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Knowledge and Perception of Risks and Use of E-Cigarettes (Vaping) Among Adults in the Eastern Province of Saudi Arabia

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ABSTRACT

Introduction: *In the last decade, electronic cigarettes have emerged and spread over the world. Different generations varying in designs and features were developed.* ***Objectives:*** *The main objective of this study is to examine the level of awareness, knowledge, and perception about e-cigarettes and their use among the adults in the eastern province of Saudi Arabia aged 18 and above. We also examined the reasons e-cigarettes are used and whether adults who use e-cigarette were at risk of smoking conventional tobacco or e-cigarettes helped them quit smoking or not.* ***Procedure/ method:*** *A cross-sectional survey was conducted and data was obtained through an online questionnaire. Targeted people were aged 18 and above and lived in the eastern province. Data collected included demographics such as age, sex, income, etc. The questions tested their knowledge and awareness on electronic cigarettes regarding safety, usage, and whether it led to conventional cigarette use, or quitting of the same.* ***Results:*** *The total number of participants was 1080. The prevalence of vaping among participants was 33.6%. The most common age group of participants who did vaping was 18-24 years. 53.8% of participants believed that electronic cigarettes were not safer than nicotine products. 34.3% thought that electronic cigarettes were safer than regular cigarettes and tobacco products, whereas 46.6% of them thought that they are not safer. 46% believed that electronic cigarettes contained dangerous chemicals while 18.4% thought the opposite. 11.6% reported that they had been pushed into using traditional tobacco. 26.8% reported that they quit tobacco products after switching to electronic cigarettes, whilst 16.8% reported that they reduced the usage of tobacco products after the switch. Yet, 17.9% kept using traditional tobacco products in the same quantities after switching to electronic cigarettes.* ***Conclusion:*** *Vaping is increasingly used among adults and a significant amount of people are unaware of its risks. Even though it may help some people quit traditional smoking, its risks have been established and hence, awareness should be raised.*

Keywords: Electronic cigarette, Vaping, KSA, Eastern province, Awareness

INTRODUCTION

Back in 2003, electronic cigarettes (e-cigarettes) emerged in China, after which it became available worldwide, mostly through the internet. It is operated by batteries to heat and vaporizes a solution that contains nicotine, which is then inhaled by the user. Designed in many shapes, the initial design was meant to mimic the looks of a traditional tobacco cigarette. Later generations were different in designs and features; the more advanced it was, the more customizable it would be, i.e., with the option to refill the same device with different solutions, hence altering the flavors, and the capability to adjust the heating strength [1-7].

Purpose

The purpose of this study is to examine the levels of awareness, knowledge, and perception of e-cigarettes and its use among adult residents of the eastern province in Saudi Arabia aged 18 years and above as well as the reasons behind their use. The purpose is also to determine if adults are at risk of smoking conventional tobacco if they are merely using electronic cigarettes and have not conventionally smoked before.

Problem

The electronic cigarette is a new product of smoking tobacco which is predominantly used by young adults between

18 and 25 years old [8]. Most of them believe that e-cigarettes help them quit smoking and are less harmful than traditional cigarettes [9]. However, it has many adverse health effects due to the substances it contains much more than what a traditional cigarette contains-such as formaldehyde, toxic gases, free radical, and heavy metals [9]. The electronic cigarette is now a global trend, which affects the health of young adults. As studies have shown, this may increase oxidative-carbonyl stress, inflammatory reactions, DNA damage, and alter the function of respiratory cells [8]. In this study, we look forward to answering these questions to discover awareness in the public of this new habit.

Research

In this survey, we tried to question many aspects of electronic cigarettes' use. The awareness of electronic cigarettes, potential harms, personal experiences of negative health effects and replacing traditional tobacco smoking with e-cigarettes.

A study was conducted in the Texan Poison Center, regarding the harmful health effects of electronic cigarettes, which exposed 225 cases from 2009 to 2014. Most of the patients presented with vomiting and nausea. Some of the patients reported headache and ocular irritation [10].

Ingestion of liquid nicotine is a major health concern. One case reported death by cardiac arrest after a person attempted suicide by ingesting 15 ml of concentrated liquid nicotine (100 g/ml) [11]. Another recent case reported a 6-year-old girl losing her hearing after ingesting 7 ml liquid which consisted of 8.4 mg nicotine (nicotine ratio of 1.2 mg/ml) [12].

The potential short-term and long-term health risks that stem from using electronic cigarettes are similar to that of traditional tobacco smoking since both have nicotine as the main component (excluding nicotine-free electronic cigarettes).

There are studies regarding the effectiveness of using electronic cigarettes as a tool to ease traditional tobacco smokers into quitting, such as the study conducted by Farsalinos and Polosa [4]. A prospective study showed that 29 out of 71 participants quit tobacco products after 12-months [4]. Another study (Cahn and Siegel) conducted based on a survey given to American citizens who were on a 2-week trial of electronic cigarettes, found out that after 6 months the rate of abstinence and usage of traditional tobacco products decreased. The study's results revealed that 31.0% of the 222 participants quit and the other 66.8% reduced their use [2].

This study's survey will cover these aspects of electronic cigarettes ' use and will try to answer some of the concerns mentioned above.

Hypothesis

- There is no relationship between demographic factors and the use of electronic cigarettes among adults in the eastern province
- There is a relationship between demographic factors and the use of electronic cigarettes among adults in the eastern province
- The adult residents of the eastern province are not aware of the risks of electronic cigarettes
- The adult residents of the eastern province are aware of the risks of electronic cigarettes
- The use of electronic cigarettes among adults in the eastern province does not lead to the subsequent use of conventional tobacco products
- The use of electronic cigarettes among adults in the eastern province leads to the subsequent use of conventional tobacco products
- The use of electronic cigarettes does not help smokers quit
- The use of electronic cigarettes helps smokers quit

METHODS

Study Design and Participants

This is a cross-sectional survey aimed to observe the attitude of the adults of the eastern province in the kingdom

towards e-cigarettes. An online questionnaire was hosted at Google forms and responses were collected. The participation in the study was voluntary and we insured the anonymity of the participants.

