Original Article

Prevalence and attitudes associated with the use of electronic cigarettes among university students in the Northeastern region of Brazil

Prevalência e atitudes associadas ao uso do cigarro eletrônico em estudantes universitários na região Nordeste do Brasil

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ABSTRACT

Objective: Assess the prevalence and attitudes associated with the use of electronic cigarettes (EC) in university students in the Northeastern region of Brazil. **Methods:** A cross-sectional study was conducted on the campus of the University of Fortaleza (UNIFOR) from February to March 2023. The study population consisted of 300 regularly enrolled students from the four UNIFOR Science Centers, aged 18 years and above, who agreed to participate in the research by electronically signing the Informed Consent Form. Participants were recruited through on-campus approaches, invitations made by researchers, and through social media promotion. The data collection instrument was made available through a link to the research instrument created by the authors using Google Forms®, containing questions that addressed sociodemographic data and tobacco-related attitudes. **Results:** The prevalence of e-cigarette use was 24% (n=72). Most of the sample-initiated e-cigarette use upon entering the university environment (n=38; 52.8%), with a predominance in the age group of 16-20 years (n=53; 73.6%), and a frequency of daily use (n=25; 34.7%), as well as social use (n=22; 30.6%). Furthermore, the main reasons for starting to use were curiosity and the influence of friends/peers (71.4% and 56%, respectively). **Conclusions:** The prevalence of EC use among university students was notably high, particularly among individuals aged 16 to 20 years. Curiosity and peer influence emerged as the primary reasons for initiating EC and a substantial proportion of students reported EC as their first contact with smoking.
Keywords: Electronic Nicotine Delivery Systems. Vaping. Universities.

INTRODUCTION

Electronic cigarettes (EC) are devices that vaporize substances to be inhaled through the respiratory system[1]. Several components are required for its operation, including the battery, the heating element that vaporizes the substance, and the reservoir, also referred to as the atomizer, which stores the substance[2]. Furthermore, in the battery of the EC, there is a sensor that detects the user's suction, activating the atomizer and initiating the vaporization of the liquid (e-liquid/juice) contained in the heating element, which will subsequently be inhaled by the user[3].

The composition of the juice is characterized by various harmful substances, such as liquid nicotine, which is mostly dissolved by vegetable glycerin or propylene glycol. Additionally, it contains various aldehydes and alcohols with the aim of creating numerous flavors, making them more appealing to adolescent and young adult populations[2]. E-liquid manufacturers provide insufficient information regarding the chemical composition present in the solutions[1].

According to the Brazilian National Cancer Institute (INCA)[4,5], the organism can be exposed to chemical elements in different ways through EC use. One of these ways would be by the device itself, through the release of metal nanoparticles. Moreover, another form of exposure would be directly related to the vaporization process, as the elements contained in the vapor include carcinogens and cytotoxic substances, potentially causing pulmonary and cardiovascular diseases.

In 2019, approximately 2,400 cases of lung injuries related to EC use were reported through the Centers for Disease Control and Prevention (CDC) in the United States[6], considered an outbreak in the country, with a total of 48 fatalities. These injuries were designated as EVALI (E-cigarette or Vaping product use-Associated Lung Injury), characterized as a potential inflammatory reaction related to additives and solvents present in the composition of e-liquid.

Patients affected by EVALI may present pneumonitis, and in more severe cases, a case of respiratory failure. Vitamin E acetate has been found in counterfeit cartridges and in samples of bronchoalveolar lavage fluid, being identified as one of the possible causes of this pathology[7,8].

In a conducted study, a growing incidence of EC use was observed among university students. During this moment of life, EC consumption may be related to various factors, such as the challenges of academic life, emphasizing the quantity of activities to be undertaken and the responsibility required in this context. Furthermore, it is possible to correlate the use of EC with psychological distress, exemplified by conditions such as depression and anxiety, in addition to the influence of social pressure and stress[9,10].

Despite EC being designed as a device with the intention of serving as an alternative for smoking cessation, there is no evidence to confirm the effectiveness of this goal. The results have proven inconclusive, with the possibility of leading to a more complex issue: the use of EC as a starting point for the consequent smoking in youth[9].

The interest in conducting this research started from the observation in the literature regarding the scarcity of scientific evidence about the prevalence of EC use in the university setting. Additionally, to our knowledge, few prevalence studies have been conducted in the northeastern region of the country.

The objective of this study was to assess the prevalence and attitudes associated with EC use among university students in the Northeastern region of Brazil.

METHODS

A cross-sectional study was conducted on the campus of the University of Fortaleza (UNIFOR) from February to March 2023, following the recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines[11].

The study population consisted of university students, and the sample was estimated at 217 participants according to the sample size calculation. The sample size was calculated using BioEstat 5.3 software (Belém, Pará, Brazil) based on the primary outcome of the study, which is the prevalence of EC use in university students. This sample was derived from the population of students regularly enrolled in undergraduate courses at UNIFOR (16,400 students), with a sampling accuracy of 5% and a 95% confidence interval.

