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Knowledge, Awareness, and Misconceptions about Vaping and its Related Side Effects among Adults in Saudi Arabia

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Abstract

Background: The global rise in electronic cigarette (e-cigarette) use has prompted serious concerns regarding public health and safety. While these devices are often marketed as safer alternatives to conventional cigarettes or as aids for smoking cessation, emerging evidence highlights widespread misconceptions about their health risks. In Saudi Arabia, where e-cigarette usage has become increasingly common among adults, understanding public knowledge and perceptions is critical for developing effective health policies and educational initiatives. **Objectives:** This study aimed to assess the level of knowledge and Misconceptions regarding the health risks and side effects of vaping among adults in Saudi Arabia. **Methods:** This study employed a descriptive cross-sectional design to assess the level of knowledge and awareness regarding the health risks and side effects of e-cigarette use among adults in Saudi Arabia. Data were collected using a structured, self-administered questionnaire developed based on previously validated surveys and adapted to the local context. Knowledge and awareness scores were calculated and categorized into low, moderate, and high levels. Associations between knowledge, awareness, and participant characteristics were analyzed using the Chi-square test. **Results:** The mean age of participants was 25.02 ± 7.34 years; males were 58.4%, single (73.0%), and held a bachelor's degree (44.1%). 20.6% reported present or previous e-cigarette use. Among users, the most reported reason for initiating vaping was smoking reduction or cessation (4.6%), followed by enjoyment of flavor variety (4.2%). Most participants recognized that e-cigarettes are nicotine delivery systems (91.1%), can cause respiratory diseases (87.1%), and are harmful during pregnancy (85.1%). The belief that e-cigarettes burn tobacco (37.6%). High knowledge and awareness levels were observed in 51.5% and 36.7% of participants, respectively. A significant positive association was found between knowledge and awareness levels ($\chi^2 = 53.230$, $P < 0.001$). Knowledge level was significantly associated with gender ($P = 0.042$), while awareness level was significantly associated with gender ($P < 0.001$), age group ($P = 0.001$), educational level ($P < 0.001$), and history of e-cigarette use ($P < 0.001$). Participants also reported several adverse effects related to vaping, particularly poorer sleep quality (56.3%), worsening financial status (49.5%), worsen mood 20.4%, reduced appetite (49.5%), impaired endurance (45.5%), and decreased concentration (44.4%). **Conclusion:** Participants generally showed adequate knowledge regarding e-cigarettes, but there are still some incorrect beliefs about the safety of vaping and its effectiveness for quitting smoking. Higher knowledge was associated

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with increased awareness and differed based on demographic factors and smoking-related traits. The reported adverse effects and ongoing misunderstandings emphasize the necessity for focused public health education initiatives to enhance awareness of the risks associated with vaping and to promote evidence-based tobacco control measures in Saudi Arabia.

Key words: Adverse effects, awareness, electronic cigarettes, knowledge, misconceptions, Saudi Arabia, smoking cessation, vaping

INTRODUCTION

Vapes, often known as electronic cigarettes, are battery-operated devices that heat a liquid to create an aerosol that is sometimes mistaken for "vapor." The user inhales this aerosol, which is a combination of tiny particles, and onlookers may passively inhale it when it is exhaled.[1] In addition to delivering additional compounds, such as cannabis or illegal narcotics, the liquid usually contains nicotine, the addictive ingredient in regular cigarettes. Fruit, candy, menthol, and mint are just a few of the colorful looks and flavors that are commonly used to promote e-cigarettes to younger audiences. The term "vaping" is frequently used to describe the use of these devices.[2,3]

The use of electronic cigarettes has increased rapidly over the years; in 2021, there were an estimated 82 million users globally, including 9.2 million users in the Middle East, raising potential health concerns.[4] Compared to the general population, adolescents and young adults are more likely to use e-cigarettes. The prevalence of e-cigarette use during the past 30 days is 9.8% among people aged 12–16 worldwide.[5] In 2004, e-cigarettes were first made available. Since then, the sector has grown to be worth billions of dollars. In 2021, the Middle East market was predicted to be worth 490 million dollars, while North America had the greatest market share at 10.3 billion dollars. On a worldwide level, however, e-cigarette marketing, sales, and content are still mostly unregulated.[6,7]

The prevalence of e-cigarettes in Saudi Arabia's general population has only been the subject of a few published research.[8] Nevertheless, 12.2% of Saudi citizens reported smoking tobacco, according to the national survey.[9] Adolescent tobacco use incidents rose by 17% in Saudi Arabia.[10] According to a recent survey conducted in Jeddah, Saudi Arabia, 51.4% of the general population uses e-cigarettes while attending high school or college.[11] Over time, the Saudi government has modified its laws governing the sale and use of e-cigarettes. These gadgets were prohibited from being imported or sold in 2015.[12] E-cigarettes were becoming more and more popular in the community despite the ban. The government lifted the ban in 2019 and implemented regulations controlling the sale of electronic cigarettes that forbid sales to individuals under the age of eighteen. 2020 saw the official introduction of e-cigarettes into the Saudi market following the implementation of laws.[7]

