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Knowledge and perception of risks and use of e-cigarettes among adults in Saudi Arabia: A cross sectional study

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ABSTRACT

The prevalence of e-cigarette use is increasing worldwide. Evaluating the impact of e-cigarettes on public health and taking preventative and intervention strategies in to account would necessitate an understanding of how to describe and analyse e-cigarette use, awareness and misconceptions. This study aimed to determine the current level of understanding and perception of the hazards and use of e-cigarettes among Saudi Arabia's adult population. Between July and October of 2022, a cross sectional online survey was administered. Logistic regression was used to determine the characteristics that predicted knowledge about e-cigarettes. This study included 495 participants in all. Participants in the study demonstrated a reasonable degree of knowledge of electronic cigarettes with a mean score of 7.0 (1.4), representing 63.6% of the highest possible score. Males, students and individuals with a high-income level (more than 300,000 SAR) were significantly more likely to be knowledgeable about e-cigarettes ($p \leq 0.01$). Approximately one-third of them (36.0%) confirmed prior usage of e-cigarettes or vaping. The two most often cited reasons for using e-cigarettes or vaping were convenience of use (73.6%) and contemporary size and shape (15.7%), respectively. E-cigarette use is widespread in Saudi Arabia and the public must be made more aware of their detrimental health effects. It is recommended that policy makers intensify health activities in order to improve public awareness of this significant health risk and counteract commercial companies' promotional efforts that encourage the use of e-cigarette devices. More research is required to develop techniques that could effectively reduce e-cigarette use.

Keywords: E-cigarettes, Knowledge, Saudi Arabia, Vaping

1. INTRODCUTION

Electronic cigarettes, often known as e-cigarettes are being promoted more and more as alternatives to traditional cigarettes or as tools to help smokers quit (Tan et al., 2014). Since e-cigarettes first become available in 2002, there has been a phenomenal rise in their consumption. Their entire user base increased from roughly 7 million in 2011 to 41 million in 2018, indicating a sharp increase in their global usage (BBC News et al., 2019). E-cigarettes produce aerosol by heating a liquid that often contains nicotine the addictive ingredient found in traditional cigarettes and other tobacco products flavourings and other compounds that contribute to the aerosol's formation. E-cigarette use is most frequently cited for reasons of curiosity, flavour or taste and perceived reduced risk compared to other tobacco products (Aqeeli et al., 2022; Centers for Disease Control and Prevention et al., 2021).

Adult understanding and perception of e-cigarettes are major concerns due to the increased adult usage of e-cigarettes in Saudi Arabia. Even while some evidence suggests that e-cigarettes are a healthier alternative to conventional cigarettes and that they may be useful in helping smokers quit, other studies show that many people have misconceptions about using e-cigarettes and their potential side effects (Wang et al., 2019). Previous studies have shown that consumers think that e-cigarettes help people quit smoking by reducing cigarette consumption or satisfying cravings. Additionally, given the notion that e-cigarette components are ecologically friendly, e-cigarettes are utilized as both cheaper and healthier alternatives to traditional cigarettes as well as smoking cessation tools (Farsalinos et al., 2014; Wang et al., 2019). Despite the scarcity of scientific information about the health impacts of e-cigarettes or their potential to replace or reduce other tobacco use, e-cigarette use has considerably expanded around the world (Bold et al., 2018). Although there is little information on the long-term effects of e-cigarette usage, an epidemic of "e-cigarette or vaping, product use associated lung injury" (EVALI), has been affecting the USA since March 2019 (Pray et al., 2020). Research increasingly demonstrates a link between using electronic cigarettes and unpleasant respiratory symptoms and illnesses (Meo et al., 2019; Soule et al., 2020; Strickland et al., 2020). While flavourings are believed to be safe for consumption, there are no safety data available for inhalation exposures (Cao et al., 2020). The specific chemical components and concentrations of those components that are harmful are still mostly unknown. However, recent research indicates that e-cigarette use is also rising among non smokers. One of the major risks identified was a concern about the possibility that e-cigarettes could act as a gateway to conventional cigarette smoking among nonusers, especially with regard to the young population and its impact on short- and long-term health outcomes (Eltorai et al., 2019; Kwon et al., 2020; Romijnders et al., 2018; Siegel et al., 2019). Evaluating the effect of e-cigarettes on the public health and taking in to account preventative and intervention measures will require an understanding of how to describe and assess e-cigarette dependence, awareness and false impressions. We aimed to ascertain how well informed and how individuals in Saudi Arabia currently perceived the risks of using e-cigarettes.

