THE CHEMISTRY OF MEDICINAL PLANTS: A LITTLE ABOUT SCIENCE AND CULTURE AT UFCG'S PET-CHEMISTRY

Liliane Santos Gomes[1], Jociele Cristine Alves Nogueira[2], Dyego dos Santos Souza[3] and José Carlos Oliveira Santos[4]

ABSTRACT

The text discusses the lack of motivation of high school students in relation to Chemistry, highlighting the importance of methodologies that connect teaching to everyday life, especially through the use of medicinal plants. The objective is to arouse students' interest in the discipline, integrating science and culture.

Keywords: Chemistry, Medicinal plants.

INTRODUCTION

The lack of interest and aversion of high school students in the discipline of Chemistry are common and multifaceted phenomena. Many of the reasons for this are interconnected and reflect structural problems in the education system, such as abstract and theoretical approach, traditional teaching methods, and lack of infrastructure and resources (Figaro et al., 2022). In recent decades, the teaching of Chemistry has adopted new approaches with the aim of minimizing the gap left by the traditional teaching model, which still prioritizes information disconnected from the reality of students and teachers (Silva et al., 2016).

High school students' learning of chemistry requires them to comprehensively and integrate the chemical transformations that occur in the physical world. This allows them to judge information from cultural tradition, the media and the school itself, as well as to make decisions autonomously as individuals and citizens. Several Chemistry teaching methodologies have been used to draw students' attention, arouse their interest, connect the contents of the discipline to everyday life, and demonstrate the importance and applicability of knowledge in Chemistry (Silva, 2019).

[1]PET Chemistry Group, UFCG - Paraíba
[2]PET Chemistry Group, UFCG - Paraíba
[3]PET Chemistry Group, UFCG - Paraíba
[4]PET Chemistry Group, Full Professor, UFCG - Paraíba

Chemistry is a science dedicated to the study of the transformations that result in the creation of new materials. However, it is widely visible that many students perceive the discipline of Chemistry as complex and challenging. This negative perception is probably due to the way the subject is approached in class, where the mechanical memorization of terms, formulas, and problem solving is often emphasized, often without proper contextualization. This teaching method, focused more on repetition and less on deep understanding, can make learning uninteresting and disconnected from the practical reality of students, contributing to the difficulty in understanding and appreciating the true value and application of Chemistry in everyday life. (Cardoso; Colinvaux, 1999).

When the student is unable to create a connection between the content taught and its practical application in everyday life, he tends to classify Chemistry as a difficult discipline to be understood. Bernardelli (2004) argues that the teacher must act as a facilitator of learning to transform this negative perception. To achieve this goal, it is essential that he associates the chemical content with the basic needs of the human being, such as food, clothing, housing, transportation and other aspects in which chemical concepts are present and are fundamental. In this way, teaching becomes more meaningful and relevant to the student.

Ausubel's Theory of Meaningful Learning proposes that, for learning to happen effectively, two essential conditions are necessary. First, it is essential that the student is motivated and willing to learn, because, otherwise, learning tends to be mechanical and limited to mere memorization, resulting in a superficial and temporary understanding. Secondly, it is essential that the content presented is potentially relevant and meaningful to the student. This allows the student to integrate and relate the new knowledge with previous experiences and knowledge. (PELIZZARI et al., 2002).

In Brazil, the use of medicinal plants dates back to the period before colonization, being widely practiced by indigenous peoples. When the first European settlers landed in Brazil, they came across a vast diversity of plants with healing properties that were routinely used by native tribes. Faced with the scarcity of conventional medicines, Europeans began to adopt these herbal practices to treat various ailments. Currently, Brazilian folk medicine has aroused growing interest among scientists and researchers, who see in this traditional knowledge a rich source of new active ingredients and potential therapeutic discoveries. (Lorenzi; Matos, 2008).

Human society incorporates within itself a series of data about the environment in which it lives, which allows it to interact directly with the environment, thus meeting its survival needs. This set includes knowledge about the plant kingdom with which these

communities maintain contact. Thus, the search and use of plants with medicinal properties is a practice transmitted from generation to generation, described in order to preserve this ancient tradition and attested in several phytotherapy treatises. (Corrêa Junior, 1991).

Rodrigues et al. (2011) highlight that it is essential to value students' pre-existing knowledge about medicinal plants, because from this starting point, it is possible to deepen the exploration of their chemical composition, as well as the organic functions that integrate them. Valuing students' prior knowledge not only enriches the teaching-learning process, but also facilitates the contextualization and practical application of the content covered, promoting a more meaningful and relevant engagement in the analysis of the chemical and functional properties of medicinal plants.

