



CHEMISTRY, HEALTH AND CITIZENSHIP: AN EXTENSION ACTIVITY FOCUSING ON THE HARM CAUSED BY THE USE OF ELECTRONIC CIGARETTES

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ABSTRACT

The habit of smoking is associated with several diseases, regardless of the type of cigarette used. However, electronic cigarettes do not have specific legislation that controls the amount and types of substances present in their composition. Given the increasing use of e-cigarettes, it is essential to make users aware of the dangers that these devices pose to health. This role of awareness should be widely worked on in schools and educational institutions, whether through lectures, classes or conversation circles. Considering that young people are the main ones affected by the use of electronic cigarettes, this study aimed to address this theme through a lecture held by the PET-Chemistry group of the Federal University of Campina Grande. The lecture, held at an Integral State School, dealt with the inconsequential use of electronic cigarettes and the dangers they pose to health.

Keywords: Health, Chemistry Teaching, High School.

INTRODUCTION

The use of psychoactive substances has always been present in history, whether for medicinal or religious purposes, or simply to satisfy the pleasures of users. A practice widely used to absorb these substances is the habit of smoking, which allows the absorption of components such as nicotine. Historically, this practice is linked to the religious cultures of the peoples of Central and South America (Cardoso et al., 2021). Later, the habit of smoking became popular in Europe, leading to the emergence of cigarettes, which, in the twentieth century, were already marketed worldwide. Currently, the habit of smoking is intriguingly popular among society, even though it has been proven that the psychoactive substances present in cigarettes are harmful to the smoker's health (Carvalho et al., 2023). Regardless of this fact, what is worrying is the number of young people who already use or have had some direct contact with traditional and electronic cigarettes, the

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electronic ones being popularly known as "vape" which is widely consumed by the young public and adults, who believe it to be a safer option than combustion cigarettes, however studies already point out that the development of diseases is directly linked to these devices, (Caldas et al., 2023).

E-cigarettes, also known as "pods," have become popular among young people and adults alike due to their visual appeal and the idea of being a less harmful alternative to traditional cigarettes. Initially, it was believed that these devices would be less harmful to health, which contributed to their rapid rise and acceptance, making them a fad among young people (Leite et al., 2023).

The habit of smoking is associated with several diseases, regardless of the type of cigarette used. However, electronic cigarettes do not have specific legislation that controls the amount and types of substances present in their composition. The composition and concentration of the substances in e-cigarettes are largely unknown, which can lead to faster disease development. In addition to cancer, another disease caused by inhaling e-cigarette smoke is EVALI (Correa et al., 2023). E-Cigarette Use-Associated Lung Injury, known as EVALI, has emerged as a significant public health concern in recent years, primarily due to the severe respiratory problems linked to the use of vaping devices. In 2019, EVALI gained prominence after the increase in cases reported in the United States and other countries. This condition involves severe respiratory symptoms such as persistent coughing, difficulty breathing, chest pain, fever, as well as gastrointestinal symptoms such as vomiting and diarrhea in some cases. One of the main points of attention in relation to this disease is the use of products containing tetrahydrocannabinol (THC), the psychoactive component of marijuana, in addition to other additives, such as vitamin E acetate, which are often mixed with liquids used in electronic cigarettes. Most of the documented cases involved the use of products that contained THC, especially those obtained from unregulated sources. Although the exact connection between the use of vaporizers and the emergence of EVALI is not yet completely understood, health authorities have issued recommendations to minimize the risks. In response, several countries and states have implemented stricter regulations on the marketing and use of vaporizers, with special attention to those containing THC or other additives that may be harmful.

E-cigarettes are devices that work like vaporizers, heating a mixture of liquid compounds, often called "essence." When this essence is vaporized, the user inhales the vapor, allowing substances such as nicotine, flavorings, and solvents, such as propylene glycol, to enter the bloodstream. In addition to these components, studies point to the presence of other materials, such as lead, rubber, aluminum, iron, and carbon, in the vapor



generated by these devices (Carrijo et al., 2023). The harm caused by the use of electronic cigarettes is already a reality, the cases of developed diseases are enormous, and yet many young people ignore the consequences and use "vape", even nationally known artists have had their health affected because of the excessive use of electronic cigarettes.