2. MATERIALS AND METHODS

Study design

This was an online cross sectional survey study that was conducted for the duration between July and October 2022.

Study population and participants' recruitment

The population of the study was made up of everyone who is currently resident in Saudi Arabia and is at least 18 years old. Utilizing social media platforms, the survey link was distributed (Facebook, Snapchat, Instagram and WhatsApp). Using a convenience sampling method, the study sample was generated. The cover letter outlined the study's objectives and inclusion criteria.

Questionnaire tool

This study used a questionnaire to evaluate Saudi Arabian people' current level of knowledge and perception of the hazards associated with using e-cigarettes. A previously validated questionnaire instrument by Alfaraj et al., (2020) was used in this study. The questionnaire instrument was prepared in Arabic to ensure that the vast majority of the population of Saudi Arabia could understand it. The participants' knowledge about e-cigarettes, including their understanding of its safety, components and sources of information, was examined. The first part of the questionnaire obtained information about the demographic characteristics of the participants (age, sex, education, income, nationality, occupation and area of residency). In addition, this section asked the participants whether they smoke traditional tobacco and whether vaping influenced them to try traditional tobacco. The knowledge of the participants was evaluated using 11 questions with multiple choices format. Each correct response received a score of 1, with a possible overall score of 11.

In the second section of the survey, participants were questioned about their use of e-cigarettes, including how frequently they used them, where they purchased their products, the generation of device they used, where they use it, the symptoms they experienced after using it, the withdrawal symptoms they experienced after trying to quit and whether using e-cigarettes had developed complications that required hospitalization. In addition, the questionnaire collected information on the respondents' socio-demographic characteristics. Individuals were informed that they might continue or stop participating after reading the informed consent form on the questionnaire's first page. The study's objectives were clearly stated to help the participants comprehend the significance of their participation.

Translation and piloting of the questionnaire

The original survey was written in English. We used the forward and backward translational technique to translate the original survey into Arabic. This translation method relied on conceptual translation as rather than word by word translation. The Arabic draft of the questionnaire was checked for clarity and comprehensibility by two knowledgeable healthcare professionals and academics and they concluded that participants would have no difficulty understanding it. Then, 30 Saudi Arabian participants who met the inclusion criteria for the research were subjected to a pilot study using the questionnaire. Participants were questioned regarding the clarity and understand ability of the questionnaire as well as whether any of the questions were challenging to understand. Additionally, patients were questioned about any questions that they found objectionable or disrespectful. Patients claimed that they had no trouble understanding or filling out the questionnaire.

Statistical analysis

The participant's demographic details were described using descriptive statistics. The mean was used to describe continuous data (SD). For categorical variables, data were reported as percentages (frequencies). The characteristics that predicted e-cigarette knowledge were determined using logistic regression (dummy variables defined as a total score equal to or higher than the mean score of the study participants, which was 7.0). Statistical significance was defined as a two sided $p<0.05$. Statistical Package for Social Science (SPSS) (version 27) was used to analyse the data.

3. RESULTS

Participant's demographic characteristics

A total of 495 participants involved in this study. Almost 57.0% were females. Around one-third (36.0%) of the study participants were aged 18-24 years. The vast majority of them (96.4%) were Saudis. Almost half of them (49.9%) reported that they hold diploma. Similar percentages (47.7%) of the participants were employed. Around one quarter of them (22.0%) reported that their annual income was less than 75,000 SAR. Almost 79.6% reported that they live in the central area. Around 42.0% of them stated that they have never smoked conventional cigarettes before and only smoked e-cigarettes. Around 11.8% of the participants reported that vaping prompt them to try and use traditional tobacco (traditional cigarettes) where they have not smoked traditional cigarettes before. Refer Table 1 for more information on the study participants' demographic characteristics.