OBJECTIVE

The objective of this work is to present the theme "The Chemistry of Medicinal Plants: A Little about Science and Culture" in high schools and to arouse the interest of students in Chemistry, showing the relevance of this science in everyday life. This activity aims to connect chemical knowledge with the culture and tradition of the use of medicinal plants, demonstrating how Chemistry explains the processes and benefits of these plants. In addition, it seeks to encourage integrated and critical understanding, empowering students to make informed decisions.

METHODOLOGY

The extension activity was taught in May 2024 by undergraduate students of the Chemistry Degree Course, specifically, students from the PET-Chemistry group at the Federal University of Campina Grande, located in Cuité, Paraíba. This study focuses on the application of contextualized themes during Chemistry classes in high school classes. The main objective of the lecture was to introduce the theme "The Chemistry of medicinal plants: a little about science and culture" highlighting the relationship between chemical science and the daily life of students enrolled in the educational institutions ECI EEM Prefeito Severino Pereira Gomes, located in Baraúna, Paraíba and Felipe Tiago Gomes State School, located in Picuí, Paraiba.

Interdisciplinarity was used as an educational approach to carry out this activity. This strategy was chosen to promote a deeper understanding of the topics covered, allowing students to perceive the connection between the concepts of Chemistry and real problems in the world. As Cardoso et al. (2017) point out, the knowledge acquired through interdisciplinarity offers a complete and integrated understanding of reality. Instead of

learning in a fragmented and isolated way, students are encouraged to see the connections between different areas of knowledge. This allows for a broader and interconnected view of the world, where phenomena and problems are understood in their entirety, considering multiple perspectives and dimensions.

This approach sought not only to transmit theoretical knowledge, but also to arouse the interest and curiosity of students, encouraging them to question and investigate the way medicinal plants are used and industrialized today. In addition, the use of interdisciplinarity as a pedagogical tool allowed for more dynamic and interactive learning, favoring the active participation of students and the development of critical and analytical skills.

To evaluate the lecture, a quantitative research was carried out through a questionnaire containing ten questions, which aimed to assess the level of satisfaction of the students who participated in the activity and the understanding of the functioning of medicinal plants, in addition to analyzing their previous knowledge in relation to the contents presented. This type of research is widely used for its ability to provide objective and generalizable results, through statistical techniques to analyze data and formulate conclusions.

DEVELOPMENT

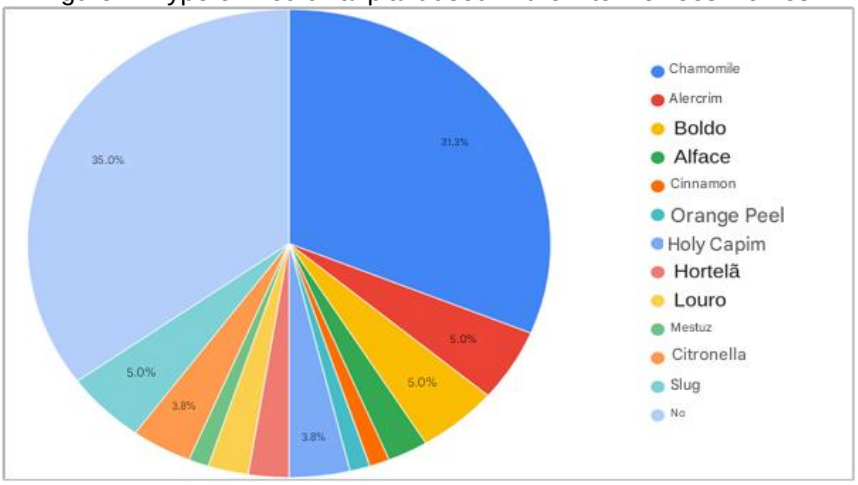
According to Melo et al. (2016), the use of medicinal plants as a didactic resource in the teaching of chemistry offers an innovative and contextualized approach, connecting the theoretical contents to the students' reality. Through the exploration of the active principles of plants, it is possible to illustrate complex chemical concepts in a more accessible and practical way. This method not only facilitates the understanding of chemical reactions, but also arouses the interest of students by showing the application of chemistry in everyday life, from the preparation of a cup of tea to laboratory experiments. Thus, the teaching of chemistry becomes more meaningful and relevant, promoting integrated and critical learning.

