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Electronic cigarettes consumption and associated factors among general population in Western Saudi Arabia

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Significance for public health

The increasing prevalence of e-cigarette consumption which is recognized by the world health organization as both toxic and an introduction for both children and adolescent to smoking. An

assessment for the prevalence of e-cigarette plays a crucial role in estimating e-cigarette as a rising alternative for conventional smoking and estimating the perception of the public health.

Abstract

Background: In recent years, consumption of E-cigarettes has increased dramatically. Several studies have focused on the prevalence of E-cigarettes among specific groups of people, using it as a substitute to traditional cigarettes, or the participant knowledge regarding risks. This research was aimed on E-cigarettes' prevalence and its association to several factors in the general population of Western Saudi Arabia.

Design and Methods: Using an observational cross-sectional study, data were collected from (n=465) above 18 years old smokers during the survey at public attractions. A validated self-administered questionnaire acquired from previous studies was employed to insure the suitability for the general population of Jeddah Saudi Arabia. Sample size was calculated via Raosoft@ and adults of either gender were included in the study. Descriptive or inferential statistical analysis was performed using SPSS.

Results: The preponderance of e-cigarette smokers used entertainment as the reason for smoking, with an average of (33.9%). Although one reason for e-cigarette consumption was to cease traditional smoking, results showed an average of (49.4%), which is the majority of those who attempted to cease traditional smoking via e-cigarette, did not succeed in quitting traditional smoking. This study also demonstrated that participant that believed that e-cigarette is beneficial had a higher chance to cease conventional smoking than who did not (32.1% versus 14.6%) which is significant ($p < 0.001$).

Conclusions: In conclusion, this study estimated the prevalence of e-cigarette consumption among the population of Jeddah, Saudi Arabia along with assessment of elements which help increase the overall e-cigarette consumption in Jeddah.

Introduction

Electronic cigarettes (vapes) are battery dependent devices that people use to consume nicotine by inhalation of vapor chemicals. E-cigarettes are based on several major components.[1-3] The first component is the reservoir which contains a liquid chemical that is mostly made of nicotine, flavorings, and other chemicals. Secondly, the vapor that is arisen from the e-cigarette is produced by a heating element that uses electricity. The heating element is supported by a battery making

the e-cigarettes both portable and rechargeable. This is one of the factors that contribute to the prevalence of e-cigarettes.[3] The popularity of e-cigarettes mainly constitutes from people who thinks that it is safer than regular cigarettes and teens.[1,2] In addition, a survey, which is from Australia, Canada, the United Kingdom, and the United States. It was conducted by Ayers et al and indicates that e-cigarettes are more prevalent in the online market than nicotine replacement therapy.[3] A study that has been conducted in the middle east, Lebanon portrayed a higher prevalence in participants that have perceived e-cigarette as less harmful to due to their lack of knowledge.[4] In contrast, a study was done in Saudi Arabia which demonstrated a higher awareness levels that contributed to a lower prevalence of regular e-cigarette smokers.[5] The availability and variety of flavours associated with addictive nicotine are other reasons that make e-cigarettes more likable.[6] Also, once entering someone's life, e-cigarettes have a deleterious influence in many aspects significantly. One of the aspects is that consuming e-cigarettes could affect a person's sleep hygiene. Compared to traditional cigarette users, it was found that electronic cigarette users are more prone to consume sleep medication.[7]

Another aspect that can affect one's life is addiction through nicotine consumption. E-cigarettes provide various options of e-liquids with total nicotine concentrations in each container ranging between 6-24 mg/ml.[8] Moreover, nicotine salt formulations gained popularity among e-cigarette users since they are known of being less harsh to the throat with total nicotine concentrations that could reach approximately 70 mg/ml.[8] Due to enormously high amounts of nicotine in e-cigarettes, they are highly addictive leading to constant consumption by users.[9] Electronic cigarette companies are working aggressively and rapidly on e-cigarette marketing. As of 2014, there were 466 brands of e-cigarettes.[10] They are using methods that were once used in the regular tobacco cigarettes back in the 1950-1960 industry such as sex content to attract youth.[11] Nowadays, it is easier for electronic cigarette companies to promote their products via social media applications and hence will become more prevalent.

Electronic cigarettes and vapes were first introduced in the United States in 2007, and its sales have been doubling rapidly to reach nearly two billion USD industry in 2013.[3] The rise in e-cigarette use has been accompanied by an increase in smoking cessation rates with a decrease in smoking prevalence.[12] A study conducted in 2015 demonstrates that more than 20% of adults in the United States aged between 18-24 had ever tried e-cigarettes.[2] Furthermore in 2014, almost one-half of current cigarette smokers with a percentage of 47.6%, in addition to the percent of recent former cigarette smokers showing 55.4% which indicate more than one-half had ever tried

