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ORIGINAL ARTICLE

Prevalence of Electronic Cigarette Use and Related Factors Among Medical Students: A Cross-Sectional Study in Anatolia

Ülken Tunga Babaoğlu, Hüseyin İlter

Department of Public Health, Kırşehir Ahi Evran University Faculty of Medicine, Türkiye

ORCID iDs of the authors: Ü.T.B. 0000-0003-0275-0537, H.İ. 0000-0002-4452-8902

Main Points

- The investigation revealed a deficiency in the knowledge of electronic cigarettes (e-cigarettes) among medical faculty students.
- All of the e-cigarette users were cigarette smokers.
- The reasons for starting to use tobacco products were found to be influence of a friend and curiosity, respectively.
- The most common reason motivating students to use e-cigarettes was found to be their social environment.

Abstract

This study aimed to investigate the frequency of electronic cigarette smoking and its related factors among medical students. A descriptive-cross-sectional online survey was administered to medical students ($n = 767$) enrolled at the Kırşehır Ahı Evran University Faculty of Medicine. Of those who participated in the study, 25.6% stated that they were using or had tried electronic cigarettes and 26.59% stated that they were active smokers. Among the students in our sample, age 21 and below (odds ratio: 5.051, 95% confidence interval: 1.584 – 16.101), being male (odds ratio: 6.972, 95% confidence interval: 2.870 – 30.335), a close friend (odds ratio: 3.989, %95 confidence interval: 1.505 – 10.570) or one of the parents using electronic cigarettes (odds ratio: 9.177, %95 confidence interval: 1.661 – 50.692) were found to increase the risk of electronic cigarette use. As the use and popularity of electronic cigarettes is increasing, the lack of knowledge among medical students on this subject reveals the need to improve the medical school curriculum.

Keywords: Addiction, alternative nicotine products, e-cigarettes, medical student, smoking habits

Corresponding Author: Ülken Tunga Babaoğlu
E-mail: utbabaoglu@ahievran.edu.tr

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Introduction

The World Health Organization (WHO) has revealed that 1.4 billion people worldwide still use tobacco and tobacco products, which is a serious problem for both public health and national economies (Karaca, 2019). The Framework Convention on Tobacco Control (FCTC), which was proposed to guide in combating the global tobacco epidemic, has been an important tool. World Health Organization has introduced the MPOWER measures to help implement effective interventions at the country level. (WHO, 2008). In Türkiye, the FCTC was signed in 2008, enacted into law, and implemented (Karaca, 2019).

The spread of effective methods for combating tobacco and tobacco product use under the leadership of the WHO has also been effective in reducing addiction. The decrease in the use of tobacco and its products has led the tobacco industry to search for new products and addicts. In this context, young people have become a new target of the tobacco industry, and to get closer to young people, products claiming to potentially reduce exposure have been put on the market. In this context, electronic

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cigarettes (e-cigarettes) have found widespread use, especially among young people. Although e-cigarettes are offered in the market as tobacco-free products, they contain nicotine and other chemicals. Studies show that half of young people have tried e-cigarettes at least once, and this rate is increasing (Özturk et al., 2021). International organizations such as the WHO, Centers for Disease Control and Prevention (CDC), and Food and Drug Administration (FDA) have shown that e-cigarettes have harmful effects on young people, at least as much as tobacco and tobacco products (CDC, 2018).

Recent research has drawn attention to the increase in e-cigarette use among students in middle school, high school, and university settings (CDC, 2018; Wang et al., 2018). According to a literature review, in a community-based study conducted in Izmir, 19.0% of participants used e-cigarettes at least once. Participants stated that health was the most important reason for their preference for e-cigarettes (Atlam et al., 2020). In another study conducted with medical students in the USA, participants stated that there were significant differences in their lack of knowledge and attitudes regarding e-cigarettes (Hinderaker et al., 2018).

