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Awareness Of Vaping Health Risks Among High School Students In Medina, Saudi Arabia – A Cross-Sectional Study

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Abstract

Background: *In recent years, electronic cigarettes have become increasingly widespread among teenagers. These battery-operated devices, commonly referred to as e-cigarettes or vapes, deliver nicotine and/or other chemicals to users in the form of an aerosol.*

Aim: *This study aimed to assess the awareness of vaping health risks among high school students in Medina, Saudi Arabia.*

Method and design: *The study is a descriptive, cross-sectional survey conducted in the Medina region of Saudi Arabia. An online questionnaire was distributed through social media from 19 February to 11 April 2024, targeting high school students. The survey was developed using Microsoft Forms and performed using an Arabic-language online structured questionnaire. The questionnaire included demographic data and inquiries about vaping knowledge, beliefs, and usage. Data were analysed using SPSS software. Descriptive statistics and relations between demographic factors and vaping awareness were assessed using cross tabulation and Chi-square/Fisher's Exact with significance set at $P \leq 0.05$.*

Results: *Of the 326 participants aged 15 to 19 years, 83.1% (271 participants) knew/heard about e-cigarettes, with social media being the primary source of information for 64.9% of them. Among those who knew about e-cigarettes, only about 14.4% had tried them. Additionally, most participants who had tried e-cigarettes reported experiencing adverse symptoms, including dizziness and changes in appetite.*

Conclusion: *This study was one of the first to evaluate high school students' awareness of e-cigarettes and vaping in Saudi Arabia. Most participants were aware of the health risks, primarily obtaining information from social media. About a quarter of those who knew about e-cigarettes had tried them, often experiencing negative symptoms like dizziness and appetite changes. The study emphasizes the need for health promotion programs to educate students about the dangers of e-cigarettes and advocates for comprehensive health education campaigns and stricter regulations to reduce future e-cigarette and tobacco use.*

Keywords: *Awareness, Vaping, Health risks, Saudi Arabia.*

1. INTRODUCTION

Electronic cigarettes were defined as battery-operated devices that deliver nicotine and other chemicals to users in the form of an aerosol [(1)]. E-cigarettes, often known as vapes, consist of a cartridge that holds e-liquid, an atomizer or heating element that heats the liquid to form a vapor that may be inhaled through a mouthpiece, and a rechargeable battery. Typically, e-liquids contain flavorings and humectants, with or without nicotine [(2)] . Nicotine from cigarette smoke is rapidly absorbed, reaching the brain in 15-20 seconds. Although the nicotine from ECs is thought to be absorbed similarly, the extent of absorption from different sites within the pulmonary system might differ [(3)]. In accordance with the Saudi Food and Drug Authority's guidelines, the Saudi Arabian government banned the import of electronic cigarettes in 2014. However, in 2019, the prohibition was eventually lifted [(4)].

E-cigarettes have grown a lot in popularity in recent years, especially with teenagers [5]. A study by Rayes et al. conducted between 2018 and 2019 among high school students in Mecca found that (20.6%) of participants used electronic cigarettes [6]. According to the 2023 National Youth Tobacco Survey (NYTS), (10%) of high school students were using e-cigarettes [7]. Peer pressure and the appealing taste and smell of e-cigarettes compared to traditional cigarettes are the main reasons for their popularity. One of the strong motivations for young people to use vaping is their desire to try new things [8]. Additionally, the rise in adolescent e-cigarette use is likely due to the tobacco industry's successful rebranding efforts and normalization of vaping through targeted advertising aimed at attracting long-term customers[9].

Various studies have been carried out to determine the association between gender and e-cigarette use. Most of these studies have reported the use of e-cigarettes was higher in males than females. The study conducted by Nawaf K. Althobaiti., et al. at Taif University Faculty of Medicine in Saudi Arabia found that e-cigarette use was more prevalent among males (9.7%) compared to females (2.4%) [1]. In Malaysia found that there is a significantly higher usage of e-cigarettes among males (18.1%) compared to females (0.4%) [10] . Another study among Canadian adolescents from 2017–2018 reported that males (40.0%) are more users of e-cigarettes than females (31.3%) [11].