e-cigarettes in the United States.[2] As a result, electronic cigarettes and vapes are becoming a new major research topic to detect its benefits for smoking cessation, as well as the effects associated with electronic cigarettes and vapes in comparison to regular cigarette smoking. Recently, considerable amount of research was conducted in several aspects of e-cigarettes. Variety of topics were covered among general public involving prevalence of use, attitude toward e-cigarettes, awareness assessment, and facts related to e- cigarettes.[12-13] Moreover, specific details have been investigated and measured in relation to e-cigarettes e.g. levels of inflammation biomarkers in e-cigarettes, use of e-cigarettes by individuals with mental health conditions, and existence of the flavoring chemical diacetyl that is associated with bronchiolitis obliterans.[13,14] Though the extensive amount of research in e-cigarettes are predisposing to a negative inference regarding e-cigarettes, others may suggest an alternative point of view, for instance, several researchers have referred to vaping as "less harmful" comparing to smoking, as smoking has been proven to be linked with a verity of diseases such as lung cancer, COPD, interstitial lung disease and others.[15] Noticeably, researchers are attempting cautiously to investigate e-cigarettes further amid elevating concerns of "renormalization" of tobacco products use.[16] With the significant increase of using e-cigarette, many studies have been conducted to evaluate different aspects regarding e-cigarette structure, mechanism, and consumption side effects.[17] However, there are still many things which have not been scientifically proven as yet. One of the problems that faces the researchers, is that the e-cigarettes are new devices that have been authorized for sale without proper investigation. Moreover, lack of scientific evidence to prove harmful side effects with prolonged exposure to e-cigarette is a leading cause of its popularity since it has been advertised exceedingly as a safer alternative for smoking.[18,19] However, more studies are required in this field to determine if vaping can really help in smoking cessation.[20,21] A significant number of individuals particularly young adults are using e-cigarettes nowadays without knowing what they are consuming or what the exact substances are present in e-cigarettes.[14,22,23] The assessment and evaluation of e-cigarette consumption among the general population of Jeddah, as well as the estimation of the demographic diversity is the aim of this research. To our knowledge this is the first research to investigate e-cigarette smoking in the general population in Jeddah, Saudi Arabia.

Methods

Study Area/Setting

Descriptive observational, Cross-sectional study, that started on December 2019, located in the city of Jeddah. Study subjects were general public of adults both genders. The data was collected by visiting various malls and public places. Legal Authorizations were provided by Jeddah Waterfront, Mall of Arabia, Al-salam Mall, King Abdullah Sport City, Red Sea Mall and other places which allowed the data collection team to distribute the physical questionnaire sheets to 465 individuals.

Study Subjects and design

Study subjects were general public of Jeddah, Saudi Arabia and both genders were included. General public with the age group 18 and above was included. A self-administered questionnaire was used in this survey. The questionnaire was distributed to the general public who had given consent for filling the questionnaire, it took 10 minutes to fill the questionnaire and the data collector was available there to answer any query. The used procedures and instruments were approved by the Institutional Review Board of the King Abdullah International Medical Research Centre.

Sample Size and sampling technique

The prevalence among general population is not known. Therefore, we considered of 50% in order to calculate the required sample size. Our estimation was calculated to be within a range of 5%, 19 out of 20 (95% confidence limit). We needed a minimum sample of 385, non-probability convenience sampling technique was used for selecting the sample.

Data Collection methods, instruments used, measurements:

A validated questionnaire was adopted from previous study to be suitable for general public.[23] Arabic translation was done and checked by the language expert. Maximum number of questions required to be answered per individual was 21 questions while the minimum was 11. Number of questions required to be answered was dependent on their previous experiences with traditional and electronic cigarettes. The questionnaire consisted of several categories of questions including behavioral, demographic, social, economic, and occupational questions. Variables in the questionnaire included qualitative and quantitative. Qualitative variables included gender, educational level, occupation, and the use of conventional and electronic cigarettes. also, reasons

for their use, flavors, knowledge and beliefs and the subjects' attitudes toward stopping them were included. Age, monthly income, frequency of use and cessation trials of e-cigarettes, and estimation of harm related to e-cigarettes use on scale from 0 to 5 were the quantitative variables.

Data management and analysis plan

Data entry was conducted on Microsoft Excel program, and statistical analysis was performed using IBM SPSS (Version 24.0. Armonk, NY: IBM Corporation). Qualitative variables were described as frequency and percentage. Quantitative variables were presented as mean (standard deviation) or median (interquartile range), whichever was appropriate. For data comparison, independent t-test, chi-square test and analysis of variance were used. The dependent variable was e-cigarettes use, and independent variables were general public characteristic, source of information, level of education and beliefs on e-cigarettes. Logistic regression analysis was used for univariate analysis. All through analysis, a P-value <0.05 was considered significant.

Results

General public Demographics

The sample of the participants were among public residing in Jeddah, Saudi Arabia (n=465) as described in Table 1. The sample was included from different areas of Jeddah, Saudi Arabia. In total, almost more than half of the respondents were males (n=271;58.3%). The majority of respondents' highest educational were college graduate (n=324;70.0%), followed by high school (n=127;27.4%), secondary school (n=7;1.5%), primary school (n=4;0.9%), and none (n=1;0.2). Respondents with a monthly income of less than SR.5000 (n=230; 51.1%) represented the majority [Table1]. Respondents whose occupation are related to health care represented (n=89;19.3%), while (n=372;80.7%) of respondent's occupation were not related to health care.

