

Prevalence and factors associated with e-cigarette use among undergraduate students: a cross-sectional study

Prevalência e fatores associados com o uso de cigarro eletrônico em estudantes universitários: um estudo transversal

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ABSTRACT

Introduction: The use of electronic cigarettes (e-cigarettes) has increased in Brazil. **Objective:** To assess the prevalence of e-cigarette use and the factors associated with its use among college students. **Methods:** This is a cross-sectional observational study, carried out with undergraduate students from two private colleges. The prevalence of the consumption of e-cigarettes, conventional cigarettes, alcohol and marijuana was evaluated. The motivations for initiating e-cigarette use and the respondents' perceptions about their use were also reported. **Results:** 518 undergraduate students were evaluated, with a mean age of 23±5.7 years, 64.09% were female and 60.42% were medical students. The prevalence of e-cigarette use was 24.32%, and the highest consumption occurred in medical school. The main motivations for starting the use of e-cigarettes were curiosity (47.70%), and the influence of friends and/or family (31.61%). Advancing age and being employed reduced the chance of using e-cigarettes by 7% and 67%, respectively, while higher family income increased the chance of e-cigarette use by 28%. The use of conventional cigarettes, alcohol and marijuana increased this chance by 6.4; 11.8 and 3.7 times, respectively. **Conclusion:** The high prevalence of e-cigarette use among undergraduate students stands out. The main reasons to start e-cigarette use were curiosity, and the influence of friends and/or family. Further, e-cigarette use was associated with age, family income, being employed, use of conventional cigarettes, alcohol and marijuana. Due to the high prevalence of e-cigarette use among Brazilian undergraduate students, higher education institutions should initiate awareness campaigns that communicate the health risks linked to their use.

Keywords: Vaping; Electronic nicotine delivery systems; Smoking; Students.

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Responsible Editor:

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Supporting sources:

There were no supporting sources.

Conflict of interests:

The authors declare they have no conflicts of interest.

Ethics Committee:

Decision number - 5.277.969.

Received on: November 11th, 2023.

Approved on: January 27th, 2024.

Publication Date: 11 July 2024.

DOI: 10.5935/2238-3182.2024e34108-en

RESUMO

Introdução: O consumo de cigarros eletrônicos tem aumentado no Brasil. **Objetivo:** Avaliar a prevalência do uso de cigarros eletrônicos e os fatores associados a seu uso em universitários. **Métodos:** Trata-se de um estudo observacional transversal, realizado com universitários de duas instituições privadas de ensino. Foram avaliados os consumos de cigarros eletrônicos, cigarros convencionais, álcool e maconha. Também foram avaliadas as motivações para iniciar o uso do cigarro eletrônico e as percepções dos entrevistados sobre seu uso. **Resultados:** 518 acadêmicos foram avaliados, com média de idade de $23 \pm 5,7$ anos, sendo 64,09% do sexo feminino e 60,42% do curso de medicina. A prevalência de uso de cigarro eletrônico foi de 24,32% e o maior consumo ocorreu no curso de medicina. As principais motivações para iniciar o uso do cigarro eletrônico foram curiosidade (47,70%) e influência de amigos ou familiares (31,61%). O aumento da idade e exercer atividade econômica reduziram a chance do uso de cigarros eletrônicos em 7% e 67%, respectivamente, enquanto a maior renda familiar aumentou a chance de consumo de cigarro eletrônico em 28%. Já o uso do cigarro convencional, do álcool e da maconha aumentou essa chance em 6,4; 11,8 e 3,7 vezes, respectivamente. **Conclusão:** Destaca-se a alta prevalência do uso de cigarros eletrônicos entre universitários. Os principais motivos citados pelos usuários do cigarro eletrônico para iniciar o seu uso foram principalmente curiosidade e influência de amigos e familiares. O consumo de cigarro eletrônico foi associado à idade, renda familiar, atividade econômica e uso de outras substâncias psicoativas. Devido à alta prevalência de uso de cigarros eletrônicos entre universitários brasileiros, faz-se necessário que as instituições de ensino realizem campanhas de conscientização para divulgação ampla dos riscos do uso de cigarros eletrônicos para a saúde.

Palavras-chave: Vaping; Sistemas eletrônicos de liberação de nicotina; Tabagismo; Estudantes.

