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Assessment of University Students' Perceptions Regarding the Effect of E-cigarettes on Oral health

Raghad Othman Ahmed Aldabbagh

College Of Pharmacy, University of Mosul, Mosul, Iraq

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*** CORRESPONDING AUTHOR:**
Raghad Othman Ahmed Aldabbagh e-mail: raghad_aldabbagh@uomosul.edu.iq

ABSTRACT

Background: Electronic cigarettes (e-cigarettes) have become popular among university students, perhaps their potential negative impacts on oral health remained underestimated. **Objective:** The present study sought to assess the knowledge of university students about the impacts of e-cigarettes on orodental health, and to investigate factors associated with knowledge deficits in this population. **Methods:** An online survey was conducted among undergraduate and graduate students aged 18-30 years at University of Mosul. Participants completed the questionnaire about their knowledge of e-cigarette components. The form included questions about periodontal complications, oral cancer risk, wound healing, and tooth enamel integrity. Demographic data and smoking history were also collected. **Results:** A total of 392 students participated in the present study, with only 32% of them being e-cigarettes smokers. Smokers were mostly mild smokers (12%) versus only 5% who were heavy smokers. The respondents were highly positive in linking e-cigarettes with stained teeth deficits, such as, stained teeth (73%), bad breath (66%), dental decay (60%), enamel discoloration (67%), while 68% reported mouth irritation, dry mouth, and ulcers. Over half of the respondents (57%) recognized that e-cigarette use changes the oral microbiome, and 71% connected it to plaque accumulation. Participants positively linked e-cigarettes to serious illness, including heart disease (72%), lung cancer (80%), and oral cavity cancers (55%). **Conclusions:** University students revealed marked knowledge concerning e-cigarette effects on oral health. These outcomes mark the urgent need for public educational programs.

Introduction

Electronic cigarettes (e-cigarettes) are currently popular among young adults, including university students, raising significant need for public health awareness regarding their impact on oro-dental health[1]. Being commercially marketed as an alternative to traditional tobacco products, e-cigarettes become more common between young and adults[2], despite evidence available about their oro-dental impact, including gum disease, tooth decay, and oral mucosal lesions, indicating critical gap in public awareness[3].

The assessment of the university students' knowledge regarding the negative impact of e-cigarettes on oro-dental health is essential for enhancing health impacts of vaping on orodental health[1]. The oro-dental deficits might potentially increase the education of vaping students to seek medical attention and protect them from short-term effects (e.g., dry mouth, gum irritation) and long-term consequences (e.g., increased risk of oral cancer)[3]. On the other hand, understanding students' knowledge levels enables healthcare providers and educators to develop targeted interventions addressing specific misconceptions about e-cigarette oral health effects, ultimately supporting informed decision-making and preventive care strategies.

The present study aimed to assess misconception among students who use e-cigarettes regarding their impact on oral and dental parameters. Enhancing knowledge about e-cigarette-induced oral health effects may ultimately enable students to make more informed decisions, reduce harmful behaviors, and promote better dental hygiene practices among this vulnerable population.

Materials and Methods

The present study is a cross-sectional study based on using electronic Google form directed towards convenient sample of those people who are a teenagers and 20s who expected to be the most suitable ages for E-cigarettes. The sample were students recruited from different colleges of University of Mosul (Iraq). The questionnaire was initially validated through a pilot study including College of Pharmacy students (n=50 student) as a pilot study to check its legitimacy and hence the reliability of outcomes.

A total of 392 participants consented to participate in the study. The first page of the questionnaire informed them that their responses would remain confidential and be used solely for research purposes.

The study was approved and registered in the College of Pharmacy-University of Mosul (Approval letter number 5/5/34689 on 13.10.2024). The study directed towards the most commonly affected group of university students, around 20-year-old. The participants have responded electronically on 20 questions (Table 1)

Descriptive statistics based on frequency and percentages was used to analyse the participants response to the questions.

Results

The demographic parameters of the targeted sample in the present study confirmed that most patients aged around 20 years (21.7±3.3) with equally matched sex, however, they were mostly single (95%). The participants were asked about their tobacco smoking habits and the outcome confirmed that the majority (83%) was non-tobacco smokers, Those who smoked or were occasionally smokers (17%) have been divided into 5% heavy smokers and 12 mild smokers based on number of cigarettes smoked per day. Moreover, demographic data regarding E-cigarettes have indicated that the starting age of smoking is on average below the legal age (16±4.5). Regarding information about e-cigarettes, the results indicated that only 7% are regularly vaping and 12% occasionally, with 11% being daily users. The average age of first-time vaping was close to legal age of smoking (19.5±5.2). All E-cigarette smokers have the desired to quit from smoking (Table 2).