The first question of the questionnaire applied at the end of the lecture presented as an extension activity, "Is any type of medicinal plant used in your home?" aims to investigate the familiarity and use of medicinal plants by students and their families. This question is fundamental to understand the cultural context and daily life of students in relation to the use of natural treatments. The answer to this question provides insights into the prevalence and importance of medicinal plants in participants' daily lives, allowing for a richer analysis of how chemical knowledge of these plants can be relevant and applied in their family routines (Figure 1). The data collected can reveal not only the frequency of use,

but also the diversity of medicinal plants used, enriching the understanding of traditional practices and their integration with scientific education.

The results obtained indicate that 35% of the participants stated that they do not use medicinal plants in their homes. Among those who answered affirmatively, chamomile was the most mentioned plant, with 31.3%, standing out as the most popular due to its calming and digestive properties. Other medicinal plants cited include rosemary, boldo and aloe, each with 5% of the responses, evidencing their common use for purposes such as improving digestion and skin care. Plants such as lemongrass and lemon balm were mentioned 3.8%, while mint and bay leaf appeared 2.5% each, and lettuce, cinnamon, orange peel and mastruz were mentioned 1.3% each. These data reflect a diversity of practices related to the use of medicinal plants among the participants, although a significant portion did not use them.

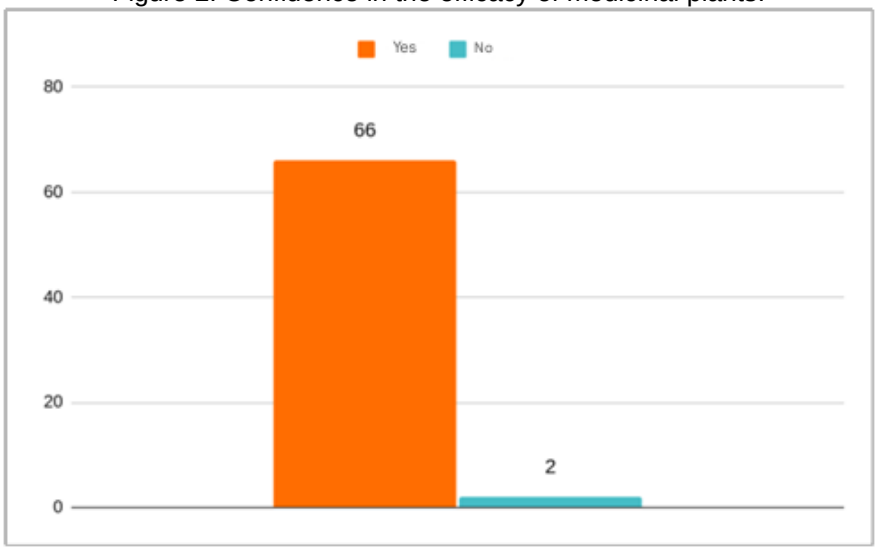
Figure 1. Type of medicinal plant used in the interviewees' homes.



Source: Survey data, 2024.

The second question of the questionnaire, "Do you trust the efficacy of medicinal plants?", seeks to understand the students' perception of the reliability and effectiveness of natural treatments. The answers to this question assess the level of confidence in medicinal plants as an alternative or complement to conventional medicines for these students (Figure 2). The data collected reveal the influence of cultural, familial and educational factors on beliefs about the efficacy of these plants. Analyzing these responses will allow us to identify trends and potential knowledge gaps, enabling educational approaches that integrate science and tradition in a balanced and informed way.

Figure 2. Confidence in the efficacy of medicinal plants.

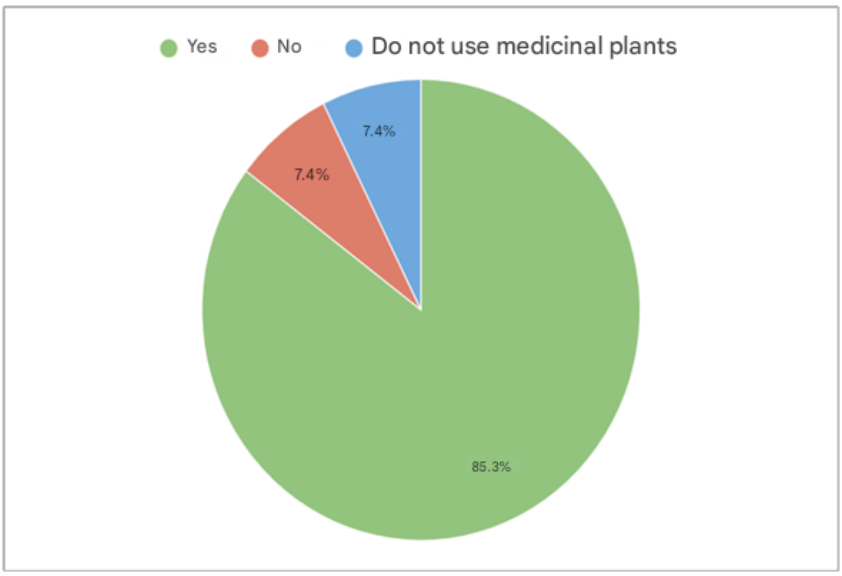


Source: Survey data, 2024.