Although some experts contend that because e-cigarettes don't burn and release fewer toxins, they are less dangerous, their growing use worldwide continues to be a serious health problem. In addition to respiratory tract irritation, palpitations, elevated blood pressure, and an increased risk of tumors among non-users exposed to secondhand e-cigarette emissions, studies have connected e-cigarettes to negative outcomes, such as thermal injuries, airway obstruction, myocardial infarction, and vascular endothelial dysfunction.[13,14] As a result, e-cigarette usage is currently considered a major and expanding hazard to public health by several public health agencies. Vaping can have more serious repercussions, such as detrimental effects on the central nervous system, even though some of the more common adverse effects, such as nausea, coughing, and inflammation, may seem minor.[15]

The need for more empirical research on e-cigarettes is highlighted by persistent knowledge gaps. Addressing misunderstandings has become a public health concern as the use of these devices continues to increase, and there is growing evidence of health dangers. One important example of a nation where e-cigarette use is becoming more common is the Kingdom of Saudi Arabia (KSA). Certain groups have been shown to have significantly greater consumption rates; among university students, the incidence is 27.7%.[2] Among adults, 26.3% reported ever using e-cigarettes,[16] and among 325 adult male smokers, one-third (33.5%) are current users.[17] However, as Al-Hamdani and Hopkins point out, the excessive dependence on university-based samples and the notable diversity in the available data underscore the necessity of additional study to close important knowledge gaps.[18]

Even while young people, especially those working in the medical field; make up a sizable portion of the population, e-cigarette use is widespread outside of educational and medical environments. Nevertheless, there is very few nationally representative research on adult populations, especially those that examine e-cigarette knowledge, attitudes, and practices (KAP) and related behavioral and sociodemographic characteristics. As a result, it is necessary to add more thorough data from the general population to the present body of evidence. Given the already overburdened healthcare system and the potential for increased e-cigarette usage to exacerbate the burden of non-communicable diseases, Saudi Arabia makes a strong case.[19,20]

Although global research on e-cigarettes is expanding rapidly, there remain significant gaps in scientific understanding regarding their long-term health effects, addictive potential, and public perceptions. The novelty of these devices, coupled with insufficient regulation and misleading marketing,

contributes to their widespread use without clear awareness of associated risks. The study highlights that individuals, particularly adults, often consume e-cigarettes without full knowledge of their contents or potential harm.

METHODOLOGY

Study design and setting

This observational, cross-sectional study, conducted between July 2025 and June 2026, evaluates Saudi Arabian adults'. The target population for this study includes Saudi residents aged between 18 and 45 years, including both males and females. Participants were recruited electronically using a convenience sampling approach.

Sample size

The sample size was calculated by Raosoft, Inc., Seattle, WA, USA at 384 individuals, using the following formula and applying the mean and standard deviation. Considering the standard deviation (=1.96) for a 95% Confidence interval and the maximum acceptable marginal error (=0.05). Therefore, the calculated minimum sample size required for this study is $n = (1.96)^2 \times 0.50 \times 0.50/(0.50)^2 = 384$ participants.

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Inclusion and exclusion criteria

The inclusion criteria were Saudi youth aged from 18 to 45 years old, both males and females, and individuals who are currently residing in Saudi Arabia. Participants who are able to read and understand Arabic or English and those who agree to participate and provide informed consent.

Exclusion criteria included individuals younger than 18 or older than 45 years of age, non-Saudi nationals, and Participants with known psychiatric disorders or cognitive impairments that may affect their ability to provide reliable responses. In addition, Individuals who decline to participate or do not provide informed consent.

Method for data collection, instrument

A structured, bilingual (Arabic/English) self-administered questionnaire was used as the primary data collection tool in this study. Data collection was conducted through participants' responses to the survey questions. The questionnaire consists of three parts:

- Part 1 begins with a brief description of the study and includes a consent question to ensure participants understand their involvement.
- Part 2 captures demographic features, such as age, gender, education level, marital status, and residential area, which are essential for analyzing the data in context.
- Part 3 focuses on participants' present smoking status, behavioral reasons for initiating electronic cigarette use, misconceptions surrounding these products, health-related issues experienced, and changes in physiological functions after the initiation of electronic cigarette use. Participants will also be asked about any changes in disease conditions following the initiation of electronic cigarette use.

The questionnaire was developed based on a comprehensive literature review and adapted from validated tools used in previous studies, ensuring both reliability and validity. With the author's permission, some of the survey questions were adapted from their questionnaire form, allowing for a more robust data collection process.