Given the increasing use of e-cigarettes, it is essential to make users aware of the dangers that these devices pose to health. This role of awareness should be widely worked on in schools and educational institutions, whether through lectures, classes or conversation circles. According to De Araújo et al. (2023), conversation circles are an effective way to address this topic with elementary school students. When dealing with everyday issues, the message becomes more impactful and is more easily absorbed by students. Awareness activities are key to reducing the number of young people who use e-cigarettes. By addressing health-related topics, these activities can be carried out in various institutions, aiming to raise awareness not only among young people, but also among the general public.

Considering that young people are the main ones affected by the use of electronic cigarettes, this study aimed to address this theme through lectures held by the PET-Chemistry group of the Federal University of Campina Grande - Cuité, held at the State School Cidadã Integral Técnica Jornalista José Itamar da Rocha Cândido, in Cuité - PB. Therefore, lectures that address this topic have the potential to raise awareness among students in schools and prevent the increase in the number of adolescents who come into contact with electronic cigarettes or other products containing psychoactive substances, which can irreversibly affect health in some cases. In this way, it contributes to the formation of more aware young adults, with greater critical and reflective capacity about life and health.

METHODOLOGY

The lecture was promoted by students belonging to the PET-Chemistry group of the Education and Health Center of the Federal University of Campina Grande, located in the municipality of Cuité-PB. The present study is an integrative review of the literature on the effects of electronic cigarettes, developed in the form of a lecture accompanied by a form, with the objective of making students aware of the harms of the use of this device and measuring contact with electronic cigarettes.

The intervention was carried out at the Journalist José Itamar da Rocha Cândido Technical Integral Citizen School (Figure 1), in May 2024 in the municipality of Cuité-PB, with the purpose of informing and raising awareness among students about the negative

effects of electronic cigarettes, based on scientific evidence, in addition to demystifying myths and misperceptions about their use. The main focus was to promote students' awareness of health risks, with an emphasis on prevention.

Figure 1. Execution of the lecture at school.



Source: Survey data, (2024).

To increase the visibility of the lectures, Instagram was used as a dissemination tool. The communication strategy was conducted through the official profile of the PET-Chemistry group, ensuring an efficient approach to reach and involve the target audience, as can be seen in Figure 2.

Figure 2. Information posters about the lecture that took place at the school.



Source: Survey data, (2024).

For the construction of the lecture, a bibliographic survey was carried out on the impact of electronic cigarettes on human health and the environment, the different types of cigarettes and their consequences, in addition to the relationship between education and awareness about the harm to health.



The lecture began with an introduction explaining what e-cigarettes are and how they work. Then, the substances present in these devices were discussed, in addition to the presentation of the objectives of the activity. We cover the different types of electronic smoking devices, highlighting the 1st, 2nd and 3rd generations. We also discussed the cases of explosion of these devices and exposed the main adverse effects of e-cigarettes, including respiratory, cardiovascular, and neurological impacts. A comparison was also made between the effects of electronic cigarettes and traditional cigarettes, in addition to a discussion about studies that relate the use of electronic cigarettes to mental health. At the end, a space for debate was opened, allowing students to share their opinions and questions on the topic. The interest shown in the theme is evident, with the active participation of those present, who asked numerous questions and showed great curiosity throughout the lecture. At the end, there was one topic in particular that aroused special attention among the ears.

After the conclusion of the lecture, a questionnaire was applied to assess the level of knowledge of the students on the subject. The objective of this questionnaire was to obtain a survey of information about the age group of the class, the level of contact and the students' conceptions regarding the theme, and what opinions they would have about the use of electronic cigarettes and their harm to health.

