

Effectiveness of E-cigarette in smoking cessation among medical students in KAU, Jeddah, Saudi Arabia

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Authors' Affiliation:

¹Associate Professor, Family Medicine Department, Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia

²Medical Intern, King Abdulaziz University, Jeddah, Saudi Arabia

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Ranya Ghamri¹, Abdulaziz Alburaidi², Nawaf Alshaebi², Ahmed Abulfaraj², Faisal Alkenani², Abdullah Alqarni², Muath Alghamdi², Abdulaziz Alotaibi²

ABSTRACT

Background: There are a few studies that were carried out to measure the effectiveness of E-cigarettes on the actual cessation of smoking and whether E-cigarettes are a safe and secure replacement for traditional tobacco cigarettes. This requires an extensive investment of research to evaluate the product more closely and to analyze the prevalence of its use, whether it's for the purpose of smoking cessation or just as a routine smoking habit. **Methods:** This cross-sectional study was conducted in early 2022 at the faculty of medicine in King Abdulaziz University. The study included 263 students. A standardized, anonymous questionnaire was adopted and validated by previous study. Statistical analysis using "IBM SPSS statistics ver. 20.0" was applied to evaluate and test the hypothesis. **Results:** The study included 263 students, 60.9% of them were males and 39.1% of them were females. 133 students were smokers (49 of 133 them were past smoker and 86 were current smoker). Regarding smoking type used, 23 (17.3%) were tobacco cigarettes and 90 (67.7%) were using E-cigarettes/vape and 20 (15%) were using other types of tobacco products. 36.1% of smoking participants use E-cigarettes as a method of tobacco cessation. There was a significant association between using E-cigarettes/vape regularly with marital status and academic year of participants ($P < 0.05$). **Conclusion:** This study has concluded that using E-cigarettes/vape has a role in smoking cessation among number of medical students who quit smoking after using it and it's considered a bridge for the people who intent to decrease their smoking consumption.

Keywords: E-cigarettes, vape, smoking cessation, medical students, smoking

1. INTRODUCTION

Tobacco Smoking is a notable health hazard. It plays an important role in morbidity and mortality of many diseases in the heart and lungs (Jayes et al., 2016; Morris et al., 2015) and other systems (Khani et al., 2018). Globally (WHO) approximates that there are 1.1 billion smokers (World Health

Organization, 2000). Annually, the health consequences of smoking tobacco are well known with an estimate of 7 million premature deaths from diseases related smoking. Based on World Health Organization (WHO) data, the prevalence of smoking among adolescents in the Kingdom of Saudi Arabia in 2016 was 21.2% among males and 9.1% among females. The smoking prevalence among Saudi adults was 23.7% for males and 1.5% for females. According to Alkhalaf et al., (2021) smoking was prevalent among medical students (12.4%), whereas passive smoking was prevalent among all medical students (39.9%). The study reached that 18.6% of male and 5.9% of female medical students were active smokers. Regarding the type of tobacco, they revealed that 47% of male smokers used hookah, while the percentage among female smokers using hookah reached 77.8% (Alkhalaf et al., 2021).

Electronic cigarette (e-cigarette, vape) is a non-combustible tobacco product containing nicotine, propylene glycol, flavors and vegetable glycerin (Gotts et al., 2019). Vaping is now a huge industry that is beginning to attract more smokers, former smokers and young people who have never smoked (Gotts et al., 2019). E-cigarettes came onto the market without extensive preclinical toxicology tests or long-term safety tests that are required of traditional therapies or medical devices (Gotts et al., 2019). Their usefulness as smoking cessation devices, impact on population health and safety profile compared to traditional tobacco products (Cigarettes, hookah, etc..) are still questionable (Gotts et al., 2019).