Scoring system

The questionnaire consisted of three elements: Demographic data, knowledge, and awareness of electronic cigarette use. The demographic variables, including gender, age, smoking status, and previous smoking habits, were excluded from scoring and used only for descriptive analysis. The knowledge section comprised 10 items from the "misconceptions" part, which assessed participants' understanding of nicotine content, addictive potential, health risks (including pregnancy-related effects), secondhand smoke exposure, and the relative harm of electronic cigarettes compared to traditional tobacco. The awareness section included 7 items from the "health-related issues" part, evaluating participants' perceptions of changes in physical condition, concentration, mood, endurance, appetite, sleep quality, sexual performance, prior medical diagnoses, and medication adjustments after starting e-cigarette use. One point was awarded for correct or evidence-based answers, while zero points were given for incorrect responses or "I don't know." The maximum score was 10 points for the knowledge section and 7points for the awareness section, for a total possible score of 17.

Pilot test

The questionnaire was administered to 20 individuals who were asked to complete it. This was carried out to assess the clarity of the questionnaire and the practicality of conducting the study. The data collected from this pilot study were not included in the final analysis.

Analysis and entry method

Following Data collection, the data were collected in Microsoft Excel program (2016). They will then be transferred to the Statistical Package for the Social Sciences

(SPSS), version 26 (IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.) in preparation for the data analysis.

This study encompassed a range of independent variables, namely, age group, gender, type and duration of e-cigarette use, and history of tobacco use. It also examined dependent variables, including perceived physical, psychological, and functional changes, Participants' knowledge level, and their beliefs and motivations related to e-cigarette use. Categorical study variables were analyzed using the Chi-Square test or Fisher's exact test when cell counts are low. On the other hand, the Mann–Whitney U test and Kruskal–Wallis test were used to examine ordinal variables. Spearman's correlation was used to assess the association between ordinal variables. A p-value of < 0.05 will be considered for statistical significance.

RESULTS

Table 1 showed that participants were aged 18–24 years (61.5%), male (58.4%), single (73.0%), and held a bachelor's degree (44.1%). The Eastern Region represented 39.7%. Most participants (79.4%) had never used e-cigarettes, while 20.6% reported present or previous use.

Table 2 showed that cigarette smoking was the most common product used before initiating e-cigarettes (28.7%), while 17.8% reported no previous tobacco use. About half of users (50.5%) reported using e-cigarettes once or twice daily. The most commonly used device was a liquid-based rechargeable e-cigarette (47.5%). Regarding duration of use, the majority used e-cigarettes for 2 to <3 years (25.7%) or <1 year (24.8%). About one-third of users (33.7%) reported that their e-liquid consumption had increased since they began using e-cigarettes, whereas 20.8% reported no change and 14.9% reported a decrease in consumption.

Table 3 showed that only 99 (20.6%) reported a reason for initiating e-cigarettes. The most commonly reason was the desire to reduce or quit smoking (4.6%), followed by enjoyment of the variety of available flavors (4.2%). Economic reasons were reported by 2.7% of participants, while peer pressure and reducing exposure of family members to smoking were 1.7% for each. Less common reasons included e-cigarette use as cool and fun (1.0%), not feeling shame about smoking in public (0.8%), influence from friends or family members (0.6%), and the absence of smoking bans in public places (0.2%) [Figure 1].

Table 4 showed that 91.1% agreed that e-cigarettes are a nicotine delivery system. Most respondents believed that flavored e-cigarettes contain addictive substances (69.3%), can cause respiratory diseases, such as lung cancer, chronic obstructive pulmonary disease (COPD), and asthma (87.1%), and are harmful to pregnant women (85.1%). More than half (55.4%) considered e-cigarettes a source of second-hand smoking. However, 37.6% incorrectly believed that e-cigarettes burn tobacco as a source of power. Regarding smoking cessation, only 22.8% believed that e-cigarettes could encourage long-term smokers to quit, while 31.7% believed that e-cigarettes help in smoking cessation. When compared with tobacco cigarettes, more than half of participants (52.5%) considered e-cigarettes more harmful, whereas 23.8% perceived them as less harmful. Concerning the source of harm from e-cigarette use, 55.0% believed that all components contribute equally to harmful effects.

Table 1: Sociodemographic characteristics of the study participants (n=481)

Variable	Category	*n*	%
Mean age=25.02±7.343; ranged from 18 to 45 years old			
Age group	18–24 years	296	61.5
	25–34 years	115	23.9
	35–45 years	70	14.6
Gender	Male	281	58.4
	Female	200	41.6
Marital status	Single	351	73.0
	Married	122	25.4
	Divorced	8	1.7
Education	No formal education	1	0.2
	Middle school	24	5.0
	High school	117	24.3
	Diploma	104	21.6
	Bachelor's degree	212	44.1
	Postgraduate studies	23	4.8
Residential area	North Region	148	30.8
	Central Region	63	13.1
	Eastern Region	191	39.7
	Western Region	70	14.6
	South Region	9	1.9
Ever tried e-cigarettes	Never used	382	79.4
	Former user	39	8.1
	Current user	60	12.5

Table 5 revealed that nearly half of participants reported that vaping worsened their general financial situation (49.5%) and appetite (49.5%), while 45.5% reported a worse effect on endurance and 44.4% reported worsened concentration. Mood was also negatively affected in 40.4% of participants, while 42.4% reported no change. Sleep quality appeared to be the most adversely affected domain, with 56.3% reporting worse sleep and only 9.4% reporting improvement. Regarding sexual performance, approximately half of respondents (49.5%) reported no previous sexual experience, while among those with experience, participants reported no change (26.7%), worsening (14.9%), or improvement (8.9%).