Procedure

We used a self-administered online questionnaire which comprised of 36 questions. The answers varied from 2 to 10 for each question. We used a random sampling method to obtain a more scientific outcome which would be used to represent the entire targeted population of the study. An online version of the questionnaire was hosted on Google form and distributed and spread over the region through social media applications and websites. Then, we collected and analyzed data to establish numerical statistics regarding e-cigarettes. The survey started with demographic questions which included details on nationality, sex, age, the highest academic degree achieved, occupation and income. The next question was whether subjects knew about e-cigarettes and where they knew about it. Following this were questions about the legalization of e-cigarettes: Do the subjects think that selling and purchasing e-cigarettes is legal in Saudi Arabia, what the legal minimum age for vaping is, and whether vaping should be banned in indoor spaces. Other questions about the subjects' awareness regarding vaping safety were the following: Do subjects believe e-cigarettes are safer than nicotine patches and nicotine gums, do they think e-cigarettes are safer than regular cigarettes and tobacco products, do they think e-cigarette is approved by Saudi FDA, do e-cigarettes emit only water vapor, do they contain harmful substances like nicotine, carboxylates, metals, volatile organic materials in addition to small particles, are the preservatives or flavors used in electronic cigarettes harmful or not, is exposing children to vaping is safe or not, can nicotine solutions in cartridges cause death if ingested by a child, can vaping indoors causes harm to non-smokers within the same environment and whether vaping is safer for a pregnant woman than traditional tobacco cigarettes. Specific questions were asked about e-cigarettes' usage. They were asked if they have ever used e-cigarettes before and if any of their friends or family use them. Depending on their answers, they were asked the following: how frequently do they vape, what attracted them to e-cigarettes, what generation of e-cigarettes do they use, where do they buy e-cigarettes from and whether they trust the nicotine concentration value labeled on the product. They were also asked if they vape indoors, outdoors or both, if they ever have experienced any withdrawal symptoms after using e-cigarettes, and if they ever have gone to the emergency department or been admitted to a hospital because of vaping related conditions. They were asked whether they experienced the following symptoms after vaping: change in appetite, nausea or vomiting, dizziness, headache, eye irritation, throat or mouth irritation, respiration irritation, cough. Lastly, subjects were asked if they use traditional tobacco cigarettes if vaping pushed them to try traditional tobacco cigarettes and if vaping helped them quit traditional tobacco cigarettes. All questions of this questionnaire and their collected data would not interfere with the confidentiality or the anonymity of participants as they would not be identifiable from the collected data and no questions regarding their personal identity were included.

Validation

To validate the questionnaire, questions were translated into Arabic and validated by an expert. Also, a pilot study was done, which included 43 participants selected randomly. The data were then analyzed by SPSS using a reliability test which showed an overall Cronbach's alpha of 0.778. The test showed acceptable reliability of the questionnaire.

Measures

We used Statistical Package for the Social Sciences (SPSS) to measure

- The percentage of people aware of and use e-cigarettes
- The percentage of people who stopped traditional smoking after switching to vaping, and
- The percentage of people who started traditional smoking after started vaping

Outcome Variables

- The knowledge and awareness of the population on e-cigarettes
- The percentage of e-cigarettes usage among the population, and
- The percentage of people who vaping led to quit or start traditional smoking

Materials

Surveys were made and collected using google forms. Data collection and analysis were conducted using Microsoft Excel for office 365 version (16.0.11231.20164). We used SPSS version 25 for statistical analysis.

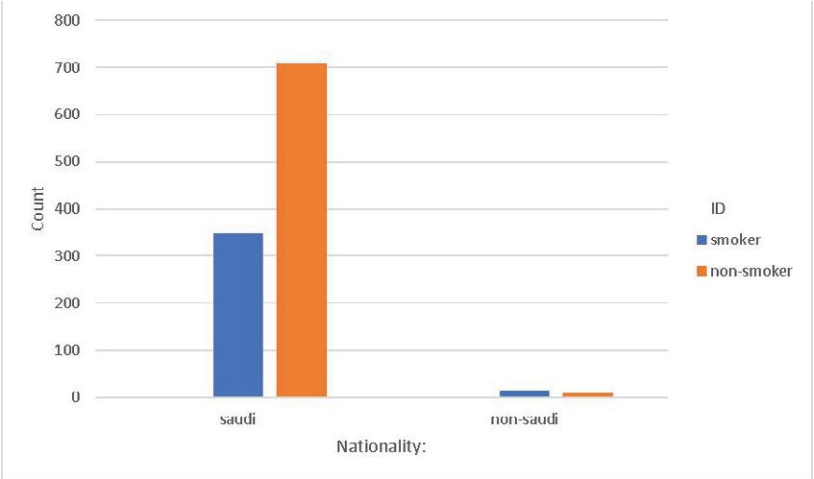
RESULTS

Analysis

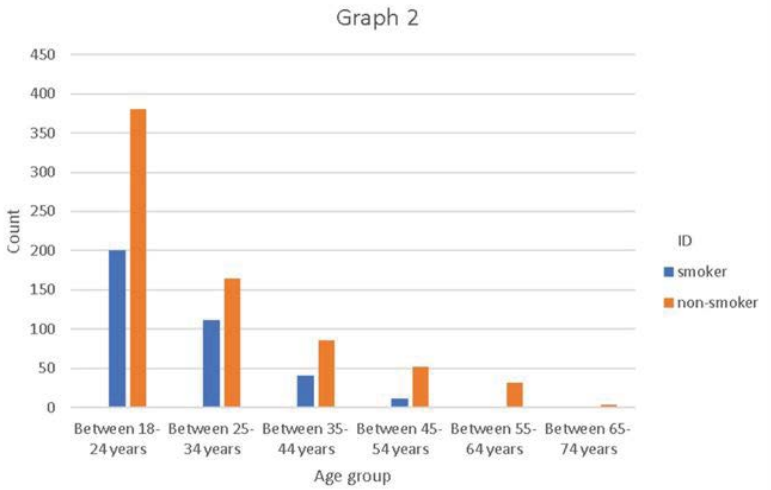
The total number of participants in this study was in 1080. Table 1 summarizes the baseline characteristics of the participants and the difference between smokers and non-smokers. As shown in Graph 1, the majority of the participants were Saudi (97.8%), while the non-Saudis were the minority (2.2%). The number of male smokers (28.3%) was higher than the number of female smokers (5.3%). The age group with the highest number of smokers was between 18-24 years (18.5%), followed by the age group between 25-34 years (10.3%) as shown in Graph 2. Table 1 demonstrates that high school diploma holders were the biggest group among smokers (18.8%), followed by bachelor's degree holders (13.5). Regarding occupational status, Graph 3 shows that employees use electronic cigarettes the most (14.4%) followed by university students (14.1%).