It should be noted that the lecture and the application of the questionnaire were held in an auditorium of the school, with the presence of the teachers responsible for the classes.

RESULTS AND DISCUSSION

A lecture was held at the Journalist José Itamar da Rocha Cândido Technical Integral Citizen State School (ECIT), aimed at young people between the ages of 13 and 20, regardless of smoking history. The event was attended by 86 students of various genders, 38.4% men, 60.5% women and 2.3% preferred not to identify themselves. The questionnaire began with the age of the listeners, where most of the students were 17 years old, the rest present in the auditorium ranged from 13 to 20 years old, with the percentages being somewhat approximate.

We can see the importance of addressing a topic like this, especially when considering the current generation, where the use of these devices, such as electronic cigarettes, has become common among young people. These products are increasingly present in the daily lives of adolescents, being promoted in various spaces, which makes it essential to discuss the risks and implications of this behavior for health.



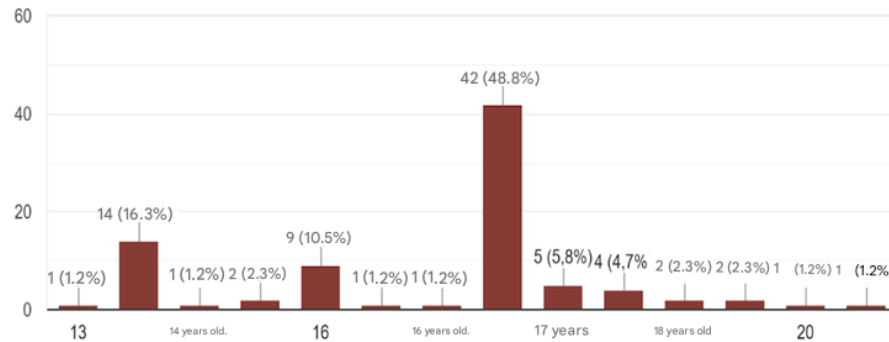
In Brazil, the use of electronic cigarettes has become increasingly common, both among smokers and non-smokers. Even people who have never used conventional cigarettes are being attracted to this electronic universe, reflecting a worrying trend of increased consumption of these devices. Quitting smoking is challenging, mainly due to the dependence caused by the nicotine present in cigarettes. In response to this challenge, alternatives have emerged designed to reduce the number of cigarettes consumed daily or even aid in complete smoking cessation. One of these innovations is the electronic cigarette, also known as vape, vaping, pod, juul, cigarettes, pens or pen drive (Bertoni; Szklo, 2021). According to the authors, this technology emerged recently, around the beginning of the twenty-first century, on the Asian continent. In 2015, the use of electronic cigarettes among residents of Brazilian capitals had a prevalence of 0.43% in the age group of 12 to 65 years, representing about 650 thousand people. However, when analyzing specifically the group aged 12 to 24 years, the prevalence was 0.71%, which shows a more accentuated use of this device among young people in Brazil.

According to Barufaldi et al. (2021), the use of electronic cigarettes presents a high risk of smoking initiation, affecting both adults and young people under 18 years of age. In addition, adolescents and young adults who use nicotine-containing e-cigarettes are more likely to develop nicotine addiction. This dependence may increase the likelihood of these individuals trying conventional cigarettes and other forms of inhaled nicotine.

After the lecture, a short questionnaire was applied in order to ascertain the level of perspective on the topic that was discussed, obtaining important information about their opinions, critical and reflective point of view. The results of the questions were plotted on graphs obtaining a better understanding of their answers.

Graph 1 shows the average age range of the school's students, which is between 16 and 17 years old, that of those who participated and were present at the lecture given, which had a total of 86 students, along with teachers, and school employees, the questionnaire was intended only for students present at the time.

Graph 1. Age of the interviewees.



