

Vaping: Is it Safer than Conventional Tobacco Smoking

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Abstract

Background: Electronic cigarette is becoming more popular worldwide recently. However, there is limited evidence on e-cigarette consumption in an environment conducive to smoking as the United Arab Emirates (UAE). The current study aimed to assess the prevalence, risk factors and awareness associated with e-cigarette use among a convenient sample of inhabitants in the northern emirate of United Arab Emirates. **Methods:** A cross-sectional descriptive study was conducted in the emirate of Ras Al Khaimah from November 2019 to January 2020. An anonymous structured self-administrative questionnaire was used to collect data from the selected participants. The objective of the study was adequately explained to participants and their consent was obtained with assured confidentiality. **Results:** Almost two thirds of the participants (66.3%; 302/455) showed low level of e-cigarette awareness with a mean score of 6.23(2.1) out of 13. The prevalence of usage was significantly higher among males (75%), Arab nationality (70.5%), occupation not health related (68.9%), higher monthly income (85.8%) and smokers (60.7%). Significant difference in the mean score of awareness toward e-cigarettes among users and non-users ($p < 0.001$, 4.30(1.33) and 9.14(2.69)) respectively. Multivariable logistic regression revealed that current smokers, male group and those showing a low score of awareness associated with e-cigarettes were likely to be users of e-cigarettes. **Conclusion:** Instituting laws that are more stringent and holding nationwide awareness campaigns regarding safe usage of e-cigarettes targeting those group identified in this study are necessary to control the increasing e-cigarette use in the near future.

Keywords:

E-cigarettes; Vaping; Risk factors; United Arab Emirates.

Background

Considerable progress has been made in tobacco control among youth in the last decades. However, the tobacco product landscape continues to evolve to include a variety of tobacco products. [1]

Electronic Cigarettes (ECs) are emerging non-combustible tobacco products that look like conventional cigarettes, cigars, or pipes.

These products use an “e-liquid” that may contain nicotine, as well as varying compositions of flavorings, propylene glycol, vegetable glycerin, and other ingredients. The liquid is heated to create an aerosol that the user inhales. [2]

The use and sale of ECs have been risen dramatically in the

recent years, especially among youth and young adults. In 2018, the rapid rise of tobacco products led the U.S. surgeon general to issue an advisory about youth e-cigarette use, calling it an “epidemic.” [3]

In 2019, youth e-cigarette use increased to even higher levels. While the most recent studies show a decrease in youth use in 2020, the rate is still alarmingly high. [4,5]

Marketing and media played a major role in making people believe that smoking vape is less harmful than tobacco cigarettes and they facilitate to smoking cessation.

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The popularity of ECs shapes, sizes and the variety of Kid-friendly flavors have also contributed to youth uptake. [6] Unlike tobacco cigarettes, e-cigarettes do not burn tobacco. Instead, they heat a flavored liquid to produce an aerosol that is inhaled into the lungs. The liquid usually contains nicotine which is a highly addictive substance naturally found in tobacco. Nicotine exposure during adolescence can harm the developing brain, which continues to develop until about age 25 years. It can affect learning, memory, attention, and mood and can increase risk for future addiction to other drugs. [1,3] Furthermore, fetal exposure to nicotine during pregnancy can result in multiple adverse consequences, including sudden infant death syndrome, altered corpus callosum, auditory processing deficits, effects on behaviors and obesity, and deficits in attention and cognition. Ingestion of e-cigarette liquids containing nicotine can also cause acute toxicity and possibly death if the contents of refill bottles containing nicotine are consumed. [7,8] In addition to nicotine, e-cigarette aerosol may contain other harmful substances, including volatile organic compounds, ultrafine particles, heavy metals, and cancer-causing chemicals that are inhaled deep into the lungs. [9]

Comprehensive tobacco control and prevention strategies for youth and young adults should address also e-cigarettes vape. Further reductions in tobacco use and initiation among youth and young adults are achievable by implementing proven prevention and educational strategies that advise youth about the dangers of nicotine and discourage tobacco use in any form, including e-cigarettes. Identifying the patterns of e-cigarette use among youth and young adults, assessing what they know about the health effects of using these products and outlines interventions that can be adopted to prevent our nation's young people from the potential of a lifetime of nicotine addiction are critical. The limited scientific knowledge on the potential health hazards of the product has sparked disagreement and concern among health advocates. [10] In light of the paucity of reliable scientific support, however, continued monitoring of the prevalence of e-cigarette and other tobacco product use among youth is important to inform public health policy, planning, and regulatory efforts.