Public health authorities are concerned regarding the growing popularity of e-cigarettes. In addition, the WHO and FDA have stated that attention should be paid to the safety of e-cigarettes and the impact of nicotine on the body (CDC, 2018). This situation is even more worrying because young people who use electronic cigarettes may be predisposed to smoking and long-term nicotine addiction.

In international studies, e-cigarette use is increasing especially among students. While the use of e-cigarettes are increasing, it is important to determine the knowledge and usage status of medical students in the fight against e-cigarettes. Since there are few studies on the prevalence and causes of e- cigarette use among medical students in our country, this study was planned to contribute to the literature. This research aimed to investigate the prevalence of e-cigarette smoking, and some associated factors among medical students of Kırşehir Ahi Evran University, Faculty of Medicine. With this research, the knowledge, attitudes, and experiences of medical students about e-cigarettes will be evaluated. The findings will serve as a source of information for the training to be developed at the university.

Material andMethods

The study is a descriptive-cross-sectional epidemiological study.

Sample Size Calculation

The study population consists of a total of 767 students studying at the Faculty of Medicine of a university located in the Central Anatolia Region of Türkiye in the autumn term of the 2023 – 2024 academic year. In the study, it was aimed to reach the entire research population without selecting a sample. The criteria for inclusion in the research group were determined as studying at the Faculty of Medicine of the relevant university, being 18 years of age or older, wanting to participate in the study, and approving the informed consent form. In the study in which it was aimed to reach the entire population, 504 (65.71%) students were reached.

Data Collection

The questionnaire items were developed based on previous questionnaires on e-cigarettes for physicians and a questionnaire for medical students (Afzal et al., 2021; Alsanea et al., 2022; Habib et al., 2020; Hinderaker et al., 2018). The questionnaire consists of 28 questions and is designed to last 5 minutes. The data collection tool consists of two parts. The first part consists of some socio-demographic characteristics of the participants. In this part, there are questions about gender, age, class, the place where they lived for the longest time before starting university, their perceived economic status, and their smoking status. The second part of the questionnaire was divided into three sections: use status, knowledge, and attitude. Participants were asked whether they had ever used e-cigarettes, whether they currently use e-cigarettes, and whether they have family members or close friends who use e-cigarettes. Information questions such as the effectiveness of e-cigarettes in smoking cessation and addictiveness were also included.

All students enrolled in the medical school were sent an online link (Google Forms) to the questionnaire via a social media contact created separately for each class. The questionnaire remained open from August 8, 2023 to October 15, 2023. The link was resent weekly until the study was completed. One week before the survey closed, face-to-face announcements were made to second and third-year students to encourage non-respondents to participate.

Ethical Committee Approval

This study was approved by Kırşehir Ahi Evran University Non-interventional Research Ethics Committee (decision no.: 2023-02/11, date: January 24, 2023) and necessary permission was obtained from the Dean's Office of Kırşehir Ahi Evran University Faculty of Medicine.

Data Analysis

Number, percentage, median, and quartiles were used for descriptive statistics in data analysis. The continuous variables to the assumption of normal distribution were evaluated with the Shapiro – Wilk test ($p < .001$) and Kolmogorov – Smirnov ($p < .001$), and the data were not normally distributed. Pearson chi-square test was used to compare independent groups. Binary logistic regression analysis was used to determine the factors affecting electronic cigarette use (Enter model). Variables with $p < .10$ in binary analyses were included in the model. Electronic cigarette use was used as the dependent variable in the models for electronic cigarette use and age, gender, how long he/she has been smoking, close friend's use of electronic cigarettes, sibling's use of electronic cigarettes, and parental use of electronic cigarettes. The explanatory power model was evaluated according to Nagelkerke R square (Nagelkerke R^2) (Hosmer – Lemeshow test value = 12.300). $p < .05$ was considered statistically significant. SPSS v23.0 software package (IBM SPSS Corp.; Armonk, NY, USA) was used for analyses.