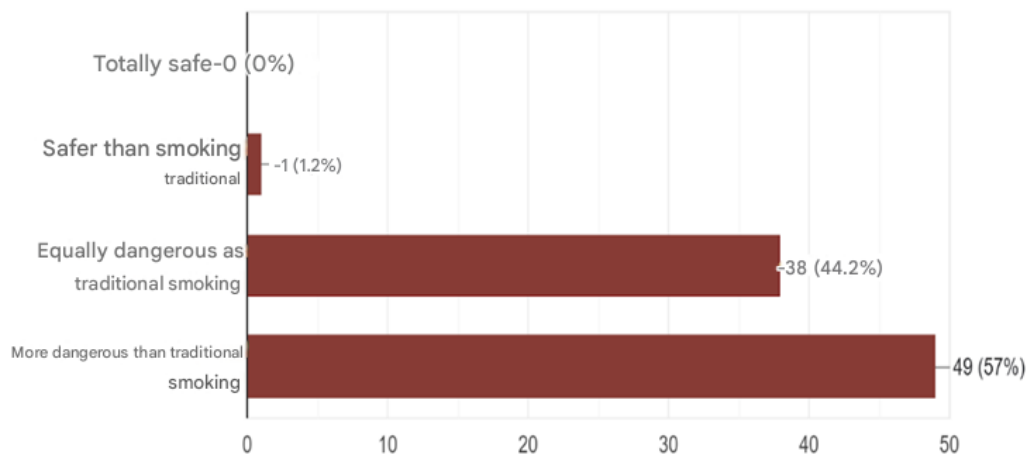
Source: Survey data, (2024).

The distribution of people according to gender identification was also analyzed, with the objective of observing whether the use of cigarettes can affect one gender more than another. The graph reveals that most of the students present were women, representing 60.5% of the total. Next were men, with 38.4%, while a minority of 2.3% preferred not to identify with any gender. The electronic cigarette is particularly attractive to young people due to its flashy designs and flavorful essences, which produce an aromatized smoke. In addition, it does not cause bad breath or generate ash (Barrabas et al., 2021). The prevalence of the use of these devices is higher among men, individuals who abuse alcohol, and people with 9 or more years of schooling (Bertoni; Szklo, 2021). There is also an increase in the consumption of these devices by women, exclusively those who have never used industrialized cigarettes.

Graph 2 shows the percentage of answers to the question focused on students' opinions about electronic cigarettes. The topic was widely discussed among students, professors and colleagues, generating debates rich in personal development and critical reflection. After the lecture, the majority of students, 57%, considered that electronic cigarettes are more dangerous than traditional cigarettes. Another 44.2% believe that e-cigarettes are equally dangerous to smoking, while only 1.2% of students believe that e-cigarettes are safer than traditional cigarettes. This demonstrates that young people have varied and, in some cases, still somewhat uncertain opinions about the danger of e-cigarettes.



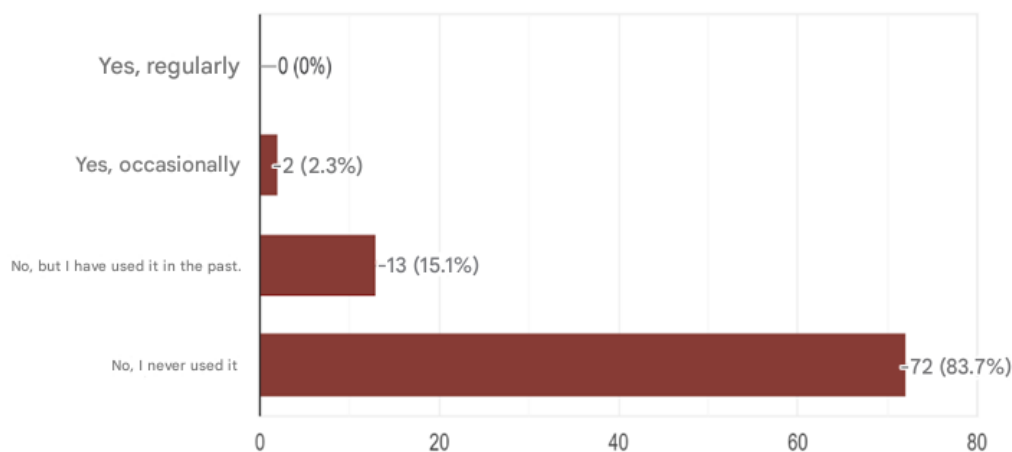
Graph 2. Students' conception of the safety of electronic cigarettes.