Table 2: Current smokers' status (*n*=101)

Variable	Category	*n*	%
Before using e-cigarettes, did you use any of these?	Cigarettes only	29	28.7
	Cigarettes and Hookah	5	5.0
	Cigarettes, Shisha, and Hookah	13	12.9
	Cigarettes, Shisha, Hookah, and Shammah	8	7.9
	Hookah only	7	6.9
	Hookah and Shammah	1	1.0
	None	18	17.8
	Shisha only	11	10.9
	Shisha and Cigarettes	7	6.9
	Shisha and Hookah	2	2.0
E-cigarettes used per day?	Never	21	20.8
	Occasionally	19	18.8
	Once or twice daily	51	50.5
	Regularly (a couple of days/week)	10	9.9
The electronic cigarette you use is associated with	Liquid-based, rechargeable device	48	47.5
	No liquid; self-charging battery	7	6.9
	Non-smoker	17	16.8
	Non-liquid device requiring charging	25	24.8
	Liquid device not requiring recharging	4	4.0
How long have you been using e-cigarettes?	<1 year	25	24.8
	1 to<2 years	8	7.9
	2 to<3 years	26	25.7
	4 to<5 years	9	8.9
	≥5 years	17	16.8
	Non-smoker	16	15.8
Has the number of milliliters of the liquid you used to use since you started ECs smoking until now changed?	Increased	34	33.7
	Decreased	15	14.9
	No change	21	20.8
	Do not know	17	16.8
	Non-smoker	14	13.9

Table 6 showed that the majority (77.5%) indicated that they had no pre-existing medical condition before initiating e-cigarette use. Asthma (5.9%) and diabetes mellitus (4.9%) were the most commonly reported diseases. After initiation of e-cigarette, 23.5% reported no change, whereas 15.7% reported worsening and only 1.0% reported improvement. Regarding respiratory diseases, most respondents (81.4%) reported that they did not have a respiratory disease. Among those with respiratory disease, 9.8% indicated that their physician increased the dosage. Furthermore, 75.5% of respondents reported not using any medications, while medication remained unchanged in 7.8%, was stopped in 6.9%, and was either increased or decreased in 4.9% of participants. Regarding addiction from E-cigarettes, 14.6% of participants reported addiction, while 6.4 reported no addiction. As shown in Table 7, 51.5% of participants had a high level of knowledge, while 39.6% demonstrated a moderate level of awareness.

Table 3: Behavioral Reasons for electronic cigarette use initiation (*n*=99)

Reason	*n*	%
Because it's cool and fun	5	1
Economic reasons (ECs cheaper)	13	2.7
Enjoy the variability of flavors in ECs	20	4.2
Friend or family member behaviors influence ECs use	3	0.6
I don't feel shame about smoking in public places unalike cigarette	4	0.8
No smoking ban in public places unalike cigarette	1	0.2
Non-Smoker	15	3.1
Normative peer pressure (the desire to be liked and "belong" to a group)	8	1.7
Reduce smoking exposure to family members	8	1.7
Reduce/quit smoking because it is not a healthy habit	22	4.6

EC: E-cigarettes

In Table 8 A statistically significant association was observed between knowledge level and awareness level (Pearson $\chi^2 = 53.230$, df = 4, $P < 0.001$). Participants with low knowledge predominantly demonstrated low awareness (90.9%), whereas participants with high knowledge were more likely to exhibit high awareness (61.5%). Furthermore, 63.2% of participants with moderate knowledge had moderate awareness. These findings indicate that higher knowledge levels were associated with higher awareness levels, demonstrating a strong positive relationship between the two variables.

Table 9 revealed a statistically significant association was found between gender and knowledge level ($\chi^2 = 6.346$, df = 2, $P = 0.042$). Male participants demonstrated a higher proportion of high knowledge levels (55.8%) compared with females (26.7%), whereas females were more likely to have moderate knowledge levels (66.7%). No statistically significant associations were observed between knowledge level and age group ($\chi^2 = 1.380$, df = 4, $P = 0.848$), educational level ($\chi^2 = 6.199$, df = 10, $P = 0.798$), marital status ($\chi^2 = 8.360$, df = 4, $P = 0.079$), e-cigarette use per day ($\chi^2 = 6.699$, df = 6, $P = 0.350$), or history of trying e-cigarettes ($\chi^2 = 3.421$, df = 4, $P = 0.490$).