The vast majority of participants, 66 of them, trust the effectiveness of these plants, while only 2 answered negatively. These data indicate a high confidence in the healing properties of medicinal plants among students, possibly reflecting the influence of family and cultural traditions, as well as a positive perception of natural medicine. In addition, the confidence expressed by the majority suggests that medicinal plants are valued as an alternative or complement to conventional treatments, highlighting the importance of integrating this traditional knowledge into the teaching of Chemistry to make it more relevant and connected to the students' reality.

The third question of the questionnaire (Figure 3), "Have you or someone you know ever had positive experiences using medicinal plants to treat diseases or health problems?", aims to investigate the incidence of successful experiences with the use of medicinal plants among students and their social networks. The answers to this question are crucial to understanding the extent and impact of natural medicine practices on the lives of participants. In addition, this information can be used to enrich the teaching of Chemistry, showing the practical application and real benefits of medicinal plants. By integrating this knowledge with the scientific curriculum, it is possible to make learning more relevant and meaningful for students, connecting theory to everyday practice and promoting a more holistic and contextualized education.

Figure 3. Knowledge of positive experiences when using medicinal plants to treat diseases or health problems.

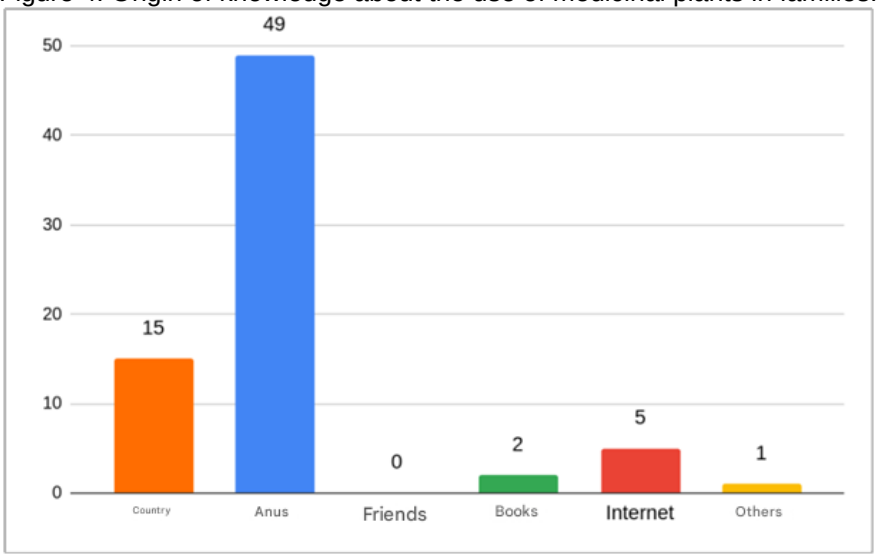


Source: Survey data, 2024.

The results indicate that a large majority of the participants, 85.3% of them, reported positive experiences with the use of medicinal plants. In contrast, 7.4% answered negatively, and another 7.4% indicated that they did not use medicinal plants. These data show that the practice of using medicinal plants is widely disseminated and valued among students and their social networks, reflecting the perceived effectiveness and real benefits of these natural treatments. The high incidence of affirmative responses suggests that medicinal plants play a significant role in health management for many, reinforcing the importance of integrating this traditional knowledge into the school curriculum. On the other hand, the presence of negative responses and non-use also highlights the need to address the efficacy and limitations of medicinal plants in a balanced and informed manner, providing students with a comprehensive understanding that includes both the benefits and limitations of these practices.

The following question, "Where did the knowledge about the use of medicinal plants in your family come from?", aims to identify the sources of knowledge that influence the practices of using medicinal plants among students and their families. This question is essential to understand how information about medicinal plants is transmitted and preserved over time. Possible answers may include family traditions, counseling from friends, referrals from health professionals, independent research, or even school teaching. By analyzing these responses, it is possible to map the main ways of disseminating this knowledge, valuing popular wisdom and cultural practices that contribute to the use of these plants (Figure 4).