During 2017-2018 the prevalence of e-cigarette use has increased, which reflected on all three measures of cigarette cessation during 2009-2018 (quit attempts, recent cessation and quit ratio) (Polosa et al., 2014). A clinical trial reported that pen-like E-cigarettes have a highly quitting rate that reached 36% at 6 months only (Adriaens et al., 2014; Polosa et al., 2014). One study was performed on 71 (M 44, F 27) regular smokers in which they had switched from traditional cigarettes to E-cigarettes for the goal of smoking cessation, at 12 months, 40.8% were classified as quitters, 25.4% as reducers and 33.8% were classified as failures (Polosa et al., 2015). There are a few studies in the literature that were carried out to measure the effectiveness of E-cigarettes on the actual cessation of smoking, however there was no study showing the relationship between E-cigarettes smoking and smoking cessation among medical students in King Abdulaziz University.

Furthermore, we've noticed a significant increase in E-cigarette use among medical students at King Abdulaziz University, which requires us to put this phenomenon into consideration and study it up close to, determine whether it is used as a way to cessate traditional cigarette smoking or just as an alternative to it. In this study our primary objective was to find the effectiveness of e-cigarette in smoking cessation and secondarily to calculate the prevalence of e-cigarette use among medical students in KAU, Jeddah, Saudi Arabia.

2. METHODS

Study design and Study setting

This cross-sectional study was conducted from January to November 2022 at the faculty of medicine in King Abdulaziz University (KAU). Ethical approval for this study was obtained from the Institutional Review Board (IRB) of KAU with number (359-21). All participants were current under graduate medical students at colleges of medicine in King Abdulaziz University, Jeddah, Saudi Arabia.

Inclusion and Exclusion criteria

The study included participants from the second year to the internship year (both males and females and Saudi and non-Saudi students). First-year students were excluded as this year is counted as a general preparatory year for all university's students and also participants that have never smoked and those with medical diseases forcing them to quit smoking.

Sample size

A total of 263 medical students participated in this study, 120 students were excluded because they never have smoked and 10 more students were excluded because they have quit smoking due to a medical condition forcing them to. We used a stratified random sampling technique. At the beginning, a proportion of students in each academic year were considered as a one group. Then, we invited all under graduate medical students who enrolled to medical colleges in KAU and they were asked to participate in the study by filling the questionnaire in both the female and male section. The required sample size for this study was calculated as 265 participants for 95% confidence interval, population size 1000, margin of error 5 %. The calculation was made using the Qualtrics sample size calculator.

Data collection Technique and tools

A standardized, anonymous questionnaire was adopted and validated by previous study (Siegel et al., 2011) from the second year to the internship year (both males and females and Saudi and Non-Saudi students). The questionnaire is distributed as an electronic form using Google forms and consists of six parts. Consent form was obtained from all participants and they have been asked to answer number of questions divided in several sections.

First part was about demographic data of the participants such as (gender, age, marital status, medical year, living area, psychological problems). Second part was assessing smoking status of the participants (the main type of smoking, history of smoking and the characteristics, amount of cessation/reduction of tobacco use after E-cigarettes/vape use, frequency of using e cigarettes / vape and opinions and believes behind using it). The Third part was about the pattern of E-cigarettes use and nicotine use of those who are not smoking for 6-month period.

Pilot test

The questionnaire was distributed on 20 individuals and asked to fill it. This was done to test the simplicity of the questionnaire and the feasibility of the study. Data of the pilot study was excluded from the final data of the study.

Data analysis

In the present study, statistical analysis using "IBM SPSS statistics ver. 20.0" was applied to evaluate and test the hypothesis. Simple frequency tables, cross tabulations and percentages. Chi square test was used to test and describe the relation between two categorized variables. Binomial logistic regression was used to test the predictors of the binary outcome variables. The level $P < 0.05$ was used as the cut-off value for significance.

3. RESULTS

As in Table 1, the study included 263 students, 60.9% of them were males and 39.1% of them were females. 32.3% of participants were in 3rd academic year, 21.1% in 5th academic year, 19.5% in 6th year and 9.8% in 2nd year. 88.7% of participants aged between 20-25 years old. 22.6% were married and 77.4% were married.