Table 1 Participants baseline characteristics

Variable	Frequency	Percentage (%)
Sex		
Females	282	57.0%
Age group		
"18-24 years"	178	36.0%
"25-34 years"	113	22.8%
"35-44 years"	80	16.2%
"45-54 years"	84	17.0%
"55-64 years"	37	7.5%
"65-74 years"	3	0.6%
Nationality		
Saudi	477	96.4%
Education level		
High school level or lower	170	34.3%

Diploma	247	49.9%
Bachelor degree	78	15.8%
Employment status		
Employed	236	47.7%
Student	146	29.5%
Unemployed	43	8.7%
Housewife	37	7.5%
Retired	33	6.7%
Family income per year		
Less than 75,000 SAR	109	22.0%
75,000 – 150,000 SAR	79	16.0%
150,000-300,000 SAR	85	17.2%
More than 300,000 SAR	100	20.2%
Don't know	122	24.6%
Area of residence		
Central area	393	79.6%
Eastern area	53	10.7%
Western area	41	8.3%
Northern area	4	0.8%
Southern area	3	0.6%
Do you smoke traditional tobacco (traditional cigarettes)?(n= 178)		
I've never smoked conventional cigarettes before and only smoked e-cigarettes	74	41.6%
A former smoker of traditional cigarettes, I do not smoke them now	65	36.5%
Dual user, I use both traditional smoking and vaping	39	21.9%
Did vaping influence you to try traditional tobacco (traditional cigarettes) in places where you had never previously smoked them? (n=178)		
Yes	21	11.8%

SAR: Saudi Riyal

Knowledge of and attitude towards electronic-cigarettes

Participants said their relatives and friends were their main source of e-cigarette knowledge (56.2%). More than half (61.6%) of them reported that they think that buying and selling e- cigarettes is allowed and legal in Saudi Arabia. Around 41.0% of them reported that the minimum age for using e-cigarettes is 18 years. Around 7.0% of them claimed to believe that vaping is less dangerous than nicotine gum or patches. Almost one-fifth of them reported that they think that vaping or e-cigarettes and their use are authorized by the "Saudi Food and Drug Authority" (SFDA). More than half of them (63.2%) reported correctly that vaping or e-cigarettes does not emit only water vapour. E-cigarettes, according to almost one third of them (32.7%), are safer than traditional cigarettes and tobacco products and the main source for this information was their own assumption.

Almost 62.0% reported that vaping or e-cigarettes contain dangerous chemicals such as nicotine, carbonylates, minerals, volatile organic compounds as well as small particles. The majority of them (78.2%) identified correctly that preservatives and flavours used in vaping or e-cigarettes are harmful. The vast majority of the participants (98.0%) identified correctly that exposing children to vaping or e-cigarettes is not safe. Around 46.5% of them identified correctly that nicotine solution at the concentration of some filled cartridges or cartons does not cause death if swallowed or ingested by a child. Around 67.5% identified correctly that indoor vaping cause harm to non smokers near (passive smoking) if they are exposed to chemicals and aerosols from vaping. The vast majority (94.3%) confirmed that vaping or e-cigarettes is not safer for a pregnant woman and her fetus. The majority of them (81.4%) reported that vaping should be prohibited indoors or in places where smoking is prohibited such as workplaces, restaurants, cafes, cinemas. For further details on the participants' response to knowledge and attitude questions (Table 2).