Source: Survey data, (2024).

Graph 3 explores the students' answers about frequent contact with electronic cigarettes. The majority said they had never used this type of product, while a minority of 15.1% reported having used it in the past, and 2.3% said they used them occasionally. It is essential that these numbers decrease, aiming to reduce the number of young people who use this type of product as much as possible.

Graph 3. Use of e-cigarettes by research participants.



Source: Survey data, (2024).

Another question was asked about the problem of the use of electronic cigarettes, where it is observed that the vast majority of listeners believe that electronic cigarettes are a problem for young people, a total of 93% of students confirm that this type of product is a risk for themselves, this is extremely important because this is the objective of this activity, make students be able to critically judge whether a product aimed at young people of their age is really good, or an illusion worked on appearance or marketing, this critical sense is



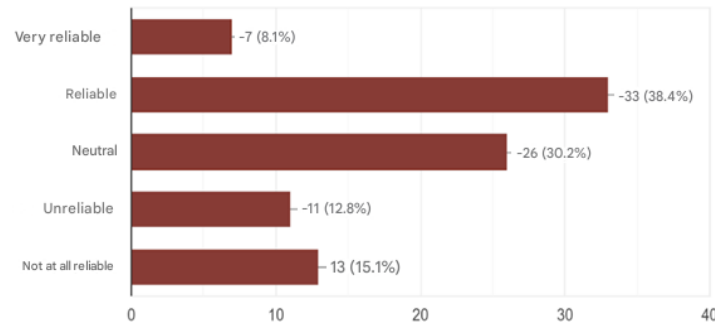
the result of awareness, yet a minority of 3.5% believe that cigarettes are not a problem, and a total of 4.7% still do not have an opinion on the topic discussed, after the lecture.

The sixth question is about the prohibition of the sale of electronic cigarettes to minors, when questioned about the opinion of the students, a total of 93% agreed that the prohibition is a favorable and right act, since in addition to not having current legislation, the production of electronic cigarettes is completely clandestine, and the level of concentration of the substances present is unrecognizable, which makes such a product very dangerous to health, generating even irreversible damage, a small group representing 4.7%, disagrees with the ban even in view of the dangers and damage it can generate, and 2.3% do not have an opinion on the issue.

Question 7 identifies the percentage of students who believe that e-cigarettes help smokers, including those who use pipes, artisanal or traditional cigarettes, to quit smoking. The vast majority, 97.7%, believe that e-cigarettes do not help in any way to quit the habit. This contradicts one of the main promises made when electronic cigarettes were launched on the market, which was precisely to help reduce addiction to traditional cigarettes. Even so, 2.3% say that yes, these E-cigarettes can be useful to reduce the number of smokers, a small percentage, but this speaks more about the point of view of each one of them, than actually happens in practice, since nicotine is the main substance that acts in such a way on the user, generating the feeling of pleasure, making the smoker become more and more addicted with each puff, making the addiction something very difficult to quit.

The distribution of responses to the eighth question reflects a significant variation in individuals' trust of health organizations that provide information about the risks of e-cigarettes (Graph 4). Most people consider these organizations to be "trustworthy" or "very reliable," which suggests that a large portion of the population believes that these sources are generally accurate and trustworthy. However, there is a considerable amount of individuals who express a more negative attitude, classifying organizations as "neutral", "unreliable" or "not at all reliable". This variation may indicate a diversity of opinions on the transparency, accuracy, or impartiality of the information provided by these organizations. Therefore, the distribution highlights the need for more transparency and effective communication by health organizations to address doubts and increase public confidence in their guidance on the risks associated with e-cigarettes.