INTRODUCTION

According to the National Cancer Institute José Alencar Gomes da Silva (INCA), more than 50 diseases are associated with smoking, including different types of cancer, cardiorespiratory diseases, and digestive diseases. In Brazil, smoking causes approximately 157,000 deaths due to its effects on health, not to mention that smokers get sick more often than non smokers¹.

Smoking has long been associated with modernity, freedom, glamour, and sociability. However, it is now recognized as a chronic neurobehavioral disorder caused by nicotine dependence². Although the harmful effects of smoking have been clearly outlined, the habit is still prevalent, especially among young adults. According to Ramis et al. (2012)³, on average, 35% of college students

are or have been smokers at some point, with 10% claiming to smoke regularly, and 90% of smokers starting tobacco use before starting university. The same study points out an inverse correlation between smoking and age, with a higher rate of the habit being observed in younger students, which may be directly linked to less knowledge about the effects of cigarettes on health³.

Over the last few years, several smoking products have emerged, including smoking pipes, hookahs, and, most recently, e-cigarettes. E-cigarettes heat a solution containing nicotine or tetrahydrocannabinol, in addition to flavourings and other additives, thus generating a vapor for inhalation. Currently, young adults are attracted to e-cigarette advertisements, reflecting their high adherence to these products. Moreover, the widespread belief that e-cigarettes only emit water vapor, do not produce second-hand smoke,

are cleaner, cheaper, could be smoked anywhere, do not cause bad breath, offer a pleasant aroma, do not cause aesthetic harm, and can help quit smoking suggests that these products are a superior choice to traditional smoking^{4,5} to young individuals. However, lung risks of e-cigarette use are rapidly emerging, and the most alarming is e-cigarette or vaping use-associated lung injury (EVALI)⁴.

Choi et al. (2013)⁶ conducted a prospective cohort study to understand the process of change from non-smokers to smokers in adolescence. It was observed that almost 50% of young adults agreed that e-cigarettes can be less harmful to health and less addictive; therefore, according to previous studies, e-cigarettes have a high degree of acceptability, especially among youth⁶. Young adults' opinions about e-cigarettes seem to be associated with social media platforms and industry marketing which induce the idea that vaping is less harmful to health⁷. However, these advertisements do not provide information about toxic and carcinogenic compounds in e-cigarettes that could already be found in conventional cigarettes. Moreover, e-cigarettes also produce other toxic substances not found in conventional cigarettes, notwithstanding that their health effects are still unknown⁸.

The use of e-cigarettes has been studied among college students worldwide⁹⁻¹¹. In Brazil, a study evaluated students from the Federal University of Mato Grosso in 2015, reporting a low prevalence of e-cigarette users. Nevertheless, the authors emphasized a concern about the potential increase in consumption among students. Therefore, attention should be directed to college students in order to promote educational and preventive campaigns regarding the use of e-cigarettes¹².

Considering the points raised and the growing prevalence of e-cigarettes use among young adults, we hypothesize that the economic status of college students from private institutions may be a contributing factor for the increase in usage. Beyond that, there are few studies about e-cigarettes use in the Brazilian state of Minas Gerais (MG).

Moreover, the present study was aimed at evaluating the prevalence and factors associated with the use of e-cigarettes among college students in private higher education institutions in the city of Barbacena, MG.

METHODS

STUDY DESIGN/POPULATION

A cross-sectional study was conducted between March and August, 2022, among college students. The sample was recruited by convenience and included regularly registered college students over the age of 18. The students who did not consent to participate in the study and the ones that were not present during the recruitment were excluded.

PROCEDURES

After the institutional agreement and the consent of coordinators and professors, the participants were assessed at the beginning or at the end of their classes, and during their breaks to sign the Free and Informed Consent followed by

filling out the self-reported and anonymous questionnaire. The main purpose of the questionnaire was to evaluate smoking status, conventional cigarette use, e-cigarette use, marijuana use, perceptions and reasons for using e-cigarettes. After students had completed the questionnaires, each one was deposited in a ballot box. The researchers ensured the privacy and confidentiality of the data used to fully preserve the participants' anonymity, besides avoiding their stigmatisation.

The obtained data will not be used to harm people and institutions that participated in the study and the data will be exclusively used for the purpose established in the study protocol, according to the terms of resolution 466/12 of the National Health Council.