Table 1 Baseline characteristics of the participants and the difference between smokers and non-smokers

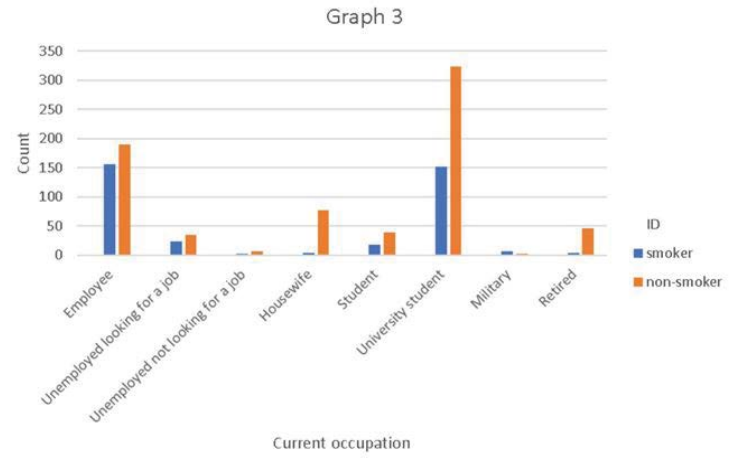
Variables		Smoker n (%)	Non-smoker n (%)	Total n (%)
Nationality	Saudi	349 (32.2%)	707 (65.5%)	1056 (97.8%)
	Non-Saudi	14 (1.3%)	10 (0.9%)	24 (2.2%)
Gender	Males	306 (28.3%)	275 (25.5%)	581 (53.8%)
	Females	57 (5.3%)	442 (40.9%)	499 (46.2%)
Age	18-24	200 (18.5%)	381 (35.3%)	581 (53.8%)
	25-34	111 (10.3%)	164 (15.2%)	275 (25.5%)
	35-44	40 (3.7%)	86 (8%)	126 (11.7%)
	45-54	11 (1%)	52 (4.8%)	63 (5.8%)
	55-64	1 (0.1%)	31 (2.9%)	32 (3.0%)
	65-74	0 (0%)	3 (0.3%)	3 (0.3%)
Highest Academic Degree	Lower than high school diploma	6 (0.6%)	23 (2.1%)	29 (2.7%)
	High school diploma	203 (18.8%)	423 (39.2%)	625 (58%)
	Bachelor's degree	146 (13.5%)	234 (21.7%)	380 (35.2%)
	Master's degree	4 (0.4%)	22 (2.0%)	26 (2.4%)
	Doctorate	4 (0.4%)	15 (1.4%)	19 (1.8%)
Total Family	Less than 75,000 S.R. a year (6250 S.R. monthly)	57 (5.3%)	104 (9.6%)	161 (14.9%)
	Between 75,000 to 150,000 S.R. a year (between 6250 to 12,500 S.R. monthly)	84 (7.8%)	153 (14.2%)	237 (21.9%)
	Between 150,000 to 900,000 S.R. a year (between 12,500 to 25,000 S.R monthly)	80 (7.4%)	175 (16.2%)	255 (23.6%)
Current occupation	More than 900,000 S.R. a year (more than 25,000 a month)	33 (3.1%)	60 (5.6%)	93 (8.6%)
	I don't know	109 (10.1%)	225 (20.8%)	334 (30.9%)
	Employee	156 (14.4%)	189 (17.5%)	345 (31.9%)
	Unemployed looking for a job	23 (2.1%)	34 (3.1%)	57 (5.3%)
	Unemployed not looking for a job	2 (0.2%)	7 (0.6%)	9 (0.8%)
	Housewife	3 (0.3%)	77 (7.1%)	80 (7.4%)
	Student	18 (1.7%)	39 (3.6%)	57 (5.3%)
	University Student	152 (14.1%)	323 (29.9%)	475 (44.0%)
	Military	6 (0.6%)	2 (0.2%)	8 (0.7%)
	Retired	3 (0.3%)	46 (4.3%)	49 (4.5%)



