Original Article

Comparison of Salivary pH Among Smokers and Non- Smokers by Keeping DMFT at Unity

Usman Zafar Kayani, Hashim Bin Mansoor, Hamza Asif, Naufal Nadeem, Ayesha Aslam, Hira Zafar Kayani

ABSTRACT

Objective: To evaluate the effects of smoking on salivary pH and compare it among smokers and non-smokers while keeping DMFT (Decayed Missing Filled Teeth) index at unity.

Study Design and Setting: Cross sectional study carried out among young male undergraduate students with age range of 19-25 years at Army Medical College (Rawalpindi) over a period of 2 months from 1st January to 1st March 2018.

Methodology: The sample size was 58; from which equally 29 were smokers and 29 were non-smokers. Sample size was calculated by WHO sample size calculator. Unstimulated saliva using a simple drooling method was used to collect in a sterile container from each of the subject. The pH was assessed by using a portable KETOTEK digital pH meter. DMFT was recorded by using dental mirrors and probes under illumination of dental unit. All the readings, along with demographic data were entered in performa. Data was analyzed using SPSS version 24. Descriptive statistics were calculated. Mean salivary pH between the study groups was compared using Independent sample t test. $P<0.05$ was taken as significant.

Results: Total of the 58 study subjects, 29 were smokers and 29 were non-smokers. Mean salivary pH of the whole study sample was 7.2±0.45. A statistically significant difference was observed between smokers and non-smokers; whereas smoker's salivary pH was significantly lower than that of non-smoker's ($P<0.001$).

Conclusion: It can be concluded that, the mean salivary pH levels decreases with tobacco consumption in smoked form.

Key Words: DMFT, pH meter, Un-stimulated Saliva

How to cite this Article:
Kayani UZ, Mansoor HB, Asif H, Nadeem N, Aslam A, Kayani HZ. Comparison of Salivary pH Among Smokers and Non-Smokers by Keeping DMFT at Unity J Bahria Uni Med Dental Coll. 2020;10(3): 224-7 DOI: https://doi.org/10.51985/JBUMDC2020033

INTRODUCTION:

Saliva is a major component of oral cavity and it plays a critical role in homeostasis[1]. Saliva performs a lubricative function, wetting food and permitting the initiation of swallowing, and protecting mucosal surfaces of the oral cavity from desiccation. Moreover, saliva also protects the various oral tissues by its anti-bacterial action. For all the designated functions salivary pH plays a vital role[1]. Normal salivary pH of a non-deficient healthy person ranges between 7.1- 7.5, which is slightly alkaline.

The pH value of saliva refers to the acidic or basic content of the saliva which has an overall effect on the oral hygiene and general health of the oral cavity. The variability of the pH is dependent on many local and systemic factors. One of the local factors is tobacco smoking[1], which not only deteriorates the general health of an individual but it can also lead to fluctuations within the oral cavity. One of these fluctuations is variation in the pH of the saliva. [1] Smoke from tobacco contains various chemical compounds which directly interact with the salivary contents. Some of these contents are oxidants while others are acidic in nature. These contents release free radicals which lead to hazardous effects on the health of the individuals.[2]

DMFT (Decayed Missing Filled Teeth) is directly a measure of the oral health of an individual.[3] DMFT is an epidemiological tool that is widely utilized in oral health surveys. [4] As DMFT is altered by factors such as; types of food intake, oral flora, mental status of individual etc. [5] Hence it could alter the salivary pH.

Salivation is a complicated process, and salivary composition and flow rate vary greatly under various circumstances and

Usman Zafar Kayani
House Officer Armed Forces Institute of Dentistry
National University of Medical Sciences, Rawalpindi
Email: usmankiani010@gmail.com

Hashim Bin Mansoor
House Officer Armed Forces Institute of Dentistry
National University of Medical Sciences, Rawalpindi

Hamza Asif
House Officer Armed Forces Institute of Dentistry
National University of Medical Sciences, Rawalpindi

Naufal Nadeem
House Officer Armed Forces Institute of Dentistry
National University of Medical Sciences, Rawalpindi

Ayesha Aslam
Senior Lecturer, Department of Prosthodontics
Armed Forces Institute of Dentistry, National University of Medical Sciences, Rawalpindi

Hira Zafar Kayani
Demonstrator, Department of Operative Dentistry
Margalla Institute of Health Sciences, Rawalpindi

