Comparing the PH of saliva in smokers and non-smokers in the population of Tabriz

Hosein Eslami¹, Zahra Jamali¹, Solmaz Pourzare Mehrbani¹, Sahar Khadem Neghad.²*

¹ Assistant Professor, Department of Oral and Maxilla Facial Medicine, Tabriz University of Medical Sciences, Tabriz, Iran.
² Post graduate student, Department of Oral and Maxilla Facial Medicine, Tabriz University of Medical Sciences, Tabriz, Iran.

*Corresponding Author Email: skhdent@gmail.com

Abstract

Introduction:
Saliva plays a critical role in homeostasis of oral cavity, since creates the balance in oral cavity ecosystem. Respecting very important roles and various functions of saliva in oral cavity, this study aimed to compare the salivary pH in smoking and non-smoking healthy individuals in referees to oral medicine department of Tabriz dental school.

Materials and methods:
In this study 50 smoking patients and 100 healthy non-smoking individuals as a control group were selected from referees to oral medicine department of Tabriz dental school. After explanation of study aims to individuals and signing informed consent by them, 1 ml of saliva was taken by a sampler and sent to laboratory in a closed container. Metrohm pH meter was utilized for salivary pH measurement. Mann u-Whitney test was used in order to determine the significance of difference in pH between smoking patients and healthy individuals. P<0.05 was considered significant in this study.

Findings:
The mean of pH in smoking patients and healthy non-smoking individuals were 6.43 ± 1.88 and 7.66 ± 0.85, respectively. Mann u-Whitney test revealed that the difference between salivary pH between smoking patients and healthy individuals was significant (P<0.05). The difference in age mean between two groups was not significant (P>0.05).

Conclusions:
Based on the findings of this study, the salivary pH level in smoking patients was lower than healthy non-smoking individuals.

Keywords: saliva, pH, smoking, nonsmoking
Introduction
The use of cigarettes has become a prevalent habit in societies. Smoking has many negative effects on the oral cavity. Staining the teeth and restorations, decreasing the ability to smell and taste and the formation of oral lesions like smokers' palate, smokers' melanosis, hairy tongue, and possibly oral candidiasis, tooth decay, periodontal disease, failure of implant treatment, cancer and precancerous lesions of oral cavity are some of the effects that can be noted.

Saliva plays a very important role in the homeostasis of the oral cavity, because it creates a balance in the ecosystem of the oral cavity (3). With regard to this, changes in quantitative and / or qualitative in saliva secretion can lead to local unpleasant effects (caries, oral mucositis, candidiasis, infections of the oral cavity, masticatory disorders) or effects outside the mouth (dysphagia, halitosis, body weight loss).

Property of the saliva's buffering is one of the important functions based mainly on the bicarbonate density, which is related to the saliva's flow rate. Therefore, anything that causes a decrease in the flow of saliva can reduce the capacity of buffering and thus increases the risk of decaying. Frequent decreases in the pH values of the saliva to less than 5.5 will cause demineralization and caries in the tooth.

The amount of PH in the saliva increases with smoking at first, but the long-term continuation of smoking reduces this amount. Parvinen and colleagues reported in their study that the amount of pH in the saliva of smokers was lower than both sexes in non-smokers. Avsar and colleagues also acknowledged that the pH, flow rate and the capacity of buffering in inactive children who smoke (passive smoker) were lower than children in the control group. These children are also at high risk of caries.

According to the high prevalence of smoking in Iranian society and since no study about the relationship between smoking and salivary pH has been ever done in Iran, we aimed to compare the pH of saliva in smokers and non-smokers in the society of Iran.