The chemical analysis of e-cigarettes has revealed several toxins that increase the risk of cancer [12]. This may also increase the risk of respiratory diseases, including asthma and chronic obstructive pulmonary disease (COPD) [13]. A study conducted at the Texan Poison Center between 2009 and 2014 analyzed 225 cases of the detrimental health consequences of electronic cigarettes. The majority of the patients exhibited symptoms of nausea and vomiting, while a few patients complained of eye discomfort and headaches [14]. The use of E-cigarettes has been linked to the development of acute lung injury [15]. E-cigarette use has been shown to negatively impact memory and executive function in adolescents. Additionally, a study has indicated that both nicotine and non-nicotine components of E-cigarettes can lead to increased aggressiveness, impulsivity, attention issues, and thoughts of suicide among adolescents [5].

There is a widespread assumption that consuming electronic cigarettes is safer than traditional cigarettes, because electronic cigarettes do not contain combustion, and most of the known harmful effects are caused by this combustion [2]. Several studies have examined e-cigarette use and perceptions. In 2022, Aqeeli et al. conducted a study on students at Jazan University that found that most participants (70.2%) strongly agreed or agreed that e-cigarettes have harmful effects on health, (23.1%) of participants felt that the health risks from using e-cigarettes were lower than from smoking cigarettes [4]. In 2019, Alfaraj et al. conducted a study targeting individuals aged 18 and above who lived in the eastern province. The study found that (34.3%) thought that e-cigarettes were safer than regular cigarettes and tobacco products [16]. In another study conducted on young adult found that only (24%) strongly agreed that vaping had negative health impacts, indicating a misperception of their relative risks [17].

Although the literature on e-cigarettes is rapidly expanding, data on high school students' knowledge and beliefs about the health risks of e-cigarettes in Saudi Arabia is still scarce. Given the significance of this information in devising effective strategies and interventions to educate students about the dangers of electronic smoking and reduce its prevalence, this study aims to assess awareness of the health risks of vaping among high school students in the Medina region.

2.THE OBJECTIVES OF THE STUDY

1. The main objective of this study is to investigate the awareness and beliefs about the health risks of electronic cigarettes among high school students in the Medina region, Saudi Arabia**.**
2. To determine the prevalence of vaping among high school students in Medina region.
3. To identify the sources of information about vaping that high school students rely on.
4. To identify the health risks associated with vaping.

3. METHODOLOGY

3.1. Study design

A Descriptive, cross-sectional study was conducted from 19 February to 11 April 2024 to assess the awareness of high school students about vaping health risks in Medina regions, Saudi Arabia.

3.2. Study population

The main targets of the study were high schools' students residing in Medina regions in Saudi Arabia, which includes Al-Madinah Al-Munawarah, Yanbu, Alola, Al-Mahad, Al-Henakiyah, Khaybar, Badr, and Al-Ais. Inclusion criteria involved all high school students, male and female aged from 15-19 years of age, who study in high schools in the Medina regions in Saudi Arabia. We excluded individuals who used traditional cigarettes.

3.3. Sampling and sample size

Convenience sampling techniques were used to recruit the study participants. We opted for a 95% confidence level with a 5% margin of error and a response distribution of 50%. We utilized Raosoft® website to calculate the sample size, the projected sample size was calculated to be 383 Participants.

3.4. Study tool.

Data was collected using an Arabic-language online structured questionnaire that was designed using Microsoft Forms and circulated through social media. The structured questionnaire required a completion time of approximately 5 minutes. In the introduction to the questionnaire, we explained the purpose of the study and ensured that the data collected was confidential for research purposes only. The questionnaire consists of two sections. The first covers demographic questions about gender, age, nationality, religion, types of schools, and knowledge about vaping. Participants were asked if they knew about e-cigarettes. Those who answered “yes” completed the remaining questions in the first section related to their knowledge. They were first asked about the sources of their knowledge regarding e-cigarettes. Subsequently, they were queried about their beliefs regarding the legality of buying and selling e-cigarettes and whether there is a minimum age for using e-cigarettes. Following this, questions regarding vaping safety were posed, which included the following: If indoor vaping should be outlawed, perceptions on the relative safety of e-cigarettes compared to nicotine patches and gums, traditional cigarettes, and tobacco products, as well as opinions on the approval status of e-cigarettes by the Saudi FDA. Additionally, participants were asked about their awareness of harmful substances present in e-cigarettes, including nicotine, carboxylates, metals, and volatile organic materials, as well as the perceived safety of flavors and preservatives used in these devices. Other inquiries touched upon the safety of exposing children to vaping, whether indoor vaping harms non-smokers in the same surroundings as smokers, and whether vaping is a better option for pregnant women than smoking tobacco. Participants who answered "no" moved to the second section. In the second section, participants were asked about their use of e-cigarettes. Whoever answered “yes” moved on to answering the subsequent questions, which focused on their usage history, these included questions about frequency, attraction factors, purchasing sources, usage locations, health-related incidents, and withdrawal symptoms. (appendix 1)