Table 2 Participants' response to knowledge items

Variable	Frequency	Percentage (%)
Source of information about vaping/e-cigarettes		
Relatives and friends	278	56.2%
Social media	195	39.4%
Television	19	3.8%
Magazines	3	0.6%
"Do you believe that selling and buying electronic cigarettes is legitimate in Saudi Arabia?"		
Yes	305	61.6%
"Is there a minimum age for using e- cigarettes?"		
At least 18 years old*	202	40.8%
At least 21 years old	79	16.0%
There's no age limit	44	8.9%
Smoking e-cigarettes is prohibited for all age groups	84	17.0%
Not sure	86	17.4%
"Do you believe vaping to be safer than nicotine gum or patches?"		
Yes	33	6.7%
No*	462	93.3%
"Do you think that vaping/e-cigarettes and their use are authorized by the "Saudi Food and Drug Authority" (SFDA)?"		
Yes*	105	21.2%
"Vaping / E-cigarettes emit only water vapour"		
Right	22	4.4%
Wrong*	313	63.2%
Not sure	160	32.35
"Do you believe that e-cigarettes are less harmful than traditional cigarettes and other tobacco products?"		
Yes*	162	32.7%
If you answered with (yes) or (no) in the previous question, from which source did you get this information? (n= 484)		
Just assumed	196	40.5%
The internet	106	21.9%
Social media	93	19.2%
Family and friends	73	15.1%
Magazines	11	2.3%
Newspapers	5	1.0%
"Vaping ore-cigarettes contain dangerous chemicals such as nicotine, carbonylates, minerals, Volatile organic compounds as well as small particles:"		
Right*	307	62.0%
Wrong	15	3.0%
Not sure	173	34.9%
"Do you think that preservatives and flavours used in vaping/e-cigarettes are harmless?"		
Right	39	7.9%
Wrong*	387	78.2%

Not sure	69	13.9%
"Do you think exposing children to vaping/e-cigarettes is safe?"		
Yes	10	2.0%
No*	485	98.0%
"Do you think that the nicotine solution at the concentration of some filled cartridges / cartons causes' death if swallowed or ingested by a child?"		
Yes	265	53.5%
No*	230	46.5%
"Does indoor vaping cause harm to non-smokers near (passive smoking) if they are exposed to chemicals and aerosols from vaping?"		
Yes*	334	67.5%
"Is vaping/e-cigarettes safer for a pregnant woman and her fetus?"		
Yes	28	5.7%
No*	467	94.3%
"Do you believe that smoking should be banned indoors or in public areas like restaurants, cafés, and movie theaters?"		
Yes	403	81.4%

Predictors of knowledge of electronic-cigarettes

The study participants showed moderate level of knowledge about electronic-cigarettes with a mean score of 7.0 (1.4), which represents 63.6% out of the maximum score. Males, students and individuals with a high-income level (more than 300,000 SAR) were found to have higher knowledge of e-cigarettes using binary logistic regression analysis ($p \leq 0.01$), Table 3.

Table 3 Binary logistic regression analysis

Variable	Odds ratio of being knowledgeable about electronic-cigarettes (95% confidence interval)	P-value
Gender		
"Females (Reference group)"	1.00	
Males	1.7 (1.2-2.5)	0.006**
Age group		
"18-24 years (Reference group)"	1.00	
"25-34 years"	1.1 (0.7-1.8)	0.576
"35-44 years"	0.5 (0.3-0.9)	0.011*
"45-54 years"	0.9 (0.6-1.5)	0.680
"55-64 years"	0.7 (0.3-1.3)	0.274
"65-74 years"	0.3 (0.0-3.0)	0.282
Nationality		
"Non-Saudi (Reference group)"	1.00	
Saudi	0.7 (0.3-2.0)	0.518
Education level		
"High school level or lower (Reference group)"	1.00	
Diploma	0.9 (0.7-1.4)	0.752
Bachelor degree	1.6 (0.9-2.7)	0.107

Employment status		
"Unemployed (Reference group)"	1.00	
Student	1.9 (1.2-2.9)	0.004**
Employed	1.2 (0.8-1.8)	0.301
Retired	0.5 (0.2-1.0)	0.042*
Housewife	0.5 (0.2-0.9)	0.033*
Family income per year		
Don't know (Reference group)	1.00	
Less than 75,000 SAR	0.9 (0.6-1.4)	0.665
75,000 – 150,000 SAR	0.6 (0.4-1.1)	0.101
150,000-300,000 SAR	0.9 (0.7-1.5)	0.747
More than 300,000 SAR	2.4 (1.4-4.0)	0.001**