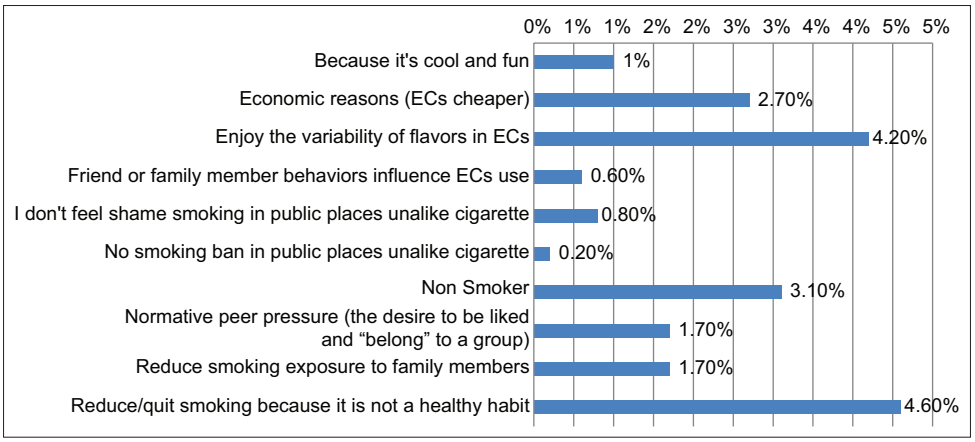


Figure 1: Behavioral reasons for electronic cigarette use initiation

Table 4: Responses to misconceptions regarding e-cigarettes among participants (*n*=101)

Question	Response	*n*	%*
E-cigarettes are a nicotine delivery system	Yes	92	91.1
	No	9	8.9
Does E-cigarettes burn tobacco as a source of power?	Yes	38	37.6
	No	63	62.4
Is there addictive material in the E-cigarettes with flavor?	Yes	70	69.3
	No	31	30.7
Are e-cigarettes a source of second-hand smoking?	Yes	56	55.4
	No	45	44.6
Can you encourage person who are smoking for long period to try quit by helping of E-cigarettes?	Yes	23	22.8
	No	78	77.2
E-cigarettes help in smoking cessation?	Yes	32	31.7
	No	69	68.3
Can E-cigarettes cause respiratory diseases (lung cancer, COPD, asthma)?	Yes	88	87.1
	No	13	12.9
Does using electronic cigarettes harmful to pregnant women?	Yes	86	85.1
	No	15	14.9
Compared to tobacco, E-cigarettes are?	Absolutely harmless	8	7.9
	Equally harmful to tobacco cigarettes	16	15.8
	Less harmful than tobacco cigarettes	24	23.8
	More harmful than tobacco cigarettes	53	52.5
Harm effect associated more with EC use? (n=100)	Associated with EC liquid needs to be charged	14	14.0
	Associated with other electrical parts; no liquid to be added	5	5.0
	Associated with the battery; no liquid should be added	18	18.0
	Equal in the harm	55	55.0
	No harm	8	8.0

COPD: Chronic obstructive pulmonary disease, EC: E-cigarettes

Table 10 showed that a significant association was found between awareness level and gender (χ^2 = 40.710, df = 3, P < 0.001). Male participants showed higher proportions of moderate and high awareness levels compared with females. Age group was also significantly associated with awareness level (χ^2 = 22.343, df = 6, P = 0.001). Participants aged 25–34 years showed the highest proportion of high awareness (15.7%), whereas participants aged 18–24 years demonstrated

Table 5: Health-related changes in physiologic functions after electronic cigarette use

Question	Response	*n*	%
Point out how impacted you in the following metrics [Financial situation in general] (*n*=99)	Better	14	14.1
	No change	36	36.4
	Worse	49	49.5
Point out how impacted you in the following metrics [Mood] (*n*=99)	Better	17	17.2
	No change	42	42.4
	Worse	40	40.4
Point out how impacted you in the following metrics [Endurance (Power of enduring difficult situations; ability to handle difficult situations till the end)] (*n*=99)	Better	16	16.2
	No change	38	38.4
	Worse	45	45.5
Point out how impacted you in the following metrics [Concentration] (*n*=99)	Better	15	15.2
	No change	40	40.4
	Worse	44	44.4
Point out how impacted you in the following metrics [Quality of Sleep] (*n*=96)	Better	9	9.4
	No change	33	34.4
	Worse	54	56.3
Point out how impacted you in the following metrics [Appetite] (*n*=99)	Better	13	13.1
	No change	37	37.4
	Worse	49	49.5
How has vaping affected your sexual performance? (*n*=101)	Better	9	8.9
	No change	27	26.7
	Worse	15	14.9
	No previous experience	50	49.5

comparatively lower levels of high awareness (4.7%). A significant relationship was observed between educational level and awareness level ($\chi^2 = 40.582$, df = 15, $P < 0.001$). Participants with diploma, bachelor's, and postgraduate education tended to show higher awareness levels than those with lower educational attainment. No statistically significant association was found between awareness level and marital status ($\chi^2 = 5.286$, df = 6, $P = 0.508$) or frequency of e-cigarette use per day ($\chi^2 = 4.172$, df = 6, $P = 0.653$). A significant association was observed between awareness level and history of e-cigarette smoking ($\chi^2 = 498.411$, df = 6, $P < 0.001$). Participants who were current or former e-cigarette users demonstrated higher awareness levels compared with non-smokers.

