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Prevalence of electronic and tobacco cigarette smoking among health sciences students in Saudi Arabia

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ABSTRACT

Objevtives: Electronic cigarette (e-cigarette) smoking or vaping is a trending habit and has gained popularity worldwide, irrespective of its harmful effects on health. This study intended to estimate the usage percentage and factors leading to the smoking of e-cigarettes among students of health sciences specialties. *Methodology:* A survey was carriedout between June 2021 and September 2021 among students of different health disciplines. A self-administered questionnaire consisting of 18 validated questions was used. *Results:* Out of 600 randomly selected participants, a total of 364 responded. The overall prevalence of vaping was 29.9%, while conventional cigarette smoking was (13.5%). Vaping was more prevalent in male students (68%) compared to females (32%). A prevalence ratio of 2.42 indicated that vaping for male students was about 2.5 times higher than female students. We found that male students vape more than female students by 2.5 times, based on a calculated prevalence ratio of 2.42. The main reason for vaping was entertainment (45.1%), followed by the desire to quit regular cigarettes (28.8%). *Conclusions:* In conclusion, prevalence of e-cigarette smoking was higher than conventional cigarette smoking. It is crucial that health professional should have adequate knowledge and education about the harms and benefits of e-cigarettes.

Keywords: Conventional Cigarettes, Electronic Cigarettes, Prevalence, Health Science Students, Saudi Arabia

1. INTRODUCTION

The electronic cigarette (e-cigarette) is adevice "that uses an "e-liquid" that may contain nicotine and varying compositions of flavorings tobacco, menthol, fruit, and other different options. The smoker breathes an aerosol created by a heat generator inside the vaping device (Dinakar and O'Connor, 2016). E-cigarettes are generally considered as less harmful than tobacco smoking and according to the Royal College of Physicians "the danger to

health associated with long term inhalation of electrtonic cigarettes vapour is unlikely to exceed 5% of the harm from smoking tobacco" (RCP London, 2016). However, the European Respiratory Society stated that there is no clear proof that e-cigarettes are safe and its long-term effects are unknown (Bals et al., 2019).

Since their release in the past ten years, the use of e-cigarettes or vaping has markedly increased. During 2017 and 2018 in the United States of America, the use of e-cigarettes increased by 78% and 48% among high and middle school students, respectively (Cullen et al., 2018). A study among university students in Malaysia showed that those who vape were 74.9% of the participants, 40.3% were both vapers and smokers of conventional cigarettes at the same time, and only 34.5% smoked e-cigarettes only (Wan Puteh et al., 2018). The prevalence of e-cigarette smoking in Central Europe and Eastern Europe among university students is estimated to be 43.7% (Brożek et al., 2019). However, a study among nursing students in Italy reported the rare use of e-cigarettes and was mainly associated with current smokers (Canzan et al., 2019).

Tobacco cigarette smoking is prevalent in Saudi Arabia. An earlier national survey reported that 12.2% of the Saudi population had tobacco usage (males 21.5% and females 1.1%) (Moradi-Lakeh et al., 2015). However, an increase of 17% or higher in tobacco smoking in adolescents, particularly college students, has been documented (Alotaibi et al., 2019). Regarding the prevalence of vaping in the general population and medical students, only a few studies have been published in Saudi Arabia (Albaik et al., 2014). A survey done by a certain study showed a prevalence of 12.2% among undergraduate medical students, particularly male students, in Riyadh (Habib et al., 2020). However, a higher prevalence (27.7%) of smoking e-cigarettes among students of the western Saudi region has been documented (Qanash et al., 2019). Although the literature expands about use of e-cigarettes, there is still ample room available to understand its prevalence among health professionals in Saudi Arabia.

This study intends to calculate the usage rate and associated factors that may lead to vaping among health sciences students of the University of King Saud in the capital of the kingdom, Riyadh.

2. METHODS

Study design and settings

This quantitative observational survey was carriedout among students of different health science colleges at King Saud University (Medicine, Dentistry, Nursing, Pharmacy, Applied Medical Sciences, and Prince Sultan College of Emergency Medicine) from June 2021 till September 2021. Using the "single proportion" formula, with a prevalence of 27.7% (Qanash et al., 2019), our sample size was calculated to be 480. However, after increasing it by 25% in case of a low response rate, our final sample size was 600, where the estimate's accuracy is 4%, and the confidence level is 95%.