The study included students regularly enrolled in the four Science Centers at UNIFOR (health, communication and management, legal, and technological), aged over 18, who agreed to participate in the research by electronically signing the Informed Consent Form.

Participants were recruited through an on-campus approach at UNIFOR, using invitations extended by the researchers and through social media promotion. The data collection instrument was made available through an access link to the research tool created by the authors using Google Forms®. The link could be accessed by a QR code featured in social media publications.

The research instrument contained the following sociodemographic data: age, gender, affiliated course, current semester, marital status, employment status, parents' education level, hours of sleep per night, family history of smoking, and past smoking history.

Additionally, participants were queried about their use of electronic cigarettes (EC). In case of confirmation, tobacco-related attitudes were further explored through the following variables: frequency of EC use; age at which EC use commenced; initiation of EC use upon entering university; duration of EC use; motivation for EC use; monthly consumption of EC juice/e-liquid bottles; use of nicotine-containing EC juice/e-liquid; concurrent use of EC with alcohol and in social activities (parties, concerts); EC use in open and enclosed environments; association of EC use with conventional cigarette use; knowledge about the harmful effects of the use of EC. However, for university students who reported not using EC, they were asked about the reasons for non-use and their reaction if someone were to smoke in their vicinity.

The data were analyzed using the Statistical Package for the Social Sciences IBM® version 20.0 (SPSS Inc., Chicago, IL). The data distribution was assessed using the Shapiro-Wilk test. For descriptive analysis, mean and standard deviation (for parametric data), median and interquartile range (for non-parametric data), relative frequency, and absolute frequency were employed. To assess the association between variables, either the Pearson correlation test or the chi-square test was applied, with values of $p < 0.05$ considered statistically significant.

The research adhered to the recommendations of Resolution 466/12 of the Brazilian National Health Council, under the Brazilian National Ministry of Health[12], which governs the ethical principles of research involving human subjects. This study was approved by the local ethics committee at UNIFOR with protocol number 4,460,813.

RESULTS

Three hundred students participated in the research, with 198 (66%) being female, an average age of 21.6 ± 4.2 years, predominance of single marital status (n=266; 88.7%), and affiliation with the Health Sciences Center (n=164; 54.7%). Other personal characteristics are described in Table 1.

Table 2 indicates the behavior of EC use, reasons for use, and perceptions of harm. The prevalence of EC use was 24% (n=72), with all participants being aware of the device (n=300; 100%), while 18.3% (n=55) use conventional cigarettes. Most of the sample-initiated EC use upon entering the university environment (n=38; 52.8%), predominantly in the age group of 16-20 years (n=53; 73.6%), with a daily usage frequency (n=25; 34.7%), and socially usage (n=22; 30.6%). Additionally, the main reasons for initiating use were curiosity and the influence of friends/peers (71.4% and 56%, respectively).

About the characteristics of the used EC devices and the environmental context, notable features include the use of nicotine-containing juices (n=58; 90.6%) and their association with alcohol consumption (n=67; 93.1%). Simultaneously, participants reported (n=24; 33.6%), for the most part, being unable to specify the quantity of juice bottles used monthly. It was also observed that EC was the first contact with cigarettes for university students (n=46; 63.9%), and the vast majority claimed to be aware of/deemed familiar with the deleterious effects associated with the use of the device (n=67; 93.1%).

Table 1. Personal and Academic Characteristics of Study Participants. Fortaleza, 2023.

Variables	n=300
Age (years)*	21,6 ± 4,2
Gender†	
Female	198/66
Male	96/32
Prefers not to identify	6/2
Marital status†	
Single	266/88,7
Married	13/4,3
Common-law marriage	12/4

<div align="center">Table 1 (continued)</div>

Others	9/3
Area of knowledge†	
Health Sciences	164/54,7
Legal Sciences	68/22,7
Communication and Management Sciences	39/13
Technological Sciences	29/9,7
Has formal employment†	47/15,7
Hours of sleep per night†	
< 6 hours	105/35
> 6 hours	195/65

Legend: Data presented as mean ± standard deviation; † Data expressed in relative and absolute frequency; % = percentage; n = number of individuals.

Table 2. Behavior of electronic cigarette use, reasons for use, and perceptions of harm. Fortaleza, 2023.