The current study aimed to assess the prevalence, risk factors and awareness associated with e-cigarette use among a convenient sample of inhabitants in Ras Al khaimah, UAE.

Subjects and Methods

Across-sectional descriptive study was conducted in Ras Al khaimah emirate, United Arab Emirates from November 2019 to January 2020. A convenient sample of 384 participants was decided based on the margin of error (5%), confidence level (95%), total population (345000) [11] and response distribution (50%). [12] The study-involved participants in the age range 18-60 years old, and included both genders and different nationalities. An anonymous structured self-administrative questionnaire was used to collect the required data from pedestrians in different places in Ras Al Khaimah (RAK). The northern emirate of UAE has two main areas, the Old Town and Nakheel, on either side of a creek that is home to

mangroves. RAK emirate also consists of several villages and new-gated residential development. [13] These areas exhibit diversity in the socio-economic status and provide a relatively representative sample of the community in RAK, UAE. The objective of the study was adequately explained to the participants and their informed written consent was obtained with assured confidentiality. Those who can neither read nor understand English or Arabic were all excluded from our study. The questionnaire included socio demographic characteristics of the studied participants, questions about the pattern of smoking, awareness of the participants about e-cigarettes usage. Dependent variables of e-cigarette use were measured using the question: 'Do you currently vape? With the response choices: 'Yes and No'. Independent variables were smoking status of participants (smoker and non-smoker), gender (male, female), nationality (Arab, Non-Arab and Emeriti), educational level (until secondary school, college and postgraduate), age group (18-25, 26-35, 36-45, 46 years and older) and marital status (single, married, widow/divorced). Awareness about e-cigarettes was measured using 13 items with response choices: Yes, No and I don't know". A value of "1" was assigned to each correct answer the participants gave upon filling the knowledge section of the questionnaire whereas a "0" was given to an incorrect answer or being unaware, (I do not know). All the negative items were recoded before the score. Participant who answered 75% or more of the questions correctly was considered knowledgeable in ECs, otherwise, he/she was considered not knowledgeable. Any score below 9/13 implied a less knowledge. These two newly recoded dichotomized random variables were used as outcomes for knowledge. The questionnaire was adopted from previous studies, translated into Arabic and properly revised by experts. To ensure validity and reliability of questions, a pilot study was carried out that included 10 participants in accordance with the inclusion criteria. Minor corrections were made based on the feedback from the pretest. The institutional ethical approval was obtained before commencement of the study. The data was entered in an IBM compatible computer, using the Statistical Package for Social Science (SPSS), version 22 (Chicago IL, USA). A descriptive analysis using means with standard deviation, frequency counts and percentages was carried out. It is important to note that in the reported Tables some counts do not add up to the total sample size, attributable to the fact that some questions have more than one response. Inferential statistics using Chi-squared analysis was used to test the association between the use of e-cigarettes, socio demographic variables and smoking status. An independent sample t-test was employed to test the mean difference of knowledge score about e-cigarettes by e-cigarette use. All bivariate analyses with $p \leq 0.25$ were included in the multiple regression model. The final model was tested using Hosmer-Lemeshow analysis; the p-value of 0.682 indicated the model is a good fit. All possible two-way interactions between the independent variables in the final model were also analyzed and analysis showed that $p < 0.05$ indicated significant two-way interaction between independent variables in final model.

Results and Observations

The study included 455 participants living in Ras Al Khaimah that represented 95.7% (455/475) responses after exclusion of the incomplete ones. The mean age of all participants was 21.6 (6.67) with 78% of them in age group 18 to 25 years. More than half of the participants (56.3%; 256/455) were male and

45.5% (207/455) were Arab nationality. Almost all were literate with 85.8% (381/455) of them attained a bachelor's degree or higher. More than two third (62.3%; 283/455) did not work in a health related occupation. The monthly income is more than 10,000 Emirati Dirhams in 60.3% (274/455) of the studied participants [Table 1].

Table 1: Demographic characters of the studied participants (N=455).