The frequency of e-cigarette and conventional cigarette consumption, smoking cessation, and the perception of e-cigarette compared to conventional smoking:

A set of questions were given to the participants to assess frequency of their e-cigarette and conventional cigarette consumption. The percentage of respondents who consumed conventional smoking such as cigarette, shisha, hookah in the last thirty days (n=187;40.7%) represented the majority, while participants who never consumed it (n=161;35%) represented the second most common percentage (Table 2). E-cigarette consumption for the participants depicted (n=224;48.6%) for respondents who never consumed it, (n=132;28.6%) for participants who have consumed it in more than thirty days, (n=105;22.8%) for participants who have consumed it the last thirty days. Rarely (n=181;72.7%) was the most chosen frequency for e-cigarette consumption portraying approximately three-fourths, while weekly consumption represented (n=23; 9.2%), which was the minority. Almost half of the participants who have attempted to quit conventional smoking via e-cigarette (n=122;49.4%) have not been successful which represented the majority, whereas respondents who have been successful in quitting conventional smoking (n=51;20.6%) represented the minority. While most respondents want to cease e-cigarette consumption (n=179;79.2%), a percentage of (n=49;20.8%) do not desire to cease it. Participants were asked the frequency of cessation of e-cigarette consumption for one day or longer in the past twelve months. (n=48;20.4%) did not desire to cease smoking, (n=24;10.2%) have attempted at least once, (n=22;9.4%) attempted more than ten times to cease e-cigarette. Respondents were asked to state the duration for which they have, in the last time, ceased e-cigarette. Most respondents have ceased for less than thirty days with a percentage of (n=72;31.4%), followed by (n=66;28.8%) did not try to cease it, cessation for more than thirty days (n=37;16.2%), and cessation for more than one year represented (n=35;15.3%). Participants were asked if they would recommend e-cigarette as a method for ceasing conventional smoking, (n=324;74.8%) disagree that they would recommend e-cigarette as alternative for quitting smoking, whereas (n=109;25.2%) would recommend e-cigarette as a method to cease conventional smoking. The harmful effect for e-cigarette were compared to conventional smoking, which was asked to the respondents. Equally dangerous, more dangerous, less dangerous, and I do not know have represented (n=151;33.6%), (n=127; 28.3%), (n=93;20.7%), (n=78;17.4%) respectively. The addictive element in both e-cigarette and conventional smoking were compared. (n=213;48.7%) have chosen conventional smoking as more addictive, and (n=203;45.1%) believed that e-cigarette and conventional smoking were both equally addictive.

Demographic and smoking characteristics associated with favorable usage of e-cigarette to aid in cessation of conventional smoking

In table 3, chi-square test was used to demonstrate that males have a significant increase in cessation of conventional smoking than females (25.5% vs 12.8%) through e-cigarette and this increase is statistically significant (P = 0.001). Conventional cigarette users have a higher percentage in cessation of cigarette smoking through e-cigarette than Hookah (26.8% vs 17.2%) which is significant (P < 0.001). In contrast, cigarette users are more prone to failed attempts of quitting conventional cigarettes than Hookah users (66.1% vs 44%) and it is statistically significant (P < 0.001). Respondents who have unknown as their reason for smoking have a noticeable increase in failing to cease cigarette smoking through e-cigarette compared to users who chose entertainment (70.0% vs 42%) which is statistically significant (P=0.001, P=0.023 respectively). Respondents who prefer tobacco flavor have a significant increase in ceasing cigarette smoking through e-cigarette than users who flavor preference do not include tobacco (38.5% vs 17.1%) (P= 0.001). The frequency of e-cigarette consumption has been observed to have a significant impact in ceasing cigarette smoking through e-cigarette as users whom consumption frequency are daily are more successful than users who consume it rarely (53.3% vs 14.9%). In addition, rarely consumers of e-cigarette are more prone to failure in ceasing smoking than daily users (53.7% vs 37.8%) and it is statically significant (P < 0.001). Respondents who chose surrounding environment as a reason for consumption of e-cigarette demonstrated an increase in ceasing conventional cigarette than user whom primary purpose is to quit conventional cigarette smoking (37.8% vs 25.8%) and it is statically significant (P=0.020, P=0.005 respectively). The primary attraction point for respondents who chose cheaper than conventional smoking depicted an increase chance in aiding to quit cigarette smoking through e-cigarette compare to users who did not chose it (40.0% vs 17.8%) (P=0.001). Respondents who believe that e-cigarette are advantageous in ceasing smoking have an increase chance to succeed (32.1% vs 14.6%), while also having a decrease in failure attempts to cease conventional smoking through e-cigarette consumption and both are statistically significant (33.3% vs 60.3%) (P< 0.001). Furthermore, a one-way ANOVA was conducted to compare the effect of mean age and how harmful is e-cigarette on the success in quitting smoking using an electronic cigarette. It was found that there was no significant effect of age and harmful effect of e-cigarette on successful quitting smoking by use of e-cigarette at the p>0.05 level. Taken together, these results suggest that age and scale of

harmfulness of e-cigarette has no effect on the success rate in quitting conventional smoking through the use of electronic cigarette. This effect can be visualized in supplementary Table 1.

Reasons of e-cigarette smoking

Entertainment (n=84;33.9%) and to aid in quitting conventional smoking (n=67;27%) were the highest rating of reason for e-cigarette smoking, respectively (Figure 1). Surrounding environment, anxiety and stress relieve, and sadness and depression were the least chosen representing (n=38;15.3%), (n=24;9.7%),(n=12;4.8%) correspondingly. An unidentifiable reason (n=55;22.2%) denoted approximately one fifth of the respondents.

Flavour preference of e-cigarette

Fruit flavour was the most selected (n=167;66%) flavour by the participants (Figure 2). Tobacco flavour represented (n=40;15.8%), followed by people whom flavours were not known (n=29;11.5%), other flavours (5.1%), mix of tobacco and menthol (n=9;3.6%), and equal percentages for both menthol flavour and no flavour with percentage of(n=8;3.2%).

