant public health problem, occupying the second place in the world ranking of morbidity. Leprosy continues to be one of the most important neglected diseases to be studied (Barros et al., 2024).

The World Health Organization (WHO) reported 140,594 new cases of leprosy worldwide in 2021, with the majority of cases recorded in India, followed by Brazil and Indonesia (WHO, 2021). In Brazil, leprosy has been a challenge for several decades, with poverty and social vulnerability being factors that contribute to inequality and proliferation of the disease (Ribeiro et al., 2022).

Leprosy is considered a notifiable disease and mandatory investigation. Brazil ranks second in the absolute numbers of leprosy cases, with about 30 thousand people diagnosed annually, second only to India (BRASIL, 2023). In 2022, Brazil recorded 26,436 cases of the disease, with a detection rate of 13.01 cases/100,000 inhabitants, considered to be highly endemiistic (Brasil, 2024; Brito, et al., 2015). The state of Pernambuco, located in the Northeast region, was responsible for 2,494 of the cases, with a detection rate of 25.61 cases/100,000 inhabitants (Brasil, 2024).

Leprosy generates high costs for the Unified Health System (SUS), with hospitalizations, treatment and rehabilitation, in addition to being accompanied by a strong social stigma. This entails several clinical and social challenges for the affected individual, from acceptance of the disease to adherence to treatment (Ribeiro et al., 2022). Thus, the objective of the study is to analyze the epidemiological profile of leprosy cases reported in the state of Pernambuco in the period from 2013 to 2022.

The period from 2013 to 2022 was chosen to analyze leprosy in Pernambuco due to the implementation of several public policies and strategies to control and prevent the disease. This interval allows us to assess the effectiveness of these interventions over time and to identify trends and changes in epidemiological patterns. The results may provide valuable information for the formulation of future policies and strategies for leprosy control, both in Pernambuco and in other endemic regions.

METHODOLOGY

This is a cross-sectional epidemiological study. The study location is the state of Pernambuco, in the Northeast of Brazil, with a territorial extension of 98,067,877 km² and a population of 9,058,931 people, with a demographic density of 92.37 inhabitants/km² (IBGE, 2022). Pernambuco is made up of 184 municipalities and the island of Fernando de Noronha, composed of 12 health

regions and four macro-regions (Metropolitan, Agreste, Sertão and Vale do São Francisco and Araripe (PERNAMBUCO, 2012).

The study population consists of all new cases of leprosy, residing in the state of Pernambuco, notified in the period from 2013 to 2022. The following databases were used: Diseases and Notification Information System (SINAN), the Department of Informatics of the Brazilian Unified Health System (DataSUS) and the Brazilian Institute of Geography and Statistics (IBGE) for population estimates.

To characterize the epidemiological profile of leprosy cases, the detection rate for each year analyzed was calculated, obtained from the following formula: Detection rate=

Casos novos de hanseníase notificados em PE no ano

População total de PE no ano

* 100.000

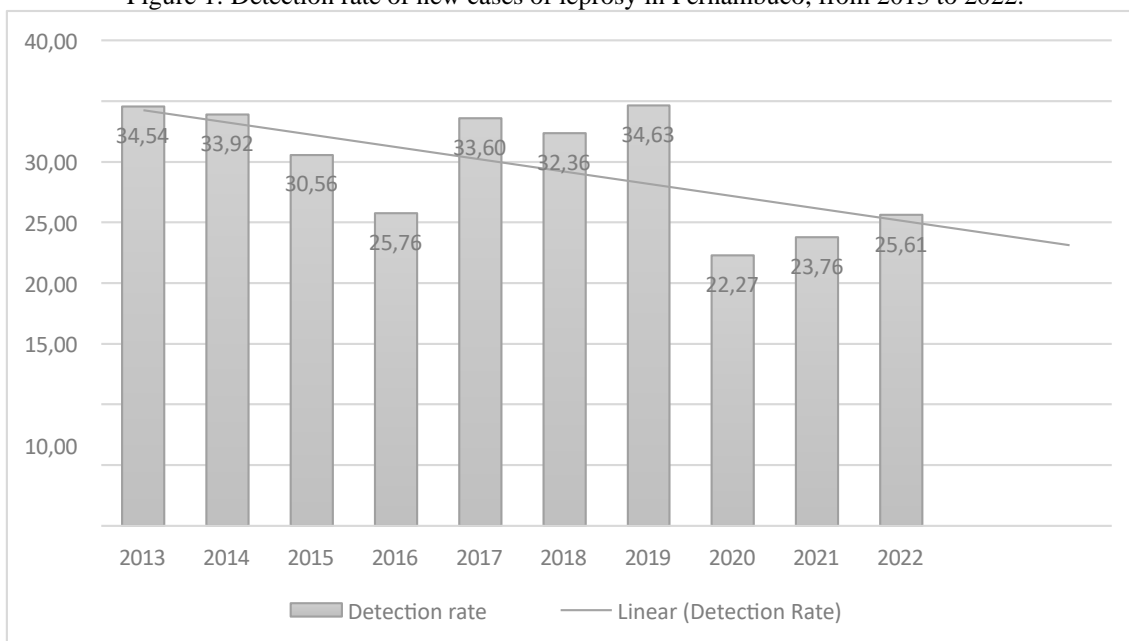
In the statistical analysis, the absolute (n) and relative (%) frequencies of the variables sex, race/color, age group, education, clinical form of notification, assessment of inability to cure, and sputum smear microscopy were calculated. For all the tests performed, a statistical significance of 5% (p<0.05) was adopted. The data were analyzed using Microsoft Excel 2019® spreadsheets and the R 4.0.2 software.

Regarding the approval of the Research Ethics Committee, the study did not need to use data in the public domain, according to Resolution No. 466/2012 of the National Health Council, dispensing with submission to the ethics committee (BRASIL, 2012).

RESULT

In Pernambuco, between 2013 and 2022, 28,109 new cases of leprosy were reported. There was a downward trend in the detection rate in 2013, 2014, 2015 and 2016. An upward trend was observed in the following years in 2017, 2018 and 2019, returning to a downward trend in 2020, 2021 and 2022. In addition, it was observed that the year 2019 stood out with the highest detection rate (34.63/100 thousand inhabitants) and the year 2020 with the lowest (22.27/100 thousand inhabitants) (Figure 1).

Figure 1: Detection rate of new cases of leprosy in Pernambuco, from 2013 to 2022.