DISCUSSION

The World Health Organization estimates that there are 1.1 billion cigarette smokers worldwide, and tobacco-related deaths reach 7 million each year. Electronic nicotine delivery systems (ENDS) provide alternatives for quitting smoking and include products, such as e-cigarettes, e-hookahs, vape pens, mods, and vaping devices. The increasing use of ENDS, or e-cigarettes, in the United States and around the world among various populations is significant. While users might believe that e-cigarettes are safer than traditional tobacco products, research indicates that there are recognized risks and harms associated with their use.[21]

This study examined the knowledge, awareness, and misconceptions regarding vaping and its associated side effects among adults in Saudi Arabia. The results showed that while over half of the participants had a high level of knowledge (51.5%), the levels of awareness were lower, with only 36.7% showing high awareness. There was a notable positive relationship found between knowledge and awareness levels, suggesting that individuals who have more knowledge are more likely to be aware of the health risks associated with vaping.

The demographic characteristics of the study group indicated that most participants were young adults between the ages of 18 and 24, predominantly male, and had a bachelor's degree. This distribution aligns with earlier studies from Saudi Arabia, which indicate that e-cigarette use and interest are more common among young adults and males. Younger adults made up the largest group of e-cigarette users and had greater access to vaping-related information via social media and peer networks, according to a report by Alghamdi *et al*.[22] A study conducted by Doumi R and others also shows similar findings. Research indicated that being male and younger age were important factors associated with the experimentation and use of e-cigarettes in Saudi Arabia.[23]

In this study, about one fifth of participants indicated that they have used e-cigarettes either currently or in the past. This prevalence is similar to the results noted by Al-Hamdani and Manly, who found that young adults are increasingly trying e-cigarettes because they believe they are less harmful and are drawn to their appealing flavors.[24] The significant number of current users identified in this study may indicate the rising popularity of vaping products in Saudi Arabia due to market growth and enhanced online advertising.

Regarding reasons for initiating e-cigarette use, smoking cessation emerged as the most frequently reported motive, followed by enjoyment of flavor variety and economic considerations. These findings are consistent with previous Saudi and international studies. Algassim *et al*., reported that many Saudi users perceived e-cigarettes as an effective tool for reducing or quitting conventional cigarette smoking.[25] Similarly, the International Tobacco Control Survey found that smoking cessation and perceived harm reduction were among the most common reasons for initiating vaping across multiple countries.[26] The popularity of flavored products observed in the present study also aligns with findings from Yingst *et al*., who reported that flavor availability is a major

Table 6: Changes in disease conditions after electronic cigarette use initiation

Question	Response	*n*	%
Did you suffer from any condition before initiating e-cigarette use? (*n*=102)	No medical condition	79	77.5
	Asthma	6	5.9
	Diabetes mellitus	5	4.9
	Atrial fibrillation	3	2.9
	Congestive heart failure	3	2.9
	Ischemic heart disease	3	2.9
	Dyslipidemia	1	1.0
	Kidney disease	1	1.0
	Asthma, COPD, and atrial fibrillation	1	1.0
Did you experience any change in this condition after initiating e-cigarette use? (e.g., asthma) (*n*=102)	No previous disease	61	59.8
	No change	24	23.5
	Worse	16	15.7
	Better	1	1.0
If you have lung disease, did your physician alter the medications you regularly use? (*n*=102)	Do not suffer from respiratory disease	83	81.4
	Dosage/number of medications increased	10	9.8
	Dosage/number of medications remained similar	5	4.9
	Medications stopped	3	2.9
	Dosage/number of medications decreased	1	1.0
Did your physician alter the medications you regularly use? (*n*=102)	Do not use any medication	77	75.5
	Dosage/number of medications remained similar	8	7.8
	Medications stopped	7	6.9
	Dosage/number of medications increased	5	4.9
	Dosage/number of medications decreased	5	4.9
Is there addictive material in the E-cigarettes with flavor?	Yes	70	14.6
	No	31	6.4

COPD: Chronic obstructive pulmonary disease

Table 7: Distribution of knowledge and awareness levels

Knowledge level	Percentage	Awareness level	Percentage
Low	10.9	Low	23.8
Moderate	37.6	Moderate	39.6
High	51.5	High	36.7

factor influencing vaping initiation and continued use among young adults.[27]

One of the most important findings of this study relates to misconceptions about e-cigarettes. Although most participants correctly identified e-cigarettes as nicotine delivery systems and recognized their potential respiratory and pregnancy-related risks, substantial misconceptions persisted. More than one-third of participants incorrectly believed that e-cigarettes burn tobacco and approximately one-third believed that flavored products do not contain addictive substances. Similar misconceptions have been documented in previous studies. A Saudi study conducted by Alzahrani *et al*. found that many participants lacked accurate knowledge regarding the constituents and mechanisms of e-cigarette devices despite being familiar with vaping products.[28] Similarly, the United States National Youth Tobacco Survey reported widespread misunderstanding regarding nicotine content and addiction potential among e-cigarette users.[29]