An online self-administered questionnaire was used in this study (Qanash et al., 2019). The response of the participants was obtained via Survey Monkey. The questionnaire consisted of questions regarding socio-demographic data (gender, college, and age), the usage of conventional or/and e-cigarettes (frequency, flavor, and addiction), and the factors which led to smoking.

Data collection and sampling technique

We used the "stratified random sampling" method to ensure randomization and good representativeness. We divided the population into six strata using Microsoft Excel, depending on which college they studied. University identities of all students were obtained from each health college, and then 100 random students were chosen from each stratum (college). The relevant colleges sent the questionnaire to the students using the students' university emails. The Institutional Review Board at the College of Medicine reviewed and approved the study (Ref No. 19/0163/IRB). Informed consent was obtained and indicated the motive of the research paper. Participation was entirely voluntary, and the participant's right not to complete the questionnaire was ensured. Also, the participants' anonymity was assured by not asking for any personal information such as their names, and there were no incentives or rewards given to participants.

Data analysis

Data collection and organization were performed using Microsoft Excel. Statistical analysis was done using IBMStatistical Package for Social Sciences (SPSS) (Version 24.0. Armonk, NY: IBM Corp). 'Pearson's'Chi-Square test and an odds ratio were used to measure the association between the categorical study and the outcome variable. The significance criteria was set at $p< 0.05$.

3. RESULTS

Participants' Socio-demographic characteristics

Out of 600 randomly selected subjects of the sample, 364 students responded, with a rate of participation of around 75%. Most participants were between 18 and 22 years (83%), while the rest were followed by the age range of 23 to 26 years. Gender-wise, participation was 52% males and 48% females. The College of Dentistry (22.3%) had the biggest participation rate, while the lowest was from The College of Pharmacy (9%) (Table 1).

Table 1 Participants' Socio-demographic characteristics

Characteristic		Frequency	%
Age	18-22	302	83.0
	23-26	62	17.0
Gender	Male	192	52.7
	Female	172	47.3
Specialty	Medicine	74	20.3
	Dentistry	81	22.3
	Pharmacy	32	8.8
	Nursing	44	12.1
	Applied Medical Sciences	76	20.9
	Emergency Medical Services	57	15.7

Smoking profile of study the participants

Among our study participants conventional cigarette smoking prevalence was 13.5%. More than half of those (59.2%) smoked daily, with the majority (83.7%) using less than half a pack daily. E-cigarettes smoking prevalence was 29.9%, higher than conventional cigarette smoking. A majority of the participants (68.2%) used e-cigarettes that contained fruit flavor, and a few (10.6%) did not know whether their cigarettes had a flavor or not. Regarding smoking frequency, 59.2% of the participants smoked conventional cigarettes daily compared to vaping (40.4%). However, the frequency of occasional smoking was higher for vaping (35.5%) thantraditional smoking (30.6%) (Table 2).

Table 2 Smoking profile of study group

Characteristic		Frequency	%
Do you smoke conventional cigarettes?	Yes	49	13.5
	No	315	86.5
How often do you smoke conventional cigarettes?	Daily	29	59.2
	Weekly	2	4.0
	Monthly	3	6.1
	Occasionally	15	30.6
What is the number of cigarettes used daily?	1-10	41	83.7
	11-15	3	6.1
	16-20	4	8.1
	More than 20	1	2.0
What is your reason for smoking conventional cigarettes?	Peer pressure and effect	9	18.3
	Sadness and depression	10	20.4
	Anxiety and stress	15	30.6
	Entertainment	15	30.6
Did you ever smoke an electronic cigarette (even if one puff)?	Yes	104	29.9
	No	244	70.1
Did your last electronic cigarette have a particular flavor?	No flavor	5	4.8
	Tobacco flavor	8	7.7
	Menthol flavor	2	1.9