SOCIODEMOGRAPHIC DATA

The questionnaire included sociodemographic variables, such as age, sex, employment status, family income, social support (living alone, with family or friends), and marital status.

SMOKING AND SOCIAL LIFESTYLE

The researchers developed a questionnaire about social and smoking habits based on a previous study by Franks et al. (2017)⁹ and the document "E-cigarettes what do we know? Studies on Electronic Smoking Devices" which was conducted by the INCA. The questionnaire included questions about smoking status (smoker or former smoker), use of conventional cigarettes (how many days used in the last 30 days), and use of e-cigarettes (how many days used in the last 30 days, and reasons for starting its use). Moreover, the students answered questions about perceptions and reasons for using e-cigarettes, such as the factors that motivate their use, personal expectations compared with other different forms of smoking, and the correlation between e-cigarette use and other psychoactive substances.

ETHICS APPROVAL

The study protocol followed the ethical principles of the Declaration of Helsinki and was approved by the Barbacena School of Medicine Research Ethics Committee (Nº 5.277.969).

STATISTICAL ANALYSIS

The normality of the data was analyzed using the Shapiro-Wilk test. Numerical variables were expressed as the mean \pm standard deviation or median (interquartile range) for normal and nonnormal distribution, respectively. Categorical variables were expressed as percentage.

The χ^2 test was used to compare the variables among courses. The association among the use of e-cigarettes and variables such as sex, age, employment, use of conventional cigarettes, use of alcohol, and use of marijuana were analyzed using logistic regression with the use of e-cigarettes as the dependent variable. A *p*-value below 0.05 was considered statistically significant. All analyses were performed using Stata v. 9.2.

RESULTS

A total of 518 college students were included in this study. The mean age was 23 (SD=5.7), predominantly female (64.09%), single (93.41%), and medical students (60.42%). Other sociodemographic data are described in table 1. Among the 518 students interviewed, 262 (50.57%) had current or past smoking habits, 11.20% used conventional cigarettes; 24.32%, electronic cigarettes; 9.26%, marijuana; and 16.60%, alcohol. The majority answered that they used conventional cigarettes, e-cigarettes, and marijuana less than 8 days per month (Table 2).

Table 3 shows that the main motivations reported by college students for using e-cigarette were curiosity (47.70%) and the influence of family or friends (31.61%). The majority (44.14%) of those who stopped the use of e-cigarettes had done so because of health concerns.

Table 1. Sociodemographic characteristics and prevalence of the use of conventional cigarettes, e-cigarettes, marijuana, and alcohol.

Variables	N	%
Gender (n=518)		
Male	186	35.91
Female	332	64.09
Marital status (n=516)		
Married	23	4.46
Single	482	93.41
Cohabitation	11	2.13
Colleges (n=518)		
Medicine	313	60.42
Other in the Health field	141	27.22
Other non-Health	64	12.36
Employees (n=518)	127	24.52
Household (n=516)		
Alone	93	17.95
With family	309	59.65
With other students	98	18.92
With a partner	16	3.09
Smoking/ Use of drugs (n=518)		
Non-smoking	256	49.42
Use of e-cigarettes	126	24.32
Use of conventional cigarettes	58	11.70
Ex-smoker e-cigarettes	34	43.59
Ex-smoker conventional cigarettes	44	54.32
Use of alcohol	86	16.60
Use of marijuana	48	9.26

Table 2. Frequency of monthly consumption of conventional cigarettes, electronic cigarettes and marijuana among college students.

Variables		
Frequency of monthly conventional cigarette consumption (n=74)		
<8 days	44	59.46
From 8 to 15 days	8	10.81
From 15 to 20 days	4	5.41
From 20 to 30 days	18	24.32
Frequency of monthly e-cigarette consumption (n=108)		
<8 days	62	56.88
From 8 to 15 days	17	15.60
From 15 to 20 days	8	7.34
From 20 to 30 days	21	19.27
Frequency of monthly marijuana consumption (n=50)		
< 8 days	25	50.00
From 8 to 15 days	6	12.00
From 15 to 20 days	5	10.00
From 20 to 30 days	14	28.00

Table 3. Motivations for e-cigarette use and reasons for its cessation among university students who are users of this type of cigarette.