Graph 1 Number of participants according to nationality



Graph 2 Number of participants according to Age group

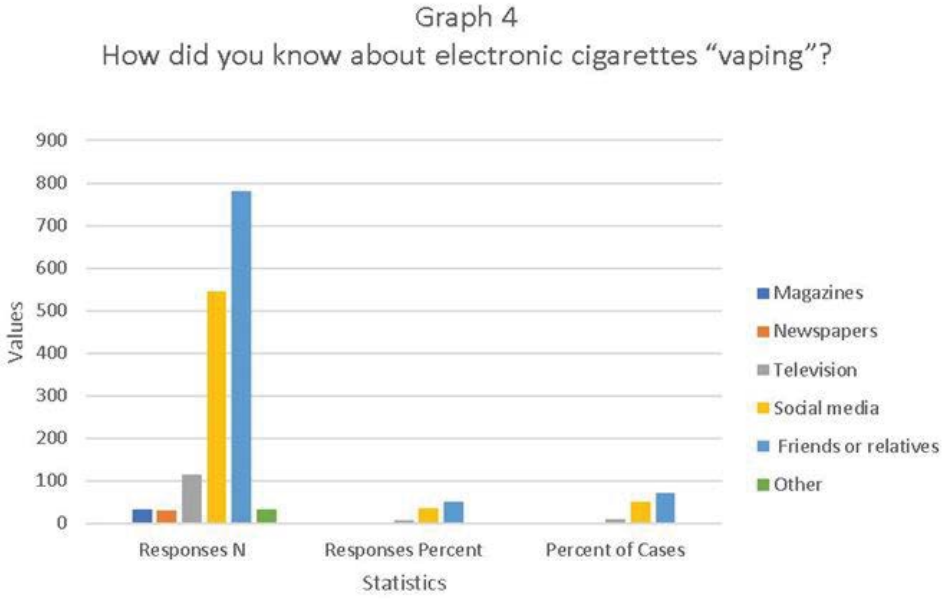


Graph 3 Number of participants according to occupation

Table 2 and Graph 4 demonstrate that the commonest way participants got exposed to e-cigarettes for the first time through friends or relatives (50.8%), the second commonest being social media (35.5%). These graphs tell us that electronic cigarettes are gaining popularity in social circles. Note that in the survey, the question on first exposure was a multiple-choice question and the participants were allowed to choose more than one option. The total number of responses to this question was 1536.

Table 2 Number of responses to questionnaire

Question	Choices	Responses		Percent of Cases (%)
		N	Percentage (%)	
How did you know about electronic cigarettes vaping	Magazines	32	2.10%	3.00%
	Newspapers	31	2.00%	2.90%
	Television	115	7.50%	10.70%
	Social Media	545	35.50%	50.60%
	Friends (or) Relatives	781	50.80%	72.50%
	Other	32	2.10%	3.00%
Total		1536	100.00%	142.60%



Graph 4 Demonstrates the participants got exposed to e-cigarettes through Magazines, Newspapers, television, Social media, friends or relatives, others

Table 3 shows that 35.9% of the participants believe that selling or purchasing electronic cigarettes is legal and allowed in Saudi Arabia. On the contrary, 23.9% believed that it is not legal to purchase or sell the product, whereas 40.2% were unsure. Participants were also questioned whether they thought electronic cigarettes were age-restricted to purchase in Saudi Arabia. 31.2% of the participants believed that it is only legal to use e-cigarettes if one is 18 years old or older, whereas 21% believed it is illegal at any age. A large number of the participants (84%) believed that vaping should be banned indoors and in the places, traditional tobacco smoking is banned too. 10.2% felt that it shouldn't be banned, while the remaining 5.8% were not sure.

Table 3 Shows numbers of participants believe on selling or purchasing electronic cigarettes

Questions	Answers	Smoker n (%)	Non-smoker n (%)	Total
Do you believe that selling and purchasing electronic cigarettes is legal and allowed in Saudi Arabia?	Yes	129 (11.9%)	259 (24.0%)	388 (35.9%)
	No	132 (12.2%)	126 (11.7%)	258 (23.9%)
	Not Sure	102 (9.4%)	332 (30.7%)	434 (40.2%)
Is there a legal minimum age for electronic cigarettes use?	At least 18 years old	198 (18.3%)	139 (12.9%)	337 (31.2%)
	At least 21 years old	58 (5.4%)	63 (5.8%)	121 (11.2%)
	There is no minimum age for electronic cigarettes use	31 (2.9%)	80 (7.4%)	111 (10.3%)
	Vaping is illegal for all ages	40 (3.7%)	187 (17.3%)	227 (21%)
	Not Sure	36 (3.3%)	248 (23.0%)	284 (26.3%)
Do you believe that vaping should be banned indoors and in places that bans cigarette smoking like: Work places, restaurants, coffee shops, and cinema theaters?	Yes	246 (22.8%)	661 (61.2%)	907 (84%)
	No	88 (8.1%)	22 (2.0%)	110 (10.2%)
	Not Sure	29 (2.7%)	34 (3.1%)	63 (5.8%)

Table 4 shows what the participants think about the safety and health issues of electronic cigarettes. 53.8% believed that electronic cigarettes are not safer than nicotine patches or nicotine gum. Also, most of the respondents didn't believe that electronic cigarettes were approved for use by the SFDA (49.9%). We found that 34.3% think that electronic cigarettes are a safer option than regular cigarettes and tobacco products. However, 46.6% thought that e-cigarettes are not significantly safer in comparison. We asked the participants if electronic cigarettes contain chemicals such as nicotine, carboxylates, and others. 46% believed that electronic cigarettes indeed contain dangerous chemicals such as nicotine, carboxylates etc., while 18.4% didn't think so, and 35.6% remained unsure. The participants were asked about their opinions on the safety of preservatives and added flavors used in e-cigarettes. 70.4% believed that they are harmful, 10.1% thought that they aren't, and the remaining 19.5% were not sure. Only 3.8% thought that it is safe to expose children to the vapor in electronic cigarettes, while 90.6% believed it is unsafe and 5.6% were not sure. A percentage of the participants (41.1%) believed that the ingestion of the nicotine solution in e-cigarettes' cartridges can cause death to a child, while 49.4% were not sure about it. When asked about second-hand smoking, 69.3% thought it is harmful, 13.2% thought it is not, and the remaining 17.5% were not sure. 62.3% of the participants did not think electronic cigarettes are safer than traditional tobacco cigarettes for pregnant women, while 15.3% thought it is safer and 22.4% were not sure. The total number of e-cigarettes users in the study was 363.

