

Prevalence and Determinants of Electronic Cigarettes Use among Governmental Secondary School Students in Makkah, 2018

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Abstract **BACKGROUND:** Since introduction in the early 2000s, e-cigarette use has rapidly increased among adolescents worldwide. However, little is known about e-cigarette uptake among adolescents in Saudi Arabia. **OBJECTIVES:** To explore the prevalence and determinants of the e-cigarette use among governmental secondary school students in Makkah, 2018. **SUBJECTS AND METHODS:** Cross-sectional descriptive study was carried out, including a random representative sample of students attending governmental secondary schools in Makkah during 2018-2019. A self-administered validated questionnaire was adopted and modified from WHO Youth Tobacco Survey 2011 consisting of socio-demographic and personal characteristics and associated determinants. **RESULTS:** The study included 301 governmental secondary school students. More than half of the students (54.2%) were females and 56.8% were Saudis. Forty-five students (15%) ever tried to use electronic cigarettes whereas twenty-seven (9%) students have used e-cigarettes in the past 30 days. Higher school grades, higher allowance, working fathers, higher educated mothers, parental smoking, friend smoking, ignorance of the fact that e-cigarettes contain nicotine and of the harmful impacts of the e-cigarettes on health are significantly associated with e-cigarette use. The main reasons for e-cigarette use among those who ever tried them (n=45) were the desire to have an experience with e-cigarette (77.8%), feeling that e-cigarette can help them quit smoking (64.4%), trying to taste and smell the e-cigarette (62.2%) and feeling that e-cigarette is safer than tobacco cigarette (60.0%). **CONCLUSION:** E-cigarettes have been tried and currently used by a considerable proportion of students enrolled in governmental secondary schools in Makkah. Some associated factors were identified.

Keywords: E-cigarette usage, E-cigarette prevalence, E-cigarette determinants, adolescents, Saudi Arabia

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1. Introduction

The utilization of electronic cigarettes (e-cigarette) has been developing and became a significant public concern. [1] The e-cigarette is a handheld, battery-powered device designed as a smoking cessation tool for adults to deliver aerosol by vaporizing flavored liquid nicotine, glycerol or propylene glycol. [2] E-cigarettes claim to be less harmful than cigarette smoking and use a valid alternative or aid to quit cigarette smoking by nicotine delivery, without the toxic effect of tobacco use. [2,3] Since their introduction to the market in the early 2000s, e-cigarette use has increased rapidly among adolescents worldwide. [4] Little is known about e-cigarette usage among adolescents in Saudi Arabia. Further studies need to be conducted to define the rate of use and long-term effect of e-cigarette and to apply proper prevention measures.

The study aims to investigate the prevalence and determinants associated with e-cigarette use among the

secondary school students in Makkah, Saudi Arabia. In addition, the collection of data on usage patterns through surveys may provide information about the property of users and the impact of those products and help to introduce appropriate interventions and policies in the future.

2. Materials and Methods

A cross-sectional descriptive study was done at the governmental secondary schools within Makkah city. Secondary government school students of all genders and nationalities were included in the study. From the total of 69060 students, stratified sampling was made using Raosoft Website. The final sample size was 302 students at 5% error, 95% confidence level, and 27% prevalence. [1]

The self-administered questionnaire was adopted and modified from WHO Youth Tobacco Survey 2011 Questionnaire. [5] The questionnaire consists of two main parts, socio-demographic and personal characteristics including age, gender, nationality, grade and associated

determinants. The questionnaire was then translated from English to Arabic. Then it was independently retranslated into English to ensure the linguistic quality. The final questionnaire was validated by three consultants.

The study was approved by the local research committee, and permitted by the Joint Program of Family Medicine in Makkah. Permission to conduct the study in the schools was also obtained from the Ministry of Education (H-02-K-076-0519-116). Written consent was obtained from each participant and their guardian. All collected data from the students are kept confidential, accessed only for scientific research. The study is self-funded by the researcher.

A pilot study was conducted on 10% of the sample size about 30 secondary school students (boys and girls), which was not involved in the study to test the validity of the questionnaire. No modifications were made according to the pilot results.

