



Oral Health Effects among Conventional Cigarette and Electronic Cigarette Smoking among Users in Saudi Arabia

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: The use of e cigarettes is on the rise in the Middle East Countries and Saudi Arabia especially. This study aims to evaluate the oral mucosal lesions caused due to electronic cigarette smoking (ECS) use and oral health, including 'gingival pain and/or bleeding', 'tongue and/or inside-cheek pain', and 'cracked or broken teeth' among adolescents.

Materials and Methods: A cross-sectional study conducted among 1300 participant in the kingdom of Saudi Arabia using a reliable and valid online questionnaire. The questionnaire was developed by the investigators and Google forms were used to collect the information. The questions were grouped into categories relating to socio-demographic data (age, gender), type of cigarette smoking (conventional, E-cigarette or booth), and cigarette smoking behavior (frequency).

Results: It was observed from the present study that even though oral mucosal lesions were more in conventional cigarette smokers but e cigarettes were not the safe option as it has ill effects also. Females used e cigarettes more (30.7%) as compared to males (28.2%). Statistically significant results were obtained for change in color of gingival, disturbed feeling in the tongue ($p < 0.000$).

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Conclusion: The usage of e cigarettes was seen more among females than males. The oral health effects and especially the change in color, dryness of the oral cavity and discoloration of the teeth were seen more with the conventional cigarettes users than the e cigarettes users. E cigarettes were also associated with ill effects of the oral cavity.

Keywords: Conventional cigarette; electronic cigarette; oral health.

1. INTRODUCTION

Oral diseases represent an increasingly important public health problem in social life [1]. One of the factors that affected the oral mucosal disease or lesions is using tobacco product in different types and forms which can be as in the form of smoke, chew, or sniff tobacco. Smoked tobacco products include cigarettes, bidis, and kreteks whereas the smokeless tobacco in a pipe or hookah (water pipe) and chewers tobacco products include chewing tobacco, snuff, dip, and snus [2].

The tobacco in different forms would be driven to cause lesions in oral mucosa, and these lesions have diverse pattern. White lesions are the most common lesions associated with the use of tobacco products. These products have all the potential to cause ill effects not only to the oral cavity but the whole body in general [3,4].

Furthermore, it has been discovered that abstaining from tobacco use can add 20 years to a teenager's life. Tobacco use causes a variety of health issues, including gum disease and tooth loss, chronic lung diseases such as emphysema and bronchitis, lung cancer, oral cancer, coughing spells, wheezing, frequent headaches, increased mucus secretion, reduced physical fitness, and poor lung growth and function in those who start smoking as children [5-7].

The common lesions are the leukoplakia and the erythroplakia, the most common subtype is Erythro-leukoplakia which is found to be associated with chewing type of tobacco products use [4]. Smoked tobacco products can be categorized into two means or can be classified Conventional Cigarette Smoking and electronic-cigarette Smoking (ECs) The use of electronic cigarettes (ECs) has grown exponentially over the past years, principally as an alternative to smoking tobacco cigarettes, the effects of acute and long-term use of ECs on the microbiota have not been explored in depth especially in the country like Saudi Arabia [8,9]. The literature has witnessed that the use of ECs is increasing rapidly and is on

the rise in the Middle East countries also. It is well known fact that the tobacco contains toxic elements such as chromium, arsenic, and lead. Poisonous gases such as carbon monoxide, ammonia, butane gas, and toluene make up the final major component. Smoking tobacco and inhaling tobacco smoke is known as traditional smoking or tobacco smoking. It has a negative impact on oral health [10].

The fact that findings prevalence and the ill effects of the EC usage have not been unearthed, and what few studies were conducted, the results were not very consistent especially when it comes to health [11]. Moreover there is severe dearth of information in the literature about the prevalence and the ill effects of electronic cigarette use in the Saudi Arabia scenario hence the present study was conducted with the aim to evaluate the oral mucosal lesions caused and adverse effects on oral health due to ECs including 'gingival pain and/or bleeding', 'tongue lesions and/or inside-cheek pain', and 'cracked or broken teeth' among adolescents of the Saudi Arabia region.

2. MATERIALS AND METHODS

Setting

Appropriate ethical authorization was accomplished to conduct a cross sectional study, which was carry out in March 2020, in the kingdom of Saudi Arabia (KSA). The survey was distributed to 1300 participants from different cities in the kingdom of Saudi Arabia (KSA) in different age groups and gender.