Items	n	%
Motivations for starting the use of e-cigarettes (n=174)		
Influence of friends or family	55	31.61
Smoking cessation	10	5.75
Influence of friends or family and smoking cessation	3	1.72
Curiosity	83	47.70
Smoking cessation and curiosity	1	0.57
Influence of friends or family and curiosity	11	6.32
Consider it sophisticated or modern	3	1.72
Consider it sophisticated or modern and curiosity	2	1.15
Other not mentioned	6	3.45
Reasons for stopping the use of e-cigarettes (n=111)		
Dislike it	21	18.92
Health concern	49	44.14
Dislike it and health concern	1	0.90
Choose not to continue	26	23.42
Don't know	14	12.61

Table 4 describes the perceptions of e-cigarettes among surveyed students (n=496). The majority (77.62%) answered that they were familiar with e-cigarettes and 16.94% agreed that e-cigarettes seem to be sophisticated or modern. Over half of the interviewed students (67.62%) became aware of e-cigarettes through friends, and 35.68% said that they would use e-cigarettes if their best friends offered them. Most of them (71.04%) did not consider e-cigarettes an effective way to provide smoking cessation; furthermore, 23.26% agreed that e-cigarette users are smokers and the exhaled vape from e-cigarettes is harmful to one's health. The main reasons for using e-cigarettes, according to the students, were curiosity (27.33%), the fact that it was odor free (26.42%), and the convenience in using it in public (19.60%). Moreover, 42.97% considered that the use of alcohol can stimulate the use of e-cigarettes.

Table 5 shows the association between sociodemographic data and psychoactive substance use among undergraduate

programs included in the study. The prevalence of psychoactive substance consumption among medical students, other undergraduate health programs, and non-health programs was, respectively: conventional cigarettes (53.45% vs. 41.38% vs. 5.17%; $p=0.02$), e-cigarettes (83.33% vs. 11.90% vs. 4.76%; $p<0.001$), marijuana (62.5% vs. 25.0% vs. 12.5%; $p=0.93$), and alcohol (91.86% vs 4.65% vs 3.49%; $p<0.001$).

Table 6 shows the data from the multivariate logistic regression, which considers the use of electronic cigarettes as a dependent variable. The analysis revealed that advancing age and being currently employed decreased the likelihood of using e-cigarettes by 7% and 67%, respectively. On the other hand, higher family income increased the odds of using e-cigarettes by 28%, and the use of conventional cigarettes, alcohol, and marijuana increased these odds by 6.4, 11.8, and 3.7 times, respectively.

Table 4. Perceptions of students about e-cigarette use.

Items	n	%
About e-cigarettes (n=496)		
Had never heard of it	9	1.81
Had already heard of it	385	77.62
Had never used and are curious about using	13	2.62
It seems sophisticated or modern	84	16.94
Had never used, are curious about using, and it seems sophisticated or modern	1	0.20
Had already heard of, had never used, and are curious about using	2	0.40
Had already heard of and it seems sophisticated or modern	2	0.40
Where they heard of e-cigarettes (n=505)		
Social media	72	14.26
Advertisement	16	3.17
From friends	342	67.72
Social media and friends	38	7.52
From health professionals	3	0.59
Social media and Advertisement	5	0.99
Social media, Advertisement, and friends	13	2.57
Social media, Advertisement, friends, and health professionals	4	0.79
Social media, Advertisement, friends, health professionals, and college	2	0.40
Advertisement and friends	2	0.40
From friends and health professionals	3	0.59
Social media, friends, and health professionals	3	0.59
Social media, Advertisement, and health professionals	1	0.20
Social media, friends, health professionals, and college	1	0.20
If you do not use e-cigarettes and one of your best friends offers them to you, would you try them? (n=454)		
Yes	162	35.68
No	221	48.68
I don't know	71	15.64