Source: Prepared by the author. Data extracted from the System of Diseases and Notifications (SINAN), 2024.

Between 2013 and 2022, 28,109 cases of leprosy residing in the state of Pernambuco were reported, resulting in a detection rate of 28.65 cases/100 thousand inhabitants. Of these, 14,791 were reported in the first five years (2013-2017), with a rate of 31.66 cases/100 thousand inhabitants. In the second five-year period (2018-2022), 13,318 cases were reported, with a rate of 27.70 cases/100 thousand inhabitants (Table 1).

Regarding the epidemiological profile of the total period, it was observed that most cases occurred in males (51.71%); of brown race/color (58.22%), followed by white (18.72%); in the 40-59 age group (37.59%); with incomplete elementary school education (34.99%); The clinical form of notification was dimorphic (38.84%). In the evaluation of the inability to cure, the unknown/blank category had the highest predominance (45.27%), followed by Grade Zero (37.16%); sputum smear microscopy was not performed in (34.91%) of the cases (Table 1).

When comparing the five-year periods individually, he observed a profile similar to the one previously described. However, in relation to the percentage variation of the absolute numbers, it was found that some points stood out, such as the increase in cases in indigenous people (55.56%); in the age group from 1 to 9 years, there was a reduction of 54.96%; and in schooling, there was an increase of 76.85% in complete higher education. In the clinical form of notification, tuberculoid disease showed a reduction of 50.59%. In addition, it was observed that in the evaluation of the inability to cure, the blank category showed an increase of 40.82%, and the sputum smear microscopy also showed an increase of 362.93% in the unknown/blank variable (Table 1).

Table 1 – Characterization of leprosy cases reported in the state of Pernambuco in the years 2013 to 2022, according to the year of notification.

Variables/ Categories	(2013-2017)		(2018-2022)		Total		D%*	X ² ; p** value
	N	%	N	%	N	%		
Sex								
Male	7516	50,81	7019	52,70	14535	51,71	-6,61%	
Female	7274	49,18	6297	47,28	13571	48,28	-13,43%	10,5; <0,005
Ignored	1	0,01	2	0,02	3	0,01	100,00%	
Race/color								
White	2767	18,71	2495	18,73	5262	18,72	-9,83%	
Black	1943	13,14	1838	13,80	3781	13,45	-5,40%	
Yellow	111	0,75	90	0,68	201	0,72	-18,92%	16,23; <0,006
Brown	8710	58,89	7656	57,49	16366	58,22	-12,10%	
Indigenous	45	0,30	70	0,53	115	0,41	55,56%	
Ign/Branco	1215	8,21	1169	8,78	2384	8,48	-3,79%	
Age group								
1-9 years	575	3,89	259	1,94	834	2,97	-54,96%	
10-19 years	1552	10,49	1024	7,69	2576	9,16	-34,02%	
20-39 years	4419	29,88	3387	25,43	7806	27,77	-23,35%	302,6; <0,01
40-59 years old	5254	35,52	5368	40,31	10622	37,79	2,17%	
60 years and over	2991	20,22	3280	24,63	6271	22,31	9,66%	
Schooling								
Illiterate	1220	8,25	877	6,59	2097	7,46	-28,11%	
Incomplete elementary school	5737	38,79	4099	30,78	9836	34,99	-28,55%	
Complete elementary school	626	4,23	558	4,19	1184	4,21	-10,86%	
Incomplete high school	760	5,14	662	4,97	1422	5,06	-12,89%	
Complete high school	1469	9,93	1558	11,70	3027	10,77	6,06%	347,3; <0,01
Incomplete higher education	129	0,87	178	1,34	307	1,09	37,98%	
Complete higher education	298	2,01	527	3,96	825	2,94	76,85%	
Not Applicable/Ignored	4552	30,78	4859	36,48	9411	33,48	6,74%	
Clinical Form of Notification								
Undetermined	2837	19,18	1835	13,78	4672	16,62	-35,32%	
Tuberculoid	2951	19,95	1458	10,95	4409	15,69	-50,59%	
Dimorphic	5080	34,35	5838	43,84	10918	38,84	14,92%	823,8; <0,01
Virchowiana	2222	15,02	1868	14,03	4090	14,55	-15,93%	
Unclassified	1096	7,41	1501	11,27	2597	9,24	36,95%	
Ign/Branco	605	4,09	818	6,14	1423	5,06	35,21%	
Assessment of Healing Inability								
Grade Zero	6756	45,68	3688	27,69	10444	37,16	-45,41%	
Grade I	1171	7,92	805	6,04	1976	7,03	-31,26%	
Grade II	398	2,69	349	2,62	747	2,66	-12,31%	1274; <0,01
Not rated	1182	7,99	1035	7,77	2217	7,89	-12,44%	
Blank	5284	35,72	7441	55,87	12725	45,27	40,82%	

Smear Smear								
Positive	2730	18,46	998	7,49	3728	13,26	-63,44%	
Negative	3786	25,60	1353	10,16	5139	18,28	-64,26%	6987; <0,01
Not realized	6600	44,62	3213	24,13	9813	34,91	-51,32%	
Ignored/blank	1675	11,32	7754	58,22	9429	33,54	362,93%	

Source: Prepared by the author, 2024. Data extracted from the System of Diseases and Notifications (SINAN) 2024.*Percentage change between the five-year periods (2013-2017) and (2018-2022). **Chi-Square Test.

DISCUSSION

The findings of the present study demonstrate a decrease in leprosy cases in the total study period in the state of Pernambuco. However, despite this decrease, growth peaks were observed in certain years, as well as disparities in the variables sex, race/color, age group, education, clinical form of notification, assessment of inability to cure, and sputum smear microscopy.

The downward trend in the leprosy detection rate in the state, especially in the first five years (2013-2016), is in line with the country's literature and may be related to the implementation of the National Leprosy Control Program in Brazil and the strengthening of disease control in Primary Health Care (PHC) (Anchieta Jefferson de Jesus et al., 2019; Lopes, Fernanda de Castro et al., 2021). From 2020 onwards, a reduction in cases was observed, possibly associated with the context of the Covid-19 pandemic, due to the interruption of prevention, diagnosis, and treatment actions with social distancing measures and access restriction in PHC.

In that same year, there was a significant reduction of 37.1% in the detection of new cases in the world compared to 2019, as a consequence of the Coronavirus health crisis, strongly impacting the diagnosis and treatment of chronic comorbidities (WHO, 2021). Brazilian research (Lima, Lucas Vinícius et al., 2021) shows that there was a drastic reduction in the notification of cases in much of the country in 2020 and 2021, due to the fragility of access to health, the population's fear of seeking care, and the increase in morbidity and mortality, culminating in the care overload of the three levels of care (Mendes, Eugênio Vilaça, 2020).