Table 1 Socio-demographic characteristics of participants (n=263)

Parameter		No.	%
Gender	Male	81	60.9
	Female	52	39.1
Medical year	Intern year	13	9.8
	2nd year	13	9.8
	3rd year	43	32.3
	4th year	10	7.5
	5th year	28	21.1
	6th year	26	19.5
Age	less than 20	9	6.8
	20- 25	118	88.7
	more than 25	6	4.5
Living Area	Central Jeddah	30	22.6
	East Jeddah	29	21.8
	North Jeddah	41	30.8
	South Jeddah	33	24.8
Marital status	Married	30	22.6
	Single	103	77.4

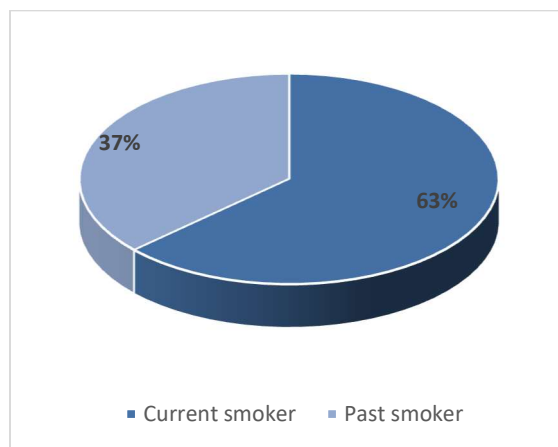


Figure 1 Smoking status among smoking participants

Table 2 shows that, regarding smoking type used, 23 (17.3%) were tobacco cigarettes and 90 (67.7%) were using E-cigarettes/vape and 20 (15%) were using other types of tobacco products (shisha, etc.), as for the motivation to utilize E-cigarettes; 48 (36.1%) as a method of tobacco cessation, 55 (41.4%) as less after effects than tobacco cigarettes at the degree of (Smell, headache, dry mouth and so on) and 30 (22.6%) with not a clear explanation.

Table 2 Smoking status, type and history among smoking participants (n=133)

Parameter	No.	%	
Smoking history (years smoked)	<1 year	18	13.5
	2-4 years	46	34.6
	5-6 years	19	14.3
	7-8 years	8	6.0
	>8 years	1	.8
	Don't know	41	30.8
Main type of smoking used	E-cigarettes/vape	90	67.7
	Other tobacco products (shisha, etc.)	20	15.0
	Tobacco cigarettes	23	17.3
Presence of psychological problems	Yes	6	4.5
	No	127	95.5
Using or used E-cigarettes/vape regularly	Yes	92	69.2
	No	41	30.8
Reason for using the E-cigarettes	As a way of tobacco cigarette cessation	48	36.1
	Less side effects than tobacco cigarettes (smell, headache, dry mouth, cough, etc.)	55	41.4
	No specific reason	30	22.6

Table 3 shows that 19.5% of participants think that E-cigarettes are absolutely harmless, 20.3% think it is equal harmful as tobacco cigarettes, 58.6% less harmful than tobacco cigarettes, while 1.5% think it is more harmful than tobacco cigarettes. 36.6% of participants partially agree, 8.3% partially disagree and 30.1% strongly agree that E-cigarettes are an effective way of smoking cessation.