Demographic characters	No	%
Age		
18-25	355	78
26-35	77	16.9
36-45	13	2.9
46-55	9	2
>45	1	0.2
Mean ± SD		21 ± 6.67
Gender		
Male	256	56.3
Female	195	43.7
Nationality		
Arab	207	45.5
Non Arab	74	16.3
Local (Emirati)	174	38.2
Education		
Less than secondary	7	1.5
Secondary school	58	12.7
University	354	77.8
Post-grad	36	8
Is your occupation is health related?		
Yes	172	37.7
No	283	62.3
Marital status		
Single	151	33.2
Married	289	63.5
divorced	15	3.3
Income		
<5000	100	21.9
5000-10000	81	17.8
10000-20000	231	50.8
>20000	43	9.5

Regarding the smoking habits of the participants in the current study, more than half of the studied sample (59.8%; 272/455)

were smokers. Shisha was the most common means of smoking (38.6%) followed by cigarettes (22.6%) and others

(17.4%). More than sixty percent (64.3%; 175/272) of them started smoking since five years [Table 2]. E cigarettes use were reported by 56% (255/455) of the studied participants. They have heard of ECs mostly through media and advertisements (62.4%), followed by friends (38.4%) and family (14.2%). More than half (54.1%) of ECs users have been using it for more than six months. An estimated 33.3% (85/255) and 19.0% (50/255) of EC users reported using it on 20 or more days and daily use respectively in the past 30 days [Table 2]. One in five of EC users (20.4%; 52/255) admitted that they have stopped smoking tobacco cigarette, shisha or medwakh and others after switching to vape. While others

continue to use both. The amount of liquid consumed per week was more than 6-15 ml by 52.2% (133/255) of the studied participants, which is equal approximately to two reservoirs. Furthermore, the amount of nicotine used was more than 9 mg per cartridge by 38.8% (97/255) of them. Only 16.2% (41/255) of EC users admitted being satisfied with vaping more than other conventional tobacco smoking. The identified reasons behind the usage of EC by the studied participants were quitting smoking (35.7%), being safer than tobacco smoking (20.4%), peer request (19.6%), cheaper price than tobacco (8.6%) and curiosity about the product (7.8%) [Table 2].

Table 2: The smoking habits of the studied participants (NO=445).

Smoking habits	No	%
What type do you smoke? (could be more than one type)		
Cigarettes	95	22.6
Medwakh	30	9.7
Shisha	160	38.6
Chewing tobacco	15	4.2
Others	52	17.4
I don't smoke	183	40.2
Duration of smoking		
<5 years	175	64.3
5-10 years	25	9.2
>10 years	72	26.5
Do you currently vape?		
Yes	255	56
No	200	44
How did you hear about e, cigarettes? (could be more than one)		
Media, advertisement	190	62.4
Family	42	14.2
Friends	96	38.4
What is the vape duration?		
<1 mo	30	11.7
1-6 months	87	34.1
>6 mo	138	54.1
Frequency of vaping during the past 30 days (current EC)		
<20 days	120	47.5
≥ 20 days	85	33.3
Daily use	50	19.6
Exclusive ECs	151	59.2
Have you quit all tobacco products after starting to vape?		
Yes	52	20.4

No	131	51.3
Occasionally go back to normal cigarettes	72	28.3
How many ml of liquid do you consume per week?		
0-15	72	28.2
15-30	133	52.1
16-30	20	7.8
>45	30	11.7
Amount of nicotine/cartridge in mg		
0	15	5.9
6-Mar	97	38
9-Jun	44	17.3
>9	97	38
20-50	2	0.8
When compared to regular cigarettes, shisha, or medwakh how much satisfaction do u get from vaping?		
Similar	76	29.8
More	41	16.2
Less	108	42.3
I never felt any effect	30	11.7
What are the reasons which motivated you to use vape?(could be more than one)		
Quit smoking	91	35.7
Flavors	40	18.7
Safer than tobacco	52	20.4
Cheaper	22	8.6
Following a friend	50	19.6
Curious about the product	20	7.8

