



USE OF ELECTRONIC CIGARETTES AMONG HEALTH SCIENCE UNIVERSITY STUDENTS

USO DE CIGARROS ELETRÔNICOS ENTRE ESTUDANTES UNIVERSITÁRIOS DA ÁREA DA SAÚDE

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ABSTRACT: To evaluate the use of electronic cigarettes among students from the Biochemistry, Pharmacy, Nursing, and Medicine programs at the Federal University of São João del-Rei (UFSJ), Divinópolis, Minas Gerais, Brazil. A cross-sectional observational study was conducted using an online questionnaire addressing sociodemographic data, perceptions about electronic cigarettes, use of conventional cigarettes, characteristics of electronic cigarette use, use of other psychoactive substances, reported toxic effects of electronic cigarette use, impact of the COVID-19 pandemic, and the Fagerström Test. Among the 335 participants, 74.8% (n=249) were female, of which 48.8% (n=120) reported having used electronic cigarettes. Meanwhile, 25.2% (n=84) were male, of which 71.4% (n=60) reported having used electronic cigarettes. Overall, 54.55% (n=180) claimed to have used electronic cigarettes. Electronic cigarettes are believed by 75.7% (n=252) to be more dangerous compared to conventional cigarettes. The increasing use of electronic cigarettes demands further research to produce information that could contribute to public health.

KEYWORDS: Electronic Nicotine Delivery Systems. Public Health. Smoking. Vaping.

RESUMO: Este estudo teve como objetivo avaliar o uso de cigarros eletrônicos entre estudantes dos cursos de Bioquímica, Farmácia, Enfermagem e Medicina da Universidade Federal de São João del-Rei (UFSJ), campus Divinópolis, Minas Gerais, Brasil. Trata-se de um estudo observacional de corte transversal, realizado por meio de um questionário online que abordou dados sociodemográficos, percepções sobre os cigarros eletrônicos, uso de cigarros convencionais, características do uso de cigarros eletrônicos, uso de outras substâncias psicoativas, efeitos tóxicos relatados do uso de cigarros eletrônicos, impacto da pandemia de COVID-19 e o Teste de Fagerström. Dos 335 participantes, 74,8% (n=249) eram do sexo feminino, dos quais 48,8% (n=120) relataram já ter utilizado cigarros eletrônicos. Por outro lado, 25,2% (n=84) eram do sexo masculino, dos quais 71,4% (n=60) relataram o uso. No total, 54,6% (n=180) dos estudantes afirmaram já ter usado cigarros eletrônicos. Para 75,7% (n=252) dos participantes, os cigarros eletrônicos são considerados mais perigosos que os cigarros convencionais. O aumento do uso de cigarros eletrônicos entre universitários reforça a necessidade de mais pesquisas que forneçam dados capazes de subsidiar estratégias de saúde pública.

PALAVRAS-CHAVE: Sistemas Eletrônicos de Administração de Nicotina. Saúde Pública. Tabagismo. Vaping.

INTRODUCTION

Electronic smoking devices, known as electronic cigarettes or "vapers," emerged in China in 2003 and have gained significant popularity worldwide over the past decade. The prevalence of electronic cigarette use shows significant variation across countries, with usage rates ranging from 4% to 6% in nations like the United States and the United Kingdom, compared to just 1% in Australia and Canada where more stringent regulations are in place¹. These electronic devices were designed to resemble conventional cigarettes, are battery-operated, and can be rechargeable or disposable. Inside, they contain a solution with various chemical substances, such as nicotine, glycerol, propylene glycol, flavorings, and colorings².

Electronic cigarettes were introduced to the market at a time when smoking rates were declining. However, their use has spread notably, particularly among young people, including university students. In 2014, electronic cigarettes were the most commonly used tobacco-derived product among middle and high school students in the United States. Risk factors for using these devices among university students include the use of other substances such as alcohol, social acceptance, and emotional associations³.

This widespread use may be related to the more socially acceptable nature of vaping compared to smoking traditional cigarettes. In a study by Scheffels et al. (2023)⁴, several participants claimed that using electronic cigarettes generated little social disapproval among peers. The lack of odor from these products is an attractive feature. Users reported preferring these devices due to the pleasant taste and smell of electronic cigarettes. This situation is concerning because most electronic cigarettes contain nicotine, and exposure to this substance during adolescence can harm the developing brain, and the long-term health effects of chronic exposure are uncertain⁵.