Table 4 Shows numbers of participants think about the safety and health issues of electronic cigarettes

Questions	Answers	Smoker n (%)	Non-smoker n (%)	Total
Do you believe that vaping is a safer option than nicotine patches or nicotine gum?	Yes	102 (9.4%)	59 (5.5%)	161 (14.9%)
	No	154 (14.3%)	427 (39.5%)	581 (53.8%)
	Not Sure	107 (9.9%)	231 (21.4%)	338 (31.3%)
Do you believe that electronic cigarette usage is authorized by the Saudi Food and Drug Administration (SFDA)?	Yes	60 (5.6%)	63 (5.8%)	123 (11.4%)
	No	156 (14.4%)	383 (35.5%)	539 (49.9%)
	Not Sure	147 (13.6%)	271 (25.1%)	418 (38.7%)
Only water vapor is emitted from electronic cigarettes	Yes	74 (6.9%)	32 (3.0%)	106 (9.8%)
	No	211 (19.5%)	373 (34.5%)	584 (54.1%)
	Not Sure	78 (7.2%)	312 (28.9%)	390 (36.1%)
Do you believe that vaping is safer than regular cigarettes and tobacco products?	Yes	221 (20.5%)	149 (13.8%)	370 (34.3%)
	No	97 (9.0%)	404 (37.4%)	501 (46.4%)
	Not Sure	45 (4.2%)	164 (15.2%)	209 (19.4%)

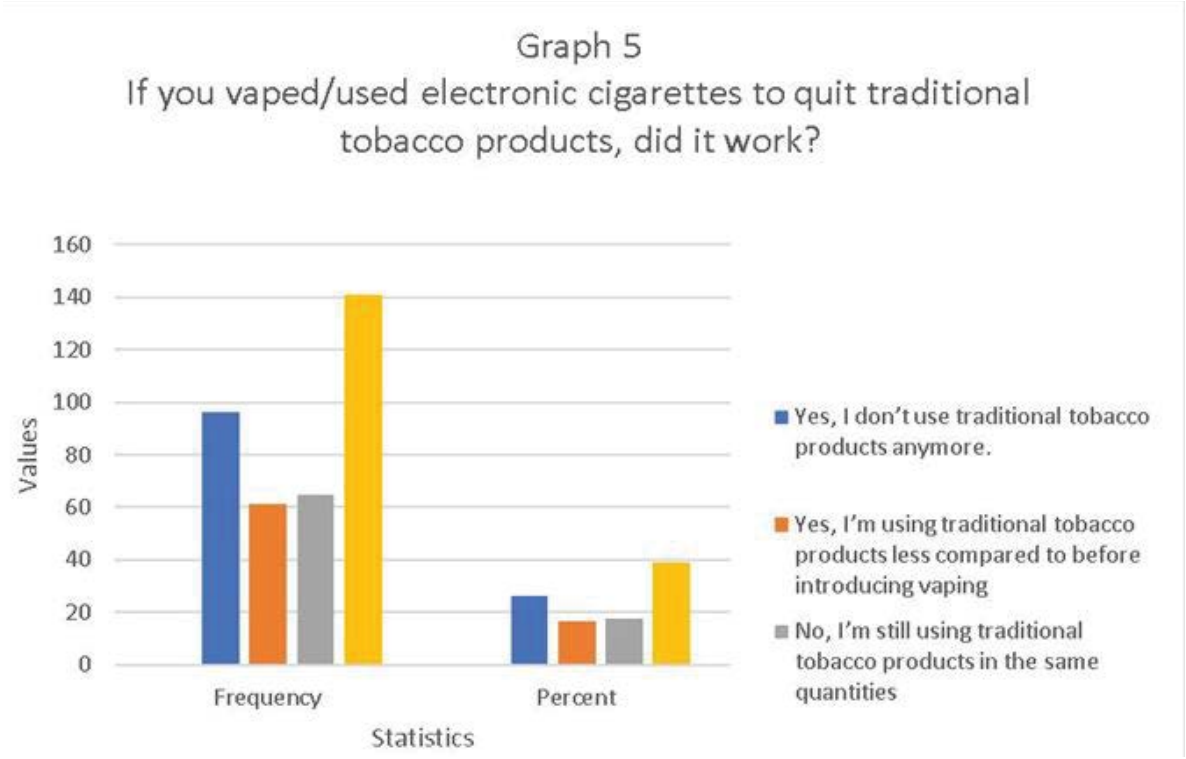
Vaping/electronic cigarettes contain dangerous chemical substances like nicotine, carboxylates, metals, volatile organic materials in addition to small particles:	TRUE	157 (14.5%)	340 (31.5%)	497 (46.0%)
	FALSE	106 (9.8%)	93 (8.6%)	199 (18.4%)
	Not Sure	100 (9.3%)	284 (26.3%)	384 (35.6%)
Do you believe that preservatives or flavors used in electronic cigarettes are not harmful	Yes	67 (6.2%)	42 (3.9%)	109 (10.1%)
	No	229 (21.2%)	531 (49.2%)	760 (40.4%)
	Not Sure	67 (6.2%)	144 (13.3%)	211 (19.5%)
Do you believe that exposing children to electronic cigarettes vape is safe?	Yes	28 (2.6%)	13 (1.2%)	41 (3.8%)
	No	309 (28.6%)	670 (62.0%)	979 (90.6%)
	Not Sure	26 (2.4%)	34 (3.1%)	60 (5.6%)
Do you believe that nicotine solutions in cartridges can cause death	Yes	148 (13.7%)	296 (27.4%)	444 (41.1%)
	No	54 (5.0%)	49 (4.5%)	103 (9.5%)
	Not Sure	161 (14.9%)	372 (34.4%)	533 (49.4%)
Is vaping indoors causes harm to non-smokers within the same environment (secondhand smoking) in case of exposure to the aerosol emitted from electronic cigarettes?	Yes	174 (16.1%)	574 (53.1%)	748 (69.3%)
	No	107 (9.9%)	36 (3.3%)	143 (13.2%)
	Not Sure	82 (7.6%)	107 (9.9%)	189 (17.5%)
Do you consider vaping safer for a pregnant woman than traditional tobacco cigarettes?	Yes	90 (8.3%)	75 (6.9%)	165 (15.3%)
	No	177 (16.4%)	496 (45.9%)	673 (62.3%)
	Not Sure	96 (8.9%)	146 (13.5%)	242 (22.4%)
Do any of your family members or friends vapes	Yes	330 (30.6%)	348 (32.2%)	678 (62.8%)
	No	27 (2.5%)	304 (28.1%)	331 (36.6%)
	Not Sure	6 (0.6%)	65 (6.0%)	71 (6.6%)