*Percent add to more than 100 due to multiple responses

Participants' awareness mean score was 6.23 (2.12), which is, is lower than the cutoff of 9 that was designated for a high level of awareness. Specifically, 66.3% (302/455) of our study population showed a lower level of awareness towards ECs with scores falling below this cutoff point. Participants' gap in EC awareness was made apparent by several questions that were answered incorrectly [Table 3]. More than half of all respondents showed a lack of awareness concerning ECs' association with lung and bladder cancer (77.5%; 353/455, 96.5%; 439/455), impaired cardiovascular and cerebral functions (78.7%; 358/455, 61.6%; 280/455) and impotence (64.6%; 449/455). About 31.7% (144/455) of the respondents were unaware that ECs contribute to second hand smoking and flavorings differ in their extent of harm (68.8%; 313/455). A

great proportion of participants falsely thought that ECs are effective as a smoking cessation method (64.2%; 292/455) and FDA approved and regulated by international agencies (67.9%; 309/455). Students-t test showed a significant difference in the mean score of awareness toward e-cigarettes among users and non- users ($p < 0.001$, 4.30(1.33) & 9.14(2.69)) respectively, which indicates those who have used e-cigarettes tend to have less knowledge about e-cigarettes. Chi-squared statistical test showed a significant higher usage of e-cigarettes among males compared to females ($p < 0.0001$, 75% (192/257) vs. 32.3% (63/195)). In addition, bivariate analysis revealed a significant association between nationality groups, smoking status and E-cigarette users. However, no association was observed between age groups, education level, marital status, and E-cigarette users [Table 4].

Table 3: Awareness of participants of dangers of e-cigarettes (No=455).

Knowledge	No	%
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Do you know, vaping is safe to your health?		
Yes, they are absolutely safe	79	17.3
Yes, they less danger than cigarettes	214	47
No they are as dangerous as cigarettes	104	22.9
NO they are more dangerous than cigarettes	49	10.8
I don't know	9	2
E cigarettes are associated with Lung cancer		
Yes	102	22.4
No	270	59.3
I do not know	83	18.2
E cigarettes are associated with cardiovascular diseases		
Yes	97	21.3
No	123	27.1
I do not know	235	51.6
E cigarettes are associated with cerebral stroke		
Yes	75	16.4
No	128	28.2
I do not know	152	33.4
E cigarettes are associated with bladder cancer		
Yes	16	3.5
No	179	39.3
I do not know	260	57.2
E cigarettes are associated with Impotence		
Yes	6	1.3
No	280	61.5
I do not know	169	3.2
Do you know,E-cigarettes do not contribute to second hand smoking		
Yes	139	30.5
No	311	68.3
I don't know	5	1.2
Do you know,Some e-liquid flavors are more harmful than others		
Yes	142	31.2
No	313	68.8
I don't know	0	0
Do you know, Swallowing the liquid in E-cigarettes accidentally can cause poisoning that is potentially fatal		
Yes	214	47.1
No	196	43.1
I don't know	45	9.8
Harmful flavorings and toxins are found in the EC aerosol		

Yes	201	44.1
No	234	51.4
I don't know	20	4.4

Do you know, vaping could help in smoking cessation?

Yes	292	64.2
No	73	16.1
I don't know	90	19.7

Do you know that vaping is addictive?

Yes, as addictive as cigarettes	234	51.4
Yes but less addictive than cigarettes	135	29.7
No they are not addictive	51	11.2
I don't know	35	7.7

Do you know e-cigarettes as smoking cessation aids are FDA approved and regulated by international agencies?

Yes	309	67.9
No	107	23.3
I don't know	38	8.4

Table 4: Association between status of EC user and sociodemographic characteristics and smoking status.

Variable	EC user No. %	EC – Non user No. %	P value
Overall (455)	255(56.0)	200 (44.0)	
Age			
18-25 (245)	151 (61.6)	94(38.4)	0.2
26-35(101)	49 (48.5)	52(52.5)	
36-45(69)	36 (52.2)	33(47.8)	
46 and older (40)	19 (47.5)	21(52.5)	
Gender			
Male (256)	192(75.0)	64(25.0)	0.0001
Female(195)	63(32.3)	132(67.7)	
Nationality			
Arab(207)	146(70.5)	61(29.5)	0.001
Non-Arab(74)	13 (17.6)	61(82.4)	
Local (Emirati (174)	96(55.2)	78(44.8)	
Education			
Until secondary(65)	30(46.3)	35(53.7)	0.1
College and PG. (390)	225(57.7)	165(42.3)	
Is your occupation is health related?			
Yes(172)	91(52.9)	81(47.1)	0.019
No(238)	164(68.9)	74(31.1)	