3.5. Data analysis

Data was analyzed using the statistical software SPSS version 25. Descriptive statistics frequencies and percentages were used to summarize the demographic characteristics and describe study variables. Cross tabulation and Chi-square/Fisher's Exact test were conducted to test the relations between e-cigarette use and demographic variables and between e-cigarette use and knowledge items, with a significance $P \leq 0.05$.

3.6. Ethical approval

This study was approved by the research and ethics board of the College of Medical Rehabilitation Sciences, Taibah University, CMR-RT-2024-08.

4. RESULTS

4.1. Demographics Data of Participants

This study included high school students in Medina and its suburbs. Of the initial 422 participants who completed questionnaires between February 19 and April 11, 2024, only 326 met the study inclusion criteria. We excluded 96 participants who were outside the study area, were either younger than 15 years or older than 19 years, and were traditional cigarette users. Their age ranged from 15-19 years old. Female participants represented 69.3% compared to males (30.7%). Saudi citizens constituted (90.8%) of participants, while non-Saudis represented (9.2%). Those enrolled in government high schools constituted 86.5%, private high school students were (10.7%), and international high school students constituted (2.8%). In addition, the

number of participants from Medina was (73.3%), while the number of participants from its suburbs constituted (26.7%).

Table 1. Demographic data and general characteristics of the participants (n=326).

Variables		Frequency (%)
Gender	Male	100(30.7%)
	Females	226(69.3%)
Nationality	Saudi	296(90.8%)
	Non-Saudi	30(9.2%)
Type of high school	Government School	282(86.5%)
	Private School	35(10.7%)
	International School	9(2.8%)
Residence	Medina	239(73.3%)
	Medina suburban areas	87(26.7%)
Data were presented as frequencies and percentages.		

4.2. Awareness and Beliefs about E-cigarettes

Table 2 showed that 271 (83.1%) of participants knew about e-cigarettes, while 55 (16.9%) did not. Their source of knowledge about electronic cigarettes was (64.9%) through social media and the minority (1.5%) from newspapers.

Table 2. Participants who did know about electronic cigarettes vaping (n= 271)

Question	Choices	Participants	
		N	Percentage (%)
Do you know about electronic cigarettes /vaping? (n=326)	Yes	271	83.1%
	No	55	16.9%
Where did you hear/know about vaping/e-cigarettes? (n=271)	Magazine	0	0
	Newspapers	4	1.5%
	Television	14	5.2%
	Social media	176	64.9%
	Friends (or) Relatives	70	25.8%
	Other	7	2.6%
Data were presented as frequencies and percentages.			

According to the data presented in Table 3, the first three questions describe participants' beliefs about buying and selling e-cigarettes. (34.7%) of participants believed that the sale and purchase of electronic cigarettes are legal and allowed in Saudi Arabia. Conversely, (26.2%) held the view that such transactions are illegal, while (39.1%)(were uncertain. Around (25.1%) of them reported that the minimum age for using e-cigarettes is 18 years. Additionally, most participants (91.1%) supported the idea that vaping should be banned indoors and in places where traditional tobacco smoking is also banned.