Results

A total of 504 people participated in this research. The median age was 21 years ($Q_1 = 19 – Q_3 = 23$) and 60.3% were female. Of the participants, 62.7% were pre-clinical students. Of the participants, 28.8% ($n = 154$) were smokers or recent quitters, and

Table 1.
Socio-demographic Characteristics of the Participants

Variables	Medium (Q_1 – Q_3)	
Age	21.00 (19.00 – 23.00)	
	Frequency	Percent (%)
Gender		
Female	304	60.3
Male	200	39.7
Class		
Pre-clinical (first – third grade)	316	62.7
Clinical period (fourth – sixth grade)	188	37.3
Smoking status		
Never used	350	69.4
Former user	9	1.8
Just quit	11	2.2
Active user who use occasionally	44	8.7
Active user	90	17.9
Time of first start*		
High school	67	43.5
University	87	56.5

Note: *Active, occasional users, active, recent quitters, and former users.

43.5% of them stated that they started smoking in high school (Table 1). The median duration of smoking among smokers is 2 years (Q_1 = 1 – Q_3 = 4).

When the participating students were asked where they heard about e-cigarettes, 35.3% (n = 178) stated that they heard about it from the internet or social media, and 28.2% (n = 142) stated that they heard about it from their friends. Among the participants, 4.6% (n = 23) stated that they used e-cigarettes and 21.0% (n = 106) stated that they tried e-cigarettes. When the monthly cartridge consumption of e-cigarette users was questioned, 60.9% (n = 14) were found to consume one cartridge. When the users were asked why they started using e-cigarettes, 41.1% (n = 44) stated that they started because of the influence of friends and 38.8% (n = 50) stated that they started using e-cigarettes because of curiosity (Table 2). It was determined that e-cigarette users also used cigarettes. In Table 2, questions were asked about the e-cigarette use of the participants in the study. 16.1% (n = 81) of the participants stated that e-cigarettes can be used for smoking cessation, and 20.2% stated that they can be equally addictive as cigarettes.

Of the participants, 31.5% thought that the sale of e-cigarettes was legal in Türkiye, 37.5% stated that e-cigarette use did not contribute to the normalization of tobacco use, and 17.3% stated that e-cigarette use would help reduce tobacco consumption (Figure 1).

Of the students, 50.6% had someone around them who used e-cigarettes. Of these, 36.5% reported that their close friends, 5.0% reported that their teachers, 4.6% reported that at least one of their parents, 3.2% reported that their siblings, and 1.3% reported that other people used e-cigarettes.

Table 2.
Electronic Cigarette Use and Knowledge Status of the Participants

E-Cigarette Use Status	**Frequency (n)**	**Percent (%)**
Where did you hear about e-cigarettes?		
I do not know what it is	86	17.1
Internet/social media	178	35.3
Family	18	3.6
Friend	142	28.2
I saw it in users	78	15.5
Teachers	2	0.4
Do you use e-cigarettes?		
No	375	74.4
Yes	23	4.6
Tried	106	21.0
E-cigarette cartridge consumption		
1 cartridge	14	60.9
2 cartridges	8	34.8
3 and above	1	4.3
Why you started e-cigarettes		
To quit smoking	20	15.5
For use in places where I cannot smoke	15	11.6
Friend/peer influence	44	41.1
Curiosity	50	38.8
Can e-cigarettes be used as a smoking cessation tool		
I do not know anything about that	241	47.8
Can be used for smoking cessation	81	16.1
Cannot be used for smoking cessation	182	36.1
Addictive properties of e-cigarettes		
I do not know anything about it.	249	49.4
Less addictive than cigarettes	91	18.1
Equally addictive as cigarettes	102	20.2
More addictive than cigarettes	62	12.3

As the place they would refer to for counseling on smoking cessation, 57.9% (n = 292) reported that they would refer to Alo171 and 7.7% (n = 39) reported that they would refer to YEDAM. When the status of receiving training on e-cigarettes was questioned, 81.5% (n = 411) stated that they did not receive any training.