*$p \leq 0.05$; **$p \leq 0.01$

Experience with electronic-cigarettes

Table 4 below described participants' experience with e-cigarettes. Around 69.5% reported that they have a family member or friend who vape. Around one third of them (36.0%) confirmed that they have used e-cigarette or vaped before. Around 43.0% of them reported that they use e-cigarettes or vape more than once a day. The most two commonly reported causes of using e-cigarettes or vaping were ease to use and modern size and shape with 73.6% and 15.7%, respectively. Fourth generation e-cigarettes were the most commonly used type of e-cigarettes (39.3%). Tobacco and cigarettes shops or hookah stores and the internet were the most two commonly reported places of buying vaping products with 50.6% and 16.9%, respectively. Almost half of them (52.8%) reported that they believe and rely on the nicotine concentration that is written on the label of the pack. Almost 66.3% reported that they have both indoor and outdoor. Figure 1 below describes the most commonly reported symptoms after vaping. Dizziness and cough were the most two commonly reported symptoms after vaping with 20.8% and 19.7%, respectively.

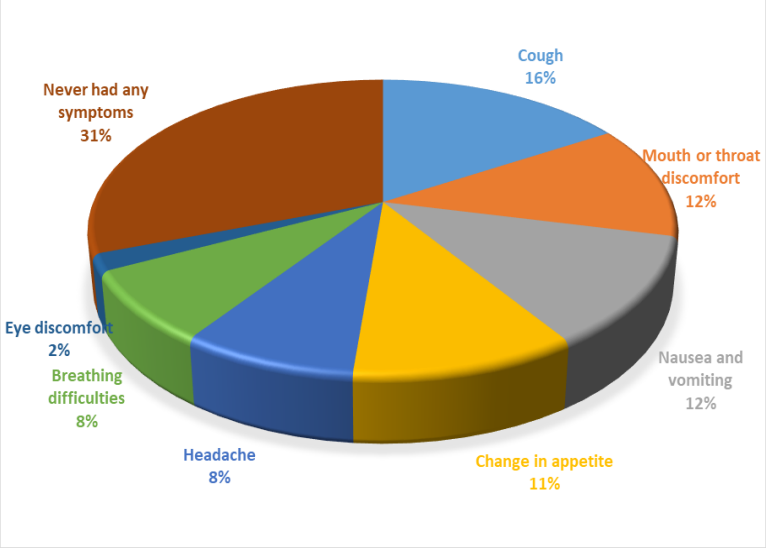

Figure 1 Symptoms experienced after vaping (n=178).

The most two commonly reported withdrawal symptoms from quitting vaping or e-cigarettes for some times were intense craving for nicotine and angry and annoyance, with 27.5% and 19.1%, respectively, (Figure 2). Only 3.0% stated that they have been to the emergency department or hospitalized with a condition related to vaping or e-cigarettes. Around one quarter of the study participants reported that vaping or e-cigarettes helped them to quit traditional tobacco products.

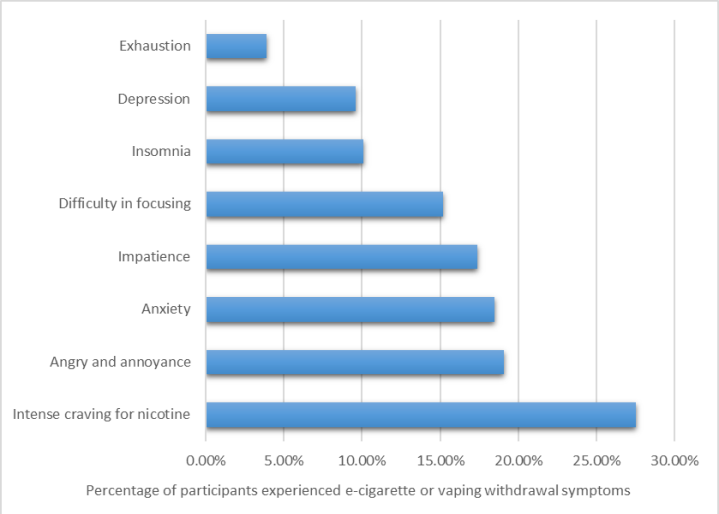

Figure 2 E-cigarette or vaping withdrawal symptoms.