Items	n	%
Do you consider e-cigarettes an effective way to provide smoking cessation? (n=511)		
Yes	56	10.96
No	363	71.04
I don't know	92	18.00
Which reasons do you consider induce the use of e-cigarettes? (n=503)		
Ease of use in public	99	19.60
Odor free	132	26.14
Curiosity	138	27.33
I don't know	30	5.94
Ease of use in public and it doesn't smell bad	27	5.35
Ease of use in public, it doesn't smell bad, and curiosity	42	8.32
Ease of use in public, and curiosity	12	2.38
It doesn't smell bad and curiosity	23	4.56
Do you consider that* (n=503)		
E-cigarettes are less harmful than conventional cigarettes	23	4.57
E-cigarette users are smokers	80	15.90
E-cigarettes induce less dependence than conventional cigarettes	12	2.39
The exhaled vape of e-cigarettes is harmful to health	36	7.16
E-cigarettes stimulate the use of alcohol	8	1.59
I don't know	32	6.36
E-cigarette users are smokers and the exhaled vape of e-cigarettes is harmful to health	117	23.26
E-cigarette users are smokers and e-cigarettes stimulate the use of alcohol	33	6.56
Do you consider that the use of any of these drugs stimulate the use of e-cigarettes*: (n=505)		
Marijuana	12	2.38
Conventional cigarettes	69	13.66
Alcohol	217	42.97
I don't consider that there is a correlation	109	21.58
Marijuana, conventional cigarettes, and alcohol	50	9.90
conventional cigarettes and alcohol	31	6.14
Marijuana and conventional cigarettes	9	1.78
Marijuana and alcohol	5	0.99

Legend: *The number of answers is smaller than the total, because only the most prevalent responses were described in the table. Some questions had the option of more than one answer.

Table 5. Association between sociodemographic data and the use of psychoactive substances among undergraduate programs included in the study.

Variables	Medicine	Other health programs	Non-health	Total of answers	p
Age	23.31± 6.05	22.59 ±5.75	22.14± 3.87	-----	0.04
Gender n (%)					<0.001
Female	211 (63.55)	91 (27.41)	30 (9.04)	332	
Male	102 (54.8)	50 (26.88)	34 (18.28)	185	

Variables	Medicine	Other health programs	Non-health	Total of answers	<i>p</i>
Household income in minimum wage(real currency) n (%)					<0.001
1-2	7 (11.67)	43 (71.67)	10 (16.67)	60	
2-3	16 (21.92)	36 (49.32)	21 (9.10)	73	
4-6	34 (40.00)	34 (40.00)	17 (20.00)	85	
6-8	26 (66.67)	6 (15.38)	7 (17.95)	39	
8-10	38 (82.61)	6 (13.04)	2 (4.35)	46	
> 10	173 (93.01)	9 (4.84)	4 (2.15)	186	
Marital status n (%)					0.618
Married	14 (60.07)	7 (30.43)	2 (8.70)	23	
Single	289 (59.86)	132 (27.39)	61 (12.66)	482	
Other	9 (81.82)	1 (9.09)	1 (9.09)	11	
Use of psychoactive substances n (%)					
Conventional cigarettes	31 (53.45)	24 (41.38)	3 (5.17)	58	0.018
E-cigarettes	105 (83.33)	15 (11.90)	6 (4.76)	126	<0.001
Marijuana	30 (62.50)	12 (25.00)	6 (12.50)	48	0.928
Alcohol	79 (91.86)	3 (3.49)	4 (4.65)	86	<0.001

Table 6. Multivariate logistic regression using e-cigarette use as the dependent variable.

	Odds ratio (IC 95%)	<i>p</i>
Age	0.93 (0.88-0.98)	0.017
Gender	1.23 (0.68-2.19)	0.486
Family income	1.28 (1.08-1.51)	0.004
Currently employed	0.33 (0.14-0.77)	0.011
Conventional cigarettes	6.40 (2.95-13.87)	<0.001
Alcohol	11.88 (6.09-23.13)	<0.001
Marijuana	3.73 (1.57-8.82)	0.003

DISCUSSION

This study assessed the prevalence and the factors associated with e-cigarette use among college students, investigating their perceptions and motivations for the use of these products. A high prevalence of e-cigarette use was observed among the studied population, exceeding the prevalence reported by the study of Gonçalves et al. (2022)¹³, which evaluated 303 medical students and showed that 6.9% of them used conventional and electronic cigarettes, while 4.9% used just the electronic ones. In Brazil, the 2019 National Health Survey reported a prevalence of e-cigarette use of 0.6%, with 70% of users being adolescents and young adults. In addition, 90% of these users were non-smokers before starting e-cigarette use¹⁴. In the present study the main reasons for initiating e-cigarette use were curiosity and the influence of friends or family, mirroring the findings of the study published by Gonçalves et al. (2022)¹³.