Received: 05-Mar-2020
Accepted: 02-Jul-2020

conditions.[6,7] An unstimulated saliva is referred to as mixture of secretions, that enter the mouth in the absence of exogenous stimuli and this unstimulated flow from salivary glands is called as basal salivary flow rate, that is protecting the oral tissue and is secreted for about 14 hours a day.[8] Gilmen et al. (2008) stated that the smoking habit was more frequently found in high school and university individuals with an average individual smoking till 8.4 pack years.[9] Moreover, the systemic review in Saudi Arabia by E Ingle suggests that the Streptococcus mutans had a colony count of $46X10^4$ and $3.85X10^4$ among smokers and non-smokers and DMFT score depicts a direct relationship with a decreased salivary pH.[10] One of the study in India stated the significant relationship of smoking to DMFT at P-value of 0.02). [11] According to the study conducted in Karachi 91.4% subjects had pH level of 7 in the control group (non-smokers), whereas in the experimental group (smokers), 68.6% subjects had pH of 6 while 8.6% showed pH level of 5.[12]

None of the previous researches in the medical or dental literature has used DMFT as a confounding factor before analyzing relationship of salivary pH with smoking and indeed it was the rationale of the study. Therefore the aim of the study was to evaluate the effects of smoking on salivary pH and compare it among smokers and non-smokers while keeping DMFT (Decayed Missing Filled Teeth) index at unity. By this the significance of the detrimental effects on the pH of saliva can be established primarily and the overall oral health ultimately.

METHODOLOGY:

This comparative cross-sectional study was conducted in a 2-month time frame from 1st January to 1st March 2018. The target population was young male undergraduate's students with age range of 19-25 at Army Medical College (Rawalpindi). The ethical approval was obtained after a review of the research synopsis by the relevant ethical review committee of the Armed Forces Institute of Dentistry. A non-probability consecutive sampling design was adopted to reach the specified sample size that was calculated by WHO sample size calculator. An experimental and control group were created namely smoker (who smokes at least 5 cigarettes a day) and non-smoker respectively, both with a confounding factor (DMFT) at unity.

The DMFT was intentionally contained at 1 since literature suggests that a higher DMFT score is directly related to a lower salivary pH. An extra-oral examination was performed with after obtaining informed consent from the subjects, followed by a detailed intra-oral examination on a standard dental unit. Decayed, missing, filled teeth (DMFT) index was then noted using artificial illumination along with a dental mirror and probe. Furthermore, 10ml unstimulated saliva using a simple drooling method was collected in a sterile container from each of the subject and then pH was assessed using a portable Digital pH meter ketotek pH TDS METER made in Xiamen, China . Each patient was first familiarized with this type of saliva collection and was educated via audiovisual aid. Data was analyzed using SPSS version 24. Descriptive statistics were calculated. Mean salivary pH between the study groups was compared using Independent sample t test. $P<0.05$ was taken as significant.

RESULTS:

The results obtained were quite significant, of the 58 study subjects, 29 were smokers and 29 were non-smokers. Mean salivary pH of the whole study sample was 7.2±0.45 (Table 1). A statistically significant difference was observed between smokers and non-smokers (Table 2), where smoker's salivary pH was significantly lower than that of non-smoker's ($P<0.001$).

DISCUSSION:

Salivation is a complicated process, and salivary composition and flow vary greatly under various circumstances and conditions.[6,7] The results of this study depicted that there was a significant relationship of salivary pH with the smoking habit of an individual. It was observed that there was an inverse relation of salivary pH with smoking tobacco, showing that with increase in the smoking behavior of the subject, there will be a significant decrease in the salivary pH of respective individuals. Gilmen et al. (2008) stated that the smoking habit was more frequently found in high

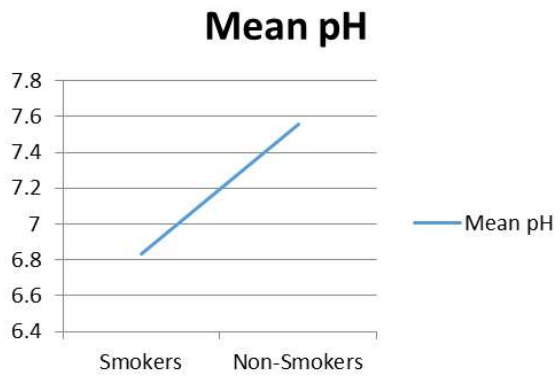
Table 1: Mean salivary pH of the study sample

	Minimum	Maximum	Mean ± SD
Salivary pH	6.4	8.0	7.19±0.45

Table 2: Comparison of Mean Salivary pH between smokers and non-smokers

Smoking Status	N	Mean Salivary pH	P value
Smokers	29	6.83±0.27	<0.001
Non-Smokers	29	7.56±0.24	

Figure 1: Shows the declining salivary pH as a comparison between smokers and non-smokers.



school and university individuals with an average individual smoking 8.4 pack years [rate ratio (RR) = 1.58, confidence interval (CI) = 1.31, 1.91].[9] It is important that the community workers and educationists impart the knowledge of salivary pH shift.