When e-cigarette use was analyzed according to gender, 82.6% of e-cigarette users were male (p < 0.001). Close friends of 65.2% of

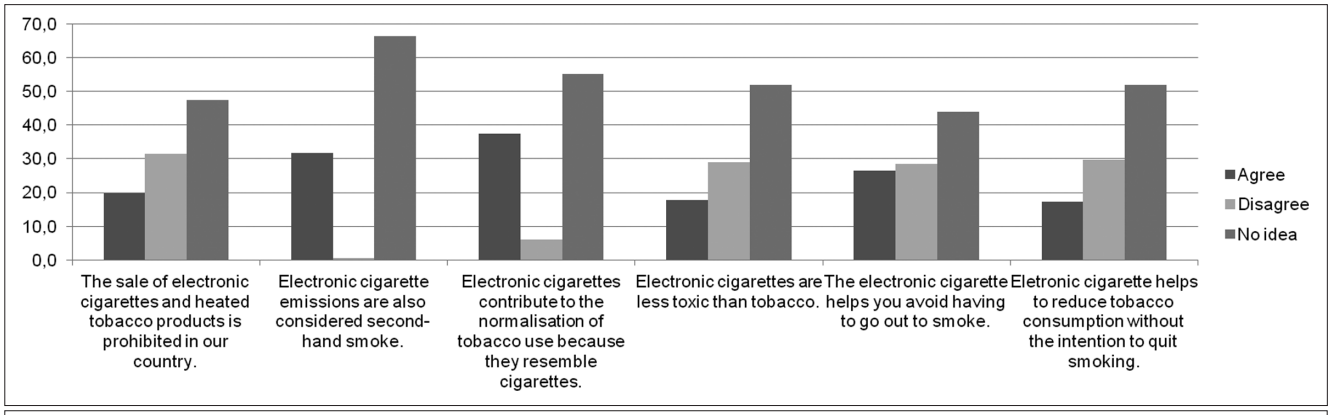

Figure 1. Electronic cigarette knowledge and attitudes of the participants.

e-cigarette users were also e-cigarette users ($p = .007$). All of the e-cigarette users were also cigarette smokers. Among e-cigarette users, 65.2% believed that e-cigarettes were less addictive than traditional cigarettes ($p < .001$). Of the e-cigarette users, 43.5% stated that they could be used for smoking cessation ($p < .001$). In the models created using the enter strategy for e-cigarette use and affecting risk factors, the dependent variable explains 27.5% of the variance according to Nagelkerke ($p < .001$) (not presented in table). When the factors affecting the smoking status of the students in the study were analyzed by logistic regression analysis, it was found that the age was 21 and below (odds ratio (OR): 5.051 95% CI: 1.584 – 16.101), male (OR: 6.972, 95% CI: 2.870 – 30.335), e-cigarette use status of close friends (OR: 3.989 %95 CI: 1.505 – 10.570), e-cigarette use by a parent (OR: 9.177 %95 CI: 1.661 – 50.692), and e-cigarette use by a sibling (OR: 9.067 95% CI: 1.843 – 44.602) were found to significantly increase the risk of e-cigarette smoking (Table 3).

Table 3.
Investigation of Risk Factors Affecting Students' Electronic Smoking Rate by Logistic Regression Analysis

Variables	Odds Ratio	95% CI	*p*
Age			.006
22 and above	1		
21 and below	5.051	1.584 – 16.101	
Gender			<.001
Female	1		
Male	6.972	2.870 – 30.335	
E-cigarette use by a closed friend			.005
No	1		
Yes	3.989	1.505 – 10.570	
E-cigarette use by a parent			.011
No	1		
Yes	9.177	1.661 – 50.692	
E-cigarette use by a brother			.007
No	1		
Yes	9.067	1.843 – 44.602	

Note: CI, confidence interval; p, logistic regression analysis enter model.