Teófilo (2014) in his analyses, concludes that all regions of Brazil showed an increase in the average detection rate in the indigenous population, with the Northeast being the most endemic region and with the highest rate, surpassing the country's average. The high detection rates among these peoples are associated with historical isolation; these communities face difficulties in accessing medical care due to the distance from hospital centers and the logistical complexities of the displacement of health professionals (Barros, Ian da Costa Araújo et al., 2024).

Regarding sociodemographic variables, the predominance of cases in males suggests behavioral factors and cultural difficulties in health care for this population. Research reinforces that men, compared to women, tend to seek health services less, influenced by masculinity as a restrictive

factor, which makes it difficult to adopt self-care practices. In this context, seeking health services is often associated with weakness, fear and insecurity (Gomes, Romeu et al., 2007).

In addition, the development of leprosy among this population group usually involves more severe clinical manifestations, greater physical disabilities, high rates of treatment abandonment, and higher mortality (Souza, Eliana Amorim et al., 2018). However, other studies highlight that differences in the response to infection are more associated with physiological than behavioral risk factors, which can be explained by hormonal changes in adolescence, such as estrogen and testosterone levels, which create a favorable environment for the growth of *M. leprae* and result in a higher bacillary load in men (Nobre, Mauricio Lisboa et al., 2017; Guerra-Silveira, Felipe Abad-Franch, Fernando, 2013).

With regard to the age group, the data are similar to those of other studies, in which the economic, social and psychological losses for the patient, his family and society are highlighted. This is because leprosy can cause physical disability, compromising the ability to work and affecting the economically active age group (Araújo, Daniella Azevedo Lobo et al., 2016; Vêras, Gerlane Cristinne Bertino et al., 2023). A study conducted by Ribeiro and Gabriela de Cássia (2012) to assess factors associated with physical disability highlighted that 46.5% of the interviewees were out of the labor market, of which 33.3% were away from their work activities due to complications resulting from leprosy. Although the adult age group of 40 to 59 years is the majority in this study, there is a concern about the increase in cases in young people aged 10 to 19 years, considering that the clinical signs of the disease are not easily recognized in childhood, requiring a careful diagnosis. In addition, the social and physical problems and stigmas associated with the disease, which affect the mental health of patients, cannot be neglected (Pires, Carla Andrea A et al., 2012; Ferreira, Isaias Nery; Alvarez, Rosicler Rocha Aiza, 2005).

Other studies point out that racial inequalities reflect health consequences, with the worst indicators observed in brown and black populations, in addition to higher prevalence of chronic diseases in black people when compared to white people (Malta, Débora Carvalho et al., 2015). the transmission of the infectious agent and the increase in cases of the disease, considering the sanitary conditions, precarious social and economic aspects (Barbosa, Débora RM et al., 2014).

Regarding the clinical form of the disease, studies converge with the findings of this study, highlighting a statistical and quantitative superiority of patients classified as Borderline and Virchowian form, suggesting a late diagnosis (Silva, Sobrinho RAS et al., 2009; Lima, HMN et al., 2014). Most individuals did not present physical disability at diagnosis (37.16%), having been classified as Disability Grade 0, which differs from what has been reported in the literature. However, there was a predominance of ignored data in this variable, which may have impaired the analysis. Sputum smear microscopy was not performed in 34.91% of the cases, which neglects the

diagnosis, since it is a quick, low-cost, minimally invasive laboratory procedure and has good accuracy for classifying the clinical form of the disease (Buhner-Sékula S, 2008).

As limitations of this study, the use of secondary data from information systems stands out, which may present inconsistencies in terms of quantity, quality and processing of information. In addition, the amount of ignored data can compromise the accuracy and integrity of the analyses, affecting the reality of the epidemiological profile of the disease. This can hinder the identification of risk groups and the implementation of more precise interventions.

It is also necessary to emphasize the difficulties in diagnosis and the underreporting of new cases of the disease, which are associated with the weaknesses of health surveillance systems and the lack of adequate professional qualification (Sánchez, Mauro Niskier et al., 2021).

Finally, the results of this study are important, because although it shows a trend of decrease in leprosy cases in the period from 2013 to 2022, some years there were peaks of increase. Furthermore, this study revealed that the cases in the state of Pernambuco have established population groups such as men, brown people, individuals aged 40 to 59 years and with incomplete elementary education. These findings highlight the urgent need to strengthen health surveillance actions and implement effective public policies to address this problem.

In addition, the results are in accordance with the existing literature and can offer *valuable insights* for decision-making regarding leprosy control strategies and coping with the disease in the state. It is essential that further research be conducted to deepen the understanding of the conditioning and determining factors of leprosy, as well as to investigate the possible variations in the detection coefficients of leprosy in Pernambuco.

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A novel scoring system to reduce bias in placental microsurgery training

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ABSTRACT

Objective: The manual skills required for microsurgical interventions have reached a level of complexity that presents a significant challenge to practitioners. The assessment and validation of these skills have become a fundamental aspect of training programs, with the implicit responsibility of establishing specific and efficient methodologies, as well as the proper validation of acquired skills. It is of paramount importance that a training program is free from bias, particularly in relation to the selected simulator details. In order to provide enhanced training quality and accurate results, this paper presents a novel and logical approach to classifying a placental simulator.

Method: A standardized microsurgical training protocol, previously published in the literature, was performed with the addition of a new variable for the assessment of vascular quality and measurement of simulator difficulty level (SDL). This quality assessment was also intended to serve as a comprehensive understanding of the current difficulty level of the particular simulator, allowing the operator to adjust a proper level of caution and finesse. Subsequently, a statistical analysis was conducted to examine the impact of the SDL on the protocol main variables.

Results: Thirty-four placentas were used for sixty-three procedures. The time decreased from 42 minutes (first attempt) to 21 minutes (attempt number 47). Then a plateau level was reached with small variations in time. The mistake rate also decreased from an average of 35% major mistakes to 12.25%. Even after reaching the plateau level, both time and mistakes shown irregular and small variations.

For 21 samples graded as High difficulty (HD), the mistake score accounted 53, with an average of 2,52. For 31 samples graded as Regular difficulty (RD), accounted 24, average of 0,77. For 11 samples graded as Low difficulty (LD), accounted 6, average of 0,54. These results were confirmed after filtering for “first procedure on that simulator” only.