Appeal to e-cigarette

The lack of distinctive odor (n=68;28.5%) was the most common appealing factor followed by the consideration that e-cigarette is less harmful for one's health, portrayed one fifth(n=48;20%) of the participants (Figure 3). The curiosity of testing a new product depicted (n=45;18.8%), while the usage in areas that prohibit conventional smoking represented (n=43;17.9%). In addition to e-cigarette being able to be used in prohibited areas, (n=40;16.7%) of the respondent allotted their decision due to e-cigarette being cheaper than conventional smoking. The least chosen answers were, second-hand inhalation is considered less harmful than conventional smoking, other, failing to quit both e-cigarette and conventional smoking, and fire safety which represented (n=26;10.8%), (n=23;9.6%), (n=22; 9.2%), (n=12;5%) respectively.

Discussion

An electronic cigarette (e-cigarette), which was first introduced in 2007, is a device that is used for inhaling nicotine under a vapor, which has a variety of flavors.[1,3,24] To our knowledge, this is the first cross-sectional research that investigated the prevalence in adults using e-cigarettes in

Jeddah, Saudi Arabia as there are insufficient data regarding the prevalence of e-cigarettes in this region.[23] E-cigarettes users are significantly more prone to thermal injuries due to battery explosion.[25] In addition, an increased risk for developing myocardial infarction has also been noted in e-cigarette users.[18] E-cigarettes have been associated with neutrophil activity upregulation in the lungs through the actions of acrolein, an e-cigarette vapor that is associated with increased neutrophil extracellular trap formation, which have been linked to alterations in the lung.[26] This study found a significant gender association (P = 0.001) in which males have a higher chance of quitting than females (25.5% versus 12.8%) while using e-cigarettes as aids to stop conventional smoking. In addition to demographic variability, participants who had a perception that an e-cigarette is a healthier option than a conventional cigarette had a lower percentage of failing to quit e-cigarette than those participants who thought e-cigarettes were not safer than conventional smoking (37.5% versus 52.4%) with a P = 0.010, which was statistically significant. These factors appeared to have contributed to the objective of this epidemiological study, which aimed to assess the prevalence of e-cigarette use in the general public in Jeddah, Saudi Arabia. 465 respondents were chosen from different parts of Jeddah, Saudi Arabia.

A prevalence of 51.4% (28.6% and 22.8% were for smoker in the last thirty days and more than thirty days, correspondingly), which is a higher than a previous study that targeted medical students in the same region with a percentage of 14.1%. This could be explained as the majority of participants were males (58.3% versus 34.7%).[23] Male participants were more likely to experiment with e-cigarette consumption which was indicated among King Saud University's students in Riyadh.[27] Additionally, same study reported a lower prevalence (25.6%) of e-cigarette smokers as the study revealed high awareness levels among medical students.[27] In addition, a study that was conducted in Qassim university demonstrated a lower percentage for e-cigarette users (10.6%), in comparison, to this study.[28] A similar study was done for the general public with a percentage of 33.5%.[6] In comparison, a cross-sectional analysis that was conducted in Greece reported consumption of e-cigarette (16.6%) demonstrating considerably less percentage than this study, however, the study has found independent association between multiple variables with increased risk of e-cigarette consumption smoking including male gender.[29] The sudden increase in e-cigarette popularity can be attributed to various factors due to e-cigarette being popular in diverse age groups. In addition, the amalgamation of e-cigarette advertisement and the lack of extensive research have impacted e-cigarette since it has been promoted as an effective alternative for ceasing conventional smoking.[30]

With the multi-factorial success of e-cigarette our study demonstrates that e-cigarette has become popular among young adults. Entertainment was the main reason for e-cigarette consumption (33.9%), likewise conventional smoking had a percentage of 37.1% of users for entertainment purposes. In the other hand, sadness and depression was marked as the least reason with only (4.8%) for electronic cigarettes users and (10.3%) for conventional smoking users. In a study that was performed in the same region targeting medical students a higher percentage for users of e-cigarette (49%) than the general public for who chose entertainment as the main reason for e-cigarette consumption.[23] Moreover, a higher percentage (7.8%) was concluded for the minority of the medical students who use electronic cigarettes due to depression, and (16.2%) for those who uses conventional smoking for the same reason.[23] In addition, aiding in ceasing conventional smoking was the second most chosen reason for e-cigarette consumption, while conventional smoking consumption was due to the surrounding environment. In contrast, a study that was conducted in China reported aiding in ceasing conventional smoking was the most chosen factor for e-cigarette consumption.[31] 49.4% of users who have attempted to cease conventional smoking via e-cigarette have not been successful, while 20.6% were successful in ceasing conventional smoking via e-cigarette, which is lower than a study performed in King Saud University, Riyadh, Saudi Arabia presenting 24.3%.[27] The consideration of e-cigarette being less harmful than conventional smoking represented one-fifth of the participants, which can be attributed to advertisements and insufficient awareness campaigns.[30]

In this study, the percentage of male conventional smokers was the majority among other groups with a percentage of 77.8%, only 25.5% did succeed in quitting smoking through e-cigarette use. In addition, among the highest educational status, college graduates had the highest percentage of e-cigarette consumption with a percentage of 69%. However, a study in Hong Kong was constructed among young adults with a sample size of n=1186 participants stated that high school graduates or less had a higher percentage of e-cigarette consumption, with a percentage of 13% from a 145 sample compared to college graduates which had a percentage of 8.5% from a 126 participant sample.[10] Additional results to this study indicate surprising predominance in e-cigarette use between low monthly income groups compared to high income ones. Despite the age, gender, and monthly income, there are various reasons for smoking. From the participants who used conventional smoking in this study, anxiety and stress relieve was the reason for smoking in about 49 of the participants. Scarcely, 17 of whom successfully quit conventional smoking, which

represent a percentage of 29.8%. Moreover, although a study conducted in Saudi Arabia on medical students claim that 35.9% of n=399 sample size strongly agreed that e-cigarettes are better for patients than conventional smoking and tobacco products,[23] this study demonstrated different perspective among general population, as the majority of e-cigarettes consumers desire to cease e-cigarette consumption.