Marital status			
Single (151)	79(52.3)	72(47.7)	0.3
Married (289)	169(8.5)	125(43.2)	
divorced(15)	7(46.7)	8(53.3)	
Income			
<5000(100)	1(0.01)	99(99.0)	0.0001
5000-10000(81)	43(53.1)	38(46.9)	
>10000(247)	211(85.8)	36(14.2)	
Smoking status			
Smoker(272)	165(60.7)	107(39.3)	0.001
Nonsmoker(183)	85(46.4)	98(53.6)	

Males participants were 2.7 times likely to become E-cigarette users than females (OR=2.7, 95% CI: 0.6–1.68). Moreover, participants with higher education attainment and higher monthly income were more likely to become E-cigarette users (OR=1.69, 95% CI:1.05–2.72), (OR=2.92, 95% CI:1.28–6.65) respectively. Participants who do not work in a health-related occupation were twice as likely to be E-cigarette users

(OR=2.408, 95% CI: 1.233-4.705). The odds of current smoking using e-cigarettes was 2.5 times that of non-smoking (OR=3.46, 95% CI: 1.85–6.50). In addition, ECs users were found to be three times less likely to have attained a higher level of knowledge or awareness (OR=.304, 95% CI: 0.107-0.865) [Table 5].

Table 5: Multiple logistic regression of the association of E-cigarettes use with socio demographic and smoking status.

	Adjusted odd ratio	95% confidence interval for odd ratio	
		Upper limit	Lower limit
Gender			
Male	2.73	0.6	1.68
Female	1		
Nationality			
Arab	3.2	1.43	7.23
Emirati	2.9	1.28	6.64
Non Arab	1		
Education			
Until secondary	1		
College and PG	1.69	1.05	2.72
Monthly income			
5000-10000	1		
>10.000	2.92	1.28	6.65
Occupation is health related			
Yes	1		
No	2.408	1.23	4.7
Smoking status			
Smoker	2.46	1.85	6.5
Non-smoker	1		

Discussion

This is, to our knowledge, the first study to show the increasing popularity of ECs among a sample of people residing in Ras Al Khaimah, UAE. More than half of the studied respondents were ECs users for more than 6 months. Among the current e-cigarette, 59.2% admitted exclusive EC (only using EC) and 33, 3% reported using ECs on 20 or more days in past 30 days. These results are similar to a study conducted in United States in 2019 where 63,6% and 34.2% of youth reported exclusive EC and usage more than 20 days respectively. [14]

The current study results showed a higher use of e-cigarettes among younger age groups (18-25years), which is consistent with the findings by Al-Houqani M., and Fikri M. [15,16] This finding is expected because of the greater interest of the younger age group of participants to new products compared to the older age group, as reported by Helm et al. [17] The prevalence of e-cigarette users was significantly higher among males compared to females (75% vs. 32.3 %), which was similar to the trend of tobacco product usage. [18] However, the actual smoking rates could even be higher still than those indicated by self-reported rates as smoking was not considered socially or culturally acceptable, particularly among women. Consequently, some people who smoke chose not to reveal this. [19]

According to smoking epidemic model by Lopez et al. [20] smoking emerges first among high status groups, who are more open to the latest lifestyle trends, innovations and have the resources to adopt them first. The current study finding also showed higher prevalence of e-cigarette use among participants with higher monthly income. Another plausible reason for our findings can be associated with the diffusion of the use of manufactured e-cigarettes, being both technological and cultural innovations attract the high status group. [21] Health-related occupation displayed a lower prevalence level of ECs as their major, occupation must equip them with the knowledge to make better-informed judgments about health.

