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ABSTRACT

THE EFFECT OF VAPE AND HOOKAH SMOKING ON ORAL HEALTH STATUS AMONG MALE DENTAL STUDENTS AT AL-HIKMA UNIVERSITY COLLEGE

Background: Electronic cigarettes (especially vapes) and hookahs are increasingly widely used**.** The oral environment that is exposed to vape and hookah aerosol increases the risk of mouth, leading to tooth decay, gum disease, and bad oral breath. Hookah is known to cause several types of diseases, such as cardiovascular events, chronic pulmonary diseases, gastrointestinal disorders, respiratory diseases, cancer, and effects on the oral health of smokers.

Objectives: The study aimed to estimate the risk and impact of hookah and vape smoking on male oral health, especially periodontal health and dental caries among students of the dentistry department at Al-Hikmah University College.

Materials and Methods: 25 male dental students who are vape and hookah users were selected randomly, with an age range of 18- 25. The students' dental caries were recorded according to the decay-missing-filled (DMF) index. Periodontal health status was assessed by measuring the probing pocket depth.

Results: The results showed that Decayed-Missing-Filled Surfaces and Decayed-Missing-Filled Teeth indices are higher among the vape + hookah group, followed by hookah, while the lowest is in the Vape group. However, these results didn't reach a statistically significant difference between the three groups. Normal pocket depth was recorded among the sample.

Conclusion: It is mandatory to recommend education of the population on the risks of vaping and hookah smoking to avoid smoking in general, since they have adverse effects on the oral cavity and subsequently on general health, as they contain a number of potentially toxic substances.

Keywords: Dental caries; periodontal health; Electronic cigarettes; vape; hookah.

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INTRODUCTION

Smoking often plays a considerable role in the severity and prevalence of oral health, which is also associated with various systemic health issues. The oral products that last for up to several hours per day that contact the oral mucosa, especially all forms of nicotine and tobacco, affect oral health [1]. Smokers have a greater accumulation of plaque and tartar, which are the main factors in the progression and inception of gum disease. Smoking not only leads to oral bleeding and inflammation of the gums but can also result in the deterioration of the bone that supports the teeth [2, 3]. Currently, smokers using heated electronic nicotine delivery systems and tobacco products are the prominent smoking individuals seen in the dental practice. The laboratory assays confirmed the presence of carcinogenic compounds and inflammatory biomarkers in these types of products, which seem to have a significant influence on peri-implant parameters and periodontal health [4].

Nicotine products are a crucial risk factor for public health problems in the world. In addition to cardiovascular and systemic, respiratory disease, Vaping is posing emerging detrimental effects on oral health. Vapes are linked with elevated periodontal disease and gingivitis, as well as decreased antioxidant effects of saliva. Flavored liquids of vapes may also be a caries risk factor [4, 5]. Recent studies indicate that the use of vapes is linked with a high risk of periodontitis and tooth caries [2, 6]. A modern meta-analysis study involving 45,000 participants showed that tooth loss was linked with Smoking (odds ratio [OR] = 3.0), periodontal disease (OR = 2.5), and cancer in the oral cavity (OR = 3.8). In contrast, vaping indicates a moderate, though considerable, relation with gum recession (OR = 1.5) and periodontal disease (OR = 1.7), with some evidence still making an appearance on prolonged effects on oral health [6]. These NVPs (nicotine vaping products) increase concerns that the marketing of these new products might reverse and/or slow down the steady decline in cigarette consumption that has taken place since the early 1980s, because of promoting dual use. In particular, some public health officials have raised concerns that the marketing of NVPs may lead some non-smoking teens and young adults to take up smoking [7,8]. Several cross-sectional studies exploring the factors associated with vaping and socio-demographics have shown that those who have tried nicotine vaping products are more likely to be younger, current smokers, believe that vaping is less harmful than smoking cigarettes, and are motivated to quit smoking [9, 10]**.** The rising popularity of electronic cigarettes as a cessation aid has led many to perceive them as a healthier, safer, and more socially acceptable alternative to traditional cigarette smoking. This perception is largely rooted in assertions that e-cigarettes do not contain the harmful chemicals found in tobacco smoke [11]. Nicotine replacement therapy is considered an intermediate step between smoking and becoming nicotine-free [12, 13]. Furthermore, similar to cigarettes, tools like Hookah can cause various diseases such as chronic pulmonary, respiratory disease, gastrointestinal disorders, cancer, and cardiovascular events. In contrast, the persistent use of hookah could lead to different types of symptoms, including the hard palate, lips, soft tissues, tongue, and nicotine dependence, which E-cigarette users reported. Most commonly, smokers reported pain, black tongue, bad taste, bad breath, burning, oral mucosal lesions, dryness, burns, and irritation [14]. Hookah and cigarettes are considered to be the most common factors for the appearance of oral cavity diseases like candidiasis, glossopyrosis, stomatopyrosis, changes on the lips, and tongue [15]. The objective of the study was to estimate the effect of hookah and vape smoking on male oral health, especially periodontal health and dental caries among dental students at Al-Hikmah University College.