79.2% of the general public desire to cease e-cigarette, which is enormously high. In accordance with our findings, a study conducted in Lebanon also demonstrated that majority of the participants had ever thought about quitting cigarette smoking (72.5%).[4] Similarly, 66.2% of medical students have considered ceasing e-cigarette consumption in Saudi Arabia.[23] This can be contributed to the participants receiving a higher education levels, as college was the majority representing 70% in Saudi Arabia, 44.3% in Lebanon of all respondents.[4] 42.8% of participants believed e-cigarette was harmful to one's health, and 72.7% of e-cigarette users reported rare consumption of e-cigarette due to less addictive characteristics of the respondents and overall smoking history. In addition, the majority of the participants have attempted to cease smoking e-cigarettes, yet only 31.4% did attempt to cease smoking e-cigarette for less than thirty days, whom were the same participants who chose entertainment (33.9%) as a reason for e-cigarette consumption. In comparison, between the addictive aspect in e-cigarette and conventional smoking, conventional smoking was considered more addictive by almost half the participants. However, 49.4% of the respondents have failed to cease e-cigarette. In a study done in the United Kingdom 67% considered e-cigarette to be less harmful than conventional smoking representing the majority.[32] In this study, 42.8% of the participants considered the harmful effects of e-cigarette to be dangerous and 33.6% considered e-cigarette and conventional smoking to be equally dangerous, while only 20.7% considered e-cigarette to be less harmful than conventional smoking which is representing the minority. In contrast, in a study that was conducted in the United States the majority of current smokers of e-cigarette perceived it as less harmful than conventional smoking (84.7%).[19] This contrast could be explained through the participants educational level as the majority of participants had only high school education in the survey conducted in the United States.[19] Similar results were reported by a study conducted on medical students from Qassim which showed that 69.4% of the participants thought that e-cigarette are less harmful than conventional smoking, while, 8.2% perceived e-cigarette as equally dangerous as conventional smoking.[28]This disparity among medical students from different regions of Saudi Arabia needs to be investigated further.

Conclusions

In conclusion, this study demonstrates the awareness and prevalence of e-cigarettes among the general population of Jeddah, Saudi Arabia. In this study, the prevalence has been estimated by 51.4%, which is enormously huge, and compared to earlier studies the number is drastically increasing over time. Moreover, the main reason of its popularity has been identified as entertainment, while the second reason is aiding to cease conventional smoking. Although the majority believes e-cigarettes to be effective in ceasing conventional smoking, this study shows the opposite. Only a small percentage managed to succeed with this manner. Finally, the results show that there is lack of awareness among the population. Raising awareness is essential to change misleading concepts reflected by advertisements for marketing purposes in order to decrease the prevalence of e-cigarettes.

Ethics approval and consent to participate: The study was approved by the Institutional Review Board of King Abdullah International Medical Research Center, Jeddah, Saudi Arabia with (SP19/548/J and Memo. Ref. No. IRBC/2248/19). A written informed consent was obtained from each participant before data collection.

Consent for publication: Not applicable.

Availability of data and materials: The datasets generated or analyzed during the study are available from the corresponding author on acceptable request.

Competing interests: The authors declare that they have no conflicts of interest.

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Table 1. Baseline characteristics in the studied group.

Demographics		**N**	**%**
Gender	Male	271	58.3
	Female	194	41.7
	Total	465	100
Highest Educational Status	Primary school	4	.9
	Secondary school	7	1.5
	High school	127	27.4
	College	324	70.0
	None	1	.2
	Total	463	100
Monthly income (SR)	<5000	230	51.1
	5000-15000	165	36.7
	15000-30000	47	10.4
	>30000	8	1.8
	Total	450	100
Occupation Related to Healthcare	Yes	89	19.3
	No	372	80.7
	Total	461	100

Table 2. Conventional smoking and e-cigarette consumption among general perception

		N	%
Have you ever tried conventional smoking (Cigarette, Shisha, Hookah)?	Yes, in last 30 days	187	40.7
	Yes, but not in last 30 days	112	24.3
	Never	161	35.0
	Total	460	100
Have you ever tried an e-cigarette (even 1 or 2 puffs)?	Yes, in last 30 days	105	22.8
	Yes, but not in last 30 days	132	28.6
	Never	224	48.6
	Total	461	100
How often do you smoke electronic cigarettes?	Daily	45	18.1
	Weekly	23	9.2
	Rarely	181	72.7
	Total	249	100
Have you been successful in quitting smoking through the use of an electronic cigarette?	Yes	51	20.6
	No	122	49.4
	I don't use conventional cigarettes	74	30.0
	Total	247	100
Do you want to stop smoking e-cigarettes for good?	Yes	187	79.2
	No	49	20.8
	Total	236	100
During the past 12 months, how many times have you stopped e-cigarette smoking for 1 day or longer because you were trying to quit smoking cigarettes for good?	1 time	24	10.2
	2 times	13	5.5
	3-5 times	19	8.1
	6-9 times	10	4.3
	>10times	22	9.4
	did not try to quit smoking cigarette	48	20.4
	I am not currently smoking	99	42.1