Figure 4. Origin of knowledge about the use of medicinal plants in families.



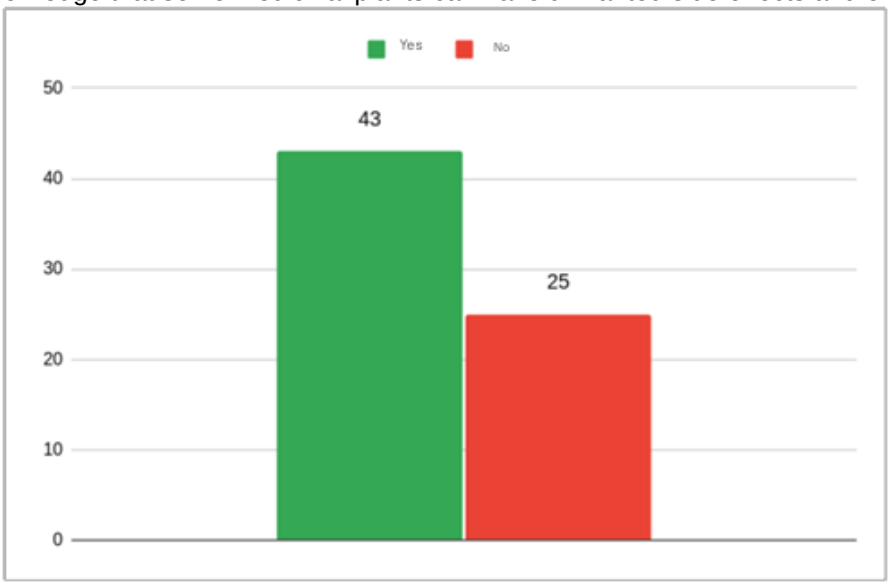
Source: Survey data, 2024.

Understanding the origins of this knowledge can also help integrate these practices into formal teaching, contextualizing scientific learning and making it more meaningful. In addition, recognizing the influence of different sources of knowledge can promote a more inclusive and respectful dialogue between science and tradition, enriching the cultural and educational repertoire of students. The results obtained for the question "Where did the knowledge about the use of medicinal plants in your family come from?" reveal that most students acquired this knowledge mainly through their grandparents, with 49 answers indicating this source. Next, 15 participants mentioned that they learned about the use of medicinal plants from their parents. The internet was mentioned by 5 students, while books were mentioned by 2, and only 1 person indicated other sources. No student mentioned friends as a source of knowledge. These data highlight the strong influence of the older generations in the transmission of knowledge about medicinal plants, underlining the importance of family traditions and ancestral wisdom in this context. The presence of the internet as an emerging source also suggests a gradual shift in the ways of acquiring knowledge, although still less prevalent compared to familiar sources.

The fifth question of the questionnaire, "Did you know that some medicinal plants can have unwanted side effects and even be toxic?", seeks to assess the students' level of knowledge about the potential risks associated with the use of medicinal plants. This question is crucial to understand if students are aware that, despite the benefits, some plants can cause adverse effects or toxicity if used inappropriately. Recognizing that medicinal plants are not risk-free is key to promoting a safe and informed use of these natural resources. Awareness of side effects and toxicity can prevent health problems and encourage the search for appropriate guidance when using plants for medicinal purposes.

The results of this question, illustrated in Figure 5, will reveal the need for a more comprehensive and balanced education, which includes both the benefits and risks of medicinal plants.

Figure 5. Knowledge that some medicinal plants can have unwanted side effects and even be toxic.



Source: Survey data, 2024.