Additionally, it was found that a second attempt on the same simulator was always a more quality (less mistakes made) and faster (less time to achieve the goal) one.

Conclusion: The SDL score (assessed by measuring vascular and perivascular variables) demonstrated the anticipated concordance with the time taken and the errors committed. The SDL score and its interpretation

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can be effectively employed to reduce bias and justify the variance resulting from minor simulator discrepancies.

Details about regular variations (arising from the biological substrates used as simulators and/or real surgical scenarios) should be taken into account when assessing the effectiveness of microsurgical procedures.

Keywords: Microsurgical training, Simulator assessment, Skill validation, Difficulty level.

INTRODUCTION

The training of microsurgical skills has become a significant global demand and an important academic challenge ¹. The surgical technique has evolved in many fields, with the use of the surgical microscope becoming increasingly prevalent for a range of procedures. These include tumor resection, artery bypass, soft tissue/flap reconstruction, and ductal re-permeabilization, among others.

The skills required for these types of procedures necessitate proper instruction, education, and training. The role of microsurgical training centers has become fundamental ². According to recent publications, the time required to acquire basic but consistent skills at high magnification levels ranges from 40 to 150 hours at the microsurgery laboratory, always under a properly designed and validated protocol ^{3,4}.

The requisite dexterity for microsurgical procedures necessitates a considerable investment of effort to acquire and subsequently maintain. Consequently, training centers should be equipped not only for instructional purposes, but also for regular practice.

The issue of accessibility and affordability of microsurgical education and training represents a significant challenge. Approximately a half of the hospitals and care centers where microsurgery is performed lack a microsurgical training center within the same city, whether for initial instruction or training. The remaining half that do have a training center in the same city, face significant challenges in accessing or affording instruction or training. This situation is particularly prevalent in developing countries ⁵.

In light of the aforementioned points, it is recommended that the use of efficient methods, which facilitate the reduction of learning curves and microscope working times, and the selection of appropriate yet cost-effective simulators, be encouraged.

In the domain of microsurgery training, particularly concerning placental microsurgery, several authors have explored scoring systems aimed at reducing bias and enhancing competency assessment.

First, an interesting contribution is from Colombian authors ⁶, who implemented a practical training course using dye-perfused human placentas. In their study, participants with varying levels of experience performed multiple surgical exercises and subsequently completed a questionnaire designed to evaluate their training experience. This approach underscores the importance of structured feedback in training environments, which is critical for minimizing bias in skill assessment.

Second, the development of standardized scoring systems, highlighted in other study ⁷, where the researchers introduced the SParTA Score, a new assessment tool specifically designed for microsurgical training. This scoring system allows for benchmarking performance and learning

outcomes, thereby providing a reliable framework for evaluating trainees' skills and reducing subjectivity in assessments. Similarly, emphasized the necessity of validated tools for objective assessment in microsurgery, noting that traditional methods often lack the rigor needed to ensure consistent evaluation across different trainees ⁸.

The significance of structured training programs is also analyzed in other work ⁹, who investigated the objectivity of scoring in microvascular anastomosis simulation training. Their findings suggest that the implementation of objective scoring criteria can enhance the fairness and reliability of evaluations, thereby addressing potential biases inherent in subjective assessments. This aligns with the broader literature advocating for competency-based training frameworks, which necessitate accurate and objective assessment tools to define and quantify surgical skills effectively ¹⁰.

Moreover, the exploration of alternative training models, such as the three-step approach ¹¹, which utilizes latex gloves, endovascular prostheses, and human placentas, further illustrates the innovative strategies being employed to enhance training efficacy while minimizing bias. This method not only prepares trainees for clinical applications but also provides a comparative framework to validate training outcomes.

Therefore, the integration of structured scoring systems and objective assessment tools is central in reducing bias in placental microsurgery training. The collective insights from these authors highlight the necessity for standardized evaluation methods that enhance the reliability of skill assessments and ultimately improve training outcomes.

Regarding equipment, the variety of simulators is considerable, encompassing different types, objectives, and costs. The microsurgical training process begins with the use of inanimate objects to develop fundamental skills. This is followed by the manipulation of biological tissues to gain familiarity with the characteristics of real tissue and to practice “optimal tension” ¹² while handling different components. Ultimately, experimental animals can be employed as simulators, with or without recovery periods. The former option is costlier and raises ethical concerns but offers a superior level of simulation.

The use of placenta as a simulator provides a reliable and proven method for obtaining and maintaining microsurgical skills ^{13,14,15}. However, some information gaps have been identified in this regard. Due to regular variability, labor nuances, maternal clinical records, previous pathologies, and pregnancy factors such as eclampsia, diabetes, and obesity, the tissues of different placental samples can vary significantly. These circumstances have the potential to introduce significant bias in the comparison of data from microsurgical training procedures, which could have direct implications for the evaluation of the operator's skills and the implementation of modifications to the training

program. Furthermore, the comparison between different operators may be misinterpreted or even impossible.

Finally, the introduction of the Simulator Difficulty Level (SDL) score is a significant advancement in microsurgical training. The objective of this paper is to synthesize the aforementioned issues and present a novel theoretical and practical instrument for circumventing placental simulator bias. In this vain, by quantifying the difficulty of placental simulators, the study provides a structured method for assessing training effectiveness, which is critical in a field where precision and skill are paramount. The next section will focus on the materials and the methods involved. Then, the results of the fieldwork will be showed. On this basis, we will discuss these results for concluding with some recommendations.

MATERIALS AND METHODS

A kaizen/therblig-based protocol ⁴ that had been previously tested and published was selected to conduct this study. The full methodology was retained with slight modifications to reduce the task time.

The "only 1 operator" technique was also retained as an extra precaution to avoid inter-operator bias and to focus on the features and peculiarities of the simulator.

In addition, a new exclusion criterion about the use of the simulator was created, aiming to assure the biological tissue optimal condition: any placental simulator more than 6 hours after labor and delivery had to be discarded. No preservation methods were allowed for this trial, only blood and clot washing with wet gauze over the fetal side.

WORKSTATION

Optical microscope 50X maximum magnification level, continuous zoom lens, foot control for zoom and focus. Led light system, manually adjusted.

Basic set of instruments (2 forceps, 1 vascular dilator, 1 side-curved scissors).

Vascular suture, mononylon, 11/0.