	Total	235	100
When you last tried to quit for good, how long did you stay off cigarettes?	<30 days	72	31.4
	>30 days	37	16.2
	>6 months	19	8.3
	>1 year	35	15.3
	I did not try quitting e-cigarette smoking	66	28.8
	Total	229	100
Would you recommend electronic cigarettes as a good way to quit smoking? For all	Yes	109	25.2
	No	324	74.8
	Total	433	100
Do you think that electronic cigarettes comparing to conventional smoking? For all	More dangerous	127	28.3
	Less dangerous	93	20.7
	Equally dangerous	151	33.6
	Don't know	78	17.4
	Total	449	100
Which one do you think is more addictive? For all	Conventional cigarette	219	48.7
	Electronic cigarette	28	6.2
	Both	203	45.1
	Total	450	100

Table 3. Demographics variability, general perception, and smoking habits in regard to e-cigarette smoking cessation

	Have you been successful in quitting smoking through the use of an electronic cigarette?						p-value
	Yes		No		I don't use conventional cigarettes		
Variables	n	%	n	%	n	%	
Gender							
Male	39	25.5%	80	52.3%	34	22.2%	0.001*
Female	12	12.8%	42	44.7%	40	42.6%	
Highest Educational Status							
Primary school	0	0.0%	1	50.0%	1	50.0%	
Secondary school	0	0.0%	3	100.0%	0	0.0%	
High school	19	27.1%	32	45.7%	19	27.1%	0.465**
College	32	18.7%	86	50.3%	53	31.0%	
None	0	0.0%	0	0.0%	1	100.0%	
Monthly income							
<5000	20	17.2%	59	50.9%	37	31.9%	
5000-15000	20	21.1%	48	50.5%	27	28.4%	0.479**
15000-30000	9	33.3%	12	44.4%	6	22.2%	
>30000	1	16.7%	3	50.0%	2	33.3%	
Occupation Related to Health care							
Yes	9	18.4%	23	46.9%	17	34.7%	0.710*
No	42	21.2%	99	50.0%	57	28.8%	
Have you ever tried conventional smoking (Cigarette, Shisha, Hookah)?							
Yes in last 30 days	30	20.1%	87	58.4%	32	21.5%	
Yes but not in last 30 days	17	24.3%	30	42.9%	23	32.9%	<0.001*
Never	4	14.8%	4	14.8%	19	70.4%	
What type of smoking?							
Cigarette							
No	14	15.1%	33	35.5%	46	49.5%	<0.001*
Yes	34	26.8%	84	66.1%	9	7.1%	

	Have you been successful in quitting smoking through the use of an electronic cigarette?						p-value
	Yes		No		I don't use conventional cigarettes		
Variables	n	%	n	%	n	%	
Shisha							
No	40	22.3%	95	53.1%	44	24.6%	0.908*
Yes	8	19.5%	22	53.7%	11	26.8%	
Hookah							
No	28	26.9%	66	63.5%	10	9.6%	<0.001*
Yes	20	17.2%	51	44.0%	45	38.8%	
Reasons of smoking							
Surrounding environment							
No	32	19.6%	86	52.8%	45	27.6%	0.221*
Yes	17	27.9%	33	54.1%	11	18.0%	
Sadness and depression							
No	41	20.5%	107	53.5%	52	26.0%	0.300*
Yes	8	33.3%	12	50.0%	4	16.7%	
Anxiety and stress relieve							
No	32	19.2%	87	52.1%	48	28.7%	0.049*
Yes	17	29.8%	32	56.1%	8	14.0%	
Entertainment							
No	34	23.8%	85	59.4%	24	16.8%	0.001*
Yes	15	18.5%	34	42.0%	32	39.5%	
Unknown							
No	41	23.6%	84	48.3%	49	28.2%	0.023*
Yes	8	16.0%	35	70.0%	7	14.0%	
Have you ever tried an e-cigarette (even 1 or 2 puffs)?							
Yes in last 30 days	27	26.5%	45	44.1%	30	29.4%	
Yes but not in last 30 days	21	16.5%	71	55.9%	35	27.6%	0.087*
Never	3	16.7%	6	33.3%	9	50.0%	
Did the last e-cigarette you smoke have a particular flavor?							

	Have you been successful in quitting smoking through the use of an electronic cigarette?						p-value
	Yes		No		I don't use conventional cigarettes		
Variables	n	%	n	%	n	%	
No flavor							
No	48	20.3%	117	49.4%	72	30.4%	0.686**
Yes	2	28.6%	4	57.1%	1	14.3%	
Tobacco flavor							
No	35	17.1%	101	49.3%	69	33.7%	0.001*
Yes	15	38.5%	20	51.3%	4	10.3%	
Menthol flavor							
No	47	19.8%	117	49.4%	73	30.8%	0.120**
Yes	3	42.9%	4	57.1%	0	0.0%	
Mix of tobacco and menthol							
No	46	19.6%	117	49.8%	72	30.6%	0.166**
Yes	4	44.4%	4	44.4%	1	11.1%	
Fruit flavor							
No	20	24.7%	42	51.9%	19	23.5%	0.239*
Yes	30	18.4%	79	48.5%	54	33.1%	
Other flavor							
No	49	21.2%	113	48.9%	69	29.9%	0.473*
Yes	1	7.7%	8	61.5%	4	30.8%	
I don’t know							
No	47	21.7%	110	50.7%	60	27.6%	0.076*
Yes	3	11.1%	11	40.7%	13	48.1%	
How often do you smoke electronic cigarettes?							
Daily	24	53.3%	17	37.8%	4	8.9%	
Weekly	1	4.5%	10	45.5%	11	50.0%	<0.001*
Rarely	26	14.9%	94	53.7%	55	31.4%	
Reasons of e-cigarette smoking?							
Surrounding environment							