More than half of participants perceived e-cigarettes as more harmful than traditional tobacco cigarettes. This finding is in consistent with earlier studies. For example, the study by Alghamdi *et al*. reported that 38.7% of participants strongly agree that e-cigarettes are as harmful as regular cigarettes. 46.6% strongly agree that E-cigarettes are addictive. 44.8% think that E-cigarettes are not less harmful to cardiac health.[22] The increased perceived risk identified in this study may indicate a growing public awareness due to reports of lung injuries linked to vaping

Table 8: Association between knowledge level and awareness level

Knowledge level	Low awareness *n* (%)	Moderate awareness *n* (%)	High awareness *n* (%)	Total *n* (%)
Low	10 (90.9)	1 (9.1)	0 (0.0)	11 (10.9)
Moderate	9 (23.7)	24 (63.2)	5 (13.2)	38 (37.6)
High	5 (9.6)	15 (28.8)	32 (61.5)	52 (51.5)
Total	24 (23.8)	40 (39.6)	37 (36.6)	101 (100.0)
Chi-square test of association				
Test		χ^2	df	*P*-value
Pearson Chi-square		53.230	4	<0.001
Likelihood ratio		50.636	4	<0.001

Table 9: Association between knowledge level and participants' characteristics (*n*=101)

Variable	Low *n* (%)	Moderate *n* (%)	High *n* (%)	χ^2 (df)	*P*-value
Gender				6.346 (2)	0.042
Female (*n*=15)	1 (6.7)	10 (66.7)	4 (26.7)		
Male (*n*=86)	10 (11.6)	28 (32.6)	48 (55.8)		
Age group				1.380 (4)	0.848
18–24 years (*n*=51)	5 (9.8)	21 (41.2)	25 (49.0)		
25–34 years (*n*=39)	5 (12.8)	12 (30.8)	22 (56.4)		
35–45 years (*n*=11)	1 (9.1)	5 (45.5)	5 (45.5)		
Education				6.199 (10)	0.798
No formal education (*n*=1)	0 (0.0)	0 (0.0)	1 (100.0)		
Middle school (*n*=9)	2 (22.2)	5 (55.6)	2 (22.2)		
High school (*n*=17)	2 (11.8)	6 (35.3)	9 (52.9)		
Diploma (*n*=34)	4 (11.8)	11 (32.4)	19 (55.9)		
Bachelor (*n*=35)	2 (5.7)	14 (40.0)	19 (54.3)		
Postgraduate (*n*=5)	1 (20.0)	2 (40.0)	2 (40.0)		
Marital status				8.360 (4)	0.079
Single (*n*=70)	4 (5.7)	29 (41.4)	37 (52.9)		
Married (*n*=28)	7 (25.0)	8 (28.6)	13 (46.4)		
Divorced (*n*=3)	0 (0.0)	1 (33.3)	2 (66.7)		
E-cigarette use per day				6.699 (6)	0.350
Never (*n*=21)	0 (0.0)	8 (38.1)	13 (61.9)		
Occasionally (*n*=19)	3 (15.8)	10 (52.6)	6 (31.6)		
Once/twice daily (*n*=51)	7 (13.7)	17 (33.3)	27 (52.9)		
Regularly (*n*=10)	1 (10.0)	3 (30.0)	6 (60.0)		
Ever tried e-cigarette smoking				3.421 (4)	0.490
Never/non-smoker (*n*=2)	0 (0.0)	1 (50.0)	1 (50.0)		
Yes, but quit (*n*=39)	6 (15.4)	17 (43.6)	16 (41.0)		
Current user (*n*=60)	5 (8.3)	20 (33.3)	35 (58.3)		

and broader public health campaigns addressing the dangers of vaping.

The findings also demonstrated considerable awareness regarding respiratory complications associated with vaping. More than 87% of participants recognized the potential association between e-cigarette use and respiratory diseases, including asthma, COPD, and lung cancer. These findings were on the line as reported by Alqahtani *et al*.,[30] The significant level of risk perception noted in this study may