Design

A self administered online questionnaire composed of 17 questions related to E cigarettes and conventional cigarettes was used. Convenience sampling method was employed for collection of data and the participation in the study was voluntary and anonymous.

Response data was obtained via (Google forms). Participants were given a 1 week to complete the

survey. The study protocol was reviewed and approved by Riyadh Elm University (REU) Research Center. IRB Number: FRP\2020\224\132.

Instrument

A 17 item self reported questionnaire related to E cigarettes and conventional cigarettes was developed by the investigator team. The questionnaire content was validated by expert methodologist. The study reliability was carried out by conducting a pilot run of 12 participants. Cronbach's alpha for the 12 participants showed that Cronbach's alpha was at the level of 0.652. Cronbach's alpha based on standardized item 0.734, which considered acceptable for reliability analysis. The questions were grouped into categories relating to socio-demographic data (age, gender), type of cigarette smoking (conventional, E-cigarette or both, and cigarette smoking behavior (frequency). As well as E cigarette and conventional cigarette related questions separately.

Statistical Analysis

Data collection, configuration and analysis are implemented using Excel program. Descriptive statistics of frequency distribution and percentages were calculated for the categorical variables. Relationship between categorical variables of smoking variables, oral health effects and oral mucosa, gender and age groups was assessed by applying Chi-square test. Chi-square test was applied to explore any significant association between smoking variables, gender and age groups of the study participants. A p value less than ($p < 0.05$) was considered statistically significant. All the data was analyzed by using SPSS version 25 (Armonk, NY: USA).

3. RESULTS

A total of 1300 participants responded to electronic survey that was distributed. Majority of them were females (68.9%, majority age between 18-25 years (58.2%), Prevalence of conventional cigarettes users and e cigarettes users were (49.2%) and 29.9%.

The baseline characteristics of the participant group are summarized in Table 1. According to Table 1 49.2% used conventional, 20.8% dual use, 29.9% only E-Cigarettes.

Table 2 shows about the distribution of questionnaire responses. Here we can see that change in the gingival color (47.8%), Disturbance in the feeling of the tongue (37.9%), increase in the calculus or plaque (45.5%), Bad breath (23.8%), brown/black pigmentation (11.8%), Change in the mouth after smoking was reported by (20.7%), tooth discoloration while smoking (54.9%) was reported by conventional cigarette smokers.

In Table 3a it was observed that change in the gingival color, mostly in the age group of 18 years, increase in the calculus and plaque deposition was significantly associated with both gender and age of the study participants ($p < 0.000$). The disturbed feeling in the tongue was significantly associated with age group of 18 years. ($p < 0.040^*$).

In Table 3b it was observed that discoloration in tooth and bad mouth breath was significantly associated with both gender and age of the study participants ($p < 0.000$). The finding of change in the mouth and cracked tooth in the mouth was significantly associated with age group of 18-25 years and 18 years respectively. ($p < 0.009^*$) and ($p < 0.012^*$).

Table 1. Characteristics of the study participants

Characteristics		n	%
Gender	Male	404	31.1%
	Female	896	68.9%
	Total	1300	100.0%
Age	Less than 18	242	18.6%
	18-25	756	58.2%
	Above 25	302	23.2%
	Total	1300	100.0%
Type Cigarette	Conventional	640	49.2%
	E-Cigarette	389	29.9%
	Both	271	20.8%
	Total	1300	100.0%

Table 2. Distribution of the questionnaire responses

Questionnaire items	Responses	n	%
Did you notice any change in gingival color after conventional or e-cigarettes smoking	Yes, after conventional cigarette	622	47.8%
	Yes, after e-cigarettes	103	7.9%
	No, I did not notice anything	575	44.2%
Did you feel any disturbance feeling with Your tongue after been smoking?	Yes, after conventional cigarette	493	37.9%
	Yes, after e-cigarettes	169	13.0%
	No, I did not notice anything	638	49.1%
Have you noticed increase in calculus or plaque accumulation after smoking?	Yes, after conventional cigarette	591	45.5%
	Yes, after e-cigarettes	163	12.5%
	No, I did not notice anything	546	42.0%
What did you notice after long time of smoking?	Bad breath smell	310	23.8%
	Teeth fall or mobility	47	3.6%
	Brown/black pigmentation	153	11.8%
	All the above	326	25.1%
	None of the above	464	35.7%
Have you noticed any change in your mouth after smoking?	Yes, after conventional cigarettes	269	20.7%
	Yes, after e-cigarettes	75	5.8%
	No, I did not notice anything	956	73.5%
Have you noticed any tooth discoloration while smoking?	Yes, after conventional cigarettes	714	54.9%
	Yes, after e-cigarettes	136	10.5%