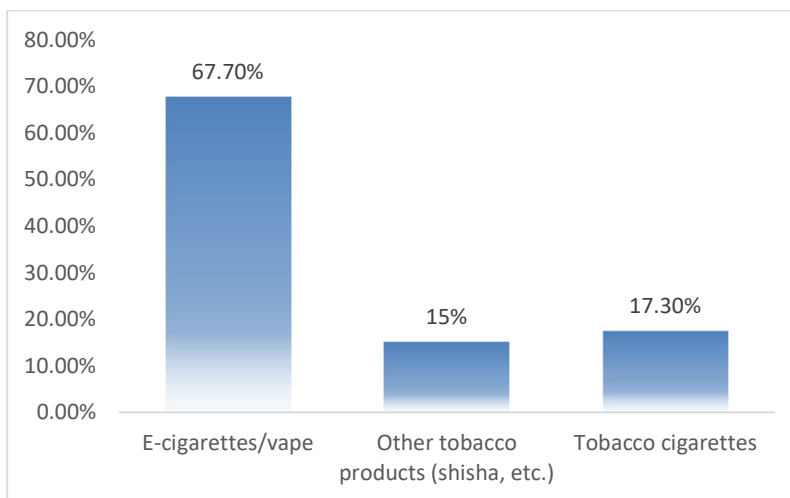


Figure 2 Main type of smoking used among study participants (n=263)

Table 3 Awareness about E-cigarettes among study participants (n=263)

Parameter	No.	%	
E-cigarettes compared to tobacco cigarettes are	Absolutely Harmless	26	19.5
	Equal harmful as tobacco cigarettes	27	20.3
	Less harmful than tobacco cigarettes	78	58.6
	More harmful than tobacco cigarettes	2	1.5
E-cigarettes are an effective way of smoking cessation	Neither agree nor disagree	28	21.1
	Partially agree	46	34.6
	Partially disagree	11	8.3
	Strongly agree	40	30.1
	Strongly disagree	8	6.0

As in Table 4 after using E-cigarettes, 54.9% of individuals reduced their overall nicotine usage, while 57.1% reduced the number of tobacco cigarettes they smoked per day. As to of times utilized each day; larger part of the members used to smoke from 5-10 times each day with 32 (24.1%), the remaining of participants under multiple times from 11 to 15 times each day and are in excess of multiple times. About E-cigarette used, one third of the patient used smoke every day while the other in some days, interestingly nicotine utilization of the individuals who are not smoking for a very long time period were (51.1%) utilizing just E-cigarette, (10.5%) are sans nicotine, (7.5%) utilizing without tobacco nicotine items. Table 5 shows a significant association between using E-cigarettes/vape regularly with marital status and academic year of participants ($P < 0.05$).

Table 4 Determinants of use of E-cigarettes among smoking participants (n=133)

Parameter	No.	%	
Reduced overall nicotine use after e-cigarette use	Yes	73	54.9
	No	19	14.3
	Don't know	41	30.8
Reduced number of tobacco cigarettes per day after e-cigarette use	Yes	76	57.1
	No	16	12.0
	Don't know	41	30.8
Number of previous quit attempts	0	18	13.5
	1-2	38	28.6
	3-5	21	15.8
	>5	15	11.3
	Don't know	41	30.8
Quit/abstained for a	< 1 week	14	10.5

period of time	1-4 weeks	26	19.5
	1-3 month	16	12.0
	>3 month	22	16.5
	Don't know	55	41.4
Reason for return to smoking	Craving	28	21.1
	Others	6	4.5
	Stress	24	18.0
	Successfully quit and never returned	22	16.5
	Don't know	53	39.8
Number of times used per day	0	9	6.8
	<5	16	12.0
	5-10	32	24.1
	11-15	13	9.8
	16-20	11	8.3
	>20	11	8.3
	Don't know	41	30.8
Weekly pattern of e-cigarette use	Everyday use	49	36.8
	No current e-cigarette use	10	7.5
	Only uses some days	33	24.8
	Don't know	41	30.8
Nicotine use of those who are not smoking for 6- month period	Nicotine-free	14	10.5
	Using only E-cigarettes	68	51.1
	Using tobacco-free nicotine products	10	7.5
	Don't know	41	30.8

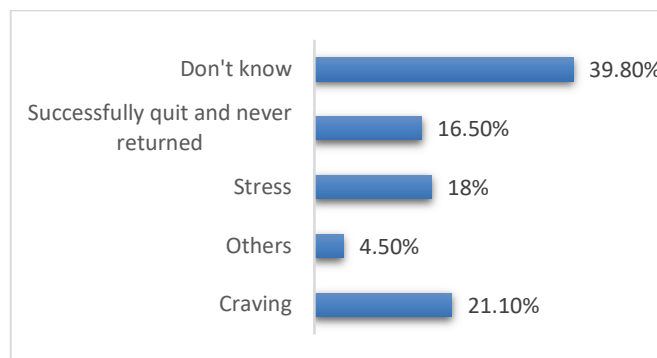


Figure 3 Reason for return to smoking among study participants (n=263)