Table 10: Association between awareness level and participants' characteristics

Variable	Low *n* (%)	Moderate *n* (%)	High *n* (%)	χ^2 (df)	*P*-value
Gender				40.710 (3)	<0.001
Female (*n*=200)	3 (1.5)	10 (5.0)	2 (1.0)		
Male (*n*=281)	21 (7.5)	30 (10.7)	35 (12.5)		
Age group				22.343 (6)	0.001
18–24 years (*n*=296)	16 (5.4)	21 (7.1)	14 (4.7)		
25–34 years (*n*=115)	8 (7.0)	13 (11.3)	18 (15.7)		
35–45 years (*n*=70)	0 (0.0)	6 (8.6)	5 (7.1)		
Education				40.582 (15)	<0.001
No formal education (*n*=1)	0 (0.0)	0 (0.0)	1 (100.0)		
Middle school (*n*=24)	4 (16.7)	4 (16.7)	1 (4.2)		
High school (*n*=117)	5 (4.3)	7 (6.0)	5 (4.3)		
Diploma (*n*=104)	7 (6.7)	14 (13.5)	13 (12.5)		
Bachelor (*n*=212)	6 (2.8)	15 (7.1)	14 (6.6)		
Postgraduate (*n*=23)	2 (8.7)	0 (0.0)	3 (13.0)		
Marital status				5.286 (6)	0.508
Single (*n*=351)	18 (5.1)	26 (7.4)	26 (7.4)		
Married (*n*=122)	6 (4.9)	13 (10.7)	9 (7.4)		
Divorced (*n*=8)	0 (0.0)	1 (12.5)	2 (25.0)		
E-cigarette use per day				4.172 (6)	0.653
Never (*n*=21)	2 (9.5)	11 (52.4)	8 (38.1)		
Occasionally (*n*=19)	5 (26.3)	8 (42.1)	6 (31.6)		
Once/twice daily (*n*=51)	15 (29.4)	17 (33.3)	19 (37.3)		
Regularly (*n*=10)	2 (20.0)	4 (40.0)	4 (40.0)		
Ever tried e-cigarette smoking				498.411 (6)	<0.001
Never/non-smoker (*n*=382)	0 (0.0)	2 (0.5)	0 (0.0)		
Yes, but quit (*n*=39)	14 (35.9)	15 (38.5)	10 (25.6)		
Current users (*n*=60)	10 (16.7)	23 (38.3)	27 (45.0)		

reflect the influence of global media coverage and health education initiatives.

Participants who used e-cigarettes also reported several adverse effects on daily functioning and wellbeing. About half reported worsening financial status, appetite, endurance, and concentration, while sleep quality was the most negatively affected domain. These findings support emerging evidence suggesting that nicotine-containing vaping products may negatively influence sleep quality, cognitive performance, and psychological wellbeing. Centers for Disease Control and Prevention, supported our findings.[31]

Regarding pre-existing medical conditions, most participants reported no prior disease before initiating e-cigarette use. However, among those with chronic conditions, a notable proportion reported worsening symptoms after vaping initiation. Previous research has demonstrated that vaping may exacerbate respiratory diseases, particularly asthma. Gotts *et al*. highlighted that aerosol constituents in e-cigarettes can induce airway inflammation and potentially worsen existing pulmonary diseases.[32] Therefore, the worsening of disease conditions reported by participants in this study may be biologically plausible.

The present study found various demographic factors related to knowledge and awareness. Male participants showed notably greater levels of knowledge compared to female participants. This finding is consistent with earlier studies in Saudi Arabia that indicated men have more exposure to information about smoking and a higher rate of smoking compared to women. Awareness levels were notably linked to factors, such as gender, age, educational attainment, and previous experience with vaping. Individuals between the ages of 25 and 34, those with higher levels of education, and current or former e-cigarette users showed increased awareness. Alqahtani *et al*. reported similar results, indicating that educational level and previous experience with vaping

were important factors in determining awareness and risk perception of e-cigarettes.[30]

The significant association found between knowledge and awareness levels is one of the key findings of this study. Participants with a high level of knowledge were significantly more likely to show a high level of awareness, while those with low knowledge mostly displayed low awareness. This relationship indicates that educational programs designed to enhance factual knowledge about vaping may also increase awareness of the risks associated with vaping and help decrease misinformation. Several public health studies examining smoking behaviors in adolescents and young adults have shown similar connections between knowledge about tobacco and awareness of its risks.[26]

The results revealed that although Saudi adults have adequate understanding of e-cigarettes, there are still significant misunderstandings about how the devices work, their potential for addiction, and their effectiveness in helping people quit smoking. Public health authorities should focus on educational campaigns based on evidence that directly address these misunderstandings and highlight the known health risks linked to vaping. These interventions may help increase awareness and lead to better decision-making about e-cigarette use among people in Saudi Arabia.

CONCLUSION

This study showed that adults in Saudi Arabia generally have a moderate to high level of knowledge and awareness about e-cigarettes and the health risks linked to them. There are still several misconceptions, especially regarding the safety of vaping, how it works, and its effectiveness in helping people quit smoking. There was an association between knowledge and awareness, suggesting that higher levels of knowledge may lead to better awareness of the risks associated with vaping. Participants also noted various adverse effects they associated with using e-cigarettes, especially poor mood and sleep quality, decreased concentration, lower endurance, and deteriorating financial circumstances. These findings highlight the need for specific educational campaigns and public health measures to correct misunderstandings and promote information about the possible health effects of e-cigarette use among adults in Saudi Arabia.

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ETHICAL APPROVAL

The study was fully explained to all participants, and it was emphasized that participation was voluntary. Written informed consent was obtained from each participant before enrollment. All collected information was securely stored and used exclusively for research purposes.

INFORMED CONSENT

Written informed consent was obtained from all study participants.

DATA AND MATERIALS AVAILABILITY

All data generated or analyzed during this study are included in this published article.

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