Table 4 Participants' experience with electronic-cigarettes

Variable	Frequency	Percentage
"Does anyone in your family or circle of friends a vapour?"		
Yes	344	69.5%
"Have you ever vaped or used an e-cigarette?"		
Yes, constantly	73	14.7%
Yes, sometimes	49	9.9%
Yes, only once or twice	56	11.3%
No	317	64.0%
"How often do you vape or use electronic cigarettes?"(n= 176)		
More than once a day	76	43.2%
Tried it only once	35	19.9%
Once or twice a month	33	18.8%
Once or twice a week	22	12.5%
Once a day	10	5.7%
"What drew you to vaping or using e-cigarettes?"(More than one answer could be chosen) (n= 178)		
Ease to use	131	73.6%
Its modern size and shape	28	15.7%
Amount of vapour	17	9.6%
Tricks to do with vapour	14	7.9%
Good marketing	7	3.9%
Attractive colours	7	3.9%
"Which electric cigarette generation do you use?"(n= 178)		
First generation	25	14.0%
Second generation	47	26.4%
Third generation	16	9.0%
Fourth generation	70	39.3%
Others	20	11.2%
"Where do you purchase your vaping supplies?"(n= 178)		
Tobacco & cigarettes shops/ hookah stores	90	50.6%
The internet	30	16.9%
Stores that sell e- cigarettes and its products	26	14.6%

Friends	16	9.0%
Supermarket	9	5.1%
Grocery shops	2	1.1%
Others	5	2.8%
"Do you trust and rely on the pack's labelled information on the nicotine content?"(n= 178)		
Yes, I believe and trust the label	94	52.8%
No, I don't believe and trust the label	42	23.6%
I smoke nicotine- free cigarettes	5	2.8%
Not sure	37	20.9%
"Where do you vape?"(n= 178)		
Indoors	22	12.4%
Outdoors	38	21.3%
Indoors and outdoors	118	66.3%
"Have you ever been hospitalized or taken to the ER for an e-cigarette or vaping-related condition?"(n= 178)		
Yes	5	2.8%
"Did vaping or using e-cigarettes help you stop using traditional tobacco products?"(n= 178)		
Yes, I do not use traditional tobacco products now and I quit them	44	24.7%
Yes, I smoke less traditional tobacco than before	15	8.4%
No, I still smoke the same amount of conventional smoking as before	26	14.6%
Doesn't apply to me (I don't smoke traditional tobacco)	93	52.2%

4. DISCUSSION

This study aimed to examine Saudi Arabian individuals' current level of knowledge and perception of the hazards and use of e-cigarettes. The key findings of this study are: 1) One third of the study participants reported that they think that e-cigarettes are safer than regular cigarettes and tobacco products, 2) Almost half of them reported that vaping or e-cigarettes contain dangerous chemicals such as nicotine, carbonylates, minerals, volatile organic compounds as well as small particles, 3) The vast majority of them identified correctly that exposing children to vaping or e-cigarettes is not safe, 4) Over half of them identified correctly that indoor vaping cause harm to non smokers near (passive smoking) if they are exposed to chemicals and aerosols from vaping, 5) The vast majority confirmed that vaping or e-cigarettes is not safer for a pregnant woman and her fetus, 6) The study participants showed moderate level of knowledge about electronic-cigarettes, 7) Males, students and those with high income level were most likely to be knowledgeable about e-cigarettes, 8) Around one-third of them confirmed that they have used e-cigarette or vaped before.

In our study, around one-third of them (36.0%) confirmed that they have used e-cigarette or vaped before. A previous study in Saudi Arabia stated that 33.6% of the adults were users of vaping devices and the majorities were aged 18-24 years (Alfaraj et al., 2020). Similarly, another study in Saudi Arabia by AlBaik et al., (2014) stated that 33.5% of the study participants were e-cigarettes users. Electronic cigarettes, also referred to as "e-cigarettes," are small, portable nicotine delivery systems that are gaining popularity as a potential substitute for smoking traditional tobacco (Alfaraj et al., 2020). An earlier systematic review of 24 studies discovered that e-cigarette marketing costs and online social media engagement have risen over time that e-cigarettes are frequently promoted as a healthier substitute to traditional cigarettes and that exposure to e-cigarette promotions and advertisements may be linked to e-cigarette use (Collins et al., 2019). This systematic study also showed a connection between e-cigarette marketing and reduced perceptions of e-cigarette risk and desire to use e-cigarettes, highlighting the necessity of advertising limitations that support public health goals (Collins et al., 2019).