Materials and Methods
In this study, 50 smokers and 100 non-smokers were randomly selected for the study. Inclusion criteria of the study included male smokers who were smoking more than 1 year and experienced at least one cigarette a day, went to dental faculty for dental procedures and also individuals with ages between 20-30 years. And exclusion criteria were systemic diseases and certain medications that affect the quantity and quality of saliva. The results of Pilot study were applied for determining the sample. Ten individuals were selected from each group and their saliva PH was measured. In this study, the mean of PH obtained for smokers and non-smokers were 6.12 ± 1.06 and 7.55 ±0.37, respectively. Considering $\alpha=0.05$, potency 80% and 0.5 unit difference in PH levels of 48 patients were estimated for each group and to increase the validity of the study, 50 patients were studied. In order to control confounding variables as well as synchronization, the number of samples in the control group was considered twice of the smokers groups. Non-stimulated saliva was collected using standard methods. All patients were asked to avoid eating and drinking at least two hours before sampling. All samples were collected between the hours 9-11 AM in order to minimize the change in the composition of saliva. Non-stimulated saliva was collected using Spiting method so that each patient evacuated all the gathered saliva in their mouth in a sterile tube for ten minutes and 1-2 times per minute and then the collected samples were sent to laboratory. Metrohm devices were used for measuring the pH level in the laboratory. That is, after calibration, the electrode device was washed with distilled water that has been distilled twice and was placed in the container containing patient's PH. A time passed for the number on the monitor to be fixed and then the corresponding number was recorded as the pH of saliva. In order to avoid the impact of intervention on the pH of saliva, it was asked from all of the participants to avoid eating, drinking and smoking two hours before taking saliva samples (13,14). The data gained from the study by using descriptive statistics (mean, standard deviation), U Mann Whitney test was applied for the comparison
between the PH means of two groups and data was analyzed using statistical software SPSS.16. The value of p <0.05 was considered significant in terms of statistics. Normal distribution of data was assessed using Kolmogorov-Smirnov test.

Findings
According to the Information in Table (4-2), it can be seen that average of pH in the studied non-smokers' samples was 7.66± 85/0 in which 0/80 was the least and 8/8 was the most obtained for the pH. 25% had PH under 7/30, 25% between 7/30 and 7/6, 25 percent between 7/85 and 8/10 and 25 percent had PH more than 8/10. The average of pH in the studied smokers' samples was 6/43± 1/88, in which 0/60 and 8/80 were the minimum and the maximum achieved for the pH. 25% had PH under 6/10, 25% between 6/10 and 6/80, 25% between 6/80 and 7/40 and 25% had PH higher than 7/40.

Table (4-1): pH dispersal distribution in the studied samples (nonsmokers and smokers)

<table>
<thead>
<tr>
<th>Maximum</th>
<th>Minimum</th>
<th>Standard deviation ± Mean</th>
<th>Number</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/8</td>
<td>0/80</td>
<td>7/66 ± 0/85</td>
<td>100</td>
<td>(nonsmokers) pH</td>
</tr>
<tr>
<td>8/80</td>
<td>0/60</td>
<td>6/43 ±1/88</td>
<td>50</td>
<td>(smokers) pH</td>
</tr>
</tbody>
</table>

Figure (4-1): pH dispersal distribution in the studied samples (nonsmokers)
Figure (4-2): pH dispersal distribution in the studied samples (smokers)

Kolmogorov-Smirnov test:
In order to select appropriate statistical tests for analyzing the collected data, it is necessary to evaluate variables distribution type in terms of nature of dispersal. In this study, Kolmogorov-Smirnov test was used in the case. Finally, according to data from Table 4-4, it can be observed that the significance level of the test on the variable pH was less than 0/50. It can be judged that the dispersal distribution of the pH is not normal and non-parametric tests were used for this variable.

Table (4-2): Kolmogorov-Smirnov test for detecting position of the data in the studied groups

<table>
<thead>
<tr>
<th>Significant level</th>
<th>Test</th>
<th>Standard Deviation</th>
<th>Mean</th>
<th>Number</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>0/008</td>
<td>1/66</td>
<td>0/85</td>
<td>7/66</td>
<td>100</td>
<td>(nonsmoker) pH</td>
</tr>
<tr>
<td>&lt;0/001</td>
<td>2/04</td>
<td>1/88</td>
<td>6/43</td>
<td>50</td>
<td>(smoker) pH</td>
</tr>
</tbody>
</table>

Comparing the mean of pH according to smoking status:
According to the results of Table and Figure (4-4) and U Mann-Whitney (UMann-Whitney), it is observed that the median of pH was obtained 7/85 and 6/80 in samples of nonsmokers and smokers, respectively. According to statistic U=1037/50 and significance level p<0/001 at confidence level 95%, the difference
observed in the median of pH of two studied groups was significant and the amount of it was higher in the samples of non-smokers (P<0.001).