PROTOCOLLED TASK PROGRAM

- 1- **Setup:** a biological simulator was placed on the laboratory table, following the same rules as the previous Kaizen/Therblig experience ⁴. The exposure was flat and directly under the microscope to avoid any interference related to position, angles and handling of the optical device.

2- **Simulator difficulty level (SDL) test:** after selecting a Grade II arterial vessel between 1.5 and 2.5 mm, 4 maneuvers were designed to assess vessel and perivascular connective tissue characteristics.

A) Thickness: dissecting the near side of the selected vessel (Figure 1.a) for 10mm.

During this step, the thickness of the perivascular connective tissue was classified from very thick, to very thin (Table 1).

B) Flexibility: dissection all around the vessel (Figure 1.b). Once the vessel was freed from its bottom surface, a thin latex layer was placed under the vessel to assure complete 360 degrees dissection. Finally, taking the vessel perivascular connective tissue from proximal and distal dissected extremities, the bottom surface attempted to be exposed and a small torsion force was applied for this goal. The vessel response was then classified from very flexible, to very rigid (Table 1).

C) Adhesion: dissection over the top surface of the vessel down to the adventitial level (Figure 1.c). During this step, different layers were manipulated and separated/cut off. The adhesion shown by those layers, specially those near vessel adventitia, was classified from very adherent, to very loose (Table 1).

D) Wall: during the previous step (adventitia dissection) or while working directly on the vascular wall (while suturing at the final stage of the procedure assesment), the vessel and perivascular tissue was closely watched (Figure 1.d). If some of those maneuvers caused partial or complete disruption of the vessel walls or borders, it was classified within the range of very friable to very strong vessel wall (in accordance with the safety and correctness of the maneuver that caused disruption) (Table 1).

Once all classification steps were completed, the difficulty of the placenta was determined using a numerical scale (ranging from -8 to +8) and subsequently graded with a final assessment, resulting in three categories: Regular difficulty, High difficulty, and Low difficulty (Table 2).

3- **Assessed Procedure** (details can be seen at referred articles⁴)

- 1) *Artery dissection:* perform a 360-degree dissection around a 1 mm artery. A thin latex or plastic layer should be able to pass underneath the completely exposed vessel.
- 2) *Adventitia dissection:* all connective tissue should be dissected from the vessel wall, leaving only the adventitia or near-adventitia layer. The primary goal of this task is to eliminate any connective tissue that may occlude the vessel once it is cut, or any connective tissue flap that may protrude into the vessel lumen after suturing.
- 3) *Termino-Terminal suture:* once the adventitia dissection is performed, the vessel is cut with scissors. Then a termino-terminal bypass technique with a 11/0 suture following the

previous protocol and advice ⁴ was performed. Five stitches were required. After suturing, a patency test was required to assess suture quality.

Time elapsed for each task and mistakes score should be registered following the previously published protocol instructions.

DATA COLLECTION AND ANALYSIS

Following the same Kaizen-based protocol, data were collected and a database built (raw data table is shown at the additional material section). Time, mistakes and SDL were given with numerical and precise values. Statistical analysis was then performed to identify correlations and significant associations.