Once the approval has been taken from the school's director, the researcher contacted with classes' leaders to distribute the questionnaire during activity hours. Then, the questionnaire was collected after being filled out on the same day. The questionnaire was distributed by the researcher in girl's schools and by a well-trained assistant in boy's schools. The researcher was available to clarify any issue.

Data was entered using SPSS version 25 (IBM Corp., Armony, NY). Frequency and percentage were used to describe data. Chi-square and Fischer exact tests were used for testing the association between e-cigarette usage from their potential associated factors from the other side, with a significance of P-value <0.05 and CI 95%.

3. Results

3.1. Socio-demographic Characteristics

The study included 301 governmental secondary school students. Table 1 presents their socio-demographic characteristics. More than half of the students (54.2%) were females and 56.8% were Saudis. The highest percentage of them (40.9%) were recruited from the first level whereas 30.2% from the second level and 28.9% from the third level. Daily pocket money ranged between 5 and 10 Saudi Riyals among 63.8% of the students and school performance was either excellent or very good among the majority of the students (85.4%). Working father or mother was mentioned by 72.8% and 18.9% of the students, respectively. About one-third of students' fathers (31.8%) and 19.6% of students' mothers had an academic level of education.

3.2. Pattern of E-cigarette Use

As clear from Figure 1, 23.6% of the students have heard about the existence of electronic cigarettes. Forty-five students representing 15% of the students ever tried to use electronic cigarettes as shown in Figure 2. Twenty-seven (9%) students have used e-cigarettes in the past 30 days.

Figure 3 among current smoking (n=27), 12 students (44.4%) used e-cigarettes less than 5 days whereas 4 students (14.8%) used them for more than 21 days in the past 30 days.

Table 1. Socio-demographic characteristics of governmental secondary school students participated in the study (n=301)

	Categories	Frequency	Percentage
Gender	Male	138	45.8
	Female	163	54.2
Nationality	Saudi	171	56.8
	Non- Saudi	130	43.2
Grade	1 st level	123	40.9
	2 nd level	91	30.2
	3 rd level	87	28.9
Daily pocket money in Riyals	Less than 5	91	30.2
	5-10	192	63.8
	11-15	9	3.0
	More than 15	9	3.0
School performance	Excellent	129	42.9
	Very good	128	42.5
	Good	43	14.3
	Poor	1	0.3
Father working	Yes	219	72.8
	No	82	27.2
Mother working	Yes	57	18.9
	No	244	81.1
Father education	Elementary	40	13.3
	Intermediate	39	13.0
	Secondary	84	27.9
	Academic	96	31.8
	Other	42	14.0
Mother education	Elementary	50	16.6
	Intermediate	60	19.9
	Secondary	82	27.3
	Academic	59	19.6
	Other	50	16.6

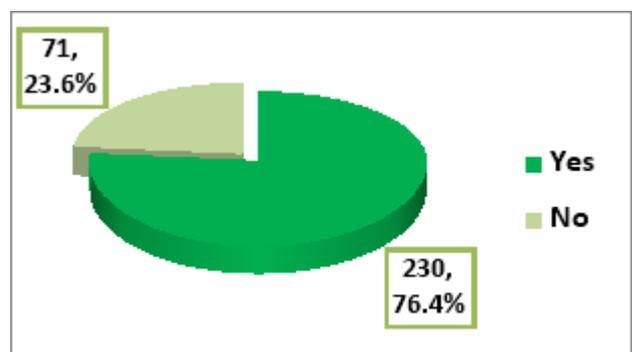


Figure 1. History of hearing about the existence of the electronic cigarettes among governmental secondary school students in Makkah AlMukarramah

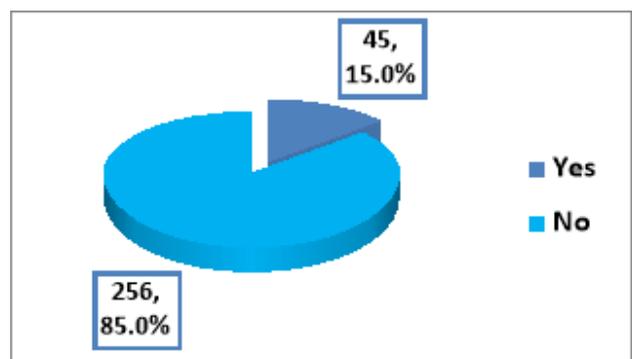


Figure 2. History of ever trying to use electronic cigarettes among governmental secondary school students in Makkah AlMukarramah

