Original Research Article

Periodontal disease and salivary pH: Case control study

Mayuri Prasad[1*], Toshi[2], Rajat Sehgal[3], Manisha Mallik[4], Aaysha Tabinda Nabi[5], Sneha Singh[6]

[1]Postgraduate student, [2,4,5]Senior Lecturer, [3]Reader,
Department of Periodontics, Buddha Institute of Dental Science and Hospital, Patna, India
[6]Senior Lecturer, Department of Periodontics, Mithila Minority Dental College and Hospital, Darbhanga, India
[*]Corresponding author email: **mayuripd04@gmail.com**

International Archives of Integrated Medicine, Vol. 6, Issue 2, February, 2019.

Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 30-12-2018 **Accepted on:** 19-01-2019
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: Mayuri Prasad, Toshi, Rajat Sehgal, Manisha Mallik, Aaysha Tabinda Nabi, Sneha Singh. Periodontal disease and salivary pH: Case control study. IAIM, 2019; 6(2): 1-6.

Abstract

Background: Saliva is complex fluid maintaining microbiological flora and oral hygiene. It has varying composition and has diagnostic and prognostic value. The present case-control study was aimed at finding the association between salivary pH and periodontal disease.
Materials and methods: Three groups consisting of persons with healthy gingiva, persons with generalized chronic gingivitis and those with generalized chronic periodontitis were studied.
Results: It was seen that the saliva of patients suffering from chronic generalized gingivitis was alkaline in nature while that of patients with chronic generalized periodontitis was acidic when compared with health individuals. The difference between the groups was significant (p=0.00).
Conclusion: Salivary pH can have prognostic value for periodontal disease.

Key words

Case-control study, Gingivitis, Periodontitis, Salivary pH.

Introduction

Saliva has been important contributor to oral hygiene. Biochemical composition of saliva, its PH and enzymatic contents determine oral health and onset of diseases inside the oral cavity [1]. On the other hand, saliva is key to diagnosis of certain systemic illnesses and assessing the risk for development of many diseases [2]. It is the complex thick secretion of major and minor salivary glands [3]. Its primary function is to keep mouth moistened which facilitates speech and deglutition. It also maintains pH of oral

cavity by its buffering action and eliminating acid produced by bacteria during metabolism of carbohydrates. Removal of food debris and bacteria is another important action which helps in prevention of tooth decay [4].

Salivary secretion may be resting (unstimulated) which is contributed by parotid (25%), submandibular (60%), sublingual (7-8%) and minor salivary glands (7-8%). Stimulation determines the quantity, constitution and pH of saliva. Normal salivary flow rate is 800-1500 ml per day which is affected by environmental conditions, circadian rhythms, health status of the individual and physical activity [1].

pH of oral cavity is maintained between 6.7 to 7.3. Bacteria present in the oral cavity metabolize carbohydrate and produce acids. On the other hand, metabolism of sialine and urea produces ammonia which raises pH. Saliva acts as a buffer due to presence of bicarbonate, peptides, protein and phosphates and helps in maintenance of pH. Due to slow diffusion of saliva through dental plaque, acids accumulate in it. After consumption of sugar, dental plaque pH is further reduced to levels below 5.0 [5]. This provides an acidogenic environment for the growth of aciduric bacteria resulting in dental caries [5]. Prevotella intermedia develops between pH 5-7, Porphyromonas gingivalis develops between pH 6.5 to 7 and Fusobacterium nucleatum develop between pH 5.5 to 7 [6]. Dental caries tends to further lower the salivary pH and thus a vicious cycle is established. It has been found that anaerobic gram negative bacterial flora helps in the formation and progression of marginal periodontal inflammation. A biofilm is formed on the tooth surfaces near the gingival neck and in the gingival sulcus by pathogenic bacteria establishing a true ecosystem. This aggravates the periodontal disease [7]. Gopinath, et al. have observed that salivary flow rate, salivary pH, salivary viscosity, and salivary buffering capacity were lower in subjects with dental caries [8].

Studies have been conducted to compare the crevicular pH and degree of inflammation of the gingivae [6, 9, 10]. Baliga, et al. found that patients with chronic generalized periodontitis had a more acidic pH of saliva as compared to the clinically healthy group [11]. Studies regarding salivary pH and periodontal disease are scanty in this region. Hence, the present study was done to explore the association between salivary pH and periodontal disease.

Aim and objectives

The present study was conducted to find the association between salivary pH and periodontal disease.