The results of the current study are particularly concerning given the high percentage (94.1%) of exposure to nicotine through the use of e-cigarettes, specifically for young people, this is of particular concern because it could promote the development of nicotine dependence, making it easier to the transition to cigarette or other combustible tobacco product use. On the other hand, it may delay cessation among current smokers and serve as an obstacle that maintains smoking habits. [3,19,22,23] This is obvious in the current study results in which 35.7% of the participants who were smokers turned to e-cigarettes in an attempt to quit smoking. Nevertheless, most of the people who took on e-cigarettes ended up as a dual user rather than quitter. [24] Subsequently, 79.6% and 54.0%, of the current study ECs users were not or less able to quit or satisfied with it compared with conventional tobacco respectively. Moreover, a current smoker has a greater propensity to use e-cigarettes compared to a non-smoker. Cornelius et al. [25]

reported that 36.9% of e-cigarette smokers also currently smoked cigarettes. Similar finding in the current study showed that 40.3% of the studied respondents who use EC also smoke other tobacco. Thus, the study results support earlier evidence that e-cigarette use increases the frequency and amount of cigarette smoking in the future. [1,26]

E-cigarettes are advertised using the same themes and tactics that have been shown to increase youth initiation of other tobacco products, including cigarettes. The current study results showed that 62.4% of respondents said they had seen e-cigarette in media and advertisements. Wang, et al. reported, about 7 in 10 middle school and high school students (69.3%) that represent more than 18 million youth are EC users because of the widespread of advertisements in News outlets and social media sites. [27]

Various flavors like fruit, candy, mint, and menthol are the primary reason youth reported using e-cigarettes. [28] These flavors look like those found in shisha that is popular in most of the Arab culture and showing the highest frequency of use in the current study (38.6%). ECs have the potential to be used as a portable shisha, which might justify the study's result that the common reason to start EC smoking was its flavors as mentioned by 18.7%. Furthermore, ECs are relatively new devices, come in many shapes and sizes that make it appeals to youth. Such emerging trends increase the curiosity about the product as mentioned by 7.8% of the current study respondents.

Scientists are still learning about the health effects of e-cigarette, but the available science shows they contain harmful and potentially harmful ingredients. ECs use among youth and young adults was also attributed to its perceived reduced harmful effects compared to tobacco. Forty seven percent (47%) of the studied respondents reported that e-cigarette is safer than conventional tobacco smoking and 20.4% identified the same reason behind their motivation to use ECs. Similar to the findings drawn by a previous study in Egypt, [29] where 31.9% believed it is less harmful than the traditional cigarettes. Indeed, it is difficult for consumers to know what e-cigarette products contain. Some e-cigarettes marketed as containing zero percent nicotine, however, it have been found to contain nicotine. [30]

On the other hand, one brand of ECs that is widely used by young people called JUUL have a high level of nicotine. According to the manufacturer, a single JUUL pod contains as much nicotine as a pack of 20 regular cigarettes. [31] Nevertheless, 40.9% of the studied respondents thought that vaping is less or not addictive than cigarettes.

Evidence to suggest that ECs may be effective and advisable for quitting smoking or a safe alternative for smoking is lacking. [32] Even after massive advertisements claiming the usefulness of these devices for quitting smoking, several studies assessed the effectiveness of ECs as smoking cessation

aids found that ECs were not successful as a vehicle for smoking cessation. [33-35] Other studies presented a conflicting finding. [36-38] In the current study, while 64.2% of the studied participants reported that ECs could help in quitting smoking, a comparative question in our study addressing its use as an effective smoking cessation method obtained a 20.4% positive response [Table 2]. This finding is lower than a study conducted in Lebanon where 48.6% of the participants could use EC as an effective smoking cessation method. [39] There was a 67.9% false knowledge that e-cigarette are FDA approved as smoking cessation aid; a factor substantiated by Callahan P.'s claim that "No e-cigarette has been approved by FDA as a cessation aid". [10] Indeed, the FDA officially regulated ECs in 2016 to restrict sales to minors, help consumers better understand the risks of using these products, prohibit false and misleading product claims. Building on this groundwork, it has approved a variety of products as cessation aids to help reduce dependence on nicotine such as nicotine gum, nicotine skin patches, and nicotine lozenges. [40]

Therefore, it is clear that, there is a knowledge gap among the studied participants relevant to certain areas like ECs ingredients' hazards and ECs' harmful effects on health. The level of awareness is higher among the ECs non-users. Lim, et al. Supported this finding, reporting that knowledge and perception influences the actual behavior of smoking among adults. [41]

Our findings should be viewed in the context of additional limitations. First, the external validity of the study may be affected by the convenient sampling of the participants in the study. In addition, there are possibilities for sampling selection bias. However, participants from different areas in Ras Al khaimah were recruited. Thus, findings might have some limitation in generalization of results. Secondly, the causal relationship cannot be established due to the cross-sectional study design. Thirdly, the results obtained in this questionnaire survey were based on self-reported information, which depends on the honesty and recall ability of the respondents, as well as their understanding of the questionnaire. Finally, excluding all the respondents who had never heard about e-cigarette might affect the study results especially on the distribution of gender, age group and educational status between those who participated and those who did not.