The remaining questions present participants' beliefs regarding the safety and health risks associated with e-cigarettes. Around (11.1%) of them believe that vaping is less dangerous than nicotine gum or patches. In addition, (15.5%) of them reported that they think that vaping\e-cigarettes and their use are authorized by the "Saudi Food and Drug Authority" (SFDA). Only (17%) considered e-cigarettes a safer alternative to regular cigarettes and tobacco products, while (64.9%) disagreed. Almost (76.4%) reported that e-cigarettes contain dangerous chemicals such as nicotine, carboxylates, minerals, volatile organic compounds as well as small particles. Most of them (82.3%) identified correctly that preservatives and flavors used in vaping or e-cigarettes are harmful. The majority of the participants (89.3%) identified correctly that exposing children to vaping\e-cigarettes is not safe. Around 83% identified correctly that indoor vaping causes harm to non-smokers near (passive smoking) if they are exposed to chemicals and aerosols from vaping. The vast majority (87.4 %) confirmed that vaping\e-cigarettes is not safer for a pregnant woman and her fetus.

Table 3. Evaluating participants' awareness and beliefs about the health risks of electronic cigarettes (N= 271)		
1.Do you believe that selling and purchasing electronic cigarettes is legal and allowed in Saudi Arabia?		
Yes	N(%)	94 (34.7%)
No		71 (26.2%)
Not sure		106 (39.1%)
2.Is there a minimum age for electronic cigarettes use?		
At least 18 years old	N(%)	68 (25.1%)
At least 21 years old		39 (14.4%)
There is no minimum age for electronic cigarettes use		22 (8.1%)
Vaping is illegal for all ages		117 (43.2%)
Not sure		25 (9.2%)
3.Do you believe that vaping should be banned indoors and in places that ban cigarette smoking like: Workplaces, restaurants, coffee shops, and cinema theaters?		
Yes	N(%)	247 (91.1%)
No		20 (7.4%)
Not sure		4 (1.5%)
4.Do you believe that vaping is a safer option than nicotine patches or nicotine gum?		
Yes	N(%)	30 (11.1%)
No		140 (51.7%)
Not sure		101 (37.3%)
5.Do you believe that electronic cigarette usage is authorized by the Saudi Food and Drug Administration (SFDA)?		
Yes	N(%)	42 (15.5%)
No		151 (55.7%)
Not sure		78 (28.8%)
6.Do you believe that vaping is safer than regular cigarettes and tobacco products?		
Yes	N(%)	46 (17.0%)
No		176 (64.9%)
Not sure		49 (18.1%)
7.Vaping / electronic cigarettes contain dangerous chemical substances like nicotine, carboxylates, metals, volatile organic materials in addition to small particles?		
Yes	N(%)	207 (76.4%)
No		15 (5.5%)
Not sure		49 (18.1%)
8.Do you believe that preservatives or Flavors used in electronic cigarettes are harmless?		

Yes	N(%)	25 (9.2%)
No		223 (82.3%)
Not sure		23 (8.5%)
9.Do you believe that exposing children to electronic cigarettes vape is safe?		
Yes	N(%)	22 (8.1%)
No		242 (89.3%)
Not sure		7 (2.6%)
10.Vaping indoors causes harm to nonsmokers within the same environment (passive smoking) in case of exposure to the aerosol emitted from electronic cigarettes?		
Yes	N(%)	225 (83.0%)
No		25 (9.2%)
Not sure		21 (7.8%)
11.Is vaping/e-cigarettes safer for a pregnant woman and her fetus?		
Yes	N(%)	26 (9.6%)
No		237 (87.4%)
Not sure		8 (3.0%)
Data were presented as frequencies and percentages.		

4.3. E-cigarettes Users:

Table 4 revealed that most participants who knew about e-cigarettes had not previously used them 85.6%, while a smaller number 14.4% reported utilizing them before. Among users, the majority use e-cigarettes sometimes 6.4%.

Table 4. Electronic cigarettes use (n= 271)

Have you used an e-cigarette/vape before?	Frequency	Percent	Total
*Yes, constantly	14	4.6%	14.4%
*Yes, sometimes	20	6.4%	
*Yes, only once or twice	11	3.4%	
**No	226	85.6%	85.6%
		Total	100%

* Those who answered "yes" were called users.
** Those who answered "no" were called non-users.
Data were presented as frequencies and percentages.