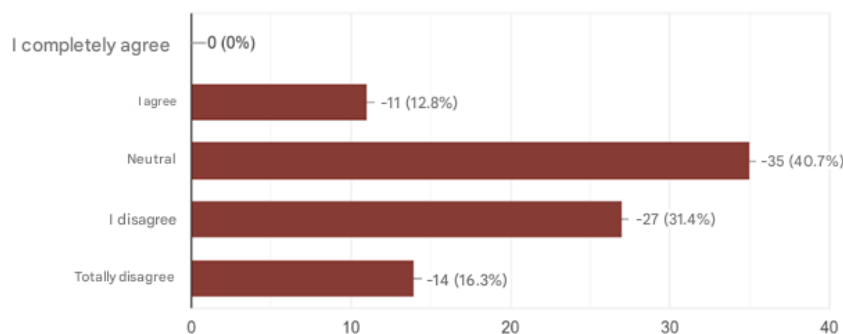
Graph 4. Degree of trust in health organizations in providing information about e-cigarettes.



Source: Survey data, (2024).

The list of responses in Graph 5 reveals a varied perspective on the impact of e-cigarettes on the environment, specifically in relation to the reduction of waste such as cigarette butts. A significant portion of people hold a neutral position, perhaps indicating that the relationship between e-cigarettes and environmental protection is not clear or convincing to them. Another 31.4% disagree with the idea that e-cigarettes have a positive impact environmentally, suggesting that they do not see a direct connection between the use of these devices and a significant reduction in cigarette waste. In addition, 16.3% strongly disagree, which may reflect a firm belief that environmental benefits are minimal or non-existent. On the other hand, only 12.8% agree with the idea that e-cigarettes can help preserve the environment by reducing the number of discarded cigarette butts.

Graph 5. Students' conception of the help of electronic cigarettes in preserving the environment.



Source: Survey data, (2024).

These data suggest that while there is some recognition of the potential benefits, most people are not convinced that these devices are a meaningful solution to the issue of waste generated by traditional cigarettes. It is important to note that, although there are still no conclusive studies proving that e-cigarettes cause specific diseases, current evidence indicates that the health problems associated with these devices are related to the chemical



substances present in vape liquids and the components of the devices themselves. As discussed already, e-cigarettes work by vaporizing a liquid solution that usually contains nicotine, propylene glycol, vegetable glycerin, and flavorings. Studies show that these liquids can release potentially harmful substances when heated. For example, some liquids may contain formaldehyde and acrolein, both of which are known for their harmful health effects when inhaled. In addition, the presence of heavy metals, such as nickel and cadmium, can be detected in vapor generated by certain devices, due to corrosion of the metal components of atomizers and coils. The impact of these fumes on respiratory and cardiovascular health is still being investigated. However, some research suggests that prolonged exposure to e-cigarette vapor can cause inflammation in the airways and affect lung function. The lack of long-term studies limits the full understanding of the risks, but the available data indicate that the use of e-cigarettes is not without risks. This distribution highlights that while some people may see an environmental advantage in e-cigarettes, most tend to be suspicious or indifferent about this issue.

The data from the tenth question reveal interesting insights into the perceived role of celebrities and influencers in the popularization of e-cigarettes. The majority of respondents, 48 people, representing 55.8%, believe that celebrities and influencers play a very influential role in the spread of e-cigarettes. This opinion highlights the significant power these public figures have over audience behavior and choices, especially when promoting products that may appear trendy and appealing. Another 27 participants, or 31.4% of respondents, consider the influence of these figures to be moderately influential. This suggests that while they recognize the relevance of celebrities and influencers, they believe that other factors also play an important role in the popularization of e-cigarettes, such as the marketing of the companies themselves or personal curiosity. A smaller portion of respondents, 6 people (7%), see the influence of celebrities and influencers as less influential, indicating that, for these individuals, the decision to use e-cigarettes may be more related to factors independent of the influence of public figures. Finally, 5 people (5.8%) believe that celebrities and influencers are not influential in the popularization of e-cigarettes, suggesting that, in their view, the decision to use these products is more autonomous and less susceptible to external influence. In summary, the survey shows that most people believe that celebrities and influencers play a relevant role in the popularization of electronic cigarettes, although there is a diversity of opinions about the intensity of this influence. In summary, the belief in the influence of celebrities and influencers is backed by a consistent track record of how these figures have shaped consumer behaviors over time. Their power to shape trends and normalize certain