According to Table 5, 39.4% reported that they used electronic cigarettes more than once daily, 5.5% said they used it once daily, 9.4% once or twice a week, 25.1% once or twice a month and the remaining 20.7% reported other variants. When asked what attracted them to electronic cigarettes, the most common answer was the easy usage of electronic cigarettes (54.8%). The most used generation of e-cigarette was the fourth generation (81%). When asked about the source, the most frequent source according to the respondents was electronic cigarette shops (55.1%), followed by friends and family (16.5%) and tobacco and shisha shops (14%). We found that 56.5% of respondents trusted the nicotine concentration value written on the product's label, 15.4% did not trust the label, 3.9% stated that they use nicotine-free cartridges and the remaining 24.2% were not sure. Respondents reported that they either they vaped indoors, outdoors or both (5.2%, 34.4%, 60.3% respectively). Only 2.5% reported that they had to go to the emergency department or be admitted to a hospital due to a condition related to vaping. The percentage of dual users was 30.3%, 38% used to use traditional tobacco cigarettes in the past, and 31.7% haven't used traditional tobacco cigarettes. Some respondents (11.6%) reported that they have been pushed into using traditional tobacco cigarettes and they hadn't used them before that. Regarding the usage of electronic cigarettes to quit traditional tobacco products, Graph 5 shows that 26.4% reported that they don't use traditional tobacco products anymore, 16.8% reported that they use traditional tobacco products less compared to before, and 17.9% still use traditional tobacco products in the same quantities. The remaining participants weren't applicable to this question as they do not use traditional tobacco products.

Table 5 Shows how frequently participants used electronic cigarettes

Variables		**Frequency**	**Percentage (%)**
How frequently do you vape?	More than once a day	143	39.4%
	Once a day	20	5.5%
	Once or twice a week	34	9.4%
	Once or twice a month	91	25.1%
	Other	75	20.7%

What attracted you to electronic cigarettes?	Ease of use	199	54.8%
	Vape volume	100	27.5%
	Marketing	14	3.9%
	Nice colors	3	0.8%
	Fun tricks with the vape	23	6.3%
	Small size and modern look	24	6.6%
What is the generation of electronic cigarettes do you use?	First-generation	14	3.9%
	Second generation	30	8.3%
	Third generation	25	6.9%
	Fourth generation	294	81.0%
From where do you buy electronic cigarettes?	Electronic cigarettes shops	200	55.1%
	Tobacco and shisha shops	51	14.0%
	Supermarket	5	1.4%
	Grocery store	2	0.6%
	Internet	45	12.4%
	Friends	60	16.5%
Do you trust the nicotine concentration value written on the product's label	Yes, I do trust the product's label	205	56.5%
	No, I don't trust the product's label	56	15.4%
	I use nicotine-free cartridges	14	3.9%
	Not Sure	88	24.2%
Where do you vape?	Indoors	19	5.2%
	Outdoors	125	34.4%
	Indoors and outdoors	219	60.3%
Have you ever gone to the emergency department or admitted to a hospital because of a condition related to vaping?	Yes	9	2.5%
	No	354	97.5%
Do you use traditional tobacco cigarettes?	I haven't used traditional tobacco cigarettes	115	31.7%
	I'm a dual user. I use both traditional cigarettes and electronic cigarettes	110	30.3%
	I'm a previous traditional tobacco smoker. I don't use currently	138	38.0%
Did vaping pushed you to try and use traditional tobacco cigarettes where you haven't used it before?	Yes	42	11.6%
	No	321	88.4%
If you vaped/used electronic cigarettes to quit traditional tobacco products, did it work?	Yes, I don't use traditional tobacco products anymore.	96	26.4%
	Yes, I'm using traditional tobacco products less compared to before introducing vaping	61	16.8%
	No, I'm still using traditional tobacco products in the same quantities	65	17.9%
	The question does not apply to me (I don't use traditional tobacco products	141	38.8%