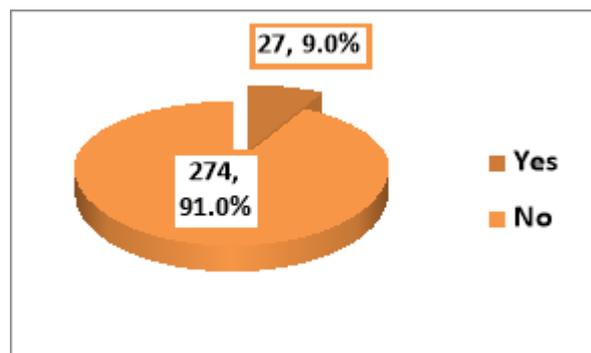


Figure 3. History of the current (Past 30 days) using the electronic among governmental secondary school students in Makkah AlMukarramah

Table 2. Participant's Opinion about electronic cigarette among governmental secondary school students in Makkah AlMukarramah

	Frequency	Percentage
Does the electronic cigarette contain nicotine?		
Yes	79	26.2
No	40	13.3
Don't know	182	60.5
Do you think that the electronic cigarette is harmful to health?		
Yes	223	74.1
No	35	11.6
Don't know	43	14.3

3.3. Participant's Opinion about Electronic Cigarette

The study showed that only 26.2% of the student knew that the electronic cigarettes contain nicotine whereas 60.5% did not know if e-cigarettes contain nicotine or not. Most of the students (74.1%) thought that the electronic cigarette is harmful to health.

Table 3. Main reasons for electronic cigarette use among ever trying students (N=45)

	Frequency	Percentage
I feel that e-cigarette is safer than tobacco cigarette	27	60.0
I feel that smoking an e-cigarette is the same as smoking tobacco cigarette	4	8.9
I feel that e-cigarette can help me to quit smoking	29	64.4
I like the taste and smell of the e-cigarette	28	62.2
I want to experiment with the cigarette	35	77.8
Offered by friends	14	31.1
Offered by family members	11	24.4
I follow idol trend (fashion)	5	11.1
E-cigarette is more economical than tobacco cigarette	19	42.2

3.4. Reasons for Electronic Cigarette Use

Table 3 summarizes the main reasons for e-cigarette use among those who ever tried them (n=45). The most frequently reported reasons were the desire to have an experience with e-cigarette (77.8%), feeling that e-cigarette can help them to quit smoking (64.4%), trying

to taste and smell the e-cigarette (62.2%) and feeling that e-cigarette is safer than tobacco cigarette (60%).

Table 4. Socio-demographic factors associated with ever-trying e-cigarettes among governmental secondary school students in Makkah AlMukarramah

	Ever trying e-cigarettes		p-value*
	Yes N=45 N (%)	No N=256 N (%)	
Gender			
Male (n=138)	25 (18.1)	113 (81.9)	0.156
Female (n=163)	20 (12.3)	143 (87.7)	
Nationality			
Saudi (n=171)	24 (14.0)	147 (86.0)	0.610
Non- Saudi (n=130)	21 (16.2)	109 (83.8)	
Grade			
1 st level (n=123)	13 (10.6)	110 (89.4)	0.006
2 nd level (n=90)	10 (11.0)	81 (89.0)	
3 rd level (n=87)	22 (25.3)	65 (74.7)	
Daily pocket money in Riyals			
Less than 5 (n=91)	9 (9.9)	82 (90.1)	0.038
5-10 (n=192)	30 (15.6)	162 (84.4)	
11-15 (n=9)	2 (22.2)	7 (77.8)	
More than 15 (n=9)	4 (44.4)	5 (55.6)	
School performance			
Excellent (n=129)	14 (10.9)	115 (89.1)	0.335
Very good (n=128)	24 (18.8)	104 (81.3)	
Good (n=43)	7 (16.3)	36 (83.7)	
Poor (n=1)	0 (0.0)	1 (100)	
Father working			
Yes (n=219)	35 (16.0)	184 (84.0)	0.412
No (n=82)	10 (12.2)	72 (87.8)	
Mother working			
Yes (n=57)	11 (19.3)	46 (80.7)	0.307
No (n=244)	34 (13.9)	210 (86.1)	
Father education			
Elementary (n=40)	5 (12.5)	35 (87.5)	0.986
Intermediate (n=39)	6 (15.4)	33 (84.6)	
Secondary (n=84)	12 (14.3)	72 (85.7)	
Academic (n=96)	15 (15.6)	81 (84.4)	
Other (n=42)	7 (16.7)	35 (83.3)	
Mother education			
Elementary (n=50)	4 (8.0)	46 (92.0)	0.328
Intermediate (n=60)	9 (15.0)	51 (85.0)	
Secondary (n=82)	13 (15.9)	69 (84.1)	
Academic (n=59)	13 (22.0)	46 (78.0)	
Other (n=50)	6 (12.0)	44 (88.0)	