Variables	n=300
Are you familiar with or have you heard about electronic cigarettes†	300/100
Currently using conventional cigarettes†	55/18,3
Currently using e-cigarettes†	72/24
Initiated the use of e-cigarettes upon entering the university environment (n=72)†	38/52,8
Age of onset of e-cigarette use (n=72)†	
Between 16-20 years	53/73,6
21 years or older	16/22,2
15 years or younger	3/4,2
Frequency of e-cigarette use (n=72)†	
Daily	25/34,7
Socially	22/30,6
Rarely	15/20,8
Only on weekends	10/13,9
Reason that contributed to the use of e-cigarettes (n=72)†	
Inherent curiosity	51/71,4
Influence of peers and friends	40/56
Stress relief/Alleviate tensions	31/43,4
Replace conventional cigarettes	10/14
Others	7/9,8
Number of bottles of juice/e-liquid used per month (n=72)†	
Cannot provide information	24/33,6
Between 1 and 3 bottles	21/29,4
Less than 1 bottle	20/28
More than 3 bottles	7/9,8
Uses e-cigarettes associated with alcohol consumption (n=72)†	67/93,1
The *juice/e-liquid* contains nicotine (n=72)†	58/90,6
The use of e-cigarettes was the first contact with cigarettes (n=72)†	46/63,9
Is aware of the deleterious effects of e-cigarette use (n=72)†	67/93,1

Legend: Data presented as mean ± standard deviation; † Data expressed in relative and absolute frequency; % = percentage; n = number of individuals.

DISCUSSION

Our findings show a significant prevalence of EC use in the university environment. In this context, most of the sample initiated the use of the device after entering university, predominantly in the age group of 16 to 20 years. The main reported reasons for initiation were curiosity and the influence of friends/peers, with a high prevalence of EC being the first contact with smoking.

In a global context, a variation in the prevalence of EC use among university students from different countries was observed. Studies conducted in universities in the United States[13], New Zealand[10], Vietnam[14], Poland[15], South Korea[16], China[17], Jordan[18], and Qatar[19] reported percentages of 6.5%, 40.5%, 13.2%, 45%, 0.8%, 16.7%, 10.5%, and 14%, respectively. No significant changes were evident to explain the differentiation between the results, but a relevant factor to be considered is the cultural diversity and smoking habits of each country.

In the Northeastern region of Brazil, a prevalence study of EC use was conducted among medical students in the state of Piauí[20], presenting a percentage of 20.1%. The data from this sample supported the results analyzed in the present study, revealing significantly similar values. In contrast, in the Central-West region, a study was conducted at a university in the state of Mato Grosso[21] with a prevalence of 0.61%. Additionally, in the Southeast region, a university in São Paulo[22] obtained a result of 12%.

However, despite significant differences between the results, one of the predominant characteristics in the previously mentioned studies is the profile of the participants, with a prevalence of females and an age range around 18 to 21 years. These data align with the results presented in our study.

From the data obtained in this study, something that proved to be alarming was the high incidence of participants reporting daily use of EC. Additionally, it was observed that most university students reported the device to be their first contact with cigarettes, a factor that propels towards the habit of smoking.

The main reasons reported by participants for initiating EC use in this study are curiosity and the influence of friends and peers, which align with findings in other studies[10,19-21,23]. Another frequently cited justification for EC consumption is the mistaken belief among many participants that EC is less harmful than conventional cigarettes, reinforcing the need for greater awareness on the subject[24].

A study conducted by Hefner et al.[23] addressed EC use among university students in association with alcohol consumption, presenting a percentage of 4.8% of students using the device while consuming alcoholic beverages. Compared to the data from our research, we obtained a result nineteen times higher than that presented by the study, highlighting the gravity and contemporaneity of excessive EC use among university students.

The most of EC user participants stated that they used nicotine-containing juice, a substance that causes extreme dependence in those who consume it. Nicotine levels detected in the e-liquids were twice the dosages specified by the manufacturers. Despite many consumers using EC as an alternative to reduce conventional cigarette use, the level of dependence may increase due to the use of an incorrect dosage of nicotine[25].

Regarding the topic of awareness of the deleterious effects associated with the use of the device, it is noticeable that those who claimed to use the EC predominantly declared themselves aware of its harmful effects. This was reinforced when compared to a study that showed similar results in both criteria[20]. This circumstance proved paradoxical and alarming, as it presented a high prevalence of use in a percentage of the population that claims to be aware of the health hazards resulting from the routine use of the device.

This study presented some limitations. One of them was the use of the Google Forms® platform for data collection which, despite its practicality, does not allow for control over duplicate responses or validation of the information provided. Another limitation to be acknowledged is the recruitment strategy, which was conducted through direct invitation and social media, potentially introducing selection bias, as individuals with greater exposure to the topic (users or those interested in the subject) may have been more inclined to participate.

In addition, data collection was conducted at a single university. However, this institution has a considerable number of students, distributed across four science centers. This diversity contributes to providing a more specific profile of electronic cigarette users within the university context. Moreover, this is one of the first studies to analyze the prevalence of EC use among university students in the Northeast region of Brazil.

Therefore, despite the university currently implementing health prevention and promotion strategies, there is a need for campaigns to be intensified, along with increased monitoring of users within the campus, given the close relationship between the university, students, and EC use.

CONCLUSION

The prevalence of EC use among university students was high, particularly among individuals aged 16 to 20 years. Curiosity and peer influence emerged as the primary reasons for initiating EC and a substantial proportion of students reported EC as their first contact with smoking.

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