Table 5 shows questions regarding electronic cigarette use among participants who know e-cigarettes (n=45). The results indicated that the majority (40%) use e-cigarettes more than once a day. The main reasons for trying e-cigarettes were ease of use (42.2%) and fun tricks with the vape (15.6%). Electronic cigarettes shops and tobacco\shisha shops were the most two commonly reported places of buying vaping products with 35.6%. Almost 42.2% reported that they vape outdoor. Only 26.7% reported needing emergency care due to vaping-related issues. Figure 1 below describes the most reported symptoms after vaping. Dizziness and change in appetite were the most two commonly reported symptoms after vaping (12%). The most two commonly reported withdrawal symptoms from quitting vaping\e-cigarettes for some times were nicotine urges and anger\agitation 14.2%, (Figure 2).

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Table 5: Questions regarding electronic cigarettes use (n=45).

Questions	Choices	Frequency	Percent
How frequently do you vape?	More than once a day	18	40%
	Once a day	6	13.3%
	Once or twice a week	2	4.4%
	Once or twice a month	11	24.4%
	Other	8	17.7%
What attracted you to electronic cigarettes?	Ease of use	19	42.2%
	Vape volume	5	11.1%
	Marketing	4	8.9%
	Nice colors	0	0
	Fun tricks with the vape	7	15.6%
	Small size and modern look	3	6.6%
	Other	7	15.6%
From where do you buy electronic Cigarettes?	Electronic cigarettes shops	16	35.6%
	Tobacco and shisha shops	16	35.6%
	Supermarket	3	6.7%
	Internet	3	6.7%
	Friends	7	15.6%
Where do you vape?	Indoors	9	20%
	Outdoors	19	42.2%
	Indoors and outdoors	17	37.8%
Have you ever gone to the emergency department or admitted to a hospital because of a condition related to vaping?	Yes	12	26.7%
	No	33	73.3%

Data were presented as frequencies and percentages.