A study carried out at a single academic health center in the United States of America (USA) included 853 college students in medicine, nursing, pharmacy, public health, and other programs. It showed a prevalence of e-cigarette use of 24.2% among these students⁹, similar to studies conducted in Saudi Arabia and France. These studies also showed a higher number of e-cigarette users, with prevalence rates of 23.0% and 21.0%, respectively^{8,11}. Despite e-cigarettes having been banned in Brazil since 2009, the current study conducted in private colleges showed a high prevalence (24.32%) of e-cigarette smokers. In contrast, Oliveira et al. evaluated 489 students from the Federal University of Mato Grosso and showed that only 0.61% of them were e-cigarette smokers¹².

The study by Franks et al. (2017)⁹, which evaluated college students in health programs, showed that the use of e-cigarettes did not differ significantly among nursing, medicine, pharmacy, and public health programs [24.6%, 22.7%, 21.6% and 20.7% respectively (*p*=0.36)]. However, in our study, the highest prevalence of e-cigarette use was among medical students. It is suggested that, due to their higher family income, they might have easier access to purchase and consume e-cigarettes, considering their relatively high average cost. This cost is approximately US\$9.80 for disposable products and US\$19.11 for reusable products¹⁵. Moreover, we demonstrated that a higher family income increases the chance of e-cigarette use by 28%.

Previous studies showed a prevalence of e-cigarette awareness of 91.9% and 99.2% among college students^{8,9}, whereas in this study, 77.62% of the students reported that they had already heard about these cigarettes. The high prevalence of e-cigarette awareness in the USA may be due to the commercialization of these smoking products since 2007¹⁶.

On the other hand, in Brazil, the commercialization, import, and advertising of all types of electronic smoking devices have been banned by Anvisa, according to Resolution No. 46, 28 August 2009. Recently, in 2022, ANVISA maintained the ban of e-cigarettes through the Regulatory Impact Analysis Report (AIR), aiming to safeguard the population from the risks and harms associated with e-cigarette use^{14,17}. Despite the ban, this study showed a surprisingly high prevalence of e-cigarette use, possibly linked to the fact that its use is not a criminal offence and is socially accepted. Students in our study reported that they gained awareness of e-cigarettes mainly through friends and social media, while in the study conducted by Franks et al. (2017)⁹, the most mentioned sources were watching someone use e-cigarettes (82%), listening to other people talk about e-cigarettes (75.6%), meeting people who use e-cigarettes (68.2%)⁹.

Regarding motivations for e-cigarette use, a cross-sectional study conducted with college students at a university in the Southeast of the USA reported that 95.0% of e-cigarette users cited curiosity as the most frequent reason to start using it, followed by friends using (81.0%), the absence of odor (77.0%), ease of use (74.0%), and enjoyable flavors (67.0%)⁷. In France, among the evaluated college students, the primary reasons for e-cigarette use were quitting or reducing tobacco use and the pleasant taste they offer (42.9%, 32.1% and 39.3%, respectively)¹¹. In the present study, curiosity, friends or family influence were highlighted as the main motivations for e-cigarette use. Similarly, a study conducted with adolescents found that obtaining e-cigarettes from friends and family was associated with their usage¹⁶. The results from these studies suggest an important social influence of family and friends on e-cigarette use.

Logistic regression analysis revealed an association between the use of e-cigarettes and age, family income, being currently employed, the consumption of alcohol, conventional cigarettes, and marijuana. Comparatively, the study by Tavolacci et al. (2016) also showed an association between e-cigarette use and smoking, the occasional use of marijuana, alcohol abuse problems, and risk of eating disorders. Roys et al. (2020)¹⁸ applied the alcohol use disorder identification test to college students and found that e-cigarettes were associated with problematic alcohol use.

According to Hammig et al. (2017)¹⁹, young adults agree that e-cigarettes are less harmful to health and less addictive than conventional cigarettes. In this context, our study presented an important finding: a minority of participants reported that these smoking products caused less dependence than conventional cigarettes and that e-cigarettes were effective as a device to quit smoking. In addition, the majority of students believed that e-cigarettes are harmful to health. Franks et al. (2017)⁹ showed that only 25.3% of the health professional students agreed that e-cigarettes were a considerable option to help quit smoking. The majority of them did not agree that e-cigarettes offered

health benefits or reduced health harms compared to conventional cigarettes.