MATERIALS AND METHODS

This study was conducted among male dental students aged 18-21 who are vape and hookah smokers at AL-Hikmah University College in Baghdad City from February 2024 to the end of March 2024. The sample size was 30 male dental students who were vape and hookah users and were selected randomly. The students who were on medication, alcohol, or systemic disease were excluded from our study. Calibrated periodontal probes were utilized to assess the pocket depth at four surfaces of all evaluated teeth, excluding the third molars. The distance from the most apical part to the gingival margin was diagnosed by inserting the probe into the gingival crevice as close as possible to the long axis of the tooth. The sites for measurements were mesiobuccal, mid-palatal/ lingual, mid-buccal, and distobuccal lines. The probe was allowed to fall by its weight without pressure being used [16]. Table 1 divides the probing pocket depth scores into three categories for ease of interpretation. Normal pocket depth was recorded with a score of 0 for healthy

students. The Score 1 reflects a slightly deep periodontal pocket, indicating early periodontal disease or inflammation, while the Score 2 suggests a considerably deeper periodontal pocket, linked with advanced periodontal disease [17].

Table 1 – probing pocket depth scores

Score 0	1-3 mm
Score 1	4-5 mm
Score 2	6 mm and greater

The diagnosis of the dental caries and decayed lesions of the students was recorded utilizing a dental explorer and mouth mirror, depending on the decay-missing-filled (DMF) index [8]. In this study, the Decayed-Missing-Filled Surfaces criteria were coded (D1-D4) and included the following categories:

Category 1: The probing proximal surface clinically appears as a brownish or white lesion without any obvious cavity; when the proximal surface is not in contact with a neighbouring tooth, the same standard for smooth surfaces is used. The occlusal surface shows hard fissures or dark pits when probing, and the lesion appears confined to enamel with only extrinsic discolouration, it is recorded as sound. In contrast, the smooth surface is a white-opaque or brownish-coloured lesion in enamel only, involving minor surface loss. It is stiff, glossy, and more frequently detached from the gingival margin.

Category 2: A proximal surface is a very dark enamel lesion caught by probing without any evidence of dentinal penetration. Occlusal surfaces are pits and fissures with distinct sticking when probing, indicative of continuing caries activity, but without any proof of dentinal penetration. In contrast, smooth surfaces are an enamel lesion (brown-dark colour or white-opaque), minor loss of the teeth surface without any doubtful dental problem, and a surface that has undergone softening, dulling, or rough.

Category 3: The carious lesions include only dentin, while pulpal penetration is not doubtful.

Category 4: A carious lesion with the possibility of definite pulpal penetration. The fraction (F) was recognized when one or more permanent restorations were present without any affected tooth area, either by primary or recurrent caries. In contrast, the fraction (M) of Decayed-Missing-Filled Surfaces index was diagnosed for teeth that had been extracted due to caries, and it was evaluated that there were four surfaces for anterior teeth and five surfaces for posterior teeth. The differentiation between extracted and unerupted teeth was made by estimating the status of the corresponding and contralateral tooth, the onset of the alveolar ridge in the area space in question, and the caries status of the other teeth.

The statistical analysis of our study was performed using the Statistical Package For The Social Sciences (SPSS), with significance levels set at $p<0.05$. Descriptive statistics, including mean and standard deviation, were used to summarize the data. The Kruskal-Wallis test was applied to categorize the severity of dental caries from D1-D4 by comparing medians, mentioning this non-parametric test. In contrast, other normally distributed variables, such as measures of dental caries experience expressed as mean ± SD, were analyzed utilizing the ANOVA test.

RESULTS

The sample of this study consists of 25 male dental students in the age range 18-25 years, distributed into two age groups: 18-21 years (19.76%), which is higher than 22-25 years (6.24%), as shown in Figure 1.

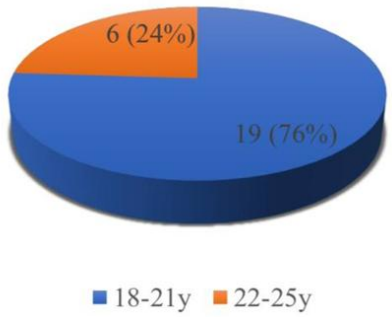

Figure 1 – Distribution of the sample according to age

The distribution of the Dental caries experience samples according to type of smoking shows that the percentage of students in the vape + hookah group is 10.40%, followed by the vape group (9.36%). In comparison, the lowest is the hookah group (6.24%). The percentage of dental caries occurrence is found to be 100%, as shown in Figure 2.