In Table 3 the perceptions of the impact of e-cigarettes on oro-dental health are presented. A discrepancy in outcomes was observed, highlighting variations in the responses and indicating a considerable research gap

Table 1. Questions about the impact of E-cigarettes on oral dental health.

Question number	Question details
1	E-cigarettes is associated with development of oral cavity cancers.
2	E-cigarettes is associated with development of stained teeth.
3	E-cigarettes is associated with development of bad breath.
4	E-cigarettes is associated with development of dental decay.
5	E-cigarettes is associated with development of mouth irritation, dry mouth and ulcer.
6	E-cigarettes is associated with development of altered test.
7	E-cigarettes is associated with development of heart disease.
8	E-cigarettes is associated with development of lung cancer.
9	E-cigarettes is associated with Impaired wound healing.
10	E-cigarettes is associated with gingival inflammation and\ or bleeding.
11	E-cigarettes is associated with increased plaque index.
12	E-cigarettes is associated with oral microbiome changes.
13	E-cigarettes is associated with tooth infection.
14	E-cigarettes is associated with increased incidence of cracked or broken teeth
15	E-cigarettes is associated with altered enamel colored and reduced luminosity
16	E-cigarettes causes psychic but not physical dependence.
17	E-cigarettes endangers passive smokers' health.
18	Quitting smoking reduces the risk of developing oral cancer.
19	Oral cancer is most commonly discovered in advanced stage.
20	Oral cancer is asymptomatic in the early stages.

Impacts of e-cigarettes on oral health: The respondents were highly positive in linking e-cigarettes with stained teeth (73%), bad breath (66%), dental decay (60%), enamel discoloration (67%), mouth irritation, dry mouth, and ulcers (68%). However, the respondents were moderately (52%) in associating e-cigarettes with gingival inflammation or bleeding, while a smaller proportion (43%) linked their use to cracked or broken teeth

Infection and Plaque: Over half of respondents (57%) recognized that e-cigarettes change the oral microbiome, and 71% connected their use to plaque accumulation, indicating a potential for hazards for periodontal disease on chronic basis.

Systemic and cancer risks: Surprisingly, participants positively linked e-cigarettes to serious illness, including heart disease (72%), lung cancer (80%), and oral cavity cancers (55%).

Other selected questions: Two-fifths (40%) recognized that e-cigarettes might impair wound healing, though 44% were unsure. Psychological dependence was a prominent theme, with 70% agreeing

Table 2. Demographic data of the studied sample of patients.

Parameters	**n (%)**
Age (Years)	21.7±3.3
Gender (M/F)	196/196 (50/50)
Marital status (S/M)	371/21 (95/5)
Tobacco smoking	
Cigarette smoking (Yes/No/Occasionally) (n=392)	32/327/33 (8/83/9)
Smoking status (Heavily smoker, Mild smoker) (n=65)	21/44 (5/12)
Age of first experience of tobacco smoking? (n=65)	16±4.5
E-cigarette	
Smoke E-cigarette? (Yes/No/Occasionally) (n=392)	28/316/48 (7/81/12)
E-cigarette use (Daily user, Intermittent user, None) (n=392)	11/65/316 (3/17/80)
Age of first experience of E-smoking? (n=76)	19.5±5.2
Do you have a desire to quit smoking? (Yes, No) (n=76)	76/0 (100/0)
Number of family members who smoke (0/1/2/3) (n=392)	349/20/19/4 (89/5/5/1)

Table 3. Knowledge about the impact of E-cigarettes on oral dental health.

Questions (n=392)*	Yes n (%)	No n (%)	May be n (%)
1	214 (55)	19 (5)	159 (40)
2	288 (73)	43 (11)	61 (16)
3	260 (66)	62 (16)	70 (18)
4	238 (60)	39 (10)	115 (29)
5	268 (68)	24 (6)	100 (26)
6	203 (52)	48 (12)	141 (36)
7	283 (72)	16 (4)	93 (24)
8	312 (80)	11 (3)	69 (17)
9	158 (40)	62 (16)	172 (44)
10	203 (52)	44 (11)	145 (37)
11	278 (71)	40 (10)	74 (19)
12	225 (57)	21 (5)	146 (38)
13	190 (48)	38 (10)	164 (42)
14	170 (43)	61 (16)	161 (41)
15	262 (67)	28 (7)	102 (26)
16	275 (70)	25 (7)	92 (23)
17	295 (75)	20 (5)	77 (20)
18	309 (79)	12 (3)	71 (18)
19	129 (33)	42 (10)	221 (57)
20	182 (46)	16 (5)	194 (49)

*The question numbers refer to Table 1

Table 4. Knowledge about the impact of E-cigarettes on oral dental health in those who have the desire to quit.