Discussion

According to the results of this study, the frequency of e-cigarette use among medical faculty students in the sample was 4.6% and the frequency of e-cigarette use was 21.0%. All e-cigarette users used cigarettes. A significant proportion of the participants indicated that close friends or family members used e-cigarettes. Most reasons e-cigarette users start using e-cigarettes are friends or curiosity. The knowledge and attitudes toward e-cigarettes among the students participating in the study were quite variable. Half of the participants stated that they had no knowledge about the smoking cessation tool for e-cigarettes and the addictiveness of e-cigarettes, while one-third stated that e-cigarettes were less addictive than cigarettes. More than two-thirds of the participants had no information or incorrect information regarding the sale of e-cigarettes in our country and health problems. The majority of students stated that they had received inadequate education about e-cigarettes. According to the results of the study, being male, being 22 years of age or younger, and having a sibling or close friend using e-cigarettes were risk factors for the utilization of e-cigarettes.

A study was conducted in the UK on e-cigarette use among medical students was 32.6% (Afzal et al., 2021). In another study of medical school students in the USA, 14.7% reported trying or occasionally using e-cigarettes (Habib et al., 2020; Hinderaker et al., 2018). In a study conducted among medical school students at a university in Saudi Arabia. In one study conducted in the same country, the rate of e-cigarette use was found to be 12.2%. Another study found that e-cigarette use among students was higher in medical school students than in pharmacy and health sciences faculties (Alsanea et al., 2022). In a study conducted among students continuing their education at two different universities in Türkiye, it was determined that the rate of e-cigarette use or experimentation was 2.9% (Özpulat & Oztaş, 2020). In the Yıldırım Beyazıt University Faculty of Medicine, the frequency of e-cigarette use was 3.7% (Kılıç et al., 2021). In 2019, another study was conducted with medical faculty students in our country, it was reported that 43.7% of students who used traditional cigarettes used e-cigarettes, and 17.2% of students who quit smoking tried e-cigarettes (Ogan et al., 2019). The prevalence of e-cigarette users among the medicine students participating in this study was 4.6%, and that of those who tried e-cigarettes was 21.0%. Studies conducted in Europe

and the USA were more effective than those conducted in our country. The reasons for this difference include the status of e-cigarettes supply, cultural differences between countries, and economic reasons. In this study, the use of e-cigarettes may have gradually increased due to curiosity or as a smoking cessation product.

According to the literature, e-cigarette use has been reported to be higher in men (Hinderaker et al., 2018; Ramo et al., 2015). In studies conducted in different regions such as the USA and Pakistan, e-cigarette use is more prevalent among smokers and men (Bandiera et al., 2016; Iqbal et al., 2018). In a population-based study conducted in Izmir, e-cigarette use was higher in men, but no statistical difference was detected (Atlam et al., 2020). This study found that being male is a risk factor for e-cigarette use, in accordance with the literature. In addition, all the e-cigarette users were smokers. The fact that the frequency of cigarette use is also high in men and that e-cigarettes can be started more easily while smoking causes the use of e-cigarettes to be higher in men.

The prevalence of e-cigarette use is high among young people (Goniewicz et al., 2013). Electronic cigarettes are relatively new devices, and younger age groups may tend to try e-cigarettes. In this study, being 21 years or older was seen as a risk factor for e-cigarette use. It is a great concern that new users of e-cigarettes, especially among the young population, often try them out of curiosity, which may be a gateway to nicotine addiction in the young population (Iqbal et al., 2018; Schoenborn & Gindi, 2015; Sutfin et al., 2013).

In a study conducted on university students in Romania, friends and siblings were found to be strong risk factors for e-cigarette use (Lotrean, 2015). In a cohort study conducted in New Zealand, close friends' use was associated with e-cigarette use (White et al., 2015). It was also found that students who had friends who had tried e-cigarettes were more likely to try them than those with traditional smokers in their family (Jeon et al., 2016). Consistent with the literature, e-cigarette use by friends and family members was found to be a risk factor. These results show that any close friend, e-cigarette, or dual user is significantly associated with the use of e-cigarettes.