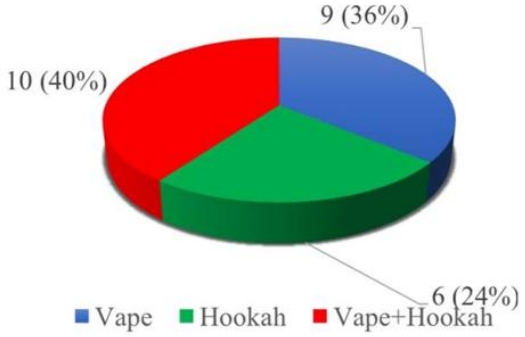

Figure 2 – Distribution of the sample according to the students' smoking group

Also, the results of dental caries among various smoking groups indicate that students who use vape + hookah show the highest mean DMFS (15.7) and DM (10.89), while use of hookah-only shows intermediate values (DMFS 12.5 and DM 8.93), and use of the vape-only has the lowest means (DMFS 11 and DM 8.44). The results showed that Decayed-Missing-Filled Surfaces and Decayed-Missing-Filled Teeth indices are higher in the vape + hookah group, followed by hookah, while the lowest is in the Vape group. Still, Kruskal-Wallis indicates that all these results didn't reach a statistically significant difference between the three groups ($p>0.05$) as shown in Table 2.

Table 2 – Dental caries experience (mean + SD) in relation to the smoking group of students

Variables	Smoking group	Min	Max	Mean	±SD	Median	Mean rank	Kruskal–Wallis	P-value
Decayed-Missing-Filled Surfaces	Vape	6	19	11.667	4.583	13	10.94	1.499	0.473
	Hookah	10	16	12.5	2.51	12.5	12.67		
	Vape +Hookah	6	31	15.7	7.558	15	15.05		
Decayed-Missing-Filled Teeth	Vape	5	14	8.444	2.789	8	10.89	1.214	0.545
	Hookah	7	12	8.933	2.041	10	13.9		
	Vape + Hookah	3	17	10	4.295	8.5	14.67		

Hence, this study represented the categories of dental lesions (D1-D4) among the different groups of smokers, indicating differences in the severity of carious lesions, although these variations were not significant ($p>0.05$). The mean D1 score was higher in the hookah group (4.333 ± 2.875) compared to the vape + hookah (2.3 ± 2.452) and vape groups (2.667 ± 4.416). For D2 lesions, the vape + hookah group had the highest mean (5.9 ± 1.37), followed by the vape (5.667 ± 5.099) and hookah groups (4.167 ± 1.941). In contrast, the progressing dental lesions such as D3 and D4 in the vape + hookah group again exhibited higher means (D3: 0.5 ± 0.707; D4: 0.9 ± 1.287), whereas the only vape group exhibited the lowest progressing dental lesions (D3: 0; D4: 0.222) as shown in Table 3.

Table 3 – Dental caries severity (mean + SD) represented by categories of DS (D1-D4) in relation to the students' smoking group

Dentinal lesions categories	Smoking group	N	Mean	±SD	Min	Max	Median	Mean-rank	Kruskal-Wallis	P-value
D1	V	9 (36%)	2.667	4.416	0	14	1	11.17	2.914	0.233
	H	6 (24%)	4.333	2.875	2	9	3.5	17.33		
	V+H	10 (40%)	2.3	2.452	0	7	2	12.05		
D2	V	9 (36%)	5.667	5.099	0	13	4	12.83	2.33	0.312
	H	6 (24%)	4.167	1.941	3	8	3.5	9.5		
	V+H	10 (40%)	5.9	1.37	4	8	6	15.25		
D3	V	9 (36%)	0	0	0	0	0	11	4.818	0.052
	H	6 (24%)	0	0	0	0	0	0		
	V+H	10 (40%)	0.5	0.707	0	2	0	16		
D4	V	9 (36%)	0.222	0.667	0	2	0	10.44	2.606	0.272
	H	6 (24%)	1	1.673	0	4	0	13.75		
	V+H	10 (40%)	0.9	1.287	0	4	0.5	14.85		

DISCUSSION

The study group consists of 25 male dental students. The age range in the first group is 18-21 years, which represents 19 (76%), which is higher than the second group, who are aged 22-25 years, which represents 6 (24%). This result is consistent with the study done by Pérez A. et al., 2021, who showed that the most significant increase in hookah use occurred in the age range of 18 to 19 years old [19]. In addition, Ghazali AF et al. (2019 found that the mean age of e-cigarette groups was 22.92 years [20]. These outcomes are due to the strong influence of younger students on smoking marketing that targets youth, and the fallacy that hookah and vaping are safer alternatives to cigarettes. Also, younger individuals may have a lower understanding of risks because of behaviours, such as students searching for social acceptance and out of curiosity, contributing to increasing usage rates in this age group.