Table 5 Association between using E-cigarettes regularly with socio-demographic characters of participants

		Using E-cigarettes/ vape regularly		Total (N=133)	P value
		Yes	No		
Marital status	Married	26	4	30	0.018
		28.3%	9.8%	22.6%	
	Single	66	37	103	
		71.7%	90.2%	77.4%	

Gender	Male	54	27	81	0.435
		58.7%	65.9%	60.9%	
	Female	38	14	52	
		41.3%	34.1%	39.1%	
Academic year	Intern year	11	2	13	0.004
		12.0%	4.9%	9.8%	
	2nd year	9	4	13	
		9.8%	9.8%	9.8%	
	3rd year	34	9	43	
		37.0%	22.0%	32.3%	
	4th year	6	4	10	
		6.5%	9.8%	7.5%	
	5th year	11	17	28	
		12.0%	41.5%	21.1%	
	6th year	21	5	26	
		22.8%	12.2%	19.5%	
Age	Less than 20	8	1	9	0.414
		8.7%	2.4%	6.8%	
	20- 25	80	38	118	
		87.0%	92.7%	88.7%	
	More than 25	4	2	6	
		4.3%	4.9%	4.5%	
Living Area	Central Jeddah	21	9	30	0.063
		22.8%	22.0%	22.6%	
	East Jeddah	25	4	29	
		27.2%	9.8%	21.8%	
	North Jeddah	28	13	41	
		30.4%	31.7%	30.8%	
	South Jeddah	18	15	33	
		19.6%	36.6%	24.8%	

4. DISCUSSION

Electronic cigarettes (or "E-cigarettes") are battery-powered nicotine delivery systems which provide users nicotine while simulating the sensory-motor consequences of smoking (hand movements and inhalation). As a result, they might also serve as a neuro biologically and psychologically effective strategy for quitting smoking. E-cigarettes may not entail the same risks of morbidity and mortality for their users compared to users of combustible cigarettes because they do not require the combustion of tobacco (Vardavas et al., 2015). This study provides for the first-time evidence on the association between e-cigarette use and smoking cessation among medical students in King Abdelaziz University.

According to our study results, 36.1% of smoking participants use E-cigarettes as a method of tobacco cessation. After using E-cigarettes, 54.9% of participants lowered their overall nicotine intake, while 57.1% decreased the number of cigarettes they smoked each day. Comparing E-cigarettes as a smoking cessation aid to placebo E-cigarettes and nicotine replacement therapy, a systematic review concluded that there were not enough studies overall and that the ones that were accessible had poor quality and typically small sample sizes (Hartmann et al., 2016). Other systematic reviews have reached similar results about the low quality of the studies and the small effects of E-cigarettes on quitting smoking with one finding overall reduced likelihood of quitting smoking in individuals who used E-cigarettes (Grabovac et al., 2021). According to four systematic reviews, E-cigarettes were more effective than a placebo at helping people stop smoking cigarettes (Eidib et al., 2017; Hartmann et al., 2016; Khoudigian et al., 2016; Rahman et al., 2015). According to another comprehensive analysis, those who used E-cigarettes had 28% lower odds of quitting than those who did not (Kalkhoran and Glantz, 2016). In five RCTs, the abstinence rate was 2.6% higher in the e-cigarette group than in the

control group, indicating that E-cigarettes may be more successful than NRT or a placebo in helping adult smokers quit (Hajek et al., 2019; Lee et al., 2019; Li et al., 2020; Soneji et al., 2017; Tseng et al., 2016).