	Have you been successful in quitting smoking through the use of an electronic cigarette?						p-value
	Yes		No		I don't use conventional cigarettes		
Variables	n	%	n	%	n	%	
No	37	18.0%	104	50.7%	64	31.2%	0.020*
Yes	14	37.8%	16	43.2%	7	18.9%	
Sadness and depression							
No	49	21.3%	112	48.7%	69	30.0%	0.327**
Yes	2	16.7%	8	66.7%	2	16.7%	
Anxiety and stress relieve							
No	43	19.7%	113	51.8%	62	28.4%	0.093*
Yes	8	33.3%	7	29.2%	9	37.5%	
Entertainment							
No	38	23.8%	85	53.1%	37	23.1%	0.011*
Yes	13	15.9%	35	42.7%	34	41.5%	
Unknown							
No	43	22.6%	93	48.9%	54	28.4%	0.511*
Yes	8	15.4%	27	51.9%	17	32.7%	
To quit conventional cigarette							
No	34	19.3%	80	45.5%	62	35.2%	0.005*
Yes	17	25.8%	40	60.6%	9	13.6%	
What attracts you to the idea of using an electronic cigarette?							
No distinctive odor							
No	36	21.3%	80	47.3%	53	31.4%	0.374*
Yes	15	22.4%	37	55.2%	15	22.4%	
Cheaper than conventional smoking							
No	35	17.8%	97	49.2%	65	33.0%	0.001*
Yes	16	40.0%	20	50.0%	4	10.0%	
Fire safety							
No	46	20.4%	113	50.2%	66	29.3%	0.225**
Yes	5	41.7%	4	33.3%	3	25.0%	

	Have you been successful in quitting smoking through the use of an electronic cigarette?						
	Yes		No		I don't use conventional cigarettes		p-value
Variables	n	%	n	%	n	%	
Considered less harmful to your health than cigarettes							
No	33	17.5%	99	52.4%	57	30.2%	0.010*
Yes	18	37.5%	18	37.5%	12	25.0%	
Second hand inhalation considered less harmful							
No	44	20.9%	105	49.8%	62	29.4%	0.777*
Yes	7	26.9%	12	46.2%	7	26.9%	
Can use e-cigarettes in places where smoking is prohibited							
No	41	21.1%	95	49.0%	58	29.9%	0.847*
Yes	10	23.3%	22	51.2%	11	25.6%	
Curious to test a new product							
No	48	24.9%	93	48.2%	52	26.9%	0.025*
Yes	3	6.8%	24	54.5%	17	38.6%	
Previously failed to quit with either products							
No	47	21.8%	102	47.2%	67	31.0%	0.068*
Yes	4	19.0%	15	71.4%	2	9.5%	
Other							
No	49	22.9%	104	48.6%	61	28.5%	0.288*
Yes	2	8.7%	13	56.5%	8	34.8%	
None of the above							
No	49	22.5%	110	50.5%	59	27.1%	0.057*
Yes	2	10.5%	7	36.8%	10	52.6%	
Do you want to stop smoking e-cigarettes for good?							
Yes	39	21.2%	93	50.5%	52	28.3%	0.773*
No	12	24.5%	22	44.9%	15	30.6%	
During the past 12 months, how many times have you stopped e-cigarette smoking for 1 day or longer because you were trying to quit smoking cigarettes for good?							
1 time	9	37.5%	14	58.3%	1	4.2%	<0.001**

	Have you been successful in quitting smoking through the use of an electronic cigarette?						
	Yes		No		I don't use conventional cigarettes		p-value
Variables	n	%	n	%	n	%	
2 times	7	53.8%	5	38.5%	1	7.7%	
3-5 times	7	36.8%	9	47.4%	3	15.8%	
6-9 times	4	40.0%	5	50.0%	1	10.0%	
>10times	7	31.8%	11	50.0%	4	18.2%	
did not try to quit smoking cigarette	9	19.1%	31	66.0%	7	14.9%	
I am not currently smoking	8	8.2%	37	37.8%	53	54.1%	
when you last tried to quit for good, how long did you stay off cigarettes?							
<30 days	22	30.6%	39	54.2%	11	15.3%	
>30 days	13	35.1%	17	45.9%	7	18.9%	
>6 months	2	10.5%	12	63.2%	5	26.3%	<0.001*
>1 year	11	32.4%	10	29.4%	13	38.2%	
I did not try quitting e-cigarette smoking	3	4.7%	35	54.7%	26	40.6%	
Would you recommend electronic cigarettes as a good way to quit smoking? For all							
Yes	27	32.1%	28	33.3%	29	34.5%	<0.001*
No	22	14.6%	91	60.3%	38	25.2%	
Which one do you think is more addictive? For all							
Conventional cigarette	28	20.1%	77	55.4%	34	24.5%	
Electronic cigarette	4	23.5%	8	47.1%	5	29.4%	0.212*
Both	19	22.4%	34	40.0%	32	37.6%	
Do you think that electronic cigarettes comparing to conventional smoking? For all							
More dangerous	19	28.8%	34	51.5%	13	19.7%	
Less dangerous	16	24.2%	31	47.0%	19	28.8%	0.083*
Equally dangerous	12	16.2%	39	52.7%	23	31.1%	
Don't know	3	8.3%	17	47.2%	16	44.4%	

*chi-square test; **Fisher's exact test.