Table 3a. Relationship of oral health effects of smoking on Gender and age of the study participant

Questionnaire items	Responses	Gender			Age			P
		M %	F %	p	18 %	18-25 %	25 %	
Change in gingival color after conventional or e-cigarettes smoking	Yes, after conventional cigarette	58.9	42.9	0.000	37.2	46.0	60.9	0.000
	Yes, after e-cigarettes	6.4	8.6		11.2	8.1	5.0	
	No, I did not notice anything	34.7	48.5		51.7	45.9	34.1	
Disturbed feeling with tongue after been smoking	Yes, after conventional cigarette	40.3	36.8	0.232	30.2	38.8	42.1	0.040*
	Yes, after e-cigarettes	10.9	14.0		15.7	13.2	10.3	
	No, I did not notice anything	48.8	49.2		54.1	48.0	47.7	
Have you noticed increase in calculus or plaque accumulation after smoking?	Yes, after conventional cigarette	54.5	41.4	0.000	35.1	45.0	55.0	0.000
	Yes, after e-cigarettes	8.2	14.5		18.6	12.8	7.0	
	No, I did not notice anything	37.4	44.1		46.3	42.2	38.1	
What did you notice after long time of smoking?	Bad breath smell	25.7	23.0	.133	23.6	23.3	25.5	.200
	Teeth fall or mobility	2.7	4.0		2.9	3.7	4.0	

Questionnaire items	Responses	Gender			Age			P
		M	F	p	18	18-25	25	
		%	%		%	%	%	
	Brown/black pigmentation	13.4	11.0		6.6	12.6	13.9	
	All the above	26.7	24.3		28.5	24.2	24.5	
	None of the above	31.4	37.6		38.4	36.2	32.1	

Table 3b. Relationship of oral health effects of smoking on Gender and age of the study participant

Questionnaire items	Responses	Gender			Age			P
		M	F	p	18	18-25	25	
		%	%		%	%	%	
Have you noticed any change in your mouth after smoking?	Yes, after conventional cigarettes	31.4	37.6	.054	38.4	36.2	32.1	.009*
	Yes, after e-cigarettes	18.6	21.7		22.3	22.0	16.2	
	No, I did not notice anything	4.0	6.6		7.0	6.6	2.6	
Have you noticed any tooth discoloration while smoking?	Yes, after conventional cigarette	77.5	71.8	0.000	70.7	71.4	81.1	0.000
	Yes, after e-cigarettes	63.9	50.9		43.4	54.4	65.6	
	No, I did not notice anything	5.9	12.5		17.4	10.7	4.3	
Have you noticed any cracked tooth after smoking?	Yes, after conventional cigarette	30.2	36.6	.070	39.3	34.9	30.1	.012*
	Yes, after e-cigarettes	17.8	15.2		13.2	15.7	18.9	
	No, I did not notice anything	7.4	5.0		7.0	4.4	8.3	
Did you notice bad mouth breath after using conventional cigar or e-cigar/	Yes, after conventional cigarette	61.6	49.6	0.000	43.4	52.6	62.9	0.000
	Yes, after e-cigarettes	8.2	12.5		17.4	11.1	6.3	
	No, I did not notice anything	30.2	37.		39.3	36.2	30.8	

Table 4. Relationship of smoking on Gender and age of the study participant

Questionnaire items	Responses	Gender			Age			P
		M	F	p	18	18-25	25	
		%	%		%	%	%	
Type of cigarette	Conventional	51.5	48.2	.533	44.2	47.4	57.9	.005*
	e-cigarettes	28.2	30.7		36.0	30.6	23.5	
	Both	20.3	21.1		19.8	22.1	18.5	
Duration of cigarette smoked	Less than 1 hour	35.6	60.8	0.000	69.4	54.9	35.1	0.000
	1- hours	42.8	28.7		22.7	32.9	41.7	