behaviors, especially among young people, is well-documented and continues to be a significant factor in the popularization of products like e-cigarettes.

The lecture generated significant reflections among the participants regarding the use of electronic cigarettes. In the 11th question of the 86 students, 27 people (31.4%) indicated that they are considering reducing or even interrupting the use of these devices. This data indicates that the lecture had a positive impact on almost a third of the participants, sensitizing them to the risks or motivations to reconsider their habit. On the other hand, only 2 people (2.3%) stated that they do not intend to change their habits in relation to electronic cigarettes, suggesting that, for this small group, the information presented in the lecture was not enough to motivate a change in behavior or because they did not really want to stop. In addition, it is important to note that the majority of participants, 57 people (66.3%), declared that they do not use electronic cigarettes. This data highlights that a large part of the staff is already away from this habit, which may reflect a previous awareness of the risks associated with the use of these devices or simply a lack of interest in using them. In short, the lecture seems to have fulfilled its objective of influencing a significant portion of e-cigarette users to rethink their behavior, while reaffirming the choices of those who have already chosen not to use these products.

The results of the survey on the lecture recommendation on the use of e-cigarettes show strong support among the participants. Of the 86 respondents, the vast majority, 63 people (73.3%), stated that they would definitely recommend the lecture to others. This reflects the effectiveness and positive impact of the presentation, suggesting that the information shared was valuable and relevant. Another 23 participants (26.7%) indicated that they might recommend the lecture. This group may have found the lecture useful, but may believe that its impact depends on the interest or need of the target audience. However, the fact that no one answered that they would not recommend the lecture reinforces that, in general, the presentation was well received and seen as an important informative resource. In summary, the lecture appears to have been highly effective, with the majority of attendees not only valuing the experience but also feeling motivated to share this knowledge with others. Working on the topic of e-cigarettes with the participants was both a fun and fruitful experience. Their excitement and active participation during the lecture showed that the event was well received and that they took the opportunity to clarify doubts and expand their knowledge. The lecture provided a space for discussions and exchange of information on relevant topics, as well as curiosities that arose during the conversations. The topic of electronic cigarettes is of great relevance, especially because much of the information about these products goes unnoticed by society. The lecture aimed



to demystify misconceptions and correct false information that is often disseminated to attract consumers. Despite restrictions and bans in some places, there are still ongoing efforts to promote and market these devices, often through innovative and deceptive strategies aimed at profiting from the health of others.

FINAL CONSIDERATIONS

This work aimed to raise awareness and deny the false information disseminated in society, which makes us believe that electronic devices are the best alternative, either to reduce the habit of smoking traditional cigarettes or because they are less harmful. Information was promoted about the harms of these devices, their dense smoke and the substances that compose it, in addition to showing the types of electronic smoking devices and how the market has advanced in these products to attract people's attention. The students' interest in the theme was verified, which aroused curiosity in other subjects not addressed at the moment, such as the use of marijuana. They asked a lot of questions and asked for a comparison between these products. Due to limited time, we were unable to clarify all doubts, but we left the discussion open for a future opportunity. Teachers present also participated, helping to clarify some issues raised. It is important to highlight that many of the participants expressed the desire to quit smoking after the lecture, indicating that the main objective, which is awareness, was achieved. A positive point is that most of those present do not have the habit of smoking.

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