Conclusion

In conclusion, the prevalence of e-cigarette use was found higher among a substantial proportion of participants who were male from Arab ethnicity, working in health unrelated occupation, having higher education attainment and higher monthly income, in addition, being smoker, and having low level of awareness about e-cigarettes use and its possible harms. Therefore, it is important to disseminate relevant information regarding e-cigarettes, especially to the identified population with a tendency to use it. Considering the conducive environment to smoking in UAE, strict measures should be undertaken to regulate its use by instituting more stringent laws and holding nationwide awareness campaigns to control the increasing e-cigarette use in the near future.

References

1. U.S. Department of Health and Human Services. E-Cigarette use among youth and young adults. A report of the surgeon general. Atlanta, GA: U.S.
2. Food and Drug Administration (FDA), "Vaporizers, e-cigarettes, and other electronic nicotine delivery systems". 2020.
3. U.S. Department of health and human services, surgeon general is advisory on e-cigarette use among youth. 2018.
4. Truth initiatives.org. E-cigarettes-facts-stats-and-regulations. 2020.
5. Centers for disease control and prevention. Quick facts on the risks of e-cigarettes for kids, teens, and young adults. 2020.
6. King BA, Gammon DG, Marynak KL, Rogers T. Electronic cigarette sales in the United States, 2013-2017. *JAMA*. 2018;320(13):1379-1380.
7. Drummond MB, Upson D. Electronic cigarettes. Potential harms and benefits. *Ann Am Thorac Soc*. 2014; 11(2): 236-42.
8. De Marco C, Invernizzi G, Bosi S, Pozzi P, Di Paco A, Mazza R, et al. The electronic cigarette: potential health benefit or mere business? *Tumori*. 2013; 99(6): 299-301.
9. King AB and VanFrank B. Protecting youth from e-Cigs: 5 Things to know - medscape and cdc. 2020.
10. Callahan-Lyon P. Electronic cigarettes: Human health effects. *Tob Control*. 2014; 23(2):36-40.
11. Facts about Ras Al Khaimah. RAK Government, 2019.
12. Raosoft sample size calculator, 2019.
13. Emirate of Ras Al Khaimah, 2020.
14. Cullen KA, Gentzke AS, Sawdey, ChangJT, Anic GM, Wang TW, et al. E-Cigarette use among youth in the United States. *JAMA*. 2019; 322 (21):2095-2103.
15. Fikri M, Abi Saab B. Global Youth Tobacco Survey (GYTS) United Arab Emirates Report. 2002.
16. Al-Houqani M, Hajat C. Tobacco smoking among UAE nationals. *Chest*. 2011;140:438A.
17. Helm R, Landschulze S. How does consumer age affect the desire for new products and brands? A multi-group causal analysis. *Rev Manage Sci*. 2013;7(1):29-59.
18. Aden B, Karrar S, Shafey O, Al Hosni F. Cigarette, water-pipe, and medwakh smoking prevalence among applicants to Abu Dhabi's pre-marital screening program, 2011. 2013;4(11):1290-1295.
19. Al-Houqani M, Leinberger-Jabari A, Al Naeemi A, Al Junaibi A, Al Zaabi E, Oumeziane N, et al. Patterns of tobacco use in the United Arab Emirates Healthy Future (UAEHFS) pilot study. *PLoS One*. 2018; 13(5):e0198119.
20. Lopez AD, Collishaw NE, Piha T. A descriptive model of the cigarette epidemic in developed countries. *Tob Contr*. 1994;3:242-247.
21. Ampel FC. Diffusion, cohort change, and social patterns of smoking. *Soc Sci Res*. 2005;34(1):117-139.
22. Hartmann-Boyce J, McRobbie H, Bullen C, Begh R, Stead LF, Hajek P. Can electronic cigarettes help people stop smoking, and are they safe to use for this purpose? *External icon*. 2016.
23. Caraballo RS, Shafer PR, Patel D, Davis KC, McAfee TA. Quit methods used by US adult cigarette smokers, 2014-2016 *external icon*. *Prev Chronic Dis*. 2017; 14:160600.
24. Nousheen I, Zain A, Syed M, Omar I, Babar I, Ammar H, et al. Prevalence and knowledge of electronic cigarettes amongst medical students, A cross sectional survey from Karachi, Pakistan *European Respiratory Journal*. 2017; 50 (S61) PA4487.