In a conducted study on medical students in the UK, 89.9% of the participants reported that the use of e-cigarettes was beneficial in reducing smoking and 56.1% stated that they would recommend e-cigarettes to patients for this purpose(Afzal et al., 2021). Regarding the attitude of college students toward e-cigarettes, 46.2% stated that they supported the use of e-cigarettes as a product for smoking cessation without any scientific basis. In a study conducted by Alzahrani et al. on medical faculty students, 17.5% of the participants stated that they would recommend smoking cessation to their patients. In addition, 35.9% of the participants agreed that e-cigarettes were a better option for patients than traditional tobacco products (Alzahrani et al., 2021). In this study, almost one-fifth of the participants stated that e-cigarettes could be used for smoking cessation, and almost half of them stated that they had no information on this subject. In a multicenter study involving the USA, Canada, the UK, and Austria, it was found that there was no difference between smoking cessation rates at the end of 1 year in smokers who reported using e-cigarettes for smoking cessation and non-users of e-cigarettes who smoke (Adkison et al., 2013).

Another international population-based study demonstrated that e-cigarette use is not effective for smoking cessation (Popova & Ling, 2013). When addressing this issue, it is important to consider various dimensions such as addiction, toxicity, and public health. In addition, although e-cigarettes are used for traditional smoking cessation, they have a high potential for dual use (Glantz & Bareham, 2018).

In a study conducted among medical school students, almost half of the participating students either did not have information about the addictive status of e-cigarettes or did not agree with this view (Alzahrani et al., 2021). In another study, participants were asked to compare the addictiveness of e-cigarettes to traditional cigarettes. The results showed that 64.9% believed that e-cigarettes were either equally or more addictive than tobacco (Afzal et al., 2021). In this study, most students stated that they did not have information on this subject, or that they were less addictive. In general, e-cigarettes are less addictive than other tobacco products. However, studies on the nicotine supply of e-cigarettes have found that they can provide nicotine equivalent to cigarettes, and the amount of nicotine can increase according to the number of uses (Dawkins & Corcoran, 2014; Vansickel & Eissenberg, 2012). In another study comparing the blood cotinine levels of e-cigarette and cigarette users, it was found that there was no difference in the blood cotinine levels between the two groups (Flouris et al., 2013). This indicates that the addictive features of e-cigarettes are similar to those of cigarettes.

These data may reflect a lack of knowledge regarding e-cigarettes among medical students. This is further supported by the fact that social media, which provides misinformation about e-cigarettes and attempts to create a positive e-cigarette image, is a source of information. In a study conducted on university students in our country, friends and social media were the most common sources of information. In this study, students stated that they heard about e-cigarettes mostly through the internet/social media. Social media tools play a role in shaping the information status of society regarding e-cigarettes. The fact that it is more effective in the young population who use social media may be effective in increasing the use of e-cigarettes in this population (Atlam et al., 2020).

Limitations and Directions/Suggestions for Future Research

This study had some limitations. The data collection tool used was an online survey. Survey studies may be affected by social desirability or recall bias. The study findings were obtained from one university and do not represent all medical faculties. Despite these limitations, this study suggests that more emphasis should be placed on increasing medical students' awareness of e-cigarettes and correcting false information about their use as a smoking cessation method.

As the use and popularity of e-cigarettes are increasing, the lack of knowledge of medical students on this subject reveals the need

to improve the medical school curriculum. It is concerning that e-cigarettes are perceived as less harmful by both users and non-users. It is necessary to increase the knowledge and awareness of medical faculty students that e-cigarettes are not a healthy alternative or solution to tobacco products, as well as studies on addiction and their negative effects. Periodic multicenter surveillance is needed to determine the extent of e-cigarette smoking in young people, which is initiated by the influence of many factors, especially close friends, and the environment, and to increase precautions.

Ethics Committee Approval: This study was approved by the Ethics Committee of Kırşehir Ahi Evran University (approval number: 2023-02/11; date: January 24, 2023).

Informed Consent: Written informed consent was obtained from the participants who agreed to take part in the study.

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