



Salivary Constituent in Relation to Dental Caries among Coffee-Shop Workers in Najaf City/Iraq

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ABSTRACT

Background: Waterpipe can be defined as an instrument which consumes tobacco and other substances such as honey, molasses and flavoring agents in which the smoke is filtered and cooled by passing through water. The water pipe has many toxins such as chromium, volatile aldehyde, poly hydrocarbon, lead, formaldehyde, carbon mono oxide, nicotine, arsenic and nitric acid. **Aims:** This study was carried out to investigate the association of some salivary constituents in relation to dental caries among water-pipe smokers. **Materials and methods:** Total 40 coffee-shop workers were included in this study, half of them were water-pipe smokers and the other were not smokers (passive smokers), their age was 22-23 years and 20 control without a history of water-pipe nor cigarette smoking their ages were matched with the study group were included in this study. Salivary samples were chemically analyzed for the detection of alpha-amylase, immunoglobulin A (IgA) and immunoglobulin G (IgG). **Results:** The total mean value of dental caries were recorded to be the highest among positive water-pipe smokers group followed by passive water-pipe smokers then control with a statistically highly significant difference ($p < 0.001$). Regarding immunoglobulin G (IgG), the control group showed the highest value while the positive water-pipe smokers group exhibited the lower one with highly significant differences between groups $p = 0.000$. Regarding salivary α -amylase, there is no significant difference between groups ($p > 0.05$). The same result was seen for salivary immunoglobulin A (IgA). **Conclusions:** This study concluded that there is an obvious difference in the prevalence of dental caries among water-pipe smokers and control. As compared to control there is a decrease of IgG in both positive and passive water-pipe smokers.

Keywords: Water-pipe, Dental caries, α -amylase, IgA, IgG

INTRODUCTION

Water pipe can be defined as an instrument which consumes tobacco and other substances such as honey, molasses and flavoring agents in which the smoke is filtered and cooled by passing through water [1]. Water pipe sharing cigarette smoking of many toxins such as chromium, volatile aldehyde, poly hydrocarbon, lead, formaldehyde, carbon mono oxide, nicotine, nitrogen, arsenic and nitric acid, but the amount of nicotine and carbon monoxide has been inhaled by water pipe is significantly more than cigarette smoking [2]. Despite one-fifth of tobacco used in water pipe smoking is sugar; it is not used alone but mixed with sugar additive as a flavoring agent such as honey and caramel, in addition to flavoring action sugar act as a surfactant and neutralizer to harsh test and decrease tobacco impaction at the throat [3].

Iraqi study revealed to the correlation between waterpipe smoking and concentration of salivary α -amylase and they found that lower the level of salivary α -amylase among water pipe smokers may be due to the alteration of HS group of amylase molecule by the effect of an aldehyde of water pipe smoker [4]. While other study found that there is no significant difference regarding salivary α -amylase among tobacco smokers and non-smokers [5]. A study compared the concentration of salivary IgA among tobacco smoker and non-smoker and they didn't find a significant difference between them [6]. The similar results approached that there is no significant and lower level of both immunoglobulin A (IgA) and immunoglobulin G (IgG) noticed among water-pipe smoker than non-smoker [7].

The aim of this study was to investigate the caries experience in relating to salivary constituents among positive and passive water-pipe smoking groups in comparison to control group.

PATIENTS AND METHODS

This study was carried out during the period from mid-November 2017 until the mid of March 2018. An approval was obtained from Ash-Sheikh Al-Tousi University College to examine the students (control group) without obligation, to ensure cooperation from college authority. And approval was also obtained from College of Dentistry, Kufa University for laboratory biochemical analysis.

The study group included 40 coffee shops workers for at least 5 years, half of them were water pipe smoker (positive smokers) and the other was non-smoker (negative smokers) both of them were between 22 and 23 years old and compared with control group consisted of 20 persons at the same age, gender, and geographic area of residency without history of positive or negative smoking.

Clinical examination was performed by using plane mouth mirror and dental probe. Caries experience was recorded according to the criteria suggested by Muhlemann in 1976, these criteria allow for recording decayed lesion by severity.