The nature of the aerosol from electronic cigarettes is influenced by the temperature at which the liquid is heated. At higher temperatures, propylene glycol and vegetable glycerin, compounds commonly found in these devices, degrade into acrolein, formaldehyde, and acetaldehyde. Metals such as chromium, nickel, copper, and lead can be present in significant amounts, being substances associated with oxidative stress, DNA inflammation, and carcinogenesis⁶.

Inhaling the components present in electronic cigarette smoke is also linked to various lung diseases, specifically to e-cigarette and vaping associated lung injury (EVALI). This disease results from using these devices and presents symptoms such as respiratory distress syndrome and lipid-laden macrophages, causing dysfunction in the pulmonary surfactant system. This system's main function is to reduce surface tension, ensuring efficient gas exchange. According to Bavel et al. (2023)⁷, additives in electronic cigarettes alter the expansion and compression cycles of the pulmonary surfactant and the organization of the lateral film.

According to findings by Vidaña-Pérez et al. (2024)⁸, in their study, frequent exposure to online advertisements for electronic cigarettes, living with family members who use these products, and the habit of being a current smoker were identified as factors associated with a higher likelihood of using electronic cigarettes. Moreover, exposure to both online advertisements and being around friends who smoke or use electronic cigarettes increased susceptibility to using any of these products. These findings highlight the significant influence of the social environment and online advertising on the adoption and continued use of electronic cigarettes.

Although the commercialization, importation, and advertising of electronic cigarettes have been banned in Brazil since 2009 by the National Health Surveillance Agency, there is widespread dissemination and marketing of this product⁹. Most exposure to advertisements occurs through social media, online sales, and in-person communications. Despite the ban, their sale is freely conducted in

various states of Brazil¹⁰. The widespread use of electronic cigarettes among young people poses a significant public health risk, serving as a gateway to other tobacco-derived products, making them vulnerable to initiation and dependence⁵.

Therefore, it is necessary to understand the use of electronic cigarettes among university students, as most of them fall within the age group with a high frequency of use. Thus, the research aims to evaluate the frequency of electronic cigarette use among students of Biochemistry, Pharmacy, Nursing, and Medicine at the Federal University of São João del-Rei (UFSJ), Divinópolis, Minas Gerais, Brazil.

METHODOLOGY

This is a cross-sectional study, conducted according to the guidelines proposed by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)¹¹. The study was conducted at the Federal University of São João del-Rei, Dona Lindu Centro-Oeste Campus (UFSJ-CCO), in the city of Divinópolis, Minas Gerais, Brazil.

Data were collected between March 2023 and May 2023 through a questionnaire via Google Forms. Participants were invited to join the study through an email sent by the coordination of each course to the respective classes. They were also informed in person in the classrooms at the Dona Lindu Centro-Oeste Campus of UFSJ, and a leaflet with a QR code linking to the questionnaire was distributed. The Informed Consent Form (ICF) was made available for download if the student agreed to participate in the study, presented as the initial text in the link generated for the questionnaire. A text box with the following question was inserted after the presentation of the ICF: "By clicking on the 'yes' option, you agree to participate in the study under the terms of this ICF. If you do not agree to participate, simply close this page in your browser."

The variables used in the study are described in Table 1.

Table 1. Blocks of questions asked in the questionnaire applied to students of Biochemistry, Nursing, Pharmacy, and Medicine courses at the Federal University of São João del-Rei (UFSJ), to evaluate the use of Electronic Cigarettes. Divinópolis, MG, Brazil, 2023.

	Questionnaire Variable
Block 1	Sociodemographic data (course, period of the course, age, sex, gender identity, sexual orientation, marital status, religion, and family income)
Block 2	Use of conventional cigarettes (motivation, risk perception, use by someone in the social circle)
Block 3	Perceptions about electronic cigarettes (how they learned about them, risk perception, access)
Block 4	Characteristics of electronic cigarette use (motivations, frequency)
Block 5	Use of other psychoactive substances
Block 6	Reported toxic effects from electronic cigarette use
Block 7	Impact of the COVID-19 pandemic on the initiation of electronic cigarette use
Block 8	Fagerström Test (to assess nicotine dependence) *

* (FAGERSTRÖM; SCHNEIDER, 1989)¹². Source: Questionnaire adapted from PeNSE (National School Health Survey) - IBGE¹³.