In our study, over one-third of participants (32.7%) stated that they believed e-cigarettes to be safer than traditional cigarettes and tobacco products and the primary source of this information was their own presumption. This was consistent with earlier research conducted in Saudi Arabia, where 34.3% of participants believed electronic cigarettes to be safer than traditional cigarettes and tobacco products (Alfaraj et al., 2020). Another study in Italy examined e-cigarettes use among nursing students and found that 30.3% of them were users of vaping devices (Canzan et al., 2019). Another study by Gorini et al., (2020) in Italy stated that the prevalence of vaping device users in 2018 has reached 17.5%. However, this was lower than the percentage of e-cigarettes users in a previous study in China, where only 8.2% of the students indicated they had ever used an e-cigarette (Fang et al., 2022). E-cigarettes are being advertised as a safer alternative to cigarettes, an effective tool for quitting smoking and a device that may be used in places where smoking is not permitted. Promotions of cutting-edge flavouring and promoting the public performance of vaping are two other significant marketing initiatives designed to win over a broader market. The public and those with vested interests, such manufacturers and sellers, appear to be the main groups discussing and promoting these devices (Mc Causland et al., 2019). E-cigarette advertising was linked to a decline in support for laws that ban usage in public areas, according to a prior study of adults in the United States (Tan et al., 2015). E-cigarette proponents typically emphasize that using these devices is smoke free and that they can be used in places where tobacco use is currently prohibited (Han et al., 2016; Kavuluru et al., 2016; Sears et al., 2017).

In our study, more than 62.0% reported that vaping or e-cigarettes contain dangerous chemicals such as nicotine, carbonylates, minerals, volatile organic compounds as well as small particles. This was also confirming the findings of a previous study in Saudi Arabia, where 46% thought that harmful substances were present in electronic cigarettes (Alfaraj et al., 2020). Glycerol and propylene glycol (PG), intense flavours and possibly varied levels of nicotine are generally found in e-cigarettes. Numerous chemical components have been found in e-cigarette cartridges, refill solutions and aerosols (National Academies of Sciences et al., 2018). There were between 60 and 70 compounds (both known and unknown) in each liquid tested for vaping solutions, totalling about 113 individual chemicals (Herrington et al., 2015; Kucharska et al., 2016). There have been numerous chemical compounds and ultrafine particles found in e-cigarette aerosols, cartridges and environmental emissions that are hazardous, carcinogenic and cause respiratory and heart disorders (National Academies of Sciences et al., 2018).

In our study, almost 98.0% identified correctly that exposing children to vaping or e-cigarettes is not safe. Besides, 94.3% confirmed that vaping or e-cigarettes is not safer for a pregnant woman and her fetus. Pregnancy related exposure to e-cigarettes may impair placental function and cause morphological defects in the fetus (Mescolo et al., 2021). The growing lung may experience physiopathologic changes as a result of this, which could subsequently compromise respiratory health. Additionally, there is indication that using e-cigarettes can cause both short- and long-term respiratory complications in children and future young people who become nicotine addicts are a serious concern. Pediatric populations are more susceptible to the negative consequences of passive vaping because of the low parental perception of the risks associated with e-cigarettes exposure for children (Mescolo et al., 2021). In our study, 67.5% identified correctly that indoor vaping cause harm to non smokers near (passive smoking) if they are exposed to chemicals and aerosols from vaping.

According to a previous study, parents who had tried, were using or intended to use e-cigarettes thought that these items would be useful in preventing their kids from being exposed to passive smoking at home (Rowa-Dewar et al., 2017). Smoking parents have stricter smoke free policies in cars and homes than e-cigarette users or double smokers, who regularly allow adults to vape while a child is around. Additionally, due to a lack of knowledge regarding the risks associated with the chemical components of e-liquids, parents regularly refill their device in front of their children without taking the necessary safety steps (Drehmer et al., 2019). An earlier study by Patel et al., (2019) revealed that a significant percentage of parents of middle and high school students had little knowledge of the various kinds of e-cigarettes and severely underestimated the risk of vaping among their own children. It is incredibly unlikely that they will intervene to prevent or restrict risky practices like vaping (Patel et al., 2019).