Collection of the stimulated salivary sample was done by using 0.5 gram of Arabic chewing gum, about one milliliter of saliva had been collected after centrifuging and stored in a deep freezer at (-20°C) in order to be analyzed for some chemical constituents by Enzyme-Linked Immunosorbent Assay (ELISA) for α -amylase, IgA, IgG.

Statistical Analysis

Data were collected and analyzed using SPSS version 21. The Kruskal-Wallis test was used to assess the statistical significance of the difference between 3 groups. Differences between 2 groups were examined by Mann-Whitney test, $p < 0.05$ was considered as statistically significant.

RESULTS

Table 1 and Figure 1 illustrates the caries experience (DMFs index and its components) among different categories of water-pipe smoking and control group.

Results showed that the mean rank values of DMFs and Ds were higher among positive water-pipe category than both negative water-pipe smokers and control categories, these differences were statistically highly significant ($p < 0.001$). Mann-Whitney test clarified that the mean rank was higher among positive water-pipe smokers than control group and statistically highly significant ($Z = 5.922$, $p = 0.000$), the similar result was found among passive water-pipe smokers in comparison with control group ($Z = 3.975$, $p = 0.000$), while there are no significant differences between positive and passive smokers ($Z = 1.947$, $p = 0.155$). Mean rank values of Ms component significantly differs among the 3 groups of scale with lower mean rank among the control group and higher for positive water-pipe smoker group ($p < 0.05$). The result of Mann-Whitney test showed that the missing experience (Ms) represented by mean rank was significantly higher among positive and passive water-pipe smokers than the control group ($Z = 2.342$, 2.329 ; $p = 0.019$, 0.020 respectively). However, there wasn't a significant difference between positive and passive smokers ($Z = 0.013$, $p = 0.990$).

For Fs component, the control group has a mean rank value higher than other 2 groups followed by positive water-pipe smokers group then the passive water-pipe smoker group value. These differences were significant ($p > 0.05$). Mann-Whitney test was used to compare between each 2 categories of water-pipe smoking, the result showed that the filling experience (Fs) represented by mean rank was significantly higher among control category than passive water-pipe smokers category ($Z = -2.442$, $p = 0.044$), but there weren't significant differences between positive smokers and control nor between positive smokers and passive smokers ($Z = -1.934$, 0.509 ; $p = 0.159$, 1.000 respectively). While concerning DMFs the result revealed that the mean rank of dental caries experience was highly significantly lower among control category than both positive water-pipe smoker category ($Z = 5.023$, $p = 0.000$) and passive water-pipe smoker categories ($Z = 3.722$, $p = 0.001$), on the other hand, the mean rank of DMFs among positive water-pipe smoker category was non-significantly higher than passive water-pipe smoker category ($Z = 1.301$, $p = 0.580$).

Table 1 Dental caries experience (median, mean rank) among water-pipe smoking and control group with statistical differences

Variables	Water-pipe smoking categories						Control			Statistical differences	
	Positive smokers			Passive Smokers			No	Median	Mean rank	Chi-value	p-values
	No	Median	Mean rank	No	Median	Mean rank					
Ds	20	13.00	44.95	20	9.00	34.23	20	3.00	12.33	36.443	0.000**
Ms		0.00	33.53		0.00	33.48		0.00	24.5	7.271	0.026*
Fs		0.00	28.38		0.00	26.1		1.00	37.03	6.641	0.036**
DMFs		19.00	42.13		13.50	34.95		4.50	14.43	27.18	0.000**