As of the most recent data from 2021, the institution had about 1530 undergraduate students. The study sample consisted of students enrolled in the courses of Biochemistry, Nursing, Pharmacy, and Medicine. The sample size was calculated using OpenEpi® software, considering the following parameters: a) an a priori prevalence of 50%, due to the lack of scientific evidence on the topic and the diversity of variables to be analyzed; b) a precision of 5%; c) a 95% confidence level; and d) a 10% loss rate. To evaluate the sociodemographic profile, characteristics related to the initiation of electronic

cigarette use; investigate the use of regular cigarettes before or after the use of electronic cigarettes; and analyze nicotine dependence among health students, a descriptive analysis of the data was performed using absolute and relative frequency with SPSS version 25 software. The study was approved by the Ethics Committee with CAAE number: 65646722.3.0000.5545.

RESULTS AND DISCUSSION

PARTICIPANT PROFILE

Considering that during the period of the present study, there were a total of 254 students enrolled in the Biochemistry course, 316 in Nursing, 428 in Pharmacy, and 365 in Medicine, the sample calculation was carried out, totaling 335 students. The study included students aged 18 to 55, with 66 (19.7%) from the Biochemistry course, 77 (23.0%) from Nursing, 104 (31.0%) from Pharmacy, and 88 (26.3%) from Medicine.

SOCIODEMOGRAPHIC AND SOCIOCULTURAL CHARACTERISTICS

Table 2 presents the sociodemographic data of students from each health-related course. Of the total participants, 74.8% (n=249) were female and 25.2% (n=84) male. Regarding gender identity, 98.3% (n=282) were cisgender. In terms of marital status, 92.7% (n=305) were single. Questions that were left unanswered or marked as 'not applicable' or 'ignored' were excluded from the final count used to calculate the percentage of responses, as shown in the tables. Regarding sociocultural data, Table 3 shows that most students had a family income above 2.5 minimum wages (47.2%, n=158). Regarding religion, 46.0% (n=143) identified as Catholic, and 19.1% (n=60) as atheist/agnostic. Concerning sexual orientation, 71.0% (n=235) were heterosexual.

Table 2. Sociodemographic data on students from health courses at the Federal University of São João del-Rei (UFSJ), who participated in this study on the use of electronic cigarettes. Divinópolis, MG, Brazil, 2023.

	Biochemistry	Nursing	Pharmacy	Medicine	Total
	N (%)	N (%)	N (%)	N (%)	N (%)
Total (n=335)	66 (19.7)	77 (23.0)	104 (31.0)	88 (26.3)	335 (100.0)
Gender (n=333)					
Male	21 (6.3)	11 (3.3)	24 (7.2)	28 (8.4)	84 (25.2)
Female	43 (12.9)	66 (19.8)	80 (24.0)	60 (18.0)	249 (74.8)
Age: Mean (SD a) (n=335)	22.9 (8.5)	21.8 (2.3)	23.6 (8.1)	24.5(10.3)	--
Period (n=335)					
1 to 2	15 (4.5)	11 (3.3)	16 (4.8)	25 (7.5)	67 (20.0)
3 to 6	38 (11.3)	53 (15.8)	25 (7.5)	35 (10.4)	151 (45.1)
7 to 9	13 (3.9)	12 (3.6)	53 (15.8)	24 (7.2)	102 (30.4)
10 to 12	0 (0.0)	1 (0.3)	10 (3.0)	4 (1.2)	15 (4.5)
Gender Identify(n=287)					
Cisgender	53 (18.5)	59 (20.6)	92 (32.1)	78 (27.2)	282 (98.3)
Transgender	1 (0.3)	0 (0.0)	0 (0.0)	2 (0.6)	3 (1.0)
Non-binary	0 (0.0)	1 (0.3)	1 (0.3)	0 (0.0)	2 (0.7)
Marital Status (n=329)					
Single	62 (18.8)	66 (20.1)	97 (29.5)	80 (24.3)	305 (92.7)
Living with partner (Stable Union)	0 (0.0)	7 (2.1)	2 (0.6)	6 (1.8)	15 (4.6)
Married	1 (0.3)	3 (0.9)	3 (0.9)	1 (0.3)	8 (2.4)
Separated/Divorced	0 (0.0)	1 (0.3)	0 (0.0)	0 (0.0)	1 (0.3)

SD: Standard Deviation. Source: Survey Data, 2023.