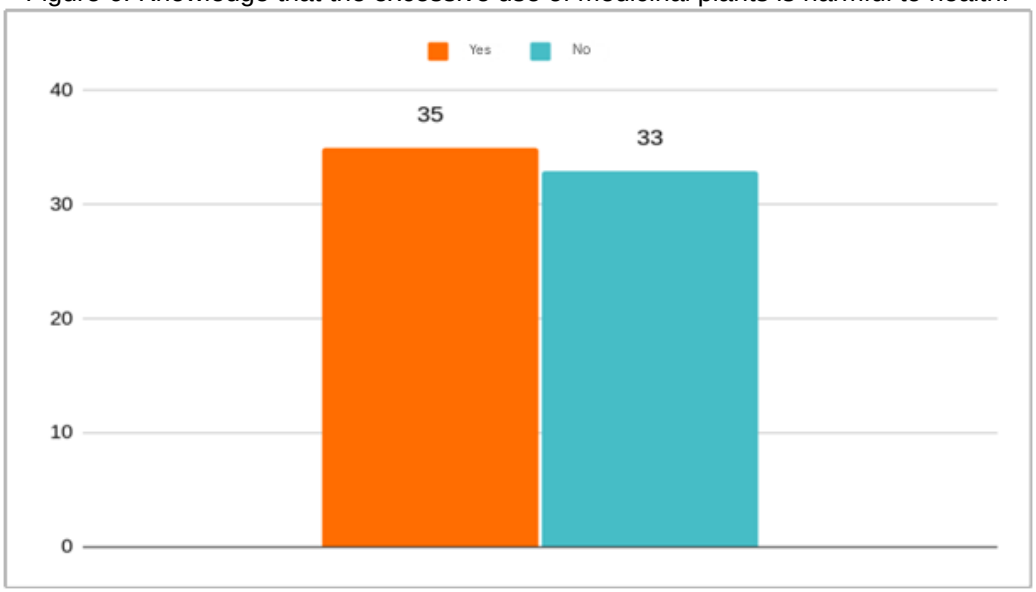
The results show that 43 students are aware of the potential risks, while 25 are unaware of these adverse effects. This significant contrast reveals that, although a majority is informed about the possible dangers of medicinal plants, a considerable portion still ignores these risks. This knowledge gap can lead to the inappropriate use of medicinal plants, increasing the possibility of unwanted side effects and poisoning. Therefore, it is essential that teaching about medicinal plants addresses not only the benefits, but also the possible risks, promoting a balanced and thorough education. This includes the need to instruct students on the importance of consulting with reliable sources and healthcare professionals before utilizing medicinal plants for treatment. This preventive approach can contribute to the safe and effective use of medicinal plants, protecting the health of students and their families.

The sixth question of the questionnaire, "Were you aware that the excessive use of medicinal plants was harmful to health?", seeks to assess the students' knowledge about the risks associated with the excessive use of medicinal plants. This question is fundamental to understand whether students are aware that even plants with therapeutic properties can cause damage to health when used in inadequate quantities (Figure 6).

Understanding safe consumption limits is crucial to avoid adverse effects and intoxication. Raising awareness about the dangers of overuse of medicinal plants helps to promote safer and more responsible practices, encouraging students to seek appropriate

guidance and to use these plants sparingly. The results of this question reveal the need for a more comprehensive education on the safe use of medicinal plants, balancing knowledge about their benefits and risks. This prepares students to make informed decisions while protecting their health and well-being.

Figure 6. Knowledge that the excessive use of medicinal plants is harmful to health.



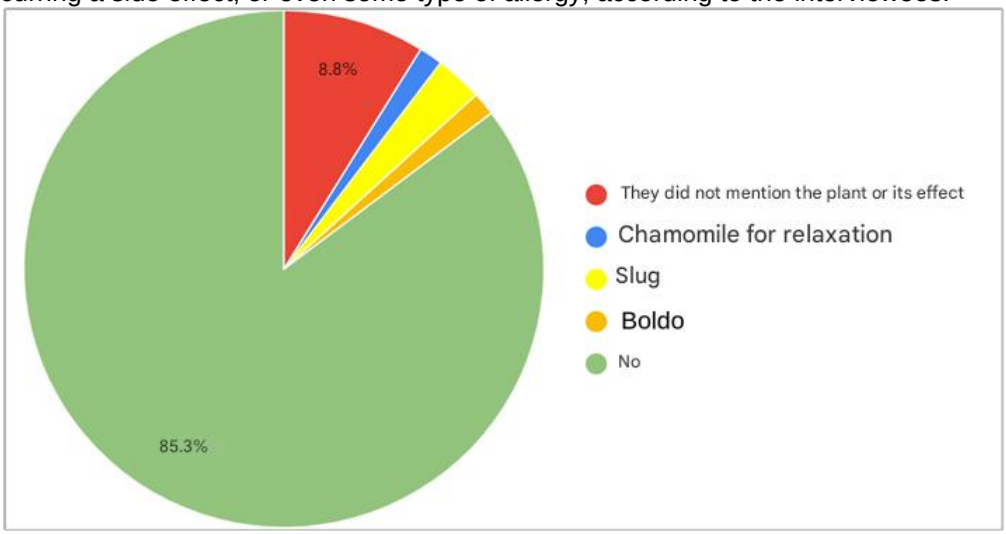
Source: Survey data, 2024.