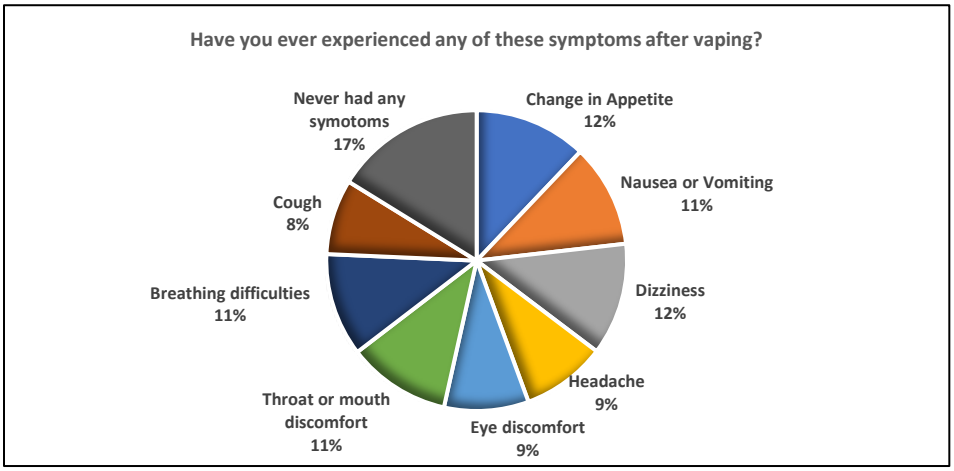

Figure1: Symptoms experienced after vaping (n=

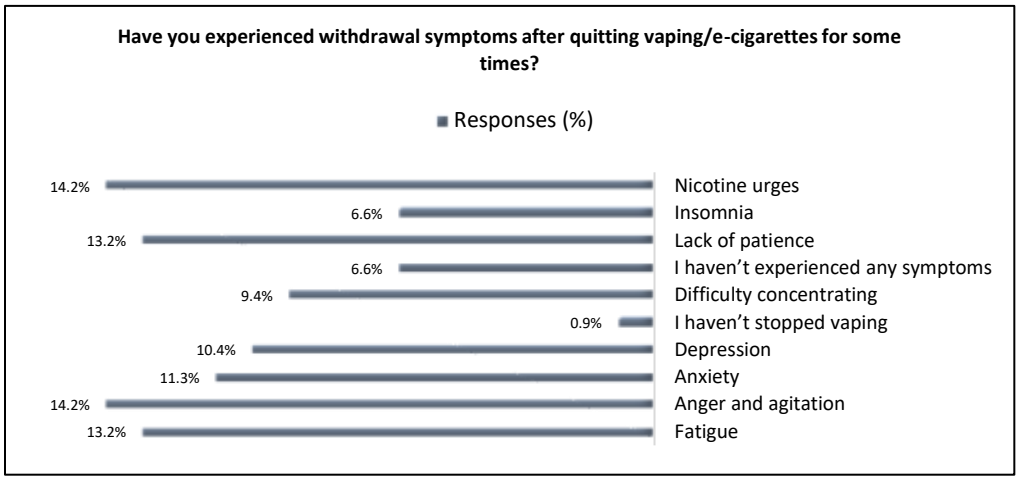

Figure 2: withdrawal symptoms after quitting vaping/e-cigarettes for some time (n=45).

4.4. Relations between Demographic Characteristics, Awareness, Beliefs, and E-cigarette Use:

4.4.1. Demographics data and e-cigarette use.

Table 7: cross-tabulation of e-cigarette use by questions related to participants' awareness and beliefs regarding buying and selling electronic cigarettes (n=271).

Questions	Choices	E-cigarettes non-users (n=226)	E-cigarettes users (n=45)	P value
Do you believe that selling and purchasing electronic cigarettes is legal and allowed in Saudi Arabia?	Yes	65 (28.8%)	29 (64.5%)	0.001*
	No	65 (28.8%)	6 (13.3%)	
	Not sure	96 (42.4%)	10 (22.2%)	
Is there a minimum age for electronic cigarettes use?	At least 18 years old	50 (22.1%)	18 (40.0%)	0.004*
	At least 21 years old	28 (12.4%)	11 (24.4%)	
	There is no minimum age for electronic cigarettes use	19 (8.4%)	3 (6.7%)	
	Vaping is illegal for all ages	108 (47.8%)	9 (20.0%)	
	Not sure	21 (9.8%)	4 (8.9%)	
Do you believe that vaping should be banned indoors and in places that bans cigarette smoking like: Workplaces, restaurants,	Yes	212 (93.8%)	35 (77.8%)	0.001*
	No	10 (4.4%)	10 (22.2%)	
	Not sure	4 (1.8%)	0 (0.0%)	

coffee shops, and cinema theaters?				
*= Significant, the significance level was set to P≤0.05				

A comparison of demographic data between users and non-users revealed statistically significant gender differences (p = 0.001). As regards gender distribution in vape users 19 of them were females (42.2%) and 26 were males (57.8%). While non-vape users they were 175 (77.4%) and 51 (22.6%). However, there were non-statistically significant differences regarding residence and type of school (Table 6)

4.4.2 Awareness, beliefs, and e-cigarette use.

The comparison in Table 7 revealed differences in beliefs between users and non-users regarding the purchase and sale of electronic cigarettes. The number of participants who believed that buying and selling electronic cigarettes is legal and permitted in Saudi Arabia was statistically higher among users (p =0.001) .Additionally, among users, most participants who believed that there is a legal minimum age for e-cigarettes (18 years old) were statistically higher than in the non-user's group (p = 0.004). Furthermore, among users, the number of participants who believed vaping should be banned was statistically lower than that of non-users (p = 0.001). The results revealed significant differences in beliefs about the safety and health issues of e-cigarettes between users and non-users. A higher percentage of users 42.2% believed e-cigarettes are safer than regular cigarettes and tobacco products compared to non-users 11.9% (p=0.001). Conversely, users were less likely (77.8%) to consider exposing children to e-cigarettes is not safe than non-users (91.6%) (p=0.008). Additionally, users were more inclined (24.5%) to consider e-cigarettes as safer for pregnant women and their fetus than non-users 6.6% (p=0.002) (Table 8).

Table 8: cross-tabulation of e-cigarette use by questions related to participants' awareness and beliefs regarding the safety and health risks of electronic cigarettes (n=271).