* Chi-square test.

3.5. Factors Associated with Ever Trying E-cigarettes

3.5.1. Socio-demographic Factors

About one-fourth (25.3%) of the students of the third level compared to only 10.6% of the first level ever tried e-cigarettes, p=0.006. Four students of those who had daily pocket money of more than 15 Saudi Riyals (44.5%) compared to 9 students of those who had less than five

Riyals (9.9%) ever tried e-cigarettes, $p=0.038$. Other socio-demographic characteristics (gender, nationality, school performance, parental job, and education) were not significantly associated with history of ever-trying e-cigarettes. (Table 4)

Table 5. Association of parental and friend smoking with ever-trying e-cigarettes among governmental secondary school students in Makkah AlMukarramah

	Ever trying e-cigarettes		p-value*
	Yes N=45 N (%)	No N=256 N (%)	
Paternal smoking			0.016
Yes (n=70)	18 (25.7)	52 (74.3)	
No (n=212)	25 (11.8)	187 (88.2)	
Don't know (n=19)	2 (10.5)	17 (89.5)	
Maternal smoking			0.011
Yes (n=11)	5 (45.5)	6 (54.5)	
No (n=286)	40 (14.0)	246 (86.0)	
Don't know (n=4)	0 (0.0)	4 (100)	
Friend smoking			<0.001
Yes (n=90)	32 (35.6)	58 (64.4)	
No (n=167)	9 (5.4)	158 (94.6)	
Don't know (n=44)	4 (9.1)	40 (90.9)	

* Chi-square test.

3.5.2. Parental and Friend Smoking

About one fourth (25.7%) of students whose fathers were smokers compared to 11.8% of those whose fathers were not smokers ever tried e-cigarettes, $p=0.016$. Similarly, 45.5% of students whose mothers were smokers compared to 14% of those whose mothers were not smokers ever tried e-cigarettes, $p=0.011$. More than one-third (35.6%) of students whose friends were smokers compared to only 5.4% of those whose friends were not smokers ever tried e-cigarettes, $p<0.001$. (Table 5)

Table 6. Association between governmental secondary school students' opinion regarding e-cigarettes and history of ever-trying them

	Ever trying e-cigarettes		p-value*
	Yes N=45 N (%)	No N=256 N (%)	
Does the electronic cigarette contain nicotine?			<0.001
Yes (n=79)	15 (19.0)	64 (81.0)	
No (n=40)	15 (37.5)	25 (62.5)	
Don't know (n=182)	15 (8.2)	167 (91.8)	
Do you think that the electronic cigarette is harmful to health?			<0.001
Yes (n=223)	27 (12.1)	196 (87.9)	
No (n=35)	16 (45.7)	19 (54.3)	
Don't know (n=43)	2 (4.7)	41 (95.3)	

* Chi-square test.