Table 3. Sociocultural data on students from health courses at the Federal University of São João del-Rei (UFSJ), who participated in this study on the use of electronic cigarettes. Divinópolis, MG, Brazil, 2023.

	Biochemistry	Nursing	Pharmacy	Medicine	Total
	N (%)	N (%)	N (%)	N (%)	N (%)
Total (n=335)	66 (19.7)	77 (23.0)	104 (31.0)	88 (26.3)	335 (100.0)
Sexual Orientation (n=331)					
Heterosexual	45 (13.6)	55 (16.6)	69 (20.8)	66 (19.9)	235 (71.0)
Homosexual	6 (1.8)	6 (1.8)	3 (0.9)	14 (4.2)	29 (8.8)
Bisexual	11 (3.3)	14 (4.2)	25 (7.6)	8 (2.4)	58 (17.5)
Asexual	1 (0.3)	1 (0.3)	2 (0.6)	0 (00.0)	4 (1.2)
Pansexual	1 (0.3)	1 (0.3)	3 (0.9)	0 (00.0)	5 (1.5)
Religion (n=311)					
Atheist/Agnostic	13 (4.2)	8 (2.3)	17 (5.5)	22 (7.1)	60 (19.1)
Catholic	19 (6.1)	31 (10.0)	56 (18.0)	37 (11.9)	143 (46.0)
Evangelical	9 (2.9)	12 (3.9)	5 (1.6)	7 (2.2)	33 (10.6)
Spirit	5 (1.6)	8 (2.6)	8 (2.6)	9 (2.9)	30 (9.7)
Unspecified Cristian	6 (1.9)	4 (1.3)	4 (1.3)	7 (2.2)	21 (6.7)
Afro-Brazilian	5 (1.6)	4 (1.3)	4 (1.3)	3 (1.0)	16 (5.2)
Buddhist	3 (1.0)	1 (0.3)	0 (0.0)	0 (0.0)	4 (1.3)
Unspecified Theism	1 (1.6)	3 (1.0)	0 (0.0)	0 (0.0)	4 (1.3)
Household Income ^b (n=335)					
Up to one minimum wage	25 (7.5)	13 (3.9)	12 (3.6)	3 (0.9)	53 (15.8)
Between 1 and 2.5 minimum wages	24 (7.2)	29 (8.7)	38 (11.3)	33 (9.8)	124 (37.0)
Above 2.5 minimum wages	17 (5.1)	35 (10.4)	54 (16.2)	52 (15.5)	158 (47.2)

^b Minimum wage (January 2023): R\$1,302.00.

GENDER AND COURSE COMPARISON OF ELECTRONIC CIGARETTE USE

To analyze the characteristics of electronic cigarette use, a comparison was made between female and male students and among the evaluated courses (Table 4). Phyo et al. (2020) reported that the prevalence of electronic cigarette users was higher among male students. In the present study, it was observed that 71.4% (n=60) of the men reported using electronic cigarettes at some point in their lives, compared to 48.8% (n=120) of the women. Men also reported earlier use, with 26.7% (n=16) using before the age of 18, compared to 20.8% (n=25) of women.

FREQUENCY AND PATTERNS OF ELECTRONIC CIGARETTE USE

In the study by Garcia et al. (2024)¹⁵, the use of electronic cigarettes among Medical students in Curitiba was also observed, with a prevalence of 39.7%. Regarding the user profile, 61% (n=136) of male participants reported using electronic cigarettes, compared to 39% (n=87) of female participants. This indicates a concerning trend of increasing electronic cigarette use among young males. The initial proposal for marketing electronic cigarettes was to aid in smoking cessation¹⁶. In this context, when asked if there was ever a transition from conventional to electronic cigarettes, 43 students reported such a migration. The reasons for migration were curiosity (67.4%, n=29), to alleviate tobacco withdrawal (20.9%, n=9), considering electronic cigarettes less toxic (11.6%, n=5), finding them more modern (2.3%, n=1), and other reasons such as practicality, pleasant smell, and flavor (9.3%, n=4).