25. Cornelius ME, Wang TW, Jamal A, Loretan C, Neff L. Tobacco Product Use Among Adults – United States, 2019. Morbidity and mortality weekly report, 2020; 69(46):1736–1742.
26. National academies of sciences, engineering, and medicine. Public health consequences of e-cigarettes, external icon. Washington, DC: The National Academies Press. 2018.
27. Wang TW, Gentzke AS, Creamer MR, Cullen KA, Hayes EH, Sawdey MD, et al. Tobacco product use and associated factors among middle and high school students—United States, 2019,external icon. *MMWR Surveill Summ.* 2019;68(SS-12):1–22.
28. Ambrose BK, Day HR, Rostron B. Flavored tobacco product use among us youth aged 12-17 years, 2013-2014. *JAMA.* 2015;314(17):1871-1873.
29. Omaira I, Eman S. Knowledge about electronic cigarettes and its perception: a community survey. *Egypt Respir Res.* 2016; 17: 58.
30. Goniewicz ML, Gupta R, Lee YH, Reinhardt S, Kim S, Kim B, et al. Nicotine levels in electronic cigarette refill solutions: a comparative analysis of products from the United States, Korea, and Poland. *Int J Drug Policy.* 2015;26(6):583–588.
31. Willett JG, Bennett M, Hair EC, Xiao H, Greenberg MS, Harvey E, et al. Recognition, use and perceptions of JUUL among youth and young adults. *Tobacco control* published online first. 2018.
32. Heydari G, Ahmady AE, Chamyani F, Masjedi M, Fadaizadeh L. Electronic cigarette, effective or harmful for quitting smoking and respiratory health: A quantitative review papers. *Lung India.* 2017;34(1):25-28.
33. Brown J, Beard E, Kotz D, Michie S, West R. Real-world effectiveness of e-cigarettes when used to aid smoking cessation: A cross-sectional population study. *Addiction.* 2014;109:1531–40.
34. Bullen C, Howe C, Laugesen M, McRobbie H, Parag V, Williman J, et al. Electronic cigarettes for smoking cessation: A randomised controlled trial. *Lancet.* 2013;382:1629–3710.
35. Dmytriiev K, Mostovoy Y, Slepchenko N, Tsymbaliuk N, Sidorov A. Role of E-Cigarettes in the smoking cessation. *Eur Respir J.* 2018; 52: PA1726.
36. Maria APM, Paula F, Teresa A, Manuel P, João O, Margarida D, et al. Electronic cigarettes knowledge and use among smokers attending an intensive smoking cessation intervention programme. *Eur Respir J.* 2018; 52: PA4550.
37. Vickerman KA, Carpenter KM, Altman T, Nash CM, Zbikowski SM. Use of electronic cigarettes among state tobacco cessation quitline callers. *Nicotine Tob Res.* 2013;15(10):1787-1791.
38. Popova L, Ling PM. Alternative tobacco product use and smoking cessation: a national study. *Am J Public Health.* 2013; 103:923–30.
39. Aghar H, El-Khoury N, Reda M, Hamadeh H, Krayem H, Mansour M, et al. Knowledge and attitudes towards E-cigarette use in Lebanon and their associated factors. *BMC Public Health.* 2020; 20, 278 (2020).
40. US food and drug administration. The facts on the FDA's new tobacco rule.
41. Lim KH, Sumarni MG, Amal NM, Wan Rozita WM, Norhamimah A. Tobacco use, knowledge and attitude among Malaysians age 18 and above. *Trop Biomed.* 2009; 26(1):92-99.