Figure (4-3) pH with the separation of two studied groups.

Discussion
Saliva is a complex fluid that plays an important role in maintaining good oral conditions. People who have deficiency in saliva secretion, will trouble in nourishing, speaking and swallowing. They are also susceptible to catch oral infections and caries (15,17). According to the main role and great functions of saliva in the mouth's cavity, in this study we compared the pH of saliva, one of the important parameters in this oral liquid, in smokers and non-smokers in the population of Tabriz. The results of this study demonstrated that pH of saliva in smokers is lower than non-smokers. In order to eliminate the influence of confounding variables in this study, samples were taken from one population and the age and sex became matched for two groups and in order to avoid the impact of intervention on the pH of saliva, it was requested from all of the participants to avoid eating, drinking and smoking up to two hours before taking saliva samples.

Saliva has major ecological effects on the microorganisms that intend to colonize in the tissues of the mouth. In addition to the effects of protection provided by mucin, saliva contains a variety of proteins that have antimicrobial activity. Saliva also participates in digestion. Liquidation of food, as well as the activities of enzymes such as amylase and lipase, starts the digestion process. Moisturizing and slippery making properties of saliva facilitate swallowing a mouthful of food (16,18,19).

In a short term, smoking leads to increased flow of saliva in parotid gland 20. Johnson stated in his study that there is no difference in salivary flow between smokers and non-smokers in the long-term based on available data 12. PH of saliva increases during smoking (21). In people with chronic smoking, salivary pH is reduced in the whole stimulated saliva. However, no difference was observed in another study. Buffering capacity of saliva decreases in smokers. Thiocyanate’s density, the product that is found in normal saliva and cigarette smoke, increases in the saliva of smokers (10,22). Parvinen and colleagues reported in their study that pH of saliva in smokers was lower than non-smokers in both sexes (13). Avsar and colleagues also acknowledged that pH amount, flow rate and capacity of buffering in disabled children who smoke (passive smoker) are less than the children in the control group. These children are also at increased risk of caries (14). Our results were consistent with the most studies and that the pH of saliva was lower in smokers.

The reason of increasing pH in some studies can be attributed to the fact that sampling in those studies was conducted shortly after smoking.

In the study of Yanagisawa and his colleagues, the relationship between smoking and quitting it was verified on the amount of tooth loss. Results showed that with increasing smoking, the rates of tooth loss will increase and the ability to protect the teeth will become more by quitting smoking (23).

Avsar and colleagues examined the relationship between passive smoking (passive smoker) and dental caries and biomarkers of saliva in children. The results showed that people are more prone to smoking, the rate of dental caries, Streptococcus mutans and Lactobacillus bacteria were more in comparison with the control group; In addition, the pH of saliva, flow rate and buffering Property were reported less in this group (14). In another study from the same researchers, it was reported that passive smoking can reduce the density of secretive IgA and increase amylase activity and the level of sialic acid in saliva (24). The results of the present study are also consistent with these results and pH of saliva was lower in smokers.
Conclusion
According to the findings of this study, the pH of saliva in smokers was lower than nonsmokers. Offers
Given that all samples of this study were male ranging between 20-30 years, it is suggested that another
study with larger sample sizes that include both genders and wider age range be done in order to verify
changes in pH of saliva under the influence of age and sex caused by smoking.

References:

Pract 12 Suppl 1, 22-32.


Educ 65, 1096-1101.


50, 535-543.

saliva in digestion. Dig Dis 9, 125-132.


11. Heintze, U. (1984). Secretion rate, buffer effect and number of lactobacilli and Streptococcus mutans of