Curiosity was the most reported reason for migrating from conventional to electronic cigarettes (62.5%, n=30). Smith (2021)¹⁷ stated that the motivations for starting use among young people and adolescents are associated with social practices, enjoyable use, vapor tricks (e.g., creating smoke rings), and flavor experimentation. This differs from adult users, who are primarily motivated to reduce nicotine

intake and quit smoking. The frequency of users citing curiosity as the reason for starting use was low (18.7%, n=9).

Students were asked if anyone in their social circle used conventional cigarettes. Of the 318 respondents, 29.2% (n=93) stated that no one used them, 54.5% (n=183) said friends did, 11.0% (n=35) indicated their fathers, 7.8% (n=25) their mothers, 5.3% (n=17) their spouses or partners, and other family members such as grandparents, uncles, and cousins were also mentioned less frequently.

Regarding the profile of electronic cigarette use by course, as shown in Table 3, a higher proportion of Medical students reported using them at some point (n=50; 57.5%), while Biochemistry students had higher usage in the last 30 days (n=16; 27.1%). Biochemistry students also reported earlier initiation, with 52.9% (n=18) starting between the ages of 13 and 18.

The COVID-19 pandemic directly affected the physical and mental health of the global population. The use of psychoactive substances increased significantly during this period, especially tobacco products¹⁸. A total of 38.1% (n=80) of the students believed that the COVID-19 pandemic influenced the initiation or increase of electronic cigarette use. While most students reported having used electronic cigarettes at some point in their lives (n=180; 54.2%), this number drops to 33.7% (n=112) for conventional cigarettes, with 15.2% (n=50) reporting use in the last 30 days. Regarding habitual cigarette use, 61.6% (n=37) reported starting with conventional cigarettes. Considering public policies and efforts to reduce smoking rates worldwide, such as tax increases and price hikes, which have shown significant results, the frequency of students who smoke or occasionally use conventional cigarettes remains notable⁵.

Electronic cigarettes are associated with social practices, self-presentation, and status gain⁴. They have been characterized as a social ritual and, in this context, offer more accessibility and freedom of use in public places and greater approval from friends and parents. Youth and adolescence carry an important transformative social context, characterized by physical, mental, and psychosocial development and changes that can contribute to the acceptance of social practices such as using electronic cigarettes^{19,20}.

Table 4. Comparison between female and male genders and among health courses regarding the characteristics of electronic cigarette use by students at the Federal University of São João del-Rei (UFSJ), Divinópolis-MG, Brazil.

	Female	Male	Biochemistry	Nursing	Pharmacy	Medicine	Total
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Have you ever used electronic cigarettes on any occasion?	n=246	n=84	n=66	n=75	n=104	n=87	n=332
Yes	120 (48.8)	60 (71.4)	34 (51.5)	38 (50.7)	58 (55.8)	50 (57.5)	180 (54.2)
No	126 (51.2)	24 (28.6)	32 (48.5)	37 (49.3)	46 (44.2)	37 (42.0)	152 (45.8)
Age at which electronic cigarette experimentation occurred	n=120	n=60	n=34	n=38	n=58	n=50	n=180
Between 13 and 15 years	8 (6.7)	3 (5.0)	6 (17.6)	0 (0.0)	4 (6.9)	1 (2.0)	11 (6.1)
Between 15 and 18 years	17 (14.2)	13 (21.7)	12 (35.3)	5 (13.2)	6 (10.3)	7 (14.0)	30 (16.7)
Between 18 and 20 years	32 (26.7)	19 (31.7)	6 (17.6)	15 (39.5)	17 (29.3)	13 (26.0)	51 (28.3)
Over 20 years	63 (52.5)	25 (41.7)	10 (29.4)	18 (47.4)	31 (53.4)	29 (58.0)	88 (48.9)
Have you used electronic cigarettes at any point in the last 30 days?	n=223	n=79	n=59	n=65	n=96	n=83	n=303
Yes	34 (15.2)	26 (32.9)	16 (27.1)	8 (12.3)	19 (19.8)	17 (20.5)	60 (19.8)
No	189 (84.8)	53 (67.1)	43 (72.9)	57 (87.7)	77 (80.2)	66 (79.5)	243 (80.2)
Dual users/use both electronic cigarettes and conventional cigarettes	n=204	n=76	n=58	n=60	n=90	n=73	n=281
Yes	12 (5.9)	20 (26.3)	10 (17.2)	6 (10.0)	8 (8.9)	8 (11.0)	32 (11.4)
No	192 (94.1)	56 (73.7)	48 (82.8)	54 (90.0)	82 (91.1)	65 (89.0)	249 (88.6)