	The mix of tobacco and menthol	7	6.7
	Fruit flavor	71	68.2
	I don't know	11	10.6
How often do you smoke electronic cigarettes?	Daily	42	40.4
	Weekly	15	14.4
	Monthly	10	9.6
	Occasionally	37	35.5
What is your reason for smoking electronic cigarettes?	Peer pressure and effect	6	5.8
	Sadness and/or depression	11	10.6
	Anxiety and/or stress	10	9.6
	Entertainment	47	45.1
	To quit conventional cigarettes	30	28.8

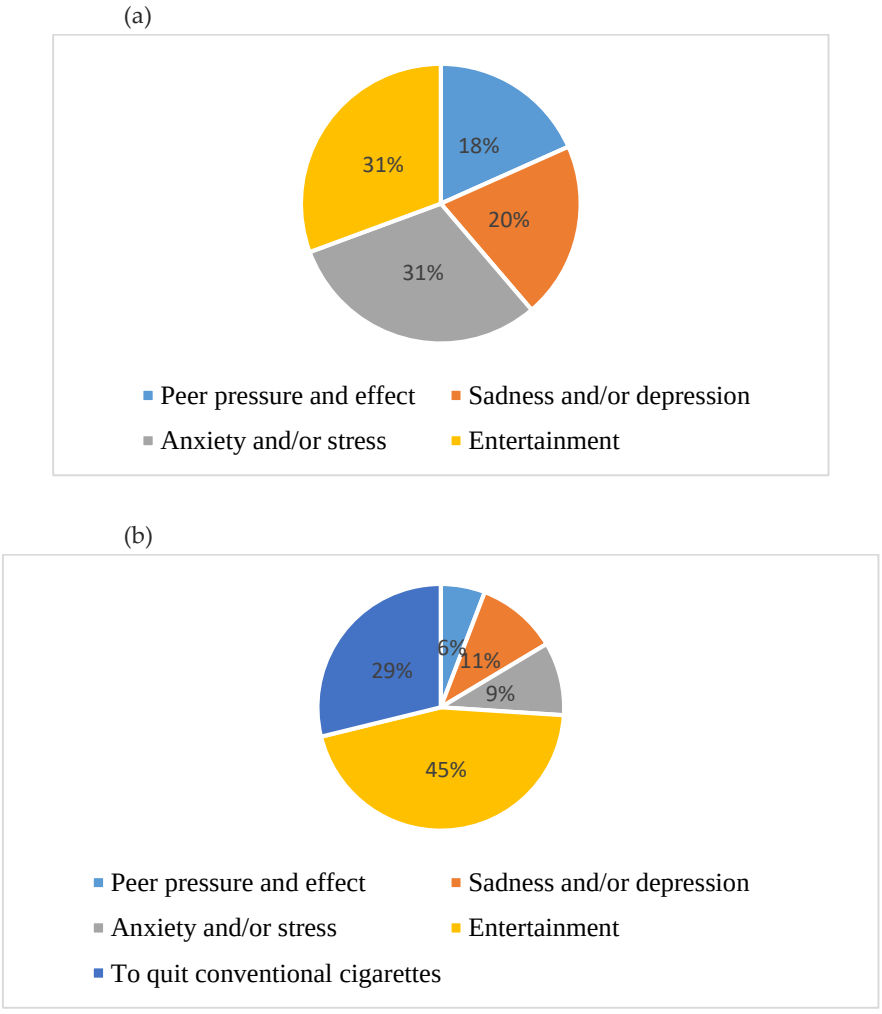

Figure 1 Reasons for smoking conventional (a) and electronic cigarettes (b)

Reasons associated with smoking

Regarding conventional cigarettes, anxiety or stress (30.7%) and entertainment (30.7%) were the main reasons. For vaping, the main reason was entertainment (45.1%), and 28.8% of the participants used it to quit conventional cigarettes (Table 2 and Figure 1). Almost two-thirds (66.2%) had successfully quit traditional smoking. When we asked vapers about the number of tries they have ever gone through to stopvaping in the past year, 21.4%, 9.5%, and 32% tried once, twice, and 3 to 5 times, respectively, while 37%

tried to quit in the first place. Out of those who had tried to quit vaping, 38% had stayed off e-cigarettes for less than 30 days, and 21.3% had managed to stay off for one to three months. One group of students (20%) had quit for a period between three months to one year, while another (20.7%) had succeeded in stopping for more than one year.