3.5.3. Opinion about Electronic Cigarette

More than one-third (37.5%) of students who did not know that e-cigarettes contain nicotine compared to 19% of those who knew that they contain nicotine ever tried

e-cigarettes, $p<0.001$. Nearly half (45.7%) of students who did not think that e-cigarette is harmful to health compared to 12.1% of student who thought that smoking is harmful to health, ever tried e-cigarette, $p<0.001$. (Table 6)

Table 7. Socio-demographic factors associated with current use of e-cigarettes among governmental secondary school students in Makkah AlMukarramah

	Current use of e-cigarettes		p-value
	Yes N=27 N (%)	No N=274 N (%)	
Gender			0.512
Male (n=138)	14 (10.1)	124 (89.9)	
Female (n=163)	13 (8.0)	150 (92.0)	
Nationality			0.586
Saudi (n=171)	14 (8.2)	157 (91.8)	
Non- Saudi (n=130)	13 (10.0)	117 (90.0)	
Grade			0.017
1 st level (n=123)	6 (4.9)	117 (95.1)	
2 nd level (n=90)	7 (7.7)	84 (92.3)	
3 rd level (n=87)	14 (16.1)	73 (83.9)	
Daily pocket money in Riyals			0.046
Less than 5 (n=91)	5 (5.5)	86 (94.5)	
5-10 (n=192)	18 (9.4)	174 (90.6)	
11-15 (n=9)	1 (11.1)	8 (88.9)	
More than 15 (n=9)	3 (33.3)	6 (66.7)	
School performance			0.515
Excellent (n=129)	8 (6.2)	121 (93.8)	
Very good (n=128)	14 (10.9)	114 (89.1)	
Good (n=43)	5 (11.6)	38 (88.4)	
Poor (n=1)	0 (0.0)	1 (100)	
Father working			0.009**
Yes (n=219)	25 (11.4)	194 (88.6)	
No (n=82)	2 (2.4)	80 (97.6)	
Mother working			0.137
Yes (n=57)	8 (14.0)	49 (86.0)	
No (n=244)	19 (7.8)	225 (92.2)	
Father education			0.344
Elementary (n=40)	3 (7.5)	37 (92.5)	
Intermediate (n=39)	4 (10.3)	35 (89.7)	
Secondary (n=84)	5 (6.0)	79 (94.0)	
Academic (n=96)	13 (13.5)	83 (86.5)	
Other (n=42)	2 (4.8)	40 (95.2)	
Mother education			0.012
Elementary (n=50)	3 (6.0)	47 (94.0)	
Intermediate (n=60)	5 (8.3)	55 (91.7)	
Secondary (n=82)	3 (3.7)	79 (96.3)	
Academic (n=59)	12 (20.3)	47 (79.7)	
Other (n=50)	4 (8.0)	46 (92.0)	

* Chi-square test, **Fischer exact test.

3.6. Factors Associated with E-cigarettes Current Use

3.6.1. Socio-demographic Factors

Table 7 shows that 16.1% of the students of the third level compared to only 4.9% of the first level currently use e-cigarettes, $p=0.017$. One-third (33.3%) of students who had daily pocket money of more than 15 Saudi Riyals

compared to 5.5% of those who had less than five Saudi Riyals currently use e-cigarettes, $p=0.046$. Students whose fathers were working were more likely to use e-cigarettes compared to those whose fathers were not working (11.4% versus 2.4%), $p=0.009$. The highest level of current use of e-cigarettes was reported among students whose mothers were academic educated (20.3%), whereas the lowest level was observed among students whose mothers were secondary school educated (3.7%), $p=0.012$. Other socio-demographic characteristics (gender, nationality, school performance, parental job and education) were not significantly associated with history of ever-trying e-cigarettes.

Table 8. Association of parental and friend smoking with current use of e-cigarettes among governmental secondary school students in Makkah AlMukarramah

	Current use of e-cigarettes		p-value*
	Yes N=27 N (%)	No N=274 N (%)	
Paternal smoking			
Yes (n=70)	12 (17.1)	58 (82.9)	0.024
No (n=212)	14 (6.6)	198 (93.4)	
Don't know (n=19)	1 (5.3)	18 (94.7)	
Maternal smoking			
Yes (n=11)	5 (45.5)	6 (54.5)	<0.001
No (n=286)	22 (7.7)	264 (92.3)	
Don't know (n=4)	0 (0.0)	4 (100)	
Friend smoking			
Yes (n=90)	23 (25.6)	67 (74.4)	<0.001
No (n=167)	3 (1.8)	164 (98.2)	
Don't know (n=44)	1 (2.3)	43 (97.7)	

* Chi-square test.