	Female	Male	Biochemistry	Nursing	Pharmacy	Medicine	Total
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Did the COVID-19 pandemic have any influence on the initiation or increase in the use of electronic cigarettes?	n=145	n=65	n=39	n=40	n=72	n=59	n=210
Yes	60 (41.4)	20 (30.8)	13 (33.3)	12 (30.0)	34 (47.2)	21 (35.6)	80 (38.1)
No	85 (58.6)	45 (69.2)	26 (66.7)	28 (70.0)	38 (52.8)	38 (64.4)	130 (61.9)

Source: Survey Data, 2023.

PERCEPTIONS AND KNOWLEDGE ABOUT ELECTRONIC CIGARETTES

Exposure to advertisements can pose a risk for initiating electronic cigarette use. A total of 56.4% (n=188) of participants stated they had seen some type of advertisement at some point (Table 5). Mantey et al. (2016)²¹ showed that youth exposure to electronic cigarette advertisements increases susceptibility to becoming users.

Digital socialization is a new dimension in youth culture, and social media contributes to the likelihood of exposure to electronic cigarettes by sharing images of practices and tricks with these devices. In the present study, 68.8% (n=221) reported gaining knowledge about electronic cigarettes through social media. The media plays an important role in disseminating these devices. Advertisements convey the perception that electronic cigarettes are less harmful¹⁷. Contrary to our study results, 75.7% (n=252) believe that electronic cigarettes are more dangerous than conventional cigarettes. In a study by Case et al. (2016)²², which assessed risk perceptions of electronic cigarettes among university students, participants preferred electronic cigarettes as a healthier alternative and for smoking cessation.

The increased perception of electronic cigarettes being more harmful to health may be due to various reasons. Communication about the risks of electronic cigarette use on social media and in information channels such as television and radio may have contributed to increased awareness of these risks. According to Bandi et al. (2022)¹⁶, these perceptions increased due to information dissemination about the EVALI epidemic.

Table 5 shows data on perceptions of electronic cigarette knowledge. According to the results, most participating students had knowledge about electronic cigarettes (95.5%, n=320). When asked about the source of this knowledge, 321 students responded; 68.8% (n=221) reported obtaining it through social media, 59.8% (n=192) from friends, 53.9% (n=173) from Internet sites, 29.3% (n=94) from scientific articles, 21.8% (n=70) from course material, and 0.6% (n=2) from shops and parties. In a study by Martins et al. (2022)⁵ which evaluated the global profile of electronic cigarette users, it was identified that users tend to be young males, which is consistent with the present study.

Table 5. Comparison between male and female genders and among health courses regarding students' knowledge about electronic cigarettes at the Federal University of São João del-Rei (UFSJ), Divinópolis-MG, Brazil.

	Female	Male	Biochemistry	Nursing	Pharmacy	Medicine	Total
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
	n=249	n=84	n=66	n=77	n=104	n=88	n=335
Do you have knowledge about electronic cigarettes?	237 (95.2)	81 (96.4)	63 (18.8)	70 (20.9)	100 (29.9)	87 (26.0)	320 (95.5)
Yes	12 (4.8)	3 (3.6)	3 (0.9)	7 (2.1)	4 (1.2)	1 (0.3)	15 (4.5)
No	n=248	n=83	n=65	n=72	n=104	n=87	n=333
Perception of health risk	17 (6.9)	13 (15.7)	8 (2.4)	5 (1.5)	13 (3.9)	4 (1.2)	30 (9.0)
Electronic cigarettes are less dangerous than conventional cigarettes	34 (13.7)	13 (15.7)	12 (3.6)	10 (3.0)	12 (3.6)	14 (4.2)	48 (14.4)