Figure 1 – Simulator Difficulty Level (SDL) assessment

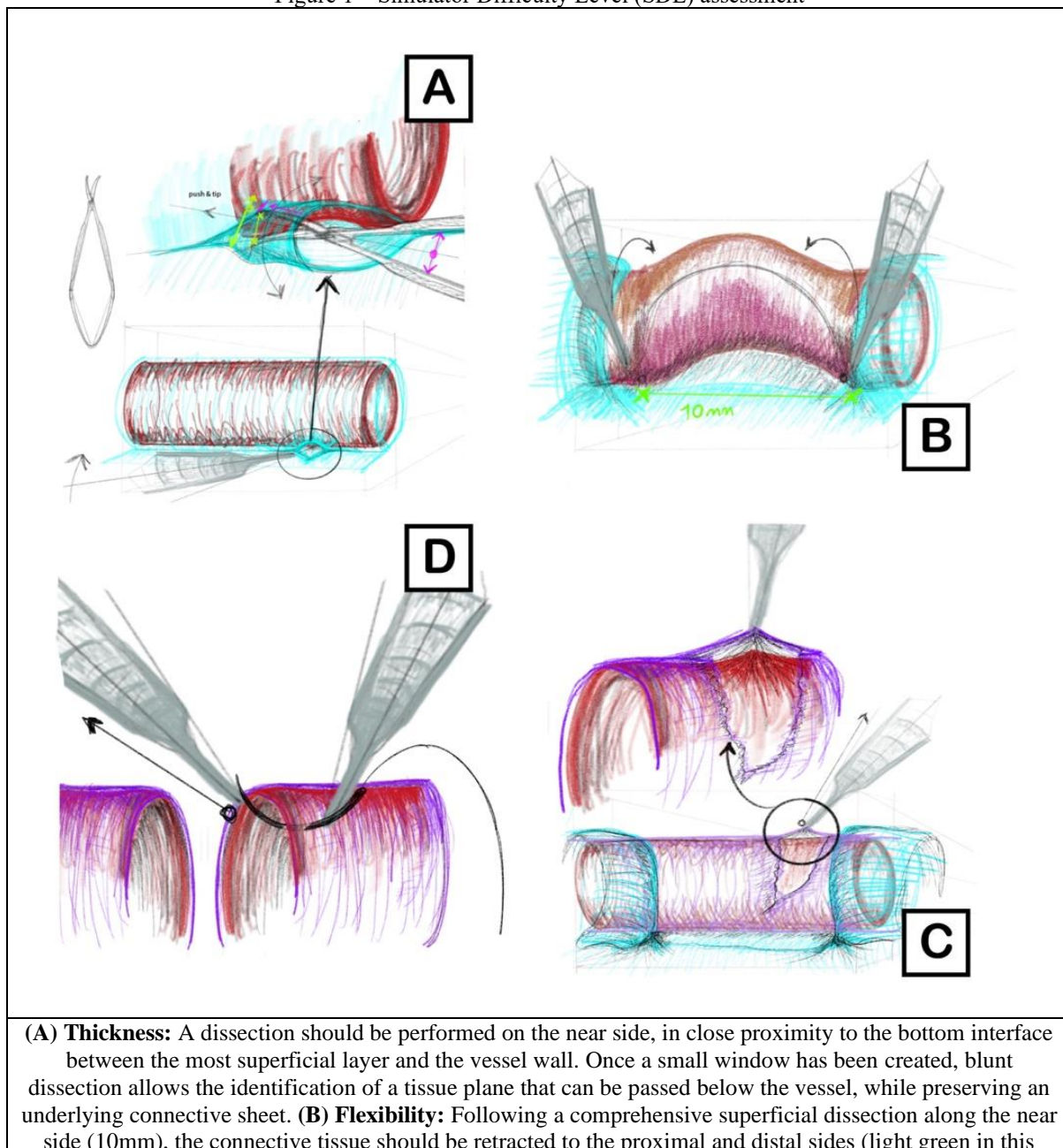


illustration). Subsequently, remaining connective tissue along vessel wall should be taken with forceps on both sides, after which the vessel should be rotated to expose its bottom side. **(C) Adhesion:** Following the elimination of superficial connective layers, the near adventitia should be dissected with precision and care. Once the top surface of the vessel has been reached, the layer should be taken with forceps and traction applied. The response of the underlying vessel wall is then observed, looking for adherence that is strong enough to avoid separating it from the vessel wall. **(D) Wall:** Once dissection of free borders is completed, suture begins. The needle passing through the vessel wall and the traction made by the suture line over the vessel border should be observed.

Source: own elaboration.

Table 1 – Simulator difficulty level maneuvers description and scoring

Maneuver	Description	Focus	Score
Thickness	Blunt dissection over the bottom and superficial margin of the near side of the vessel	The amount of connective tissue that has to be dissected to gain the bottom plane to go under the vessel (a thin layer looks transparent and smooth, low volume / a thick layer looks dull and lackluster, high volume)	+2 very thin +1 thin Regular -1 thick -2 very thick
Flexibility	After 360 degree dissection of the superficial layer, along 10mm of the vessel major axis, rotation applied with two forceps attempts to expose bottom face of the vessel	The fraction of the bottom side of the vessel that can be observed and the reaction of the vessel while stopping the rotational forces over it (a flexible vessel easily exposed)	+2 very flexible +1 flexible Regular -1 rigid -2 very rigid
Adhesion	When connective tissue over the vessel was dissected and just a thin layer of near-adventitia level remains, a fine forceps grips it to apply gentle traction to separate it from the vessel wall.	While applying gentle traction, the vessel wall should be carefully observed (low adhesion level allows to separate this layer from vessel wall without difficulties / high adhesion level is noted when the vessel wall is pulled with the near adventitia)	+2 very low adhesion +1 low adhesion Regular -1 high adhesion -2 very high adhesion
Wall	While working over the completely dissected vessel wall (mostly at the adventitia dissection stage) and/or suturing at the assessed procedure stage, special care should be taken to observe the response on that wall.	A friable vessel can be damaged with a gentle and well-performed maneuver, while a strong vessel can be very resistant even under rough maneuvers over it.	+2 very strong +1 strong Regular -1 friable -2 very friable

Source: own elaboration

Table 2 – Numeric guide for definitive simulator difficulty level (SDL) scoring

SDL	Numeric value assigned by maneuvers
Low difficulty	From (+2) and higher
Regular difficulty	From (+1) to (-1)
High difficulty	From (-2) and lower values

Source: own elaboration

It should be noted that additional data was collected regarding the appearance of the placenta. This included the presence of vascular proliferation (defined as the surface percentage with a vessel at least 1mm in diameter), umbilical cord implantation (classified as marginal, velamentous, central, or para-central), and other surface characteristics (such as bleeding, hematomas, or lipidic

inclusions). These supplementary observations were not incorporated into the difficulty level classification, but are mentioned here just as a reference.

RESULTS

The first two samples were discarded due to exclusion criteria (sample 1 did not arrive the microsurgical workstation before 6h from labor/delivery; sample 2 was maintained with ice for 3h before arrive the microsurgical workstation).

All records were taken following the protocol. The main raw data can be observed at additional material section (for its length it was placed at the end of the document).

Protocol main goals were confirmed (hand skill improvement): the initial time of 42min to complete the task, diminished significantly up to 21min; average major mistakes made in the first 20 samples was 35%, decreasing to 12,25% at the end of the trial.

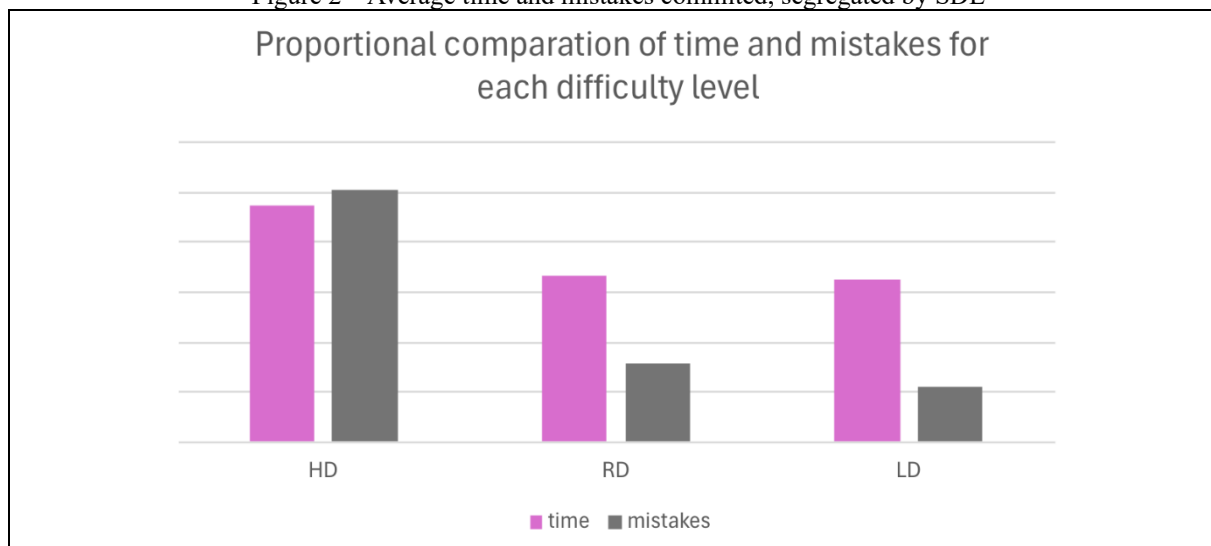
By analyzing variations patterns among all of the results, a regular variability was observed (“regular variability” defined as the tendence to increase and/or decrease in time and mistakes, for a specific protocol, with a single and skilled operator, and operating at a controlled scenario).