Association of Gender and vaping

A chi-squared test of the association between vaping and gender suggested more prevalence in male participants (68%) compared to females (32%) (p=0.001, 95% CI = 1.530-3.992). A prevalence ratio of 2.42 indicated that vaping for male students was about 2.5 times higher thanfor female students (Table 3).

Table 3 Association of vaping with gender

Did you ever smoke an electronic cigarette (even if one puff)?	Yes	No	PR	P value	95% CI
Male	71 (68%)	121(46.5%)	2.472	<0.001	1.530-3.992
Female	33 (32%)	139(53.5%)			
Total	104 (100%)	260(100%)			

PR: Prevalence Ratio

Knowledge and attitude regarding electronic cigarette use

Responding to a question about vaping, 30.2% believed that they would recommend to others as a good way to quit conventional smoking. When asked about addiction, 42.3% thought that traditional cigarettes were more addictive, while 38% stated that both types of smoking were addictive (Table 4). In response to a question about the electronic cigarettes smoking harmful effects, respondents chose the number 8 on a scale between 0 and 10 (where 0 denoted not harmful and ten extremely harmful). The smoking rate of electronic cigarettes was higher in the students of Emergency Medical Services and The College of Pharmacy (47%), while the least prevalence (20%) was noted among the students of The College of Dentistry (Table 5).

Table 4 Participants' knowledge and attitude in regard to electronic cigarette use

Questions	Answers	Frequency	%
From your knowledge, would you ever recommend vaping as a good way to quit conventional cigarettes?	Yes	110	30.2
	No	254	69.8
Which one do you think is more addictive?	Conventional Cigarettes	154	42.3
	Electronic Cigarettes	38	10.4
	Equally Addictive	139	38.2
	I believe both types of smokingare not addictive	33	9.0

Table 5 Smoking profile of study participants in different health specialties

Speciality	Questions	Answers	Frequency	%
Medicine	Do you smoke conventional cigarettes?	Yes	7	9.5
		No	67	90.5
	Did you ever smoke an electronic cigarette (even if one puff)?	Yes	16	21.6
		No	58	78.4
Dentistry	Do you smoke conventional cigarettes?	Yes	6	7.4
		No	75	92.6
	Did you ever smoke	Yes	16	19.8

	an electronic cigarette (even if one puff)?	No	65	80.2
Pharmacy	Do you smoke conventional cigarettes?	Yes	7	21.9
		No	25	78.1
	Did you ever smoke an electronic cigarette (even if one puff)?	Yes	15	46.9
		No	17	53.1
Nursing	Do you smoke conventional cigarettes?	Yes	7	15.9
		No	37	84.1
	Did you ever smoke an electronic cigarette (even if one puff)?	Yes	14	31.8
		No	30	68.2
Applied Medical Sciences	Do you smoke conventional cigarettes?	Yes	7	9.2
		No	69	90.8
	Did you ever smoke an electronic cigarette (even if one puff)?	Yes	16	21.1
		No	60	78.9
Emergency Medical Services	Do you smoke conventional cigarettes?	Yes	15	26.3
		No	42	73.7
	Did you ever smoke an electronic cigarette (even if one puff)?	Yes	27	47.4
		No	30	52.6

4. DISCUSSION

Use of e-cigarettes is a new addition, and its prevalence is increasing among the general population in Saudi Arabia (Khanagar et al., 2019). The prevalence of smoking e-cigarettes in our paper was 29.9% among health sciences students, and male students had higher odds of vaping than females. Vaping prevalence was twice as much as smoking regular cigarettes (13.5%), indicating this phenomenon's rapid spread. Recent studies conducted among medical students of various Saudi Arabian universities reported a prevalence ranging from 10.6% to 27.7%, depending upon the region (Habib et al., 2020; Qanash et al., 2019; Almutham et al., 2019). There are many reasons for the popularity of e-cigarettes smoking in the young population, like taste, enjoyment, curiosity, smoking cessation, and others (Evans-Polce et al., 2018).