The results indicate an almost even split among participants: 35 students answered yes, while 33 were not aware of these risks. This distribution reveals a significant gap in knowledge about the dangers of overuse of medicinal plants. While a slight majority recognize the potential risks, the nearly half of students who are unaware of this information represent an important concern. This lack of awareness can lead to inappropriate and potentially dangerous use of these plants. Therefore, it is crucial that the educational curriculum includes detailed information on safe consumption limits and the possible adverse effects of excessive use of medicinal plants. By promoting a deeper and more balanced understanding of the use of these plants, we can protect students' health and foster a more informed and safer approach to natural medicine.

The seventh question of the questionnaire, "Have you ever used a medicinal plant or medicine derived from it with the expectation of a specific effect and a side effect or even some type of allergy ended up occurring?", aims to identify the incidence of adverse experiences among students when using medicinal plants or their derivatives (Figure 7). This question is crucial to understanding the extent of side effects and allergic reactions that can arise from the use of these products. Additionally, they will help map the frequency and nature of unwanted effects, highlighting the importance of an informed and cautious

approach when utilizing medicinal plants. Reports of side effects and allergies reinforce the need to raise awareness about the potential risks and the importance of consulting with health professionals before starting any treatment with medicinal plants. This data is essential to promote a more complete and responsible education about the safe use of these plants, balancing knowledge of the benefits with awareness of the possible risks.

Figure 7. Use of a medicinal plant or medicine derived from it with the expectation of a specific effect and ended up occurring a side effect, or even some type of allergy, according to the interviewees.



Source: Survey data, 2024.

The results of the question show that 85.3% of the students did not have adverse experiences, indicating a mostly safe use of medicinal plants among the majority. However, 8.8% of participants reported side effects without mentioning the specific plant or expected effect, smaller portions of students mentioned the use of chamomile for relaxation with adverse results, reported problems with aloe vera, and negative reactions when using boldo. These reports of side effects, although fewer in number, highlight that even medicinal plants commonly considered safe can cause adverse reactions in some individuals. These data underscore the importance of consulting with healthcare professionals and conducting research on potential side effects before use.

The eighth question of the questionnaire, "Had your school already presented educational actions about the use of medicinal plants?", seeks to assess whether students have already been exposed to educational programs or activities about medicinal plants in the school environment. This question is important to understand the role of schools in disseminating knowledge about the safe and effective use of these plants. The answers to this question help to identify if there is an integration of this theme in the school curriculum and if students are receiving sufficient and appropriate information about medicinal plants. Incorporating this topic into the school environment can promote a greater understanding of

the benefits and risks associated with the use of medicinal plants, preparing students to make informed and safe choices. In addition, these educational actions can contribute to valuing traditional knowledge and connecting it to scientific learning, enriching the education of students in a holistic and contextualized way. The results show that only 19 students stated that their school had already promoted this type of activity, while 49 students responded negatively. These numbers indicate that most of the schools represented by the participants do not include educational actions on medicinal plants in their curricula. This gap reveals an opportunity for educational institutions to enrich students' education by incorporating the study of medicinal plants and their uses in the context of disciplines such as Chemistry and Biology. By integrating this theme, schools can provide students with more comprehensive and practical knowledge that not only values traditional wisdom but also promotes a safe and informed use of these plants. The lack of formal education about medicinal plants may also explain why some students are unaware of the potential risks and side effects associated with inappropriate use of these plants.