Once every simulator was classified, the resulting variables were confronted with the time and mistakes scores.

For 21 samples graded as High difficulty (HD), the mistake score accounted 53, with an average of 2,52. For 31 samples graded as Regular difficulty (RD), accounted 24, average of 0,77. For 11 samples graded as Low difficulty (LD), accounted 6, average of 0,54.

From 21 HD samples, the mistake score met exclusion criteria in 5 of them. The remaining 16 samples accounted 37661 seconds to be concluded (Average 2353,81 seconds). From 31 RD samples, the mistake score met exclusion criteria in 1 of them. The remaining 30 samples accounted 49924 seconds (Average 1664,13 seconds). From 11 LD samples, there were no exclusion due to mistake criteria, accounting 17807 seconds (Average 1618,82 seconds) (Figure 2).

Figure 2 – Average time and mistakes committed, segregated by SDL



Source: own elaboration. Time refers to the total time needed to complete the task (average). Mistakes refers to the total amount of mistakes committed during the task (average).

It was observed that more than one procedure was performed using the same placenta, showing a particular situation: the first attempt was always longer in time, and higher in mistakes, than a second or third attempt (always using the same placenta).

To eliminate any potential bias due to a facilitated ability rather than a simulator characteristic, a comparable assessment was conducted, but in this case, only using the first attempt on each simulator.

The number of first attempts was 26 (HD 10 with 3 exclusions / RD 12 with 1 exclusion / LD 4 with no exclusions). Resulting average mistake numbers were: HD 3,5 / RD 1,08 / LD 0,75. Resulting average time numbers were: HD 1943,14 / RD 1706,54 / LD 1791,75.

The present experience has also exposed some data about this respect: after a few days without practice, the hand skills showed a regression to earlier stages of dexterity (see the results section, sample 49 and 50), just 14 days without training showed the same procedure going slower and erratic.

A series of statistical tests were conducted to ascertain the existence of a genuine correlation between the SDL and the variables associated with the procedure, namely time and mistakes. The results of the *Chi-square* and *Asyntotic Significance* tests are as follows: a) HD samples were found to be correlated with higher mistake rates, and b) it was determined that a greater number of procedures should be tested in order to confirm the apparent correlation between SDL levels and time.

DISCUSSION

It is relatively uncommon to have access to a microsurgery training center that is conveniently located and affordable. Furthermore, such centers do not always offer an approved training protocol and hand skills personalized teaching, improvement, and certification.

The ongoing evolution of technology has introduced a plethora of sophisticated visual aids, including hybrid microscopes, exoscopes, and roboscopes, along with an array of other sophisticated technological tools, which have the potential to enhance microsurgical procedures. These technological advancements have presented a formidable challenge to surgeons' skills on a global scale, at the context of various surgical specialties.

Social and economic factors are inextricably linked to surgical indications, available technology, and training requirements. Unfortunately, these factors are unevenly distributed in resource-poor areas and developing countries. This is a significant challenge that requires innovative solutions to ensure that excellence in microsurgery is accessible to all.

To improve the effectiveness of protocols and training, carefully analysed programmes should aim to use a dedicated and proven methodology. Consideration of significant variables, accurate measurement and quality instruction are now the gold standards for achieving and maintaining operator proficiency.

By using the Kaizen/Therbligs methodology, a protocol and its objectives can be designed in accordance with the socio-economic situation, maintaining high quality standards and also demonstrating the ability to identify specific points for improvement and incorporate novel tools to improve and refine outcomes.

When evaluating overall results in large microsurgical training series, discrepancies in results may have multiple causes and origins, but all of them generating unidentified variables, not subject to measurement and acting as a bias provider. One of these multiple causes may be related to the biological characteristics of the simulator, in particular the "regular variability".

This last named concept reflects a real surgical situation (or a simulated context using a biological simulator) in which not all surgical scenarios are identical, even when confronted with analogous pathologies and controlled environments.

The SDL test enabled the operator to obtain supplementary data regarding the immediate characteristics of the simulator. The utilisation of a group of minor movements or preliminary strategies to ascertain specific features that may exhibit regular variations, appears to be relevant while analysing results.

The proposed set of maneuvers used to build the SDL score yielded two additional findings. The first was the SDL test itself serving as hands "warm up" in a safe scenario¹⁶, thereby avoiding the initial period of increased risk due to rough micromovements during the evaluated procedure.

The second was the importance of analyzing regular variabilities as an important procedure modifier, both for simulation and surgery. This warming up is strongly recommended by practitioners and routinely practiced by many microsurgical operators.

From other perspectives of this placenta-simulated trial, maternal records and pregnancy complications such as hypertension, diabetes, eclampsia, and others demonstrated correlations with placental descriptions. These findings extend far beyond the scope of this paper, but remain noteworthy. It may also be reasonable to correlate some of the findings with other placental imaging studies that have been previously published ¹⁷.

It is evident that regular variability is a common occurrence in all surgical procedures (and all biological simulations). It must be considered when working on procedures with potential biological diversity. The SDL tool has proven to be beneficial in identifying and avoiding biases by selecting appropriate sample classification, and by giving the operator solid and in-situ data to understand the level of additional care that is required.

Furthermore, the use of this kind of tools (dedicated to make a protocol more precise) will enable the avoidance of bias when reading results, evaluating skills and making comparisons.

The use of analogous indexes to assess regular variability in other surgical procedures could also be an important avenue for further investigation.

Finally, it is worth to summarize some key point in this discussion section that would contribute in the future to a more robust and comprehensive analysis of the training methodologies presented in this paper:

- Reaffirm this protocol effectiveness to improve hand skills (significant reduction in procedure time, from an average of 42 minutes during initial attempts to 21 minutes, after 47 attempts)
- The better integration of warming-up techniques.
- Addressing the information gaps regarding the placenta simulator.
- Exploring alternative training models.
- The importance of objective scoring criteria for avoiding bias.
- The broader implications of the findings for the field of microsurgery.
- Taking in count “regular variability” as an important bias generator.

CONCLUSION

This article presents a well-structured and innovative approach to improving microsurgical training through the development of a scoring system that reduces bias. In authors' opinion, its methodological rigor, practical implications, and contributions to the field could make it a valuable addition to the literature on surgical education.



The newly developed SDL tool yielded measurements that exhibited a strong correlation with time and error values. These findings were instrumental in enhancing the precision of the procedure by circumventing simulator-associated bias. In light of this experience, the concepts of "regular variability assessment" and "pre-procedure warming up" were identified as meriting further investigation.