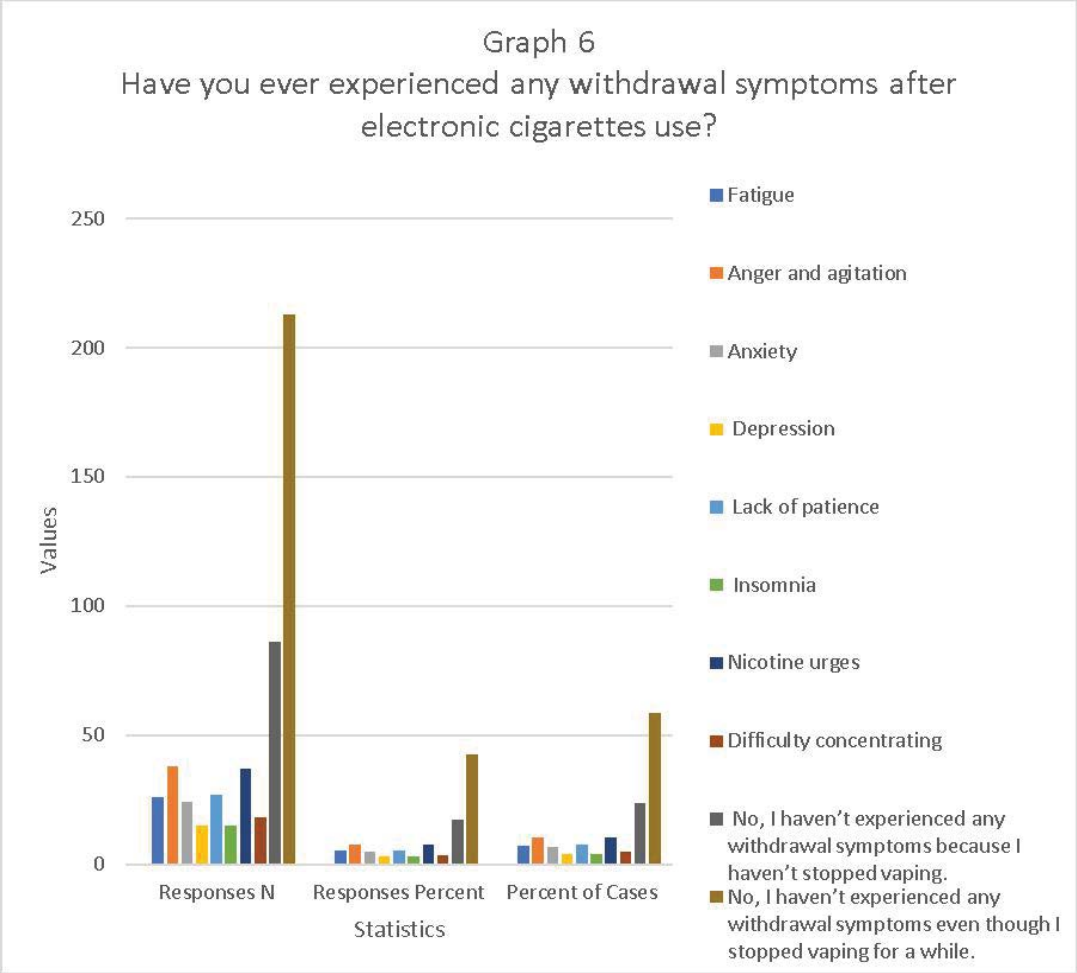


Graph 5 Demonstrates value number of participnts used electronic cigarettes to quit traditional tobacco

Graph 6 shows if electronic cigarette users experienced any withdrawal symptoms such as fatigue, anxiety, insomnia etc., whether they didn't stop using it or even if they stopped vaping for a while and they didn't experience any symptoms. As Table 6 shows, 17.2% haven't experienced any withdrawal symptoms because they haven't stopped vaping, and 42.7% didn't experience any symptoms despite the fact they stopped for a while.

Table 6 Shows symptoms of electronic cigarettes

Variables		Responses		Percent of Cases (%)
		N	Percentage (%)	
Have you ever experienced any withdrawal symptoms after electronic cigarettes use?	Fatigue	26	5.20%	7.20%
	Anger and agitation	38	7.60%	10.50%
	Anxiety	24	4.80%	6.60%
	Depression	15	3.00%	4.10%
	Lack of patience	27	5.40%	7.40%
	Insomnia	15	3.00%	4.10%
	Nicotine urges	37	7.40%	10.20%
	Difficulty concentrating	18	3.60%	5.00%
	No, I haven't experienced any withdrawal symptoms because I haven't stopped vaping.	86	0.172%	0.237%
	No, I haven't experienced any withdrawal symptoms even though I stopped vaping for a while.	213	0.427%	0.587%

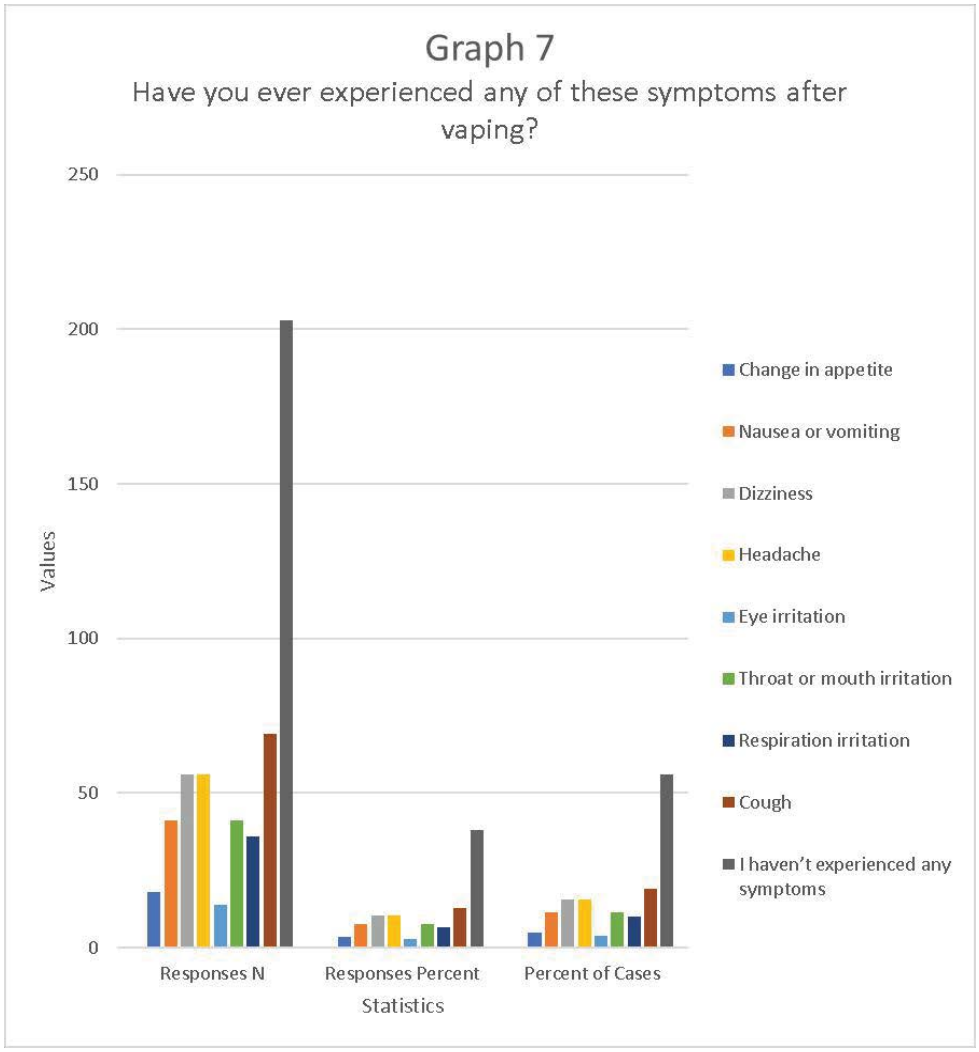


Graph 6 Demonstrate symptoms of electronic cigarettes

Table 7 shows information regarding the symptoms experienced after vaping. 38% haven't experienced symptoms after vaping and in Graph 7, we can see how some respondents have reported more than one symptom. Also, in Table 7, we found that the most frequent symptoms are cough (12.9%), followed by dizziness (10.5%), headache (10.5%), nausea or vomiting (7.7%), and throat or mouth irritation (7.7%).