Figure 1. Reasons for e-cigarette consumption

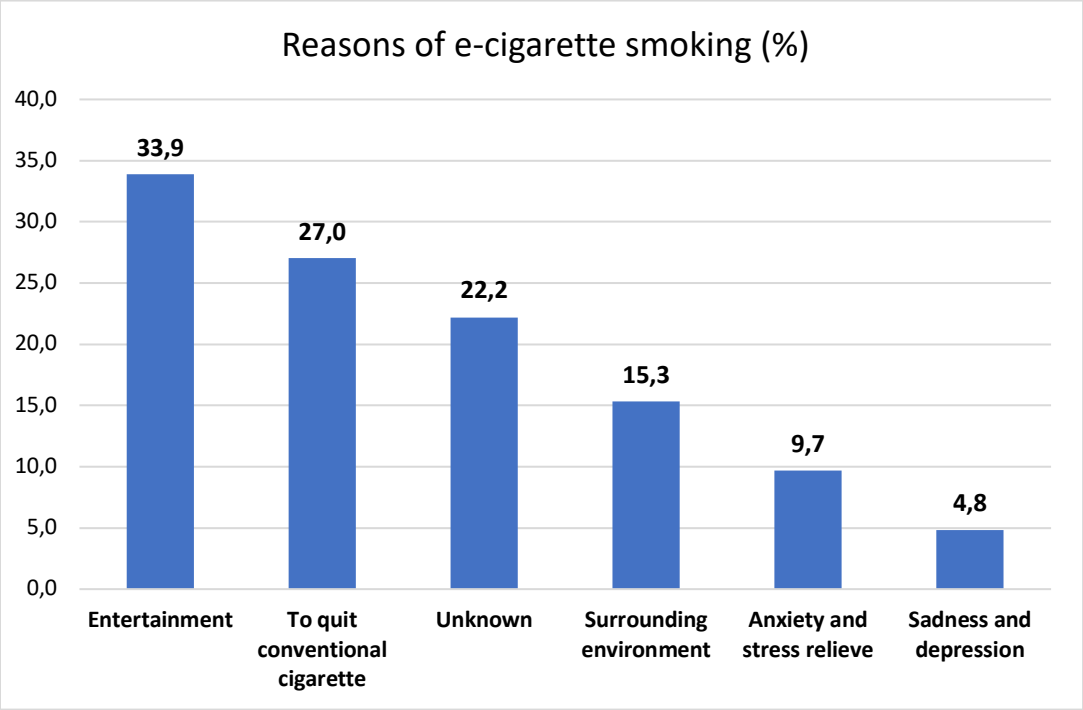

Figure 2. E-cigarette smokers flavor preference

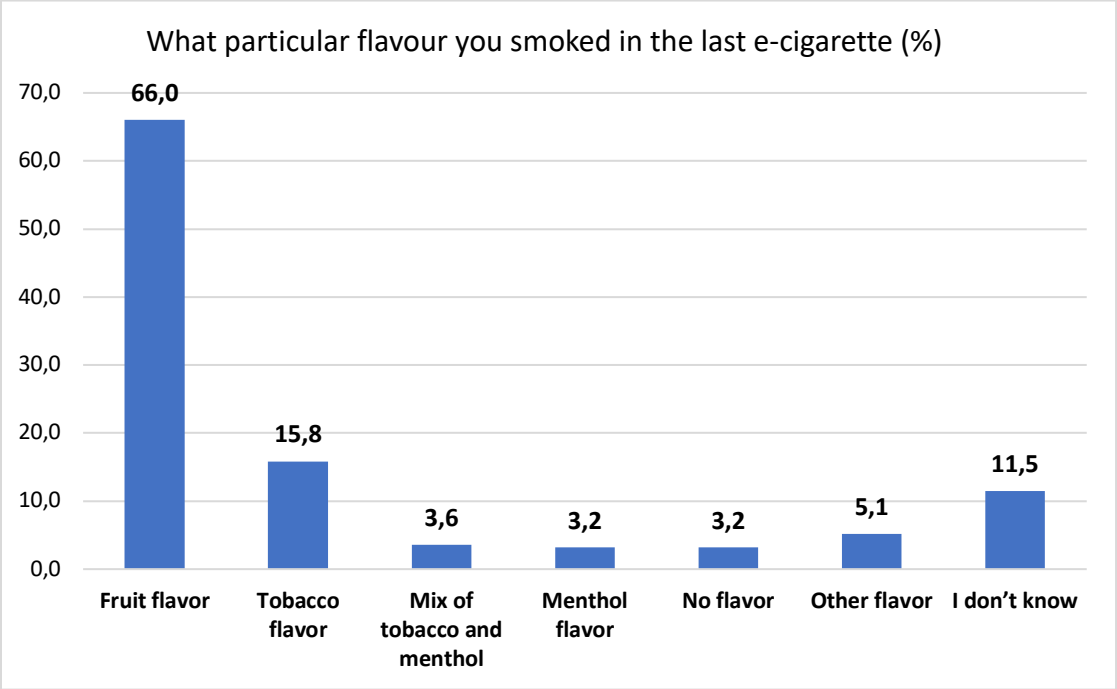

Figure 3. Appealing factors towards E-cigarettes