Questionnaire items	Responses	Gender			Age			P
		M %	F %	p	18 %	18-25 %	25 %	
per day?	More than 5 hours	21.5	10.5		7.9	12.2	23.2	
Since how long smoking	Less than 6 months	12.9	39.3	.000	57.0	31.7	8.6	.000*
	6 months to 1 year	10.4	15.4		16.9	15.1	8.3	
	More than 1 year	76.7	45.3		26.0	53.2	83.1	
Transform from conventional cigarettes to E Cigarettes or vice versa.	Yes, from convention al To e-cigarette	35.6	26.9	0.000	43.4	52.6	62.9	0.178
	Yes, from e-cigarettes to conventional	4.7	6.5		17.4	11.1	6.3	
Doctor mentioned any lesion or discoloration in your mouth	No, I did not change the type of use	59.7	66.6		69.4	63.2	63.6	
	Yes, a lesion	7.7	9.6	.024**	10.7	10.4	4.0	.002*
	Yes, discoloration	25.5	18.4		15.3	19.8	26.8	
	Both	7.7	9.5		19.1	8.7	9.3	
	None	59.2	62.5		64.9	61.0	9.9	

In Table 4 it was observed that duration of cigarette smoked, years of smoking and any lesion or discoloration in the oral cavity was significantly associated both with the gender and the age of the study participants. (p<0.000). Type of cigarette was significantly associated with age of the study participants (p<0.005). Last but not the least, transformation from conventional cigarettes to E cigarettes or vice versa was significantly associated with gender of the study participants (p<0.002).

4. DISCUSSION

The present cross sectional study was conducted to explore the Oral health effects among people using smoking kind of conventional cigarette and electronic cigarette. Nicotine consumption; in its various forms is highly increasing in Saudi Arabia. After careful observation and the available literature shows that people of Saudi Arabia are moving towards using E-cigarettes, and it is becoming acceptable to the community also, because they believe that it is the less harmful than other forms of tobacco usage in the country. Moreover with the grown-ups or mature people of the country, double utilization, i.e. E-cigarettes and ordinary cigarettes usage is high among youths and expanding quickly. Of course, as a product that includes nicotine it will have its

side effects that people may not know which includes an increase in respiratory flow resistance and respiratory impedance [12,13].

In spite of the fact that e-cigarettes convey numerous less poisons and at much lower levels than traditional cigarettes, they contain nicotine, an exceptionally addictive substance in portions intended to impersonate cigarettes. Other chemicals present in the e cigarette are highly carcinogenic and deleterious to the health and

specifically the oral health. Even though it is difficult to get E-cigarettes in a convenient store, but still it is widely available and spread among the youths; to be more specific, the present research indicated that 36% of E-cigarettes consumers were younger than 18 years. Dental professionals are at the advantageous position to do the counseling of such individuals hence; dental professionals should have a full understanding on the uses of nicotine and various available methods for cessation. Also, anticipating in anti-smoking campaigns and programs is important to increase awareness through oral health education at the time of dental treatments and also by reaching the community [9].

In a similar study that was conducted by King Saud University it showed that E-cigarettes became a popular habit among young adult's students. The prevalence of e cigarette users was 27.7%; which is almost twice as much as conventional cigarette smoker which is similar to the results of the present study where there is 36% of E-cigarette users were under the age of 18 years. Moreover, the smoking among cohort is 14.1%, majority of conventional cigarette users from the studies done at Kind Saud's university showed that (20.6% and 10.6% for male and female, respectively). While our questionnaire showed that the percentages of female participants were 68.9% and the male participant's percentage was 31.1% [14].

A review of previous study in Saudi Arabia in the year 2017 showed that majority of the participants were E-cigarettes users 62.2% compared with 29.90% which is in contrast to the present study. The expected reason behind the high percentage for electronic use in that year was due the popularity Since it was made recently available in Saudi Arabia and smoker's enthusiasm in trying a new product, as well as users have used it as a tool to quit smoking [15].

In addition, between the two different types of consumers, we have noticed high percentage of participants who did not even notice any change in their oral health after long period of tobacco smoking. Nowadays, E-Cigarettes are often marketed as a safer alternative to conventional, but the results of the present study proved that whatever is the form, tobacco in the cigarettes is usually associated with worse effect on oral health, with higher percentage detected in conventional users.

Furthermore, in a study that was performed by authors among dental professionals for their habit of Smoking. The results have shown that the majority of smoking dental professionals were male while our study have shown that the majority of the smokers were females. Also, their study was in line with ours in the manner of the need that dental professionals should be equipped with knowledge about tobacco use and various available methods for cessation and that dentists' involvement in antismoking campaigns and field-based programs is important to increase the awareness among dental professionals, healthcare providers and the general public [16].