In our study, out of those who smoked e-cigarettes, 28.9% used them as a way to quit conventional cigarettes. The success rate for those students was found to be 66.2%. However, a majority (69.8%) of the participants presumed that it was a good way of quitting conventional smoking. Similar observations have also been reported in Saudi Arabia and elsewhere, where most students used e-cigarettesto quit traditional cigarette smoking (Qanash et al., 2019; Ahmed et al., 2021). Our findings are in partial agreement with another study which reported that medical students did not belive that e-cigarteetes could help in quitting conventional smoking although they presumed that vaping is less addictive than conventional smoking (Almutham et al., 2019). In a study, at the University of Taiba, medical students believed that although e-cigarettes are less harmful and toxic and help to reduces tobacco consumption, however, that had no intention to quit conventional smoking (Alzalabani and Eltaher, 2020). It is cruicial to mention that although e-cigarttes are advertised to smokers as a solution to quit smoking, however their efficacy in this respect still a matter of concern.

Many studies suggest that vaping is not helpful in quitting tabacco smoking and dual users expose themselves to harmful effect of e-cigarettes and tobacco smoking (Grana et al., 2014). It is also possible for smoking e-cigarettes to be a factor that initiates regular cigarette smoking. Chein et al., (2019) reported that students who smoked e-cigarettes had significantly higher odds of starting conventional smoking than those who never smoked. Therefore, it could be true that vaping may be useful as a way to stop conventional cigarettes smoking, however, a lot of the harmful risks regarding vaping remain unknown. Aerosols generated by e-cigarettes induce the imbalance of oral microbial ecology and make users more prone to infections. Also, e-cigarette smokers may inhale toxins and harmful materials as a potential exposure, along with other ultrafine particles in e-cigarette aerosol (Pushalkar et al., 2020; Ganesan et al., 2020; Glantz and Bareham, 2018).

We found higher prevalenc of vaping in male students than females which is in accordance with another study in Saudi Arabia (Alzalabani and Eltaher, 2020; Ahmed et al., 2021). Although no significant differenc in male and female e-cigarette smoking has been reprted in a study carried out in Hong Kong (Jiang et al., 2019). The higher prevalence of vaping in male students, in our study, may be related to the social acceptability of smoking habits and behavior among males. Moreover, social custom and greater awareness about health-related issues contribute to less smoking prevalence among females and is consistent with other studies that took place in Saudi Arabia and elsewhere (Ahmed et al., 2021; Mandil et al., 2010; Hasim, 2000; Melani et al., 2000).

In this research, the main reason for vaping was entertainment (45.1%). About two-thirds of our participants (68.2%) used non-tobacco flavor, such as fruit flavor, in their e-cigarettes. These flavors may be more enjoyable and satisfying compared to conventional smoking (Du et al., 2020). E-cigarettes containing fruit or candy flavors provide more satisfaction compared to unflavored or tobacco-flavored ones (Gravely et al., 2020). Thus, manufacturers' promotion of different flavors and advertising campaigns leads to an increase in the prevalence of vaping in youths and adolescents. The Forum of International Respiratory Societies suggested measures to curtail e-cigarettes in these people (Ferkol et al., 2018). According to their recommendations, e-cigarettes should be regarded as tobacco products, should not contain flavorings, and should not be sold to youths.

Study strengths and limitations

Our response rate varied among different health specialties; therefore, it is necessary that the potential for nonresponse bias be recognized during the interpretation of the results. A well-established questionnaire was developed, and it may not represent the accurate perception of the general population on e-cigarettes and finally, the students could be reluctant to disclose sensitive information and provide a socially acceptable response. Our study was limited to a single institution; therefore, our findings may not represent the entire health sciences community in Saudi Arabia.

5. CONCLUSION

In conclusion, our study provides valuable information in regard to the prevalence of e-cigarettes among students of health sciences, which is twice that of regular smoking. Besides, it finds entertainment the main reason for vaping, followed by it being a way to quit conventional smoking. While e-cigarettes pose less health harm, it is crucial that health professional should have adequate knowledge and education about the harms and benefits of e-cigarettes.

Authors' Contributions

Khalid A Al-Regaiey, Sultan A Meo, Mansour A Alobrah, Bandar I Aljammaz, Tareq A Alalwan, Sulaiman F Alzomia, Ahmad A Alsobay and Muhammad Iqbal. All have contributed to the research question, study objectives, literature review, data collection, analysis and in the writing of the final report.

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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