*Significant $p \leq 0.05$; **Highly significant $p \leq 0.001$

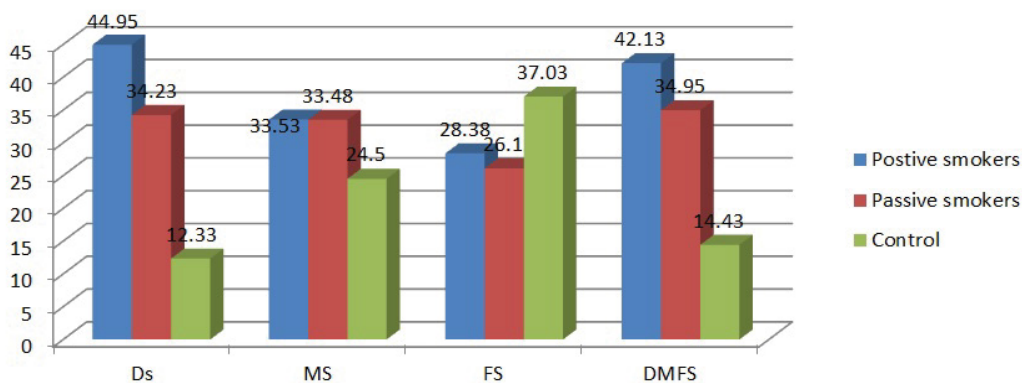


Figure 1 Mean rank of caries experience among water-pipe smokers and control group

Table 2 demonstrates the median and mean rank values of caries experience according to grades of lesion severity (D1-4). The mean rank of grades D1 and D2 of lesion severity were lower among control group with no significant difference ($p < 0.05$), while concerning grades D3 and D4 the control group was highly significantly lower than both positive and passive water-pipe smokers categories ($p \leq 0.001$). Mann-Whitney test clarified that the mean rank of grade D3 of lesion severity was highly significant lower among control category than both positive and passive water pipe smoker category ($Z=4.177, 4.122$ respectively; $p=0.000$ for both). The similar results were obtained among the mean rank of grade D4 of lesion severity ($Z=4.648, 3.820$ respectively; $p=0.000$ for both).

Table 2 Caries experience represented by grades of lesion severity (D1-D4) (Median, Mean Rank) among categories of water-pipe smoking and control group with statistical difference

Variables	Water-pipe smoking categories						Control			Statistical differences	
	Positive smokers			Passive Smokers			No	Median	Mean rank	Chi-value	p-values
	No	Median	Mean rank	No	Median	Mean rank					
D1	20	0.00	29.78	20	0.00	29.78	20	0.00	31.95	0.400	0.819
D2		1.00	34.08		0.00	25.18		0.50	30.79	3.191	0.203
D3		4.00	38.20		4.50	37.90		0.00	15.40	22.964	0.000**
D4		7.00	40.20		4.00	35.80		0.00	15.50	24.587	0.000**

**Highly significant $p \leq 0.001$

The salivary constituents among positive water-pipe smokers, passive water-pipe smokers, and control groups are shown in Table 3 and Figure 2. Mean rank values of α -amylase were higher among the control group, followed by positive water-pipe smoking category and least values for the passive water-pipe smoking category. However, all these differences were statistically not significant ($p > 0.05$). For IgA, mean rank was non-significantly higher among control category ($p > 0.05$), followed by passive smoking category and at least among positive smoking category.

On the other hand, the results showed that the mean rank of IgG was highly significantly ($p \leq 0.001$) lower among the positive water-pipe smoking category followed by passive water-pipe smoking category and the highest value was

among the control category. Mann-Whitney test showed the mean rank of IgG was highly significantly lower among positive water-pipe smoking category than control category ($Z=-4.255, p=0.000$), and significantly lower mean rank for passive water-pipe smoking than control categories ($Z=-2.915, p=0.011$).

Table 3 Salivary constituents (median, mean rank) among categories of water-pipe smoking and control group with statistical differences

Variables	Water-pipe smoking categories						Control			Statistical differences	
	Positive smokers			Passive Smokers			No	Median	Mean rank	Chi-value	p-values
	No	Median	Mean rank	No	Median	Mean rank					
α -amylase ($\mu\text{g}/\text{dl}$)	20	6.61	27.75	20	6.49	26.25	20	7.4	37.5	4.893	0.087
IgA (mg/dl)		24.85	27.83		26.81	31.75		27.75	31.93	0.705	0.703
IgG (mg/dl)		26.132	20.2		34.413	27.6		52.922	43.7	18.934	0.000**