Questions	Choices	E-cigarettes non-users (n=226)	E-cigarettes users (n=45)	P value
Do you believe that vaping is a safer option than nicotine patches or nicotine gum?	Yes	23 (10.2%)	7 (15.6%)	0.066
	No	112 (49.65)	28 (62.2%)	
	Not sure	91 (40.3%)	10 (22.2%)	
Do you believe that electronic cigarette usage is authorized by the Saudi Food and Drug Administration (SFDA)?	Yes	31 (13.7%)	11 (24.4%)	0.127
	No	131 (58.0%)	20 (44.4%)	
	Not sure	64 (28.3%)	14 (31.1%)	
Do you believe that vaping is safer than regular cigarettes and tobacco products?	Yes	27 (11.9%)	19 (42.2%)	0.001*
	No	154 (68.1%)	22 (48.9%)	
	Not sure	45 (19.9%)	4 (8.9%)	
Vaping/electronic cigarettes contain dangerous chemical substances like nicotine, carboxylates, metals, volatile organic materials in addition to small particles?	Yes	174 (77.0%)	33 (73.3%)	0.558
	No	11 (4.9%)	4 (8.9%)	
	Not sure	41 (18.1%)	8 (17.8%)	
	Yes	19 (8.4%)	6 (13.3%)	0.347

Do you believe that preservatives or Flavors used in electronic cigarettes are not harmful?	No	189 (83.6%)	34 (75.6%)	
	Not sure	18 (8.0%)	5 (11.1%)	
Do you believe that exposing children to electronic cigarettes vape is safe?	Yes	13 (5.7%)	9 (20.0%)	0.008*
	No	207 (91.6%)	35 (77.8%)	
	Not sure	6 (2.7%)	1 (2.2%)	
Vaping indoors causes harm to nonsmokers within the same environment (passive smoking) in case of exposure to the aerosol emitted from electronic cigarettes?	Yes	192(85%)	33(73.3%)	0.088
	No	17(7.5%)	8(17,8%)	
	Not sure	17(7,5%)	4(8.9%)	
Is vaping/e-cigarettes safer for a pregnant woman and her fetus?	Yes	15 (6.6%)	11 (24.5%)	0.002*
	No	204 (90.3%)	33 (73.3%)	
	Not sure	7 (3.1%)	1 (2.2%)	
*= Significant, the significance level was set to P≤0.05.				

5. DISCUSSION

This study aimed to evaluate high school students' awareness about the health risks of e-cigarettes in the Medina region of Saudi Arabia. The results revealed that 83.1% of high school students were aware of e-cigarettes, which is similar to the results of two studies conducted on adolescents in Finland and Connecticut, where the percentage of participants who knew about e-cigarettes was 85.3% and 84.3%, respectively [18][19]. On the contrary, our results were lower than a study conducted on students at King Khalid University in Saudi Arabia. Where the number of participants who knew/heard about e-cigarettes was 98.7%, this difference can be attributed to the target population difference [20].

Furthermore, it is important to determine the sources of information participants relied on about e-cigarettes. In this study, social media was the primary source. In our opinion, the use of social media as a powerful tool to disseminate accurate information and educate adolescents about the risks associated with vaping may support the use of social media.

In our study, 39.1% of participants were unsure about the legality of buying and selling e-cigarettes. These results were similar to a study conducted among adults in the Eastern Province of Saudi Arabia, at 40.2%. These findings indicate a lack of understanding among participants regarding the laws and regulations around e-cigarettes in Saudi Arabia [16].

Our study aimed to examine students' beliefs regarding the safety of e-cigarettes. Our findings revealed that 51.7% of participants did not believe that e-cigarettes were a safer alternative compared to nicotine patches or gum. This is consistent with previous studies conducted on adults in Jeddah and the Eastern Province, where the percentage reached 63.4% [21] and 53.8% [16], respectively. In addition, we found that 55.7% of participants do not believe that the use of e-cigarettes is authorized by the Saudi Food and Drug Authority. This result is consistent with the same two previous studies where the percentage reached 44.1% [16] and 49.9% [21], respectively

Our results showed that 64.9% believed that vaping was not safer than regular cigarettes and tobacco products. This contrasts with a study conducted by Anand, V et al.,2015 [22] that showed the majority of the participants (53.4%) believe that the e-cigarette as less harmful than conventional cigarettes. This difference could be attributed to the marketing of electronic cigarettes in their region as aids for quitting smoking. Also,

due to the odorless nature of e-cigarettes, and the ability to use them in locations where smoking is not allowed.