3.6.2. Parental and Friend Smoking

Table 8 demonstrates that 17.1% of students whose fathers were smokers compared to 6.6% of those whose fathers were not smokers currently use e-cigarettes, $p=0.024$. Similarly, 45.5% of students whose mothers were smokers compared to only 7.7% of those whose mothers were not smokers currently use e-cigarettes, $p<0.001$. Almost one-quarter (25.6%) of students whose friends were smokers compared to only 1.8% of those whose friends were not smokers currently use e-cigarettes, $p<0.001$. (Table 8)

Table 9. Association between governmental secondary school students' opinion regarding e-cigarettes and history of current use them

	Current use of e-cigarettes		p-value*
	Yes N=27 N (%)	No N=274 N (%)	
Does the electronic cigarette contain nicotine?			
Yes (n=79)	10 (12.7)	69 (87.3)	0.001
No (n=40)	9 (22.5)	31 (77.5)	
Don't know (n=182)	8 (4.4)	174 (95.6)	
Do you think that the electronic cigarette is harmful to health?			
Yes (n=223)	16 (7.2)	207 (92.8)	<0.001
No (n=35)	10 (28.6)	25 (71.4)	
Don't know (n=43)	1 (2.3)	42 (97.7)	

* Chi-square test.

3.6.2. Opinion about Electronic Cigarette

Slightly less than one-quarter (22.5%) of students who did not know that e-cigarettes contain nicotine compared to 12.7% of those who knew that they contain nicotine currently use e-cigarettes, $p=0.001$. More than one-quarter (28.6%) of students who did not think that e-cigarette is harmful to health compared to 7.2% of student who thought that smoking is harmful to health, currently use e-cigarette, $p<0.001$. (Table 9)

4. Discussion

Worldwide, little is known regarding safety and impacts of e-cigarettes on health. [22,23] In Saudi Arabia, as a result of lacking of studies to identify the magnitude of the problem of e-cigarettes use among adolescents, this study was carried out to tackle this problem as well as to identify factors associated with this behavior among secondary governmental school students in Makkah.

In the present study, 15% of secondary school students have ever tried to use electronic cigarettes and 9% of them have used e-cigarettes in the past 30 days. Different figured have been reported in various parts of the world. In Wales, [10] 18.5% of secondary school studies have tried e-cigarettes and 2.7% were regular users whereas in the USA, the current e-cigarette use among high school students increased from 4.5% in 2013 to 13.4% in 2014, [9] and in 2015, it became 16%. [24] However, in another American study (2013-2014), the prevalence rate was 1.21% [19]. In Poland, about 22% of the students aged between 13 and 19 years were ever tried e-cigarette smoking and 27% used them in the past 30 days.⁽¹⁾ Among students in grades 10-12 in Canada, the prevalence of ever trying e-cigarettes was 27.1% and current smoking in the past 30 days was 8.9%. [11] According to the Canadian Student Tobacco, Alcohol and Drugs Survey (2015), rate of e-cigarettes ever use and use in the past 30 days among students aged between 15 and 19 years were 26% and 6.2%, respectively. [12] In the UK, [13] rate of current use of e-cigarettes among students 11-18 years was 2% whereas that in Scotland among those aged 15 years was 3%. [25] In Hong Kong, [4] a low rate has been reported (1.1%) among adolescents. In Sweden, [14] the rate of ever trying e-cigarettes was more than 25% among students aged 15-16 years.

Comparison between the findings of the present study and others should be taken with caution due to variations in the time of study conduction, age group, and study designs.

The relatively high prevalence observed in the present study indicates that e-cigarettes are easily accessible to adolescents, although there are restrictions on the sale of tobacco products in KSA. However, they may be available for sale online as there is little control over their marketing in comparison to tobacco products.

E-cigarettes could be a new way into nicotine addiction for never smoker young population, if regular use occurs extensively. [10] A systematic review showed that 7% of non-smokers had used e-cigarettes and the current use among them was 1.5%.⁽⁸⁾ In Argentina, although e-cigarettes use is prohibited, the trial of using increased

from 1.8% to 7.6% over a 17 month period. [15] Therefore, health education for young students is very important to prevent initiation of e-cigarettes trials.

The present study demonstrated no gender difference between students regarding ever trying or current use of e-cigarettes. The same has been observed in a study carried out in Sweden. [14] However, in Studies carried out in the United States, [9] Canada, [11,16,17,26] Hong Kong, [4] New Zealand [18] and Argentina, [15] male students were more likely to try and use e-cigarettes compared to females.