Materials and methods

The present study was analytical in nature using case-control design. It was conducted at Out-Patient Department of Periodontology Department, Buddha Institute of Dental Sciences and Hospital, Patna. The study population comprised of patients reporting to OPD in three groups. Group I consisted of persons with healthy gingiva. Group II comprised of persons with generalized chronic gingivitis and Group III of those with generalized chronic periodontitis. Gingivitis was diagnosed if there was inflammation of the gingiva without loss of attachment. Gingival inflammation index (bleeding index) criteria was used for grading as follows - 0 = No bleeding, 1 = Bleeding after the probe was placed in the gingival sulcus up to 2 mm and drawn along the inner surface of the gingival sulcus. Periodontitis was diagnosed if there was loss of attachment with pocket depth of $\geq$ 5 mm in at least 30% sites.

Edentulous patients, tobacco users and patients suffering from diabetes, kidney disease, respiratory diseases and fungal infections were excluded as these conditions affect the composition of saliva or periodontal health.

The study subjects were explained about the purpose of this study and informed consent was taken. Detailed history and clinical examination

was done. Gingival and periodontal regions were thoroughly examined to note the findings.

"Common Minimal Technical Standards and Protocols" of WHO Organization/International Agency for Research on Cancer guideline was followed for collection of saliva. The respondents were asked to fast overnight and not to drink anything except water. Salivary sample was collected in the morning. They were asked to rinse their mouth well for five minutes using drinking water. They were asked not to talk or swallow the water. They tilted their head and saliva was allowed to flow naturally. The subjects spit the saliva in the collection tube once a minute for ten minutes.5 ml of the saliva was collected in sterile beakers.

Figure - 1: showing pHep pocket sized pH meter.

pH of the saliva was immediately measured so that the sample did not deteriorate. pHep pocket sized pH meter manufactured by Hanna Instruments was used for measuring pH as shown in the **Figure - 1**. It is a rugged pH tester with replaceable electrode and renewable reference junction. It has a range of 0.0 to 14.0 with resolution of 0.1 pH and accuracy of ± 0.1pH. The instrument was calibrated every day using the provided buffer solution of pH 7.01. It was stored by moistening the electrode and the protective cap with storage solution.

Data was entered in Microsoft Excel 2007 and analyzed using SPSS v 16.0. Categorical data were summarized as frequency and percentage and measurable variables were summarized as mean and SD. One way ANOVA was done to find the difference in means across different groups and post-hoc Tukey's correction was done for multiple group comparison. Test was reported to be statistically significant if the p-value was <0.05. Informed consent was taken from all the respondents and the records were kept confidential.

Results and Discussion

The present analytical study was conducted to find the association between salivary pH and periodontal disease. Three groups, each including 65 subjects were selected for the study.

Table - 1 shows the average salivary pH in three groups. It was observed that the saliva of patients suffering from chronic generalized gingivitis was alkaline in nature while that of patients with chronic generalized periodontitis was acidic when compared with healthy individuals. The difference among the groups was statistically significant (p=0.00). **Table - 2** shows plaque (PI) and gingival (GI) indices among the three groups. Mean plaque index and mean gingival index were highest in patients with chronic generalized periodontitis. **Table - 3** shows the results of multiple group comparison for pH of saliva using Tukey's test. It was seen that the difference in salivary pH among the three groups was statistically significant (p<0.05). Salivary pH, plaque index and gingival index were as per **Graph – 1**.

Baliga, et al. observed that in patients with chronic gingivitis, saliva was more alkaline and the difference with control group was statistically significant (p=0.00). Saliva of patients with chronic periodontitis was more acidic as compared with control (p=0.00) [11]. Takahashi, et al. also observed that mildly acidic pH was needed for growth of pathogens leading to periodontitis [6]. While Galgut found that there

is no association between pH and gingivitis but periodontitis was significantly associated with pH of periodontal pockets [10].

Entedhar, et al. observed that salivary pH in obese individuals with periodontitis was significantly lower than controls [12]. Umamaheshwari, et al. also observed that salivary pH was lower in individuals with periodontits without diabetes mellitus and further lower in individuals with periodontits and diabetes mellitus. The difference of salivary pH among these three groups was significant (p=0.0005). They have commented that salivary pH was more acidic among diabetic individuals due to metabolic processes [13].

Table – 1: showing average salivary pH in three groups (n-65 in each group).