	Female	Male	Biochemistry	Nursing	Pharmacy	Medicine	Total
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
No difference	195 (78.6)	56 (67.5)	45 (13.5)	62 (18.6)	78 (23.4)	67(20.1)	252 (75.7)
Electronic cigarettes are more dangerous than conventional cigarettes	2 (0.8)	1 (1.2)	0 (0.0)	0 (0.0)	1 (0.3)	2 (0.6)	3 (0.9)
Other	n=248	n=83	n=65	n=77	n=103	n=88	n=333
Have you ever seen any advertisements for electronic cigarettes?	137 (55.2)	50 (60.2)	40 (12.0)	36 (10.8)	58 (17.4)	54 (16.2)	188 (56.4)
Yes	111 (44.8)	33 (39.8)	25 (7.5)	41 (12.3)	45 (13.5)	34 (10.2)	145 (43.5)
No	n=243	n=83	n=66	n=76	n=101	n=85	n=328
How do you assess access to electronic cigarettes?	172 (70.8)	53 (63.9)	45 (13.7)	46 (14.0)	68 (20.7)	67 (20.4)	226 (68.9)
Easy access	63 (25.9)	29 (34.9)	19 (5.8)	26 (7.9)	30 (9.1)	18 (5.5)	93 (28.3)
Intermediate access	8 (3.3)	1 (1.2)	2 (0.6)	4 (1.2)	3 (0.9)	0 (0.0)	9 (2.7)

Source: Survey Data, 2023.

MOTIVATIONS AND CONTEXTS OF USE

Students were asked about the reasons for starting to use electronic cigarettes; 180 students responded, selecting multiple options; 68.8% (n=124) stated it was out of curiosity, 5.0% (n=9) to alleviate tobacco withdrawal, 66.1% (n=119) because friends/colleagues offered them, 9.0% (n=16) because they found them more modern, 33.3% (n=60) for their pleasant smell and taste, and 10.0% (n=18) to relieve stress. Regarding the need and frequency of use, 90 students responded; 68.8% (n=62) used them at parties and celebrations, 24.4% (n=22) when stressed, 15.5% (n=14) when bored, 6.6% (n=6) daily, 4.4% (n=4) weekly, 26.6% (n=24) monthly, and some reported occasional use.

An interesting observation is that even if an individual has used electronic cigarettes at some point, they are not necessarily frequent users, assuming experimental use patterns. This is evident in the results in Table 3, where 54.2% (n=180) reported using electronic cigarettes at some point, and 19.8% (n=60) reported use in the last 30 days. Among the students, 23 reported migrating from electronic to conventional cigarettes. 39.1% (n=9) cited the lower cost of conventional cigarettes, 47.8% (n=11) the easier access to conventional cigarettes, and 26.0% (n=6) stated that electronic cigarettes were less effective in satisfying their nicotine needs.

SOCIAL INFLUENCE AND PSYCHOACTIVE SUBSTANCE USE

The susceptibility to using electronic cigarettes in the future is associated with the social environment. For example, if a friend or family member uses them, the chances of a non-user trying them for the first time increase²³. Therefore, in this study, students were asked if anyone in their social circle uses electronic cigarettes. Of the 329 students, 21.6% (n=71) responded that no one they know uses them, 75.0% (n=247) reported that their friends use them, 1.2% (n=4) mentioned that their father uses them, 0.9% (n=3) said their mother uses them, and 6.6% (n=22) reported that their spouse or partner uses them. Participants also reported usage by cousins, siblings, acquaintances, and other family members.

The study by Stubbs et al. (2022)²⁴ reported that among participants who used electronic cigarettes, the first use occurred in a social setting with friends. It was also suggested that sharing among friends enabled everyone in the circle to try them. It was observed that among participants who started using electronic cigarettes, the main reason cited was an offer from friends or colleagues, which accounted for 66.1% (n=119). Although flavor was reported as an attractive reason for initiating electronic

cigarette use²⁵, in the present study, curiosity was one of the most frequently mentioned reasons for experimentation, at 68.8% (n=124).

Students were asked about the influence of alcohol on smoking habits. Regarding the need to smoke when consuming alcohol, 13.6% (n=35) reported feeling the need to smoke conventional cigarettes, and 12.8% (n=33) felt the need to use electronic cigarettes.

When asked about the use of other psychoactive substances, 239 students responded and could select more than one option. After compiling the responses, alcohol was one of the most used substances, with 95.3% (n=228) of students reporting its use. Regarding the use of psychoactive substances, 17.1% (n=41) reported using marijuana, 2.9% (n=7) reported using Ecstasy/3,4-methylenedioxymethamphetamine (MDMA), 0.4% (n=1) reported using inhalants/solvents, 14.2% (n=34) reported using tobacco, 3.7% (n=9) reported using non-prescribed medications, and 1.7% (n=4) reported using Lysergic Acid Diethylamide (LSD).