The fact that E-cigarettes are widely accessible consumer goods may be significant when looking at them as a potential smoking cessation tool. The scenario may be comparable to the discrepancies between the use of licensed NRT medications for smoking cessation in non-clinical settings and their clinical success in clinical studies. Several researches have examined the relationship between different over-the-counter nicotine products and smoking cessation. Data from the extensive population-based California Tobacco Surveys revealed that when NRT was only available by prescription, it was associated with long-term success in quitting smoking, but this association was lost when NRT was made available over the counter (Pierce and Gilpin, 2002). The findings from a study nationally representative survey of US adults indicate that E-cigarettes are not often used for quit attempts by adults (Patel et al., 2021). However, the effectiveness of the e cigarette in smoking cessation was varied in the literature. Hence the purpose of this Saudi cross-sectional study to know how effective is the use of e cigarette in smoking cessation.

The desire to stop smoking cigarettes is a popular motivation for using E-cigarettes, likely as a result of efficacy claims made in e-cigarette marketing in the US, UK and China, despite the fact that these claims had not been approved by regulatory bodies. E-cigarettes are also advertised as a way to get around smoke-free laws and people who are addicted to nicotine may use them in this way even if they don't initially intend to stop (Kalkhoran and Glantz, 2016).

Regulation of E-cigarettes may have an impact on marketing and usage motivations. Smoke-free regulations and voluntary smoke-free policies that include E-cigarettes could serve to reduce the usage of E-cigarettes as a cigarette substitute while also perhaps enhancing their efficacy in helping people quit smoking. There is a gap between the distribution of E-cigarettes for cessation as part of a monitored clinical trial and the availability of E-cigarettes for use by the general public due to the manner they are available on the market for use by anybody and for any purpose. Therefore, in order to assess E-cigarettes as a smoking cessation aid and their ultimate public health impact, considerable attention to how the devices are advertised and actually used will be required (Kalkhoran and Glantz, 2015).

Standardizing definitions of e-cigarette use, analyzing the relationship between various levels of use and various devices and smoking cessation, conducting more randomized clinical trials contrasting E-cigarettes with conventional therapies like NRT, analysing the impact of e-cigarette use on elements like motivation to quit and differentiating e-cigarette users based on their motivations for using the products should be the main objectives of future research.

Limitations and Recommendations

The study had several limitations. First, self-reported smoking consumption and quit duration were used, which could lead to recall bias, especially among former smokers. Second, the study was conducted among medical students; we were unable to use a larger sample size. The current smoking status was not objectively examined, which is standard practice in large population research. We couldn't collect data on files during the COVID-19 pandemic, so we used an online questionnaire. Another limitation is that 120 of the 263 participants were eliminated because they had never smoked. In terms of medical conditions, 133 (93%) of the 143 participants were medically free and 10 (7%) of the 143 participants were diagnosed with a medical condition that prevented them from smoking. This study did not look into nicotine addiction or how other tobacco products might affect quitting efforts. Because different types of electronic cigarette devices may play a role in smoking cessation success, this information was not included in the study. Finally, as e-cigarette use patterns and product types evolve, the link between E-cigarettes and tobacco quitting rates may shift. Despite the fact that quitting smoking is a typical marketing claim and is frequently cited as a rationale for use among cigarette users, the general conclusion from the available research is that e-cigarette use is increasing in the current regulatory environment.

We highly recommend a following study of longer periods of smoking cessation after e-cigarette use, a study in which the sample size include the whole country of Saudi Arabia, as well as, a study of the health hazard of e-cigarette in comparison to the traditional cigarette.

5. CONCLUSION

This study has concluded that using E-cigarettes/vape has a role in smoking cessation among number of medical students who quit smoking after using it and it's considered a bridge for the people who intent to decrease their smoking consumption, as a good number of our participants successfully quit smoking after switching to them.

Ethical approval

The research proposal was approved by the Regional Research and Ethics committee of King Abdulaziz University (KAU) with number (359-21)

Funding

This study has not received any external funding.

Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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