Questions (n=76)	Yes n (%)	No n (%)	May be n (%)
1	12 (16)	44 (58)	20 (5)
2	65 (85)	5 (7)	6 (8)
3	76 (100)	0 (0)	0 (0)
4	44 (58)	2 (2)	30 (40)
5	6 (8)	65 (85)	5 (7)
6	70 (92)	2 (2)	4 (6)
7	10 (13)	44 (58)	22 (29)
8	24 (31)	5 (7)	47 (62)
9	43 (57)	26 (34)	7 (9)
10	33 (43)	24 (32)	19 (25)
11	61 (80)	7 (9)	8 (11)
12	14 (18)	19 (25)	43 (57)
13	16 (21)	15 (20)	45 (59)
14	5 (7)	55 (72)	16 (21)
15	65 (85)	5 (7)	6 (8)
16	67 (88)	3 (4)	6 (8)
17	56 (74)	4 (5)	16 (21)
18	20 (26)	22(29)	34 (45)
19	1(1)	16 (21)	59 (78)
20	9 (12)	7 (9)	60 (79)
The question numbers referred to Table 1			

that vaping causes psychic (non-physical) addiction. Notably, three-quarters perceived secondhand vapor as dangerous to passive smokers, aligning with concerns about traditional tobacco.

Perception of oral cancer: Despite a high proportion of participants (79%) claimed that quitting smoking minimizes oral cancer risk, only one-third believed that oral cancer is detected only on advanced stages, and one-half knew that it can be an asymptomatic.

The perceptions of 76 participants who intended to quit smoking, expressed unclear findings and uncertainty on certain aspects but strong convictions about others, shaping the complicated outcomes observed in regard to oral health awareness among those considering cessation (Table 4).

Recognized oral health impacts: The most conceded effect was bad breath, with 100% of participants recognizing that e-cigarettes promote this effect. This consent evokes that bad breath could be one of the utmost directly evident consequences of vaping. In line with this, 85% of the respondents confirmed that e-cigarettes are associated with stained teeth and altered enamel coloration, demonstrating extensive awareness of vaping's cosmetic dental effects. Moreover, up to 80% of the respondents reported a strong association between e-cigarettes and an increased plaque index raising concerns for periodontal health implications.

Mixed perceptions of oral health impacts: a relatively high percentage of respondents (85%) reported that e-cigarettes contribute to dental decay, while 40% indicate uncertainties about this question. Similarly, responses regarding gum health revealed that 43% of participants associated e-cigarette use with gingival deficits while 25% are uncertain. Perceptions on tooth infection disclosed even higher uncertainties, with only 21% linking tooth infection to e-cigarettes consumption, and 59% were unsure.

Prominent areas of doubt: The respondents demonstrated different levels of uncertainty across several parameters with only 8% linking positively e-cigarettes with mouth irritation, dry mouth or ulcers, while 85% denied this link. Moreover, 7% accepted that vaping could lead to cracked teeth, whereas 72 rejected this belief, suggesting that these cosmetic dental effects may be underestimated.

Systemic health area beliefs: Significant knowledge gaps existed in regard to this issue. 31% of the respondents linked e-cigarettes with lung cancer, while 62% indicated no association. Moreover, 13% of the respondents linked e-cigarettes with heart diseases. Negative impact of e-cigarettes on wound healing processes showed a relatively high level of agreement with 57% acknowledging this effect while 34% disagreed.

Psychological dependence concerns: The respondents highly agree that e-cigarettes use is linked

to psychological dependence, predisposing to addiction. Moreover, 74% believe that passive smokers are in health danger from vaping.

Oral cancer associations: Participants showed low awareness (1%) regarding that oral cancer diagnosis often occurs to advanced stages and that it may be asymptomatic. Furthermore, only 26% were aware that smoking cessation reduces oral cancer risk, while 45% provided vague responses.

Discussion

The study has highlighted a strong perception of public about the link between e-cigarette use and the risk for lung cancer, while ignoring its impact on oral health, including oral cancer and impaired wound healing. These uncertain responses imply ample opportunities for public health education in relation to the association between e-cigarette use and oral health risks. The participants mostly consent that e-cigarette contribute to lung cancer and heart disease indicating that the population have clear awareness about the carcinogenic potential of vaping products. Moreover, the respondents were moderately positive in recognizing that e-cigarette use may be linked to oral cancer and to modulation of oral health through teeth staining, plaque, dry mouth, oral irritation, oral ulcers, changes enamel color, and dental caries.

These uncertain responses highlight significant opportunities for public health education regarding the association between e-cigarette use and oral health risks. While participants generally acknowledged that e-cigarettes contribute to lung cancer and heart disease, indicating awareness of their systemic carcinogenic potential, responses concerning oral health were only moderately affirmative. Participants recognized that e-cigarette use may be linked to oral cancer and a range of oral health effects, including teeth staining, plaque accumulation, dry mouth, oral irritation, ulcers, changes in enamel coloration, and dental caries.