Moreover, the systemic review in Saudi Arabia by E Ingle suggests that the Streptococcus mutans had a colony count of $46X10^4$ and $3.85X10^4$ among smokers and non-smokers respectively, it further states thatthe DMFT score i.e. decayed, missing, filled teeth index depicts a direct relationship with a decreased salivary pH.[10] Similarly, study carried out in India stated that the highest mean DMFT was seen among smokers with score of 3.65 ± 5.78, whereas that of nonsmokers was 3.01 ± 2.66, and this relationship of smoking to DMFT was found to be significant (P = 0.02).[11]

A similar research was conducted in Karachi and the results second the outcome of the current study, which stated that 91.4% subjects had pH level of 7 in the control group (non-smokers), whereas in the experimental group (smokers), 68.6% subjects had pH of 6 while 8.6% showed pH level of 5.[12]

Similarly, Pratika P. et al. (2017) also observed a lower salivary pH in smokers that was, 6.7±0.38 in comparison to 7.16±0.30 in nonsmokers. The difference was statistically significant (P < 0.001).[13] Evidence proved that hypo-salivation and decreasing pH eventually facilitates the growth of opportunistic colonies in the oral cavity.[14] Moreover a research performed in Indonesia also supports the results of the present study qualitatively, where litmus paper was used as a screening tool for adolescent behavior of smoking. The salivary pH of smokers turned out to be more acidic than that of non-smokers and the relationship of smoking with the salivary pH came out to be quite significant (p<0.005).[15]

According to the study in India which explained the mechanism of decreasing salivary pH by the change in basal salivary flow rate and stated that SFR alters salivary pH by decreasing bicarbonate secretion and this decrease in saliva bicarbonate in turn decreases the salivary pH.[16] On the contrary, the study conducted by Al-Weheb showed that the mean salivary pH was higher in smokers that is, 7.32 as compared to nonsmokers that is, 7.27.[17]

Past research has concluded that the difference in the quality of saliva without mentioning the pH change; smokers have thick saliva and nonsmokers predominantly serous nature of saliva.[8] Similarly it was stated in another research that negative correlations were found between cigarette consumption and salivary flow.[19] Moreover, a study conducted in Karachi proved a decrease in salivary pH with increase in packs consumed per day.[20]

The study can be considered as a strong evidence for general education of population at large through seminars and workshops in order to critically appraise the awareness status regarding slowly deteriorating effects of smoking.

Certain limitations may have impacted review results of the study. Only DMFT was limited to unity but DMFS was not taken into consideration. Similarly, radiographic detection of caries wasn't done, only clinical eye-balling and probing was used as a diagnostic tool. Secondly, tobacco assessment was self-reported inducing a subjective bias. Since the subjective participants knew the purpose of the study, social desirability bias would be incorporated as tobacco usage would not be reported appropriately.

CONCLUSION:

It can be concluded that smoking significantly decreases the salivary pH, further research should be conducted in order to correlate the salivary pH with various oral diseases.

Author Contribution:
Usman Zafar Kayani: Conceived the idea; analysis of the data; principal author; final approval of the version to be published; and agreement to be accountable for all aspects of the work.
Hashim Bin Mansoor: Structuring the study design; revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work.
Hamza Asif: Interpretation of data; drafting the work; final approval of the version to be published; and, agreement to be accountable for all aspects of the work.
Naufal Nadeem: Acquisition of data; drafting the work; final approval of the version to be published; and, agreement to be accountable for all aspects of the work.
Ayesha Aslam: final analysis of data; final approval of the version to be published; and, agreement to be accountable for all aspects of the work.
Hira Zafar Kayani: detailed analysis of data; aide in data collection; final approval of the version to be published; and, agreement to be accountable for all aspects of the work

REFERENCES:

1. Moss S;Clinical implications of recent advances in salivary research.J Esthet Dent. 1995; 7: 197-203
2. Khabour O.F., Alzoubi K.H., Bani-Ahmad M., Dodin A., Eissenberg T., Shihadeh A. Acute exposure to waterpipe tobacco smoke induces changes in the oxidative and inflammatory markers in mouse lung. Inhal. Toxicol. 2012;24:667–675. doi: 10.3109/08958378.2012.710918.
3. Broadbent JM, Thomson WM. (2005). For debate: Problems with the dmf index pertinent to dental caries data analysis. Community Dent Oral Epidemiol, 33(6): 400–9.
4. Abhishek M. Comprehensive review of caries assessment systems developed over the last decade. RSBO. 2012;9(3):316–21.
5. Katge F, Rusawat B, Shitoot A, Poojari M, Pammi T, Patil D; DMFT index assessment, plaque pH, and microbiological analysis in children with special health care needs; J IntSocPrev Community Dent. 2015 Sep-Oct;5(5):383-8.
6. Rooban T, Mishra G, Elizabeth J, Ranganathan K, Saraswathi TR. Effect of habitual arecanut chewing on resting whole mouth salivary flow rate and pH. Indian J Med Sci 2006;60:95-105

7. Kanwar A, Sah K, Grover N, Chandra S, Singh RR. Long-term effect of tobacco on resting whole mouth salivary flow rate and pH: An institutional based comparative study. Eur J Gen Dent 2013;2:296-9
8. Rad M, Kakoie S, NiliyeBrojeni F, Pourdamghan N. Effect of Long-term Smoking on Whole-mouth Salivary Flow Rate and Oral Health. J Dent Res Dent Clin Dent Prospects. 2010;4(4):110-114.doi:10.5681/joddd.2010.028
9. Gilman SE, Martin LT, Abrams DB, Kawachi I, Kubzansky L, Loucks EB, Rende R, Rudd R, Buka SL. Educational attainment and cigarette smoking: a causal association? Int J Epidemiol. 2008 Jun; 37(3):615-24
10. Ingle E. Evidence Based Review On Tobacco Smoking And Dental Caries. Int JC, Sep 2019; 8: 62-64.
11. Shivam AK, Azam F. Association between smoking and dental caries among people of Dhanbad district, Jharkhand, India. Int J Oral Care Res 2019;7:50-2
12. Rehan F, Khan RS, Khurshid Z, Memon MS, Naqvi S, Zafar MS. Analysis of Resting Mouth Salivary Flow Rate and Salivary pH of Tobacco Chewers and Smokers. J Pak Dent Assoc 2016; 25(4): 158-63
13. Parmar, P., Radha, G., Rekha, R., & K. Pallavi, S. (2017). Assessing Salivary Flow Rate, Salivary pH and Oral Candidiasis among Tobacco Chewers, Smokers and Healthy Controls- A Cross Sectional Study. Asian Journal of Medicine and Health, 7(4), 1-8
14. Almstahl, A., and M. Wikstrom. "Oral Microflora in Subjects with Reduced Salivary Secretion." Journal of Dental Research, vol. 78, no. 8, Aug. 1999, pp. 1410–1416
15. A. Jessica and F. Handy. Measurement of Salivary pH Using Litmus Paper as a Screening Tool of Smoking Behavior in Adolescents. Journal of Global Oncology 2018 4:Supplement 2, 213s-213s
16. Singh M, Ingle NA, Kaur N, Yadav P, Ingle E. Effect of long-term smoking on salivary flow rate and salivary pH. J Indian Assoc Public Health Dent 2015;13:11-3
17. Al-Weheb AM. Smoking and its relation to caries experience and salivary lactobacilli count. JBCD 2005;17:92-5
18. Petrušiæ N, Posavac M, Sabol I, Mravak-Stipetiæ M. The Effect of Tobacco Smoking on Salivation. ActaStomatol Croat. 2015;49(4):309-315.
19. N. J. TRUDGILL, L. F. SMITH, J. KER. Impact of Smoking Cessation on Salivary Function in Healthy Volunteers. Scandinavian Journal of Gastroenterology (1998), 33(6), 568–571.
20. Qamar, A., Baig, S., Ali, A., Zehra, N., &Memon, M. (2015). Resting Salivary Flow Rate and pH Decreases in Chewable Tobacco Users. Journal of Advances in Medicine and Medical Research, 11(3), 1-9.