*Significant $p \leq 0.05$; **Highly significant $p \leq 0.001$

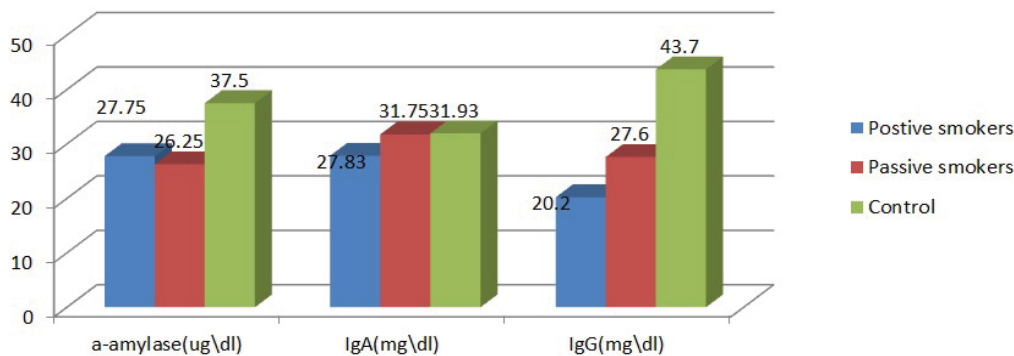


Figure 2 Mean rank of some salivary constituents among water-pipe smokers and control group

Salivary Chemical Constituents and Oral Health

The correlation coefficient between salivary α -amylase, IgA, and IgG and caries experience among the categories of water-pipe smoking are shown in Table 4. The caries experience representing by DMFs in addition to caries severity represented by grades of lesion severity (D1, D2, and Fs) were weak and negative correlated with salivary α -amylase among positive water-pipe smoking category, but grades (D3, D4, Ds, Ms, and DMFs) of lesion were weak and positive however all these correlations were not significant ($p>0.05$); while among passive water-pipe smoking category there were weak positive correlation with α -amylase with D1, D2, Ms, and Fs, for D3, D4 and Ds were weak and positive, all the correlations were not significant with salivary α -amylase ($p>0.05$). Concerning control category, there was a weak positive correlation for D3, D4, and Ds and with salivary α -amylase, the opposite result was noticed concerning D1, D2, Fs and DMFs were weak negative, however, these correlations were not significant ($p>0.05$).

Table 4 Correlation coefficient of caries experience (DMFs, Ds severity) with salivary constituents among categories of water-pipe smokers and control group

Variables	Water-pipe smoking categories												Control					
	Positive smokers						Passive Smokers						Control					
	α -amylase		IgG		IgA		α -amylase		IgG		IgA		α -amylase		IgG		IgA	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p
D1	-0.275	0.24	-0.224	0.342	0.038	0.874	0.204	0.389	-0.094	0.694	0.02	0.933	-0.044	0.852	0.307	0.189	-0.007	0.977
D2	-0.073	0.758	-0.282	0.228	-0.031	0.896	0.269	0.252	-0.481	0.032	0.021	0.929	-0.15	0.527	-0.323	0.165	-0.018	0.94
D3	0.232	0.326	0.18	0.449	0.372	0.106	-0.15	0.528	-0.464	0.039	-0.039	0.871	0.179	0.451	0.223	0.346	0.189	0.426
D4	0.007	0.977	-0.067	0.778	-0.405	0.076	-0.205	0.385	-0.151	0.526	0.067	0.78	0.044	0.855	0.134	0.572	0.312	0.18
Ds	0.203	0.39	-0.198	0.403	-0.413	0.07	-0.283	0.227	-0.384	0.094	0.082	0.73	0.073	0.76	0.22	0.352	0.073	0.76