The participants were uncertain in their responses using "may be" for certain questions. Notably, 49% were uncertain that oral cancer is asymptomatic at early stages, 57% were uncertain that oral cancer diagnosed at advanced age, 57% were uncertain about association of e–cigarettes use with tooth infection, and 44% were uncertain about the impact of smoking on wound healing. This high uncertainty rates regarding association of smoking and vaping with oral cancer reflects low public knowledge in this area suggesting the need for public education to address this gap[4,5].

Uncertainties regarding oral induction of cancer by cigarettes have been reported earlier by college students[6]. The induction of oral cancer by e-cigarettes smoke may be linked to the transport of air pollutants via the respiratory tract into the lungs which can trigger both oral and lung diseases. These pollutant toxins cause direct damage to lung tissues and disrupts the normal oral and lung tissue function, including deficits in localized immune response[7]. Additionally, oral bacteria can be affected by smoke leading to development of cancers in the digestive system. This association has been observed in patients with colorectal cancers since smoking-induced shifts in oral bacteria composition that colonize the digestive system contribute of e-cigarette vapor and other tobacco products, increasing the vulnerability harmful effects in the oral region, microbial imbalance associating with tooth decay[10]. The liquids of e-cigarettes contain different chemicals including nicotine, acetaldehyde, acrolein, formaldehyde, and various flavoring agents such as cinnamaldehyde, which may also play a role in gastrointestinal cancer development. [11,12].

The responses indicate that 40% of participants believe that smoking hinders wound healing, and 44% were uncertain. Also, 33% thought that cancer is diagnosed at advanced stages, and 57% were uncertain about that. Surprisingly, 70% of the respondents believe that e-cigarettes cause psychological but not physical dependence. This outcome suggests that participants are aware of some risks associated with vaping, while other risks including wound healing, alongside with awareness of late-stage oral cancer detection, remain underestimated. Recent studies have shown that e-cigarettes impairment of wound healing is caused via oxygen deprivation while the organic compounds in the vapor disrupt immune function by alteration of neutrophils, macrophages, and keratinocytes[13].

The survey of participants who desired to quit

(PDQ) revealed strong awareness regarding the impact of e-cigarettes use on some aspects on oral health while other consequences were under estimated. The PDQ group showed high perception in regard to the immediate impacts of e-cigarettes (85-100%), including bad breath, stained teeth, altered enamel coloration and reduced luminosity, along with changes in taste perception. These findings indicate clear recognition of the initial cosmetic impacts of vaping. In contrast, the PDQ group's perception of the dental impacts of e-cigarettes was moderate (43-80%), including dental decay, plaque buildup, impaired oral wound healing, gingival inflammation and bleeding. Analogous orodental problems associated with e-cigarettes have been reported in a previous study conducted among students [14]. A systematic review has also confirmed that e-cigarette use is associated with dental caries, periodontitis, gingival pain, and various oral symptoms[15].

The PDQ group's perception of the severe health risks associated with e-cigarettes was relatively low (13-31%), particularly in regard to oral cavity cancer, lung cancer, and heart diseases, plaque buildup, impaired oral wound healing and gingival inflammation or bleeding. These findings suggest that there are urgent needs for public health education to address such misconceptions[16,17].

Surprisingly, 85% of the PDQ group reported no association between e-cigarette use and mouth irritation, dry mouth, or oral ulcers. Moreover, 88% believed that e-cigarettes cause psychological dependence rather than physical addiction. A total of 78% of the respondents were uncertain whether oral cancer is typically diagnosed at advanced stages and 79% were uncertain whether oral cancer is asymptomatic in early phases. These misconceptions may undermine efforts to quit e-cigarette use, necessitating the need to enhance public awareness by educational initiatives[3].

The present study has several relatively notable limitations. The study was conducted online through a Google form, restricting participation to individuals with internet access. Participants were limited to those with the same demographic and socioeducational backgrounds that might affect the generalizability of the findings, while the sample size was small compared to general population density. Moreover, the participants' perception might not exactly reflect the potential risk levels. The cultural diversity might also hinder generalizability of the collected data. The participants in the study were both vapers and non-vapers

Conclusion

To sum up, the present study revealed that student have a pervasive belief that e-cigarette use adversely affects oral health, including teeth staining, dental caries, and gum deficits, while awareness regarding oral cancer and its consequences is limited. The high levels of ambiguity observed among the participants highlight the need for enhanced public health education to further clarify the scope of e-cigarette-related risks. In particular the misconception in regard to the higher risk for lung cancer than for oral cancer represents a public challenge for educational interventions

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