The strength of the study includes the exploration of the most important issue e cigarettes among people and its social acceptance. This may be attributed to the fact that less awareness about the ill effects of the e cigarettes Since the present study was done in few regions of the country and there was no direct examination of the participants, because of the COVID scenario, the results are not fully generalizable. Moreover the participant's attempt of faking good or bad might also add errors to the results. Further age could be a confounding variable which could dilute the results even though the variation was not at extreme ends. But still the present study gives a good platform to study the usage of e cigarettes and their ill effects on the oral cavity and aware us for an opportunity for the oral health education.

CONCLUSION

From the present study it can be concluded that, the usage of e cigarettes are on the rise Middle East countries and Saudi Arabia is no exception. The usage of e cigarettes was seen more among

females than males. The oral health effects and especially the change in color, dryness of the oral cavity and discoloration of the teeth were seen more with the conventional cigarettes users than the e cigarettes users. Cracked tooth and the bad smell were also seen among cigarettes smokers. The effects were little less with e cigarettes smokers but it is not the safe option.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Amato L, Cruciani F, Solimini R, Barca A,

- Pacifici R, Davoli M. Effects of electronic cigarettes on health: a systematic review of the available evidence. *Recent iProg Med.* 2020;111(1):30-43.
2. Ralho A, Coelho A, Ribeiro M, Paula A, Amaro I, Sousa J. Effects of electronic cigarettes on oral cavity: A systematic review. *Journal of Evidence Based Dental Practice*, 2019;19(4):101318.
 3. Bardellini E, Amadori F, Conti G, Majorana. Oral mucosal lesions in electronic cigarettes consumers versus former smokers, *Acta Odontologica Scandinavica.* 2018;(76)3:226-28.
 4. Andrikopoulos GI, Farsalinos K, Poulas K. Electronic Nicotine Delivery Systems (ENDS) and their Relevance in oral health, *Toxics.* 2019;67(4):61-64
 5. Goyal A, Sharma A, Agarwal S, Bhansali S, Chhabra KG, Chhabra C. Determinants of tobacco use among children of a rural village in India: An exploratory qualitative study. *APJCP* 2020;(21)1:81-86
 6. Chhabra C, Chhabra KG, Bishnoi S, Singh J, Sahu V, Lohra A et al. Exploring the predictors of quitting tobacco usage among patients attending a private dental institution—a survey from Jodhpur, India. *Oral Health Dent Manag.* 2014;13:815-20.
 7. Nimbalkar G, Dubey N, Mandwar S, Dharmapuria S, Reche A, Chhabra KG. Dental practice guidelines in the precariousness of COVID-19: a review. *Int. J. Curr. Res. Rev.* 2020;12: 82-87
 8. Ghazali AF, Ismail AF, Daud A. Caries Experience among Cigarette and E-Cigarette Users: A 6-Month Prospective Study. *Journal of Pharmaceutical Sciences and Research.* 2019;11(7):2566-69.
 9. Stewart CJ, Auchtung TA, Ajami, NJ, Velasquez K., Smith DP, De La Garza R, et al. Effects of tobacco smoke and electronic cigarette vapor exposure on the oral and gut microbiota in humans: A pilot study. *Peer J*, 2018;6:e4693
 10. Cho JH. The association between electronic-cigarette use and self-reported oral symptoms including cracked or broken teeth and tongue and/or inside-cheek pain among adolescents: A cross-sectional study. *PLoS One.* 2017(11);12(7):e0180506.
 11. Harrison R, Hicklin JD. Electronic cigarette explosions involving the oral cavity. *The Journal of the American Dental Association*, 2016;147(11):891-896.
 12. Millar, WJ, Locker D. Smoking and oral health status. *Journal of the Canadian dental association*, *J Can Dent Assoc.* 2007;73(2):155-59.
 13. Qanash S, Alemam S, Mahdi E, Softah J, Touman, AA, Alsulami A. Electronic cigarettes among health science students in Saudi Arabia. *Ann Thorac Med.* 2019;14(1):56-62.
 14. BinShabaib M, ALHarthi SS, Akram Z, Khan J, Georgios IR, Romanos E. Clinical periodontal status and gingival crevicular fluid cytokine profile among cigarette- smokers, electronic-cigarette users and never-smokers, *Archives of Oral Biology, Arch Oral Biol.* 2019;102:212-17.
 15. Huilgol P, Bhatt SP, Biligowda N, Wright NC, Wells JM. Association of e-cigarette use with oral health: a population-based cross-sectional questionnaire. *J Public Health (Oxf).* 2019;(1);41(2):354-61.
 16. Holliday R, Chaffee BW, Jakubovics NS, Kist R, Preshaw PM. Electronic cigarettes and oral health. *J Dent Res.* 2021;100(9):906-13.

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