We also found that 89.3% of participants reported that exposing children to vaping is not safer than smoking tobacco, which aligns with the findings of a study conducted by Alfaraj et al. (2019)[16], where the majority of participants (90.6%) believed it is not safer. This implies that there is agreement on the possible dangers of introducing children to e-cigarettes. Besides, (90.3%) of responders_answered the vaping was not safe for pregnant and her fetus. Early infancy and prenatal periods of e-cigarette use may be harmful to a child's respiratory system. To safeguard themselves and their unborn children, it is recommended that parents and expectant mothers abstain from e-cigarette use[23]. In contrast to our findings. According to a survey conducted by Alfaraj et al. (2019) [16] 85% of participants believed that electronic cigarettes were safer than tobacco smoking and could be used as an alternative for pregnant females.

According to our study, 83.0% of participants were worried about the negative effects on non-smokers who are present when inhaling aerosols from electronic cigarettes indoors. In a similar vein, 69.3% of participants in a study by Alfaraj et al. (2019)[16] thought that non-smokers could be harmed by e-cigarette aerosols. Also, 74.4% of participants believed there were potentially harmful substances found in e-cigarettes, such as metals, carboxylates, nicotine, and volatile organic compounds, in addition to small particles, on the other hand, 18.1% were still unsure about this. According to a survey conducted by Alfaraj et al. (2019) [16] 46% of the 1080 participants in a study agreed that e-cigarettes contain harmful material, while 35.6% were unsure.

Our study examined participants' opinions on the safety of flavors and preservatives used in electronic cigarettes. It was observed that 9.2% of respondents thought these substances were dangerous. (Alfaraj et al. 2019)[16], study showed that 70.4% of respondents expressed about the safety of flavorings and preservatives in e-cigarettes.

Our study also aims to measure the prevalence of e-cigarettes among students who are familiar with e-cigarettes. The prevalence observed in our study (16.6%) in youth aged 15–19, 2024) was lower than the prevalence reported in the latest Australian Bureau of Statistics. (17.9% in youth aged 15–17, 2020) [23] and the paper reported by Frank AM, 2017 (24.2%)[25]. This difference could be attributed to variations in sample size and because those population surveys were Australia-wide, whereas our study sampled several schools in Medina and its suburbs. On the other hand, a study reported among university students from other countries such as Qatar (14%) [26] and Jordan (10%) [27] found a lower prevalence rate. This difference might be due to differences in the age group.

We found that more than 1/3 of participants (42.2%) reported that the ease of use of e-cigarettes was the main reason to use e-cigarettes. Similar findings were reported from Pakistan (68.7%)[28]. This reason is different from that of different studies where participants' intent to quit conventional cigarette smoking (26.5%)[27], absence of smell (85.7%) [26] were the most common reasons.

The findings of experienced symptoms after vaping mostly were dizziness (12.1%) and change in appetite (12.1%). This is consistent with the results of another study (44.9%). But regarding withdrawal symptoms after quitting vaping/e-cigarettes for some times most participants have experienced nicotine urges (14.2%) and anger and agitation (14.2%). This is different from the results of the study in Jorden where most participants shown no symptoms (47%) and intense cravings for smoking (29.6%) and restlessness (22.5%) [29].

6. Limitations

There were some limitations associated with our study. First, the study used an online questionnaire to measure study variables instead of pen and paper with direct contact with participants, which may affect reliability, however we assume that all participants answer the questionnaire self-based on their own knowledge and experiences. Second, the current study utilized a convenience sample of high school students in Medina Regions, which limits the generalizability of our results. Third, we didn't ascertain whether users consume e-cigarettes with nicotine or just flavorings. Finally, we talk about vaping health risk generally; we do not specified risks as cardiovascular, respiratory, or mental.

7. CONCLUSION

Our research reveals that a significant majority of participants are aware of the health risks associated with vaping, Students' knowledge about e-cigarettes and vaping predominantly comes from non-scientific sources, with the majority relying on social media for information. Among the participants who had heard/knew about e-cigarettes, only approximately a quarter had tried them. Most of those who had tried e-cigarettes reported experiencing adverse symptoms, such as dizziness and changes in appetite. Moreover, this study highlights the urgent need for regular health promotion programs targeting high school students to enhance their understanding of the components of e-cigarettes and their harmful effects, ultimately promoting better public health outcomes in the community.

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