The findings mentioned have practical implications for surgical training programs, especially in resource-limited settings. By emphasizing the need for accessible and effective training methods, the study highlights the importance of improving surgical education globally.

Finally, the introduction of a "warming-up" phase before surgical procedures is a valuable recommendation. This practice could enhance skill retention and reduce errors, which is beneficial for both trainees and patients.

Future research should focus on the effectiveness of warming-up techniques, optimization of training duration, exploration of alternative training models, filling information gaps regarding simulators, and refining objective scoring systems. These lines of inquiry will not only enhance the training methodologies in microsurgery but also contribute to the broader field of surgical education.

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ADDITIONAL MATERIAL

Protocol raw data

ATTEMPT	ARTERY	ADVENT	SUTURE	total	sdl	error	placenta
3	0:12:56	0:03:23	0:19:19	0:35:38		1	3
4	0:16:42	0:14:19	0:12:32	0:43:33		2	4
5	0:06:48	0:09:22	0:15:01	0:31:11		0	5
6	0:08:04	0:10:48	0:32:05	0:50:57		0	5
7	0:10:19	0:07:32	0:31:05	0:48:56	-5	0	9
8	0:12:12	0:03:07	x		-5	5	9
9	0:11:30	0:10:46	0:24:18	0:46:34	-5	1	9
10	0:06:44	0:06:37	0:14:00	0:27:21	1	1	10
11	0:07:15	0:02:15	0:17:08	0:26:38	1	1	10
12	0:07:26	0:15:46	0:11:30	0:34:42	1	0	10
13	0:08:39	0:09:53	0:13:42	0:32:14	1	0	10
14	0:04:06	0:08:25	0:19:48	0:32:19	5	1	11
15	x				-5	5	12
16		x			-5	5	12
17	0:07:52	0:08:28	0:16:02	0:32:22	-5	0	12
18	x				-3	5	13
19	0:11:51	0:10:48	0:17:59	0:40:38	-3	2	13
20	0:06:06	0:09:33	0:17:19	0:32:58	-3	1	13
21	0:07:54	0:09:59	0:20:23	0:38:16	-2	6	14
22	0:07:24	0:06:43	0:17:00	0:31:07	-2	1	14
23	0:04:52	0:05:38	0:16:29	0:26:59	-2	1	14
24	0:10:48	0:07:53	0:10:46	0:29:27	-5	0	15
25	0:08:04	0:05:08	0:22:01	0:35:13	-5	1	15
26	0:08:03	0:04:33	0:15:57	0:28:33	-5	0	15
27	0:11:10	x				5	16
28	0:07:57	0:07:03	0:24:33	0:39:33	-5	2	16
29	0:06:24	0:07:40	0:22:00	0:36:04	-5	2	16
30	0:04:48	0:09:08	0:24:38	0:38:34	0	0	17
31	0:07:06	0:12:26	0:14:16	0:33:48	0	0	17
32	0:11:52	0:03:14	0:15:47	0:30:53	-1	1	18
33	0:13:11	0:02:11	0:19:10	0:34:32	-1	1	18
34	0:08:00	0:04:00	0:20:16	0:32:16	-1	0	18
35	0:08:34	0:05:02	0:16:28	0:30:04	1	1	19
36	0:08:01	0:07:38	0:12:56	0:28:35	1	1	19
37	0:04:13	0:08:16	0:20:00	0:32:29	-1	1	19
38	0:07:02	0:05:40	0:10:51	0:23:33	-1	2	19
39	0:06:35	x			-2	5	20

40	0:04:20	0:06:27	0:17:35	0:28:22	-2	1	20
41	0:03:23	0:02:50	0:18:47	0:25:00	-2	1	20
42	0:12:25	0:04:02	0:14:29	0:30:56	-2	1	20
43	0:07:12	0:10:19	0:13:58	0:31:29	2	1	21
44	0:04:58	0:04:16	0:18:06	0:27:20	2	0	21
45	0:07:38	0:06:05	0:17:17	0:31:00	-2	1	22
46	0:05:03	0:06:19	0:15:42	0:27:04	2	1	23
47	0:08:09	0:10:20	0:15:48	0:34:17	2	1	23
48	0:05:21	0:04:00	0:15:56	0:25:17	2	0	23
49	0:04:59	0:04:42	0:13:17	0:22:58	2	1	23
50	0:06:10	0:06:45	0:22:12	0:35:07	-1	2	24
51	0:07:53	0:03:10	0:22:23	0:33:26	-6	6	25
52	0:05:01	0:01:55	0:15:27	0:22:23	-6	2	25
53	0:07:02	0:04:44	0:16:49	0:28:35	4	1	26
54	0:03:16	0:03:03	0:16:11	0:22:30	4	0	26
55	0:06:20	0:03:14	0:12:57	0:22:31	4	0	26
56	0:05:01	0:04:37	0:12:49	0:22:27	4	0	26
57	0:05:56	0:08:26	0:18:17	0:32:39	-1	0	27
58	0:04:45	0:04:39	0:14:36	0:24:00	-1	0	27
59	0:06:44	0:06:16	0:10:43	0:23:43	-1	0	27
60	0:03:50	0:04:29	0:08:45	0:17:04	-6	6	28
61	0:04:13	0:03:33	0:20:49	0:28:35	-6	1	28
62	0:05:28	0:06:15	0:13:13	0:24:56	-2	1	29
63	0:04:41	0:02:47	0:13:18	0:20:46	-2	0	29
64	0:05:43	0:06:56	0:12:41	0:25:20	0	0	30
65	0:08:01	0:02:30	0:18:02	0:28:33	-5	1	31
66	0:06:06	0:04:16	0:10:06	0:20:28	-1	1	32
67	0:04:38	0:03:43	0:13:45	0:22:06	-1	0	32
68	0:04:26	0:04:13	0:15:35	0:24:14	-1	1	32
69	0:03:51	0:04:58	0:11:28	0:20:17	-1	0	32
70	0:03:40	0:06:51	0:10:30	0:21:01	-1	1	32
71	0:03:46	0:04:37	0:15:32	0:23:55	-2	1	33
72	0:03:09	0:09:09	0:11:17	0:23:35	0	0	34

NOTE : the letter 'x' appears for a procedure where the level of error met the exclusion criteria. Then, according to the given protocol, the sample was discarded as valid, but taken into account for an overall assessment of the quality and performance of the protocol.

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