Group	**Salivary pH**	**95% CI**	**Significance**
I (Healthy)	7.07 ± 0.05	7.06-7.09	*One-way ANOVA* F= 124.59 P=0.00
II (Chronic generalized gingivitis)	7.35 ±0.15	7.31-7.39	
III (Chronic generalized periodontitis)	6.85 ± 0.27	6.79-6.92	

Table – 2: showing mean plaque index and gingival index in three groups.

Group	**Plaque index**	**Gingival index**
I (Healthy)	0.32 ± 0.08	0.38 ± 0.05
II (Chronic generalized gingivitis)	1.20 ± 0.15	1.60 ± 0.09
III (Chronic generalized periodontitis)	2.45 ± 0.31	2.61 ± 0.23
Significance	*One-way ANOVA* F= 1761.5 P=0.00	*One-way ANOVA* F= 3870.5 P=0.00

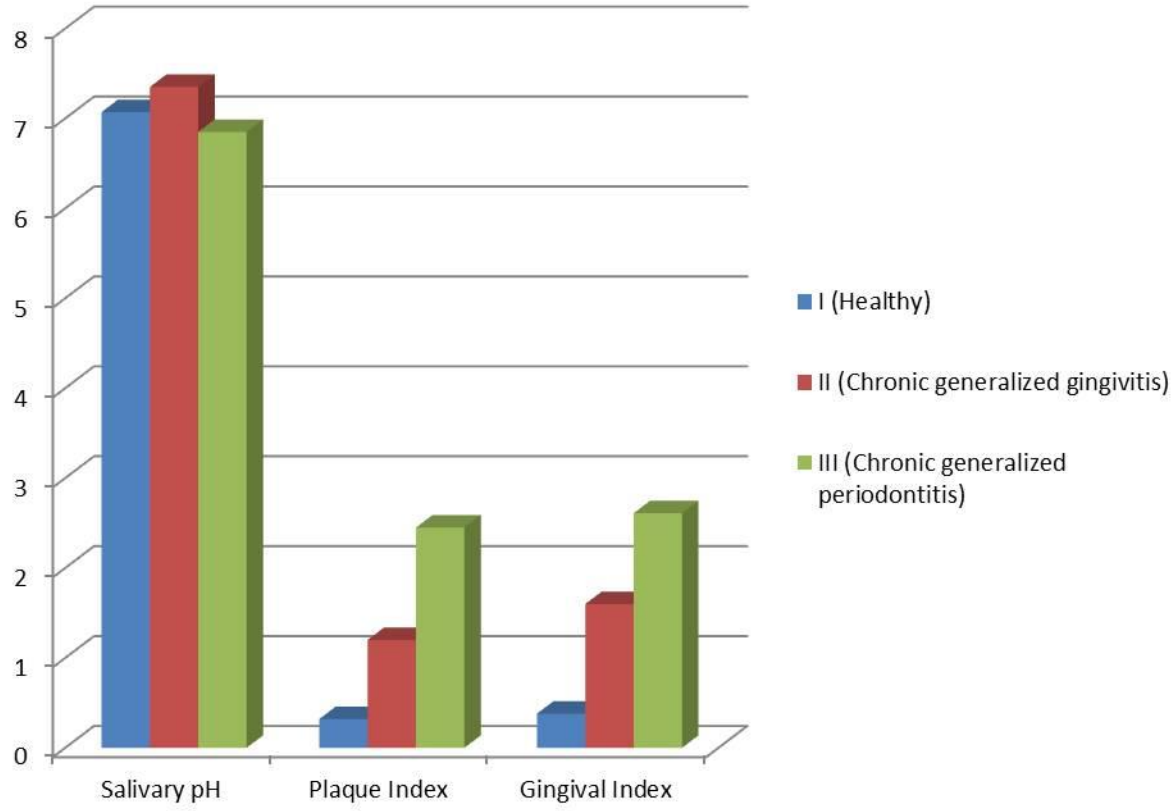
Table – 3: showing findings of multiple group comparison for pH of saliva using Tukey's test.

Groups	**Mean difference**	**Standard error**	**Signi-ficance**	**95% CI**	
				Lower limit	**Upper limit**
I (Healthy)					
II (Chronic generalized gingivitis)	-0.2756923*	0.0314306	0.000	-0.349933	-0.201452
III (Chronic generalized periodontitis)	0.2193846*	0.0314306	0.000	0.145144	0.293625
II (Chronic generalized gingivitis)					
I (Healthy)	0.2756923*	0.0314306	0.000	0.201452	0.349933
III (Chronic generalized periodontitis)	0.4950769*	0.0314306	0.000	0.420837	0.569317
III (Chronic generalized periodontitis)					
I (Healthy)	-0.2193846*	0.0314306	0.000	-0.293625	-0.145144
II (Chronic generalized gingivitis)	-0.4950769*	0.0314306	0.000	-0.569317	-0.420837