Ms	0.125	0.601	-0.352	0.128	-0.148	0.534	0.176	0.459	0.506	0.023	-0.437	0.054	-	-	-	-	-	-
Fs	-0.213	0.367	0.153	0.52	0.103	0.665	0.127	0.593	-0.073	0.761	-0.133	0.576	-0.087	0.716	-0.141	0.554	-0.123	0.605
DMFs	0.17	0.473	-0.132	0.58	-0.236	0.316	-0.054	0.823	0.157	0.509	-0.153	0.518	-0.07	0.769	0.035	0.884	-0.039	0.872

The caries experience representing by DMFs in addition to caries severity represented by grades of lesion severity (D2, D4, Ds, Ms, and DMFs) were weak and negative correlated with salivary IgA among positive water-pipe smoking category, but grades (D1, D3, and Fs) of the lesion were weak and positive however all these correlations were not significant ($p>0.05$); while among passive water-pipe smoking category there were weak negative correlation of IgA with D3, Ms, Fs, and DMFs, on the other hand, grades D1, D2, D4, and Ds were weak and positive correlation, all the correlations were not significant with salivary IgA ($p>0.05$). Concerning control category, there was a weak negative correlation for D1, D2, Fs and DMFs with salivary IgA, the opposite result was noticed concerning D3, D4 and Ds were weak positive; however, these correlations were not significant ($p>0.05$).

The caries experience representing by DMFs in addition to caries severity represented by grades of lesion severity were weak and negative correlated with salivary IgG among positive water-pipe smoking category except for D3 and Fs were weak and positive; however all these correlations were not significant ($p>0.05$); while among passive water-pipe smoking category there were weak negative correlation of IgG with the caries experience representing by DMFs in addition to caries severity represented by grades of lesion severity except with Ms was strong positive, and with DMFs was weak positive, all the correlations were not significant with salivary IgG ($p>0.05$). Concerning the control category, there was a weak positive correlation of caries experience with salivary IgG except D2 and Fs were negatively correlated with caries experience; however, these correlations were not significant ($p>0.05$).

DISCUSSION

A number of studies related to oral health among water-pipe smokers have been done in the world but till now there is no Iraqi studies had been done to determine the effect of water-pipe on dental caries among positive and passive water-pipe smoking.

Results of this study showed that caries-experience (Ds) was significantly higher among study compared to the control group. The same observations were reported by previous studies concerning tobacco smoking in general [8-12], because authors found that water pipes and cigarettes expose their consumers to the same chemicals, such as carbon monoxide, tar, and nicotine [13,14]. Studies supposed that water-pipe smokers are more susceptible to develop dental caries than non-smoker because of higher scores of plaque and calculus indices [15,16].

Ms Fraction was higher among water-pipe smokers than control, this means that even if treatment is present, it is toward extraction rather than restoration. Furthermore, poor dental treatment, deficiency in dental knowledge among workers or could be due to costly dental treatment. Previous studies reached similar results and they supposed that the periodontal diseases among water-pipe smokers are the main cause of tooth loss [16,17]. Fs fraction was lower among water-pipe smokers than control and there is no previous study to compare with.

In the present study, different salivary constituents were determined in relation to caries experience. Salivary α -amylase is non-significantly lower among positive and passive water-pipe smokers than non-smokers. These results disagree with previous studies [18-20]; at the same time agree with studies performed to found the effect of nicotine of cigarette on the salivary α -amylase [21].

Another salivary constituent measured is IgA and IgG. There is no significant difference in the concentration of IgA among water-pipe smokers and non-smokers and these results agree with another study [7]. While the concentration of IgG was significantly lower among water-pipe smokers than non-smokers that agree with studies performed on tobacco of cigarette [22,23]. Doni, et al., studied the effect of tobacco on IgG production and he found that tobacco leads to impairment of body immune function, while Frial found that tobacco causes impairment of antigen mediating signaling of T-cell leading to immunosuppression but disagree with another study which found there is no significant difference of serum IgG between water-pipe smokers and non-smokers [7,24,25].

CONCLUSION

This study concluded that water-pipe smoking might contribute to increase susceptibility to dental caries, in addition to its role in decreasing IgG concentration that negatively affects the oral health.

DECLARATIONS**Conflict of Interest**

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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