Table 7 Shows information regarding the symptoms experienced after vaping

Variables		Responses		Percent of Cases (%)
		N	Percentage (%)	
Have you ever experienced any of these symptoms after vaping?	Change in Appetite	18	3.40%	5.00%
	Nausea or Vomiting	41	7.70%	11.30%
	Dizziness	56	10.50%	15.40%
	Headache	56	10.50%	15.40%
	Eye irritation	14	2.60%	3.90%
	Throat or mouth irritation	41	7.70%	11.30%
	Respiration irritation	36	6.70%	9.90%
	Cough	69	12.90%	19.00%
	I haven't experienced any symptoms	203	0.38%	0.559%



Graph 7 Demonstrate information regarding the symptoms experienced after vaping

DISCUSSION

Electronic cigarettes, also known as e-cigarettes, are handheld nicotine delivery devices that are believed to be an alternative to traditional tobacco smoking. Based on several studies, there are no short-term effects of e-cigarettes on cardiac or respiratory systems [13-15]. However, as nitric oxide is decreased as in traditional smoking, heart rate and blood pressure increase significantly [16]. To have a better understanding of the awareness of e-cigarettes among the general population in the eastern province in Saudi Arabia, we conducted an epidemiological study to gauge their understanding, knowledge, and experience on electronic cigarettes.

1080 male and female adults of different nationalities from the eastern province of Saudi Arabia participated in the study.

The prevalence of vaping among the participants is 33.6% (28.3% males and 5.3% females), which is quite similar to the data regarding the same collection in a general survey conducted by AL Baik et al. (33.5%) [17]. We found that the most common age of the participants who vape fell between 18-24, making the most common users young adults, and their academic degree was found to be high school diploma (18.8%) and bachelor 's degree (13.5%). A similar study done in the Jeddah-western region found the prevalence to be higher among adults (14.1%) [18]. Of the e-cigarettes users, 50.8% knew about vaping from their friends and relatives. Accordingly, we believed that the reasons behind the popularity of e-cigarettes are immense advertising by friends and relatives and the fact that e-cigarettes are currently a worldwide cultural phenomenon.

We found that 30.3% of e-cigarettes smokers were dual users- those who use both traditional cigarettes and electronic cigarettes and 38% were traditional tobacco smokers in the past who do not smoke tobacco currently. We are concerned that the e-cigarette itself can be the gateway to the usage of conventional cigarettes. However, 88.4% who haven't used traditional tobacco cigarettes before, deny that electronic cigarettes have led them to try or use them. We speculated the main reasons for one to start using e-cigarettes. One of the main speculated reasons was that e-cigarettes could potentially replace conventional tobacco products and can be used as a tool to quit traditional tobacco products. Our survey's results showed that since the introduction of electronic cigarettes, 26.4% haven't used traditional tobacco products and 16.8% were using traditional tobacco products in less amount compared to their previous usage before starting the usage of electronic cigarettes.

A study on the students of health science in Jeddah revealed that 42.7% of the users of the electronic cigarette considered it as a tool for smoking cessation, 9.2% reported that quitting smoking was the sole reason to start using e-cigarettes and 5.8% of e-cigarettes users considered it after the failure of one or more smoking cessation methods [18]. Data of a study conducted in Poland showed that 58.7% of Polish students tried electronic cigarettes as an attempt to quit smoking [19]. For the same reason, 4.1% and 23.1% of different American universities' students have tried electronic cigarettes [20,21].

In our study, 221 smokers (20.5%) agree that vaping is a safer or healthier alternative to conventional cigarettes, which is less than 37% of smokers with the same opinion in the Jeddah's study [18]. A similar study in Mexico showed that 19% of middle school students believe that electronic cigarettes were less harmful than regular cigarettes [22]. In addition to these studies, another study found that 67% of the general public in the United Kingdom believe that e-cigarettes are less harmful than conventional cigarettes [23].

CONCLUSION

The number of electronic cigarette users in Saudi Arabia is growing steadily, especially among young adults. Awareness of e-cigarettes' legality, health risks, and effect on tobacco products, should be raised among the public. While many of the participants who use e-cigarettes reported no adverse health symptoms, some experienced notable negative effects, which should be investigated more. Although electronic cigarettes are promoted as a means of quitting tobacco products, it can go the other way around too. More information on electronic cigarettes should be spread through campaigns and mainstream media should be used to raise awareness readily and help the public to access the information.

Application

In 2015, the Saudi ministry of health initiated the anti-smoking program and set regulations for tobacco products. Therefore, we aimed to explore the awareness of electronic cigarettes to decide whether to start campaigns to raise awareness. As the data above shows, many of the young adults have started to use electronic cigarettes even if they were not using traditional tobacco previously.

Limitations

The major factor which affected the study is the lack of time needed to include the underage population since, for that, we needed to gain consent prior to handling the questionnaire.

As this study is limited only to the residents of the eastern province, we cannot generalize these data to the whole population of Saudi Arabia.

Additionally, since we utilized a self-administered online survey, it can be affected by social desirability bias.

Recommendations

For future studies, we recommend to target a larger sample and to include more regions of the kingdom in order to generate data that can be generalized to the Saudi population. Further clinical trials should be conducted on the effects of electronic cigarettes on health, before considering them as an alternative or cessation aid for tobacco products.

DECLARATIONS

Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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