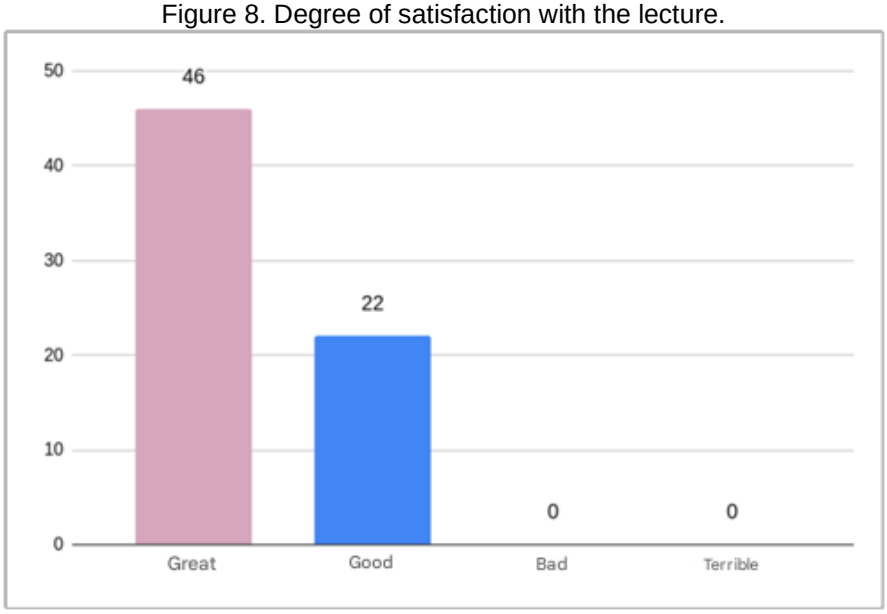
The ninth question of the questionnaire, "In your opinion, did the lecture held today help you better understand the functioning of medicinal plants?", seeks to evaluate the effectiveness of the lecture in increasing students' knowledge about medicinal plants. This question is crucial to measure the educational impact of the activity and to understand whether the objectives of providing detailed and relevant information on the use and effects of medicinal plants have been achieved. The answers to this question will provide insights into the clarity, relevance, and usefulness of the information presented during the lecture. This evaluation helps to ensure that educational efforts are effective, promoting a deeper and more practical understanding of the safe and beneficial use of medicinal plants. The results show that 84.5% of the students responded positively, while only 15.5% stated that the lecture did not help them. These figures indicate that the vast majority found significant educational value in the lecture, suggesting that it was effective in increasing knowledge and understanding about medicinal plants. The high rate of positive responses underscores the importance of such educational initiatives, demonstrating that well-structured and informative lectures can play a crucial role in the formation of students. However, the 15.5% negative responses also point to the need for continuous evaluation and improvement of pedagogical approaches, ensuring that all students can benefit fully. Adjustments to the content, teaching methodology, or interaction with students may be necessary to increase the effectiveness of these lectures and reach an even larger audience.

The tenth question of the questionnaire, "What is your degree of satisfaction with the lecture?", aims to measure the general satisfaction of the students with the lecture given on

the use of medicinal plants. This question is important to evaluate the quality and effectiveness of the presentation, as well as the receptivity of the students to the content covered. In addition to providing a clear vision about the impact of the lecture, highlighting positive aspects and areas that can be improved. Student satisfaction is a crucial indicator of educational success, as it reflects the engagement, relevance, and clarity of the information conveyed.

Understanding the degree of student satisfaction helps to adjust future presentations to better meet their needs and expectations, ensuring that similar educational initiatives are increasingly effective and impactful. In addition, positive feedback can encourage the continuity and expansion of educational programs on medicinal plants, contributing to the formation of students who are more informed and aware of the safe and beneficial use of these plants.

Figure 8. Degree of satisfaction with the lecture.



Source: Survey data, 2024.

The results of the question show an extremely positive reception: 46 students rated the lecture as "Excellent" and 22 as "Good", while no answer indicated "Bad" or "Very Bad". These data indicate a high level of satisfaction among the participants, suggesting that the lecture was well structured, informative, and relevant to the students. The results encourage the continuation of similar initiatives, and may even serve as a model for other educational activities.

FINAL CONSIDERATIONS

In view of the data and information collected, it was possible to conclude that the extension activity carried out proved to be an effective strategy to bring scientific knowledge closer to the daily reality of high school students; because the interdisciplinary approach allowed a significant integration between Chemistry and other areas of knowledge, facilitating the understanding of the topics covered and promoting a more complete and contextualized learning.

The lecture on "The Chemistry of medicinal plants: a little about science and culture" managed not only to transmit theoretical content, but also to engage students by relating science to cultural and practical aspects of daily life. This teaching format, which values students' prior knowledge and encourages active participation, proved to be essential to arouse the interest and curiosity of students, encouraging them to investigate and reflect on the application of medicinal plants. The results of the quantitative research, carried out to assess the students' perception of the lecture, indicated a high level of satisfaction and a broader understanding of the use of medicinal plants. In addition, the analysis of students' prior knowledge evidenced the importance of considering their experiences and prior knowledge as a starting point for teaching, reinforcing the relevance of pedagogical practices that connect theory to practice in a dynamic and meaningful way.

Thus, the activity not only achieved its purpose of presenting and contextualizing the theme of medicinal plants within the discipline of Chemistry, but also highlighted the importance of an interdisciplinary approach in the teaching process. This methodology enables students to create connections between different areas of knowledge and to apply this knowledge in a practical and relevant way in their lives.

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