The long-term effects of e-cigarettes on health are still unknown and their potential toxic and carcinogenic effects seem to depend on the concentration and type of e-cigarette content²⁰. Nicotine exposure causes important cardiovascular effects such as an increased heart rate²⁰. In 2019, the US Centers for Disease Control and Prevention (CDC) reported more than 2000 suspected cases of EVALI, which is associated with the inhalation of chemical substances from the e-cigarette liquid. This condition treatment is based on clinical and ventilatory support^{20,21}. Studies conducted in California²² and Hong Kong²³ with adolescent students showed an association between the occurrence of respiratory symptoms and current or previous e-cigarette use. Additionally, they reported that the risk of developing EVALI-like symptoms is directly proportional to the frequency of use^{22,23}.

Previous studies among adolescents in Brazilian public and private educational institutions have already described a high prevalence of hookah and electronic cigarette use^{13,24,25}. Unfortunately, knowledge about the harms of electronic cigarettes is limited among young individuals aged 18-34, an age group that is the largest consumer group for e-cigarettes²⁶. Our study reveals that the prevalence of electronic cigarette use remains notably high among Brazilian university students, particularly those within the health field. This is likely due to the attractiveness of these devices and the limited spread of information concerning their potential harms. Zhou et al. (2015)²⁷ showed that a significant number of medical students had used tobacco or electronic smoking devices. In this study, the students reported having little knowledge about the health effects of e-cigarettes, or their epidemiology, and received inadequate information and training during their education to provide cessation advice for e-cigarette use. These findings highlight the importance of studies focusing on this matter, as students and healthcare professionals must comprehend the motivations and perceptions of young Brazilians concerning e-cigarette use. This comprehension is critical for devising and implementing effective strategies for their cessation. Additionally, Brazilian health and education authorities should endorse the widespread dissemination of the harmful effects of these devices.

Although our study provides insight into the prevalence, perceptions, motivations, and factors associated with e-cigarette use among undergraduate students, it has some limitations. Due to the cross-sectional design of the study, we cannot infer causality in the association of the variables, and the relationship between the use of alcohol, marijuana, and conventional cigarettes can be bidirectional. This study was based on a questionnaire with previously defined questions that may have limited the motivations and perceptions about e-cigarettes among college students. In addition, this study was conducted at two private colleges; consequently, the results of this research may not be generalized for all

undergraduate students. Thus, we suggest that cohort studies must be conducted to better understand the potential health effects of e-cigarettes among undergraduate students.

CONCLUSION

This study addresses important aspects of the use of electronic cigarettes among undergraduate students. Despite e-cigarettes being banned in Brazil since 2009, there was a high prevalence of e-cigarette use in the studied population. Users cited curiosity and the influence of friends and family as the primary reasons for starting to use e-cigarettes. Additionally, the majority of respondents reported that e-cigarettes are not effective as a smoking cessation device and that they would use them if offered by their closest friends. E-cigarette consumption was associated with age, family income, engagement in economic activities, and the use of other substances such as conventional cigarettes, alcohol, and marijuana.

As e-cigarette use increases among Brazilian university students, it's crucial for higher education institutions to initiate awareness campaigns that broadly communicate the health risks linked to their use. Furthermore, by comprehending the factors associated with the use of these smoking devices, it's important to establish health policies directing actions to prevent the initiation of smoking among adolescents and young adults.

AUTHORS' CONTRIBUTIONS

We describe contributions to the papers using the taxonomy (CRediT) provided above:

Conceptualization, formal analysis; methodology; project administration; supervision; writing - original draft and editing: Leda Marília Fonseca Lucinda. *Data curation; investigation; methodology; writing - original draft and editing:* Gabriela Almeida Mattos, Gabriela Ferreira Paticcié, Iara Ana Pinto Borges, Isabela Maciel Camarano, Thamyres Albuquerque Campos Belo Fagundes, Lucas Coutinho Orellana. *Conceptualization; formal analysis; supervision; writing - original draft and editing:* Pedro Ivo Carmo Campos.

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