The study participants showed moderate level of knowledge about electronic-cigarettes with a mean score of 7.0 (1.4), which represents 63.6% out of the maximum score. A survey previous study in Europe had reported a low level of knowledge about e-cigarettes (Ferrara et al., 2019). Another study in Jordan also confirmed that the study participants showed poor level of knowledge about the content and types of e-cigarettes (Abdel-Qader et al., 2021). In our study, males, students and those with high income level (more than 300,000 SAR) were more knowledgeable about e-cigarettes. A previous large-scale study in Italy that involved more than 15,000 participants reported that males are more likely to users of e-cigarettes (Liu et al., 2020). Males and females smoke at different rates, which are mostly a reflection of how gender interacts with other social and contextual factors to affect tobacco use (Bottorff et al., 2012). Recent research on men's health behaviours has revealed different characteristics, such as inadequate self care, risk taking and a resistance to seeking professional medical care (Courtenay et al., 1998). The disparities in smoking rates between males and females are mostly a result of how gender interacts with other factors that affect tobacco use, such as ethnicity, age and socioeconomic class (Bottorff et al., 2012).

In our study, the most two commonly reported causes of using e-cigarettes or vaping were ease to use and modern size and shape with 73.6% and 15.7%, respectively. E-cigarettes are more attractive than traditional cigarettes for a number of reasons, including cost, taste diversity, accessibility and use and effect of social media. E-cigarette users, including both adults and teens have various perceptions about them. The former group might use them due to the innovative device's sense of style, while the latter may want to stop smoking traditional/combustible cigarettes by converting to e-cigarettes (Sapru et al., 2020).

About 48.0% of the individuals in our study used e-cigarettes to stop smoking. This supported the findings of a prior study conducted in Saudi Arabia, which found that about 43.0% of e-cigarette users saw them as an aid for quitting smoking (Qanash et al., 2019). Another study in Poland showed similar results and reported that almost 60.0% of vaping devices users used it for smoking cessation purposes (Brożek et al., 2017). On the other hand, a previous study in the United Kingdom reported that vaping ex-smokers are probably more prone to relapse than non vapours (Brose et al., 2019). Smoking e-cigarettes and vaping should not be used as a smoking cessation approach as previous studies prove that it is not an effective tool (Christensen et al., 2014; El Dib et al., 2017; Grana et al., 2014). Other evidence-based approaches such as nicotine patches, nasal or oral sprays, nicotine gums should be preferred to help people quit smoking (Liu et al., 2020). In addition, regulations on e-cigarettes advertising are required to achieve public health objectives (Collins et al., 2019).

This study has limitations. The cross-sectional design restricted our ability to explore causality between our study variables. The convenient study sample recruited through our online survey might have led to missing some of our targeted population. We did not estimate the number of participants who were asked to participate in this study, which might have led to non response bias. Finally, social desirability bias is suspected in this study of research.

5. CONCLUSION

In Saudi Arabia, e-cigarette use is widespread and public awareness of their harmful effects needs to be raised. Policymakers are recommended to intensify health campaigns to raise public awareness of this crucial health issue and to counteract the promotional efforts of commercial companies that facilitate the use of e-cigarettes devices. It is necessary to conduct more research to find useful strategies that could reduce e-cigarette use.

Author contribution

Rayan Abubakker Qutob, Sara Khalid Habib, Abdullah Abdulaziz AlFaisal, Malak Khalid AlSugayer, Abdullah Hussien Alghamdi, Abdullah Abdulaziz Alaryni, Yousef Mohammed Alammari, Khalid Mohammed Al Harbi, Abdullah Ibraheem Bukhari, Osamah A. Hakami participated in protocol design, data collection and investigation. Rayan Abubakker Qutob supervised this study. Sara Khalid Habib, Malak Khalid AlSugayer and Abdullah Abdulaziz AlFaisal drafted the first manuscript. All authors reviewed and approved the final manuscript.

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Ethical approval

The study was approved by the Institutional Review Board at Al-Imam Mohammad Ibn Saud Islamic University gave their clearance with IRB No.265/2022. Informed consent was obtained from the study participants prior to study commencement.

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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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