Meanwhile, the distribution of the sample according to the type of smoking demonstrates the percentage of students who smoke vape, hookah, and vape plus hookah. Although there is a tendency for higher caries indices among students who use vape and hookah together, the evidence does not conclusively demonstrate a significant association between smoking type and dental caries experience in this sample. However, it is shown that the lowest percentage is the hookah group, and the mean of vape smokers is higher than that of the hookah group. Li X et al., 2018 displayed that the percentage of vape smoking is higher than that of hookah smoking [21].

Our results indicate higher dental caries indices among students who use both vaping and hookah, suggesting a possible cumulative harmful effect, although not statistically significant. These findings may not show a significant impact in short-term use, but the risks may increase the oral health risks in the long term. Future research with longer follow-up periods and larger samples is essential to better understand the potential cumulative effect of hookah and vaping smoking on oral health.

The primary reason for this widespread e-cigarette use is that most e-cigarette users assume that e-cigarettes are safer than combustible cigarettes [22]. According to the 2019 Saudi National Survey, the national prevalence of using e-cigarettes was 2.2% among adults [23]. Furthermore, young smokers who want to decrease or prevent combustible cigarettes highly switch to e-cigarettes. Also, e-cigarette smoking has increased in popularity among young people who never smoked classical cigarettes due to the fallacy about the prevention of e-cigarettes [23-26]. However, the statistical findings of dental caries experience show that the P value is greater than 0.05, which means the results are statistically not significant, and this is inconsistent with Ghazali AF et al., 2019 [27], who showed that there was no significant difference regarding Decayed- Missing-Filled Teeth Index with 6 months follow up cohort study. However, the results of the current study are inconsistent with the study of Irusa KF et al., 2022, which shows an association between the use of vapes and the high caries risk level of the patients [28]. This can be interpreted as the duration of exposure to smoking not being identified and not being taken into consideration as a variable in this study. Thus, further study should include the duration of exposure to the risk factors of vaping and hookah smoking. In addition, the restriction of dropout of studied cases will be more likely to provide significant outcomes. Regarding probing pocket depth, the results showed that the probing pocket depth score is (0), which means normal pocket depth. The results are consistent with many studies; one modern study indicated that e-cigarette users may have a periodontal status comparable to non-smokers because the use of e-cigarettes may not be risky to periodontal health as cigarette smoking [29]. Another study has indicated a progressive enhancement in the periodontal indices for cigarette smokers who transitioned to e-cigarette smoking for about 4 months before the study [30]. This might be attributed to the number of inflammatory mediators as presented by the study of Ye et al., 2020, which demonstrated that the levels of salivary PGE2 (Prostaglandin E2) and GCF (gingival crevicular fluid) inflammatory mediators were significantly higher in CS (cigarette smokers) compared with NS (non-smoker), EC (electronic cigarettes), and DS (dual electronic cigarettes and cigarette smokers). Chronic e-cigarette smoking is associated with an adverse effect on periodontal health, however, to a lesser extent than the effects of traditional cigarette smoking [31].

CONCLUSION

The study highlights the prevalence of smoking behaviours among young male dental students, with e-cigarette use being more common than hookah smoking, driven by the misconception of e-cigarettes being safer alternatives. No statistically significant association was found between smoking and dental caries, possibly due to the short exposure duration. Additionally, normal probing pocket depth among participants indicates no immediate adverse periodontal effects, consistent with findings that e-cigarettes are less harmful to periodontal health than traditional cigarettes. However, chronic use still poses risks. Future studies should consider exposure duration and dropout rates to provide more comprehensive insights into the long-term effects of vaping and hookah smoking on oral health.

AUTHOR CONTRIBUTIONS

N.A.O. and R.N. conceived and designed the work. T.M.S., A.Y.S., and R.N. performed experiments, data processing, and collection. T.M.S. and N.A.O. analysed and interpreted the results. A.Y.S. and N.A.O. prepared the manuscript draft and did the statistical analysis. S.E.A. and L.A.G. edited the article. I.K.F. provided the supervision and approved the publication of the final version.

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CONFLICT OF INTEREST

The authors stated that they have no conflicts of interest related to the authorship and publication of this article.

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ARTIFICIAL INTELLIGENCE DISCLOSURE

The authors confirm that no artificial intelligence (AI) technologies were used during manuscript writing or editing.

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