In the present study, students of higher grades were more significantly ever tried and used e-cigarettes compared to those of lower grades. In accordance with this finding, older students in Argentina were more likely to use e-cigarettes. [15] However, in Canada, students in younger grades were more likely to use e-cigarettes. [11]

Students who had higher pocket money/day had higher rates of both ever trying and using e-cigarettes than their peers. Additionally, students whose fathers were working were more likely to use e-cigarettes. Also, in Canada [11] and Argentina, [15] students living in higher socio-economic areas were more likely to use e-cigarettes.

In disagreement with others, [15] the present study reported that students with more educated mothers were more likely to use e-cigarettes.

is usually higher among current and/or ex-smokers than among never smokers. [4,11,27] However, in the present study we did not investigate the smoking status of students and instead, we observed a higher rate of ever trying and current use of e-cigarettes among students with smoker parents and/or friends. In accordance with the present study, numerous studies reported that the rate of use e-cigarettes increases among students whose parents and/or friends were smokers. [15,27,28]

The current study revealed that ignorance of the fact that e-cigarettes contain nicotine as well as perceiving that e-cigarettes is not harmful to health were associated with higher rates of ever trying or using e-cigarettes among students. The same has been observed in a study carried out in Hong Kong. [4] In a similar study carried out in Canada, [11] the easy access to e-cigarettes and believing that e-cigarettes are not harmful to health were indicators for higher odds of using them. Czoli CD et al (2015) also observed that the students who believed that e-cigarettes could harm their health were less likely to use them. [26] In Argentina, students who believed that e-cigarettes are safer were more used of them. [15] In Sweden, the majority of e-cigarettes users were ignorant regarding the fact that they contain nicotine. [14] Trehy KL, et al (2011) reported that e-cigarettes labeled as nicotine-free may contain nicotine.

In the present survey, the main reasons for e-cigarettes use among those who ever tried them were the desire to have an experience with e-cigarette, feeling that e-cigarette can help them to quit smoking, trying to taste and smell the e-cigarette and feeling that e-cigarette is safer than tobacco cigarette. Numerous studies have shown that young smokers were less likely compared to older smokers to use e-cigarettes to quit smoking. [17,26] Many studies have reported that curiosity is the main reason for young people to use e-cigarette. [18] Additionally, some studies reported that the perception

that e-cigarettes are less harmful to health compared to cigarettes was the main reasons for their use. The reason is related to the perception that e-cigarettes are less harmful than cigarettes. [18]

The study has some limitations that should be mentioned. We did not include the smoking status of the participants to know whether students used e-cigarettes to help quit cigarette smoking or started e-cigarette use after quitting cigarettes. The results included only students who attending governmental schools which limit the possibility to generalize the results. Cross-sectional design does not allow the inference of causal relationships between e-cigarette use and potential independent factors. Despite those limitations, the results of the present study could help school administration and policymakers to develop effective preventive interventions.

5. Conclusion

A considerable proportion of students enrolled in governmental secondary schools in Makkah have already experienced e-cigarette use. Higher school level, higher daily school allowance, working fathers, maternal educational level, family and friend smoking history as well as ignorance from the fact that e-cigarettes contain nicotine and having lower perception of the harmful impacts of e-cigarettes on health were factors leading to likely usage of e-cigarettes among their peers.

The desire to have an experience with e-cigarette, the perception that e-cigarettes can help them to quit smoking, and that it provides a safer sensory experience than tobacco cigarette are the main reasons for e-cigarette use.

In this regard, the researcher made several recommendations. The Saudi government should monitor the pattern of e-cigarette use among the young population. School-based programs should target e-cigarettes use among students and teachers. Parents should play an active role through monitoring their children, not give them much pocket money, and educate them about the hazardous effects of e-cigarettes. Educating students about e-cigarettes and their hazardous effects is highly recommended. Primary care physicians could play a significant role in that issue. Looking for the sources of accessing e-cigarettes by students and controlling them as possible could have a significant role in reducing the problem. Future research is warranted including students from private schools and the smoking status of students to evaluate how e-cigarette use impacts the initiation and progression of cigarette smoking.

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