The use of other psychoactive substances alongside electronic cigarettes is a concerning factor, particularly the combined use of alcohol and nicotine. Dual use can potentiate each other's rewarding properties, which may increase the likelihood of dependence on each substance and the mutual desire to consume them. Moreover, it can increase the risk of developing head and neck cancer, cirrhosis, pancreatitis, and psychiatric comorbidity. Yang et al. (2022)²⁶ reported in their study that electronic cigarette users tend to use them longer when alcohol is consumed.

HEALTH EFFECTS AND NICOTINE DEPENDENCE

The most frequently reported toxic effects of using electronic cigarettes by students, were where more than one option (multiple effects) could be selected. In the present study, the most frequently reported toxic effects were cough (56.6%, n=47), throat irritation (49.4%, n=41), headaches (45.8%, n=38), and difficulty breathing (25.3%, n=21). According to Varella et al. (2022)²⁷, the most frequent symptoms reported by participants in their study were cough, phlegm production, or shortness of breath. Aldehydes produced during combustion, such as formaldehyde and acrolein, can hinder mucus transport over time, characteristics observed in patients with Chronic Obstructive Pulmonary Disease (COPD).

The Fagerström Test is used to assess nicotine tolerance and dependence. The questionnaire consists of six questions that evaluate the frequency and need to smoke in specific situations. Scores are assigned and evaluated as follows: 0-2 indicates very low dependence, 3-4 low dependence, 5 moderate dependence, 6-7 high dependence, and 8-10 very high dependence^{12,28}.

Analyzing the Fagerström Test results for nicotine dependence, students presented the following data: in the very low dependence category (0-2), 11 females (32.3%) and 13 males (38.2%) were observed. In the low dependence category (3-4), both genders had equal representation, with 3 individuals (9.0%) each. For moderate dependence (5), there were one female (2.9%) and two males (5.9%). No individuals of either gender were recorded in the high dependence category (6-7). In the very high dependence category (8-10), only 1 female (2.9%) was observed, while no males (0.0%) were reported.

Nicotine is the primary compound in cigarettes that causes dependence. The combustion of a cigarette releases nicotine and various other products, which are quickly absorbed in the lungs, acting on the brain and distributing throughout the body within about ten seconds. Therefore, frequent tobacco use leads to the development of tolerance and dependence. The earlier the onset, the greater the severity, dependence, and associated problems²⁹.

STUDY LIMITATIONS AND CONTRIBUTIONS

The limitations of this study include the low number of participants who answered the necessary questions, resulting in a high number of ignored responses. Consequently, the absence of this information may limit the identification of specific user profiles. Another limitation is that this is a local study, with the sample calculated based on a single public university located in the interior of Minas Gerais. Thus, there may be discrepancies compared to results found in studies with participants from other locations. To mitigate this limitation, more studies can be conducted in more universities across the country.

This study can contribute to the development of intervention strategies in universities, including educational programs on the risks of electronic cigarettes and the strengthening of tobacco control policies. Additionally, the results highlight the need for stricter regulations on the commercialization of these devices, which are prohibited in Brazil, as well as awareness campaigns specifically targeting young people.

CONCLUSION

This research found that although students from the Biochemistry, Pharmacy, Nursing, and Medicine courses at the Federal University of São João del-Rei, Campus Centro-Oeste Dona Lindu (UFSJ-CCO) have tried electronic cigarettes at some point, they are not frequent users. However, male students had a higher frequency of use. Additionally, it was observed that most students reported gaining knowledge about electronic cigarettes through social media or internet websites. This is a concerning factor, as the commercialization and advertising of these devices have been banned by ANVISA since 2009.

This study is significant for understanding the local population and proposing preventive measures, considering the toxic effects that frequent use of electronic cigarettes can have on the health of young people. Furthermore, the increase in electronic cigarette use has the potential to negatively impact years of public policy achievements aimed at combating smoking, and understanding the characteristics associated with such use is crucial for planning future interventions.

Health promotion plays a fundamental role in preventing the use of electronic cigarettes, especially among university students. Educational strategies and awareness campaigns are essential to inform about health risks and combat the misconception that e-cigarettes are harmless. Regulatory measures are also necessary to restrict access to and the appeal of these products among young people.

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