*The mean difference was significant at the 0.05 level

Gaur, et al. in their study conducted upon school children of Rural and Urban Jaipur City found that there was positive correlation (+0.063) between pH and plaque scores in winter season, probably due to more consumption of sweet foods. Positive correlation (+0.045) was also observed between pH and gingival scores during this period [14]. Seethalakshmi, et al. found that the salivary pH was lower among diabetics and was associated with higher DMFT score [5]. Goyal, et al. have reported that there was decreased salivary pH and increased incidence of dental caries in uncontrolled diabetics as compared to non-diabetics and controlled diabetics which signifies the importance of salivary pH in this particular group [15].

Graph - 1: Bar chart showing salivary pH, plaque index and gingival index.



The present study concludes that salivary pH can be used to evaluate the severity of periodontitis and can have prognostic value also for periodontal disease and its treatment. Salivary diagnostics is gaining interest and this study provides newer insights in the same.

References

1. Nair AU, Thavarajah R, Ranganathan K. Saliva and dental practice. J Dr NTR Univ Health Sci., 2012; 1: 72-6.
2. Lasisi TJ, Duru ME, Lawal BB. Salivary Secretion and Composition in Malaria: A Case-control Study. Niger. J. Physiol. Sci., 2015; 30: 119-123.
3. Pfaffe T, Cooper-White J, Beyerlein P, Kostner K, Punyadeera C. Diagnostic Potential of Saliva: Current State and Future Applications. Clinical Chemistry, 2011; 57(5): 675–87.
4. Abdelrazik M, Baghdadi H, Alali K. Functional biochemistry and microbiology of human Saliva. IJASR International Journal of Academic and Scientific Research, 2013; 1(1): 52-9.
5. Seethalakshmi C, Jagat Reddy RC, Asifa N, Prabhu S. Correlation of Salivary pH, Incidence of Dental Caries and Periodontal Status in Diabetes Mellitus Patients: A Cross-sectional Study. Journal of Clinical and Diagnostic Research, 2016; 10(3): ZC12-ZC14.
6. Takahashi N, Saito K, Schachtele CF, Yamada T. Acid tolerance and acid-neutralizing activity of Porphyromonas gingivalis, Prevotella intermedia and Fusobacterium nucleatum. Oral Microbiol Immunol., 1997; 12: 323-8.
7. Cormos G, Ionas M, Bota G, Stef L, Boitor GC, Ormenisan A, Maris M, Mitariu MC. The Contribution of Salivary pH in Periodontal Health Assessment. REV. CHIM. (Bucharest), 2016; 67(9): 1697-1700.

8. Gopinath VK, Arzreanne AR. Saliva as a diagnostic tool for assessment of dental caries. Arch Orofac Sci., 2006; 1: 57-9.
9. Fujikawa K, Numasaki H, Kobayashi M, Sugano N, Tomura S, Murai S. PH determination in human crevicular fluids. Examination of the pH meter and evaluation of the correlation between pH level and clinical findings or the microflora in each periodontal pocket. Nihon Shishulyo Gakkai Kaishi, 1989; 31(1): 241-8.
10. Galgut PN. The relevance of pH to gingivitis and periodontitis. J Int Acad Periodontol., 2001; 3: 61-67.
11. Baliga S, Muglikar S, Kale R. Salivary pH: A diagnostic biomarker. J Indian Soc Periodontol., 2013; 17: 461-5.
12. Entedhar R. Study the levels of Leptin, and Adiponectin with Paraoxonase in Obese Individuals (male & female). Tikrit J. of Pure Science, 2015; 20(2): 167-17.
13. Umamaheswari TN, Srineeraja P. Study of salivary pH in patients with the prevalence of periodontitis with or without diabetes mellitus. Asian J Pharm Clin Res., 2016; 9(4): 393-395.
14. Gaur A, Anup N, Sharma R. Variation in Salivary Parameters and its Correlation with Plaque and Gingival Status among 12 to 15 Years Schoolchildren of Rural and Urban Jaipur City in Winter and Summer Seasons. Int J Clin Pediatr Dent., 2012 Jan; 5(1): 39-48.
15. Goyal D, Kaur H, Jawanda MK, Verma S, Parhar S. Salivary pH and dental caries in diabetes mellitus. International Journal of Oral & Maxillofacial Pathology, 2012; 3(4): 13-16.