Original Article

A COMPARATIVE STUDY ON SALIVARY pH IN DIABETIC PATIENTS WITH PERIODONTITIS AND WITHOUT PERIODONTITIS

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Abstract

Introduction: Diabetes mellitus is a common chronic disease that has emerged as a major health-care problem currently Diabetes mellitus affects 240 million people worldwide.Periodontal infections are persistent, gram-negative infections that damage not just the tissues around the tooth but also pose a systematic threat to immunocompetent cells and cells involved in the inflammatory cascade.
Aim: The study aims to assess the comparison on salivary pH in diabetic patients with periodontitis and without periodontitis
Materials and methods: The participants were explained about the procedure and were able to sign on the informed consent. 5 saliva samples were collected from patients with diabetes and periodontitis and 5 samples were collected from patients with diabetes and without periodontitis. The samples were collected in an Eppendorf tube passively. The samples were stored in -20 until needed. Statistics statistical analysis was performed using the SPSS (IBM SPSS Statistics for Windows, version 23.0, Armonk, NY: IBM Corp.Released 2015). The one-way ANOVA with the Tukey HSD post hoc test was used. The test was done to compare the groups and $p>0.05$ was considered significant.
Results: The salivary pH values of subjects in group 1 ranged from 7.0 to 7.5 with a mean of 7.3 ± 0.08. Similarly, salivary pH values of subjects in group 2 ranged from 5.5 to 7.0 with a mean of 6.0 ± 0.43, and salivary pH values of subjects in group 3 ranged from 6.5 to 7.5 with a mean of 6.9 ± 0.27 . The difference in mean ph value between group 1, group 2, group 3 was highly significant ($p>0.05$)
Conclusion: The present study concludes that diabetic patients with periodontitis have reduced pH when compared to patients without periodontitis. Diabetic Mellitus has been consistently documented to be associated with altered salivary composition and function which disrupts the homeostasis of the oral cavity. This predisposes them to various oral ailments including dental caries and periodontitis.

KEYWORDS: Diabetes mellitus, Innovative technique, Periodontitis, Saliva, pH

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INTRODUCTION

Diabetes mellitus is a common chronic disease that has emerged as a major health-care problem currently Diabetes mellitus affects 240 million people worldwide. (Seethalakshmi, 2016) . It is characterized by increased glucose levels. This hyperglycemic state affects multiple systems which are due to impaired insulin secretion. Diabetes mellitus manifests in altering the salivary composition and its functions(Aren *et al.*, 2003; Puttaswamy, Puttabudhi and Raju, 2017)). There are three main types of diabetes mellitus type 1,type2, and gestational diabetes. Diabetes raises the risk of periodontal disease progression in both severity and frequency. Even if plaque levels are comparable to non-diabetic control, diabetic people may experience increased gingival inflammation. Furthermore, diabetic individuals' periodontal deterioration was found to be more severe, with increased bone loss and attached loss.

Periodontal infections are persistent, gram-negative infections that damage not just the tissues around the tooth but also pose a systematic threat to immunocompetent cells and cells involved in the inflammatory cascade. Periodontitis is a dangerous gum infection that destroys the soft tissues and can eventually destroy the bone that supports the teeth

if left untreated. Periodontitis can result in tooth loosening or even tooth loss. It is common but largely preventable. It's usually the result of poor oral hygiene(Trivedi *et al.*, 2019). There are many oral manifestations seen in diabetic patients such as xerostomia caused due by polyuria, gingivitis, periodontitis, multiple periodontal abscesses, dental caries, infections of the tongue, and oral mucosa-like chronic atropHic candidiasis and in few cases with burning mouth syndrome (Puttaswamy, Puttabudhi and Raju, 2017; Trivedi *et al.*, 2019). People with diabetes are more likely to develop oral problems such gingivitis, periodontal disease, and alveolar bone loss, all of which have been linked to poor glycemic control. Pathogenic bacteria are initiated in the oral environment, causing damage to the hard and soft tissues of the oral cavity, resulting in increased cariogenic activity and periodontal diseases. (Schmalz *et al.*, 2017) Our team has extensive knowledge and research experience that has translate into high quality publications(Rao and Kumar, no date; Krishnan and Lakshmi, 2013; Devi and Gnanavel, 2014; Varghese *et al.*, 2015; Samuel *et al.*, 2019)(Kamisetty *et al.*, 2015; Patturaja and Pradeep, 2016; Felicita, 2017; Jain, 2017; Kumar, 2017)

Saliva has a preventive effect; a clinically significant decrease in salivary functioning can lead to the development of tooth caries. Diabetes mellitus has also been linked to an increase in infection transport in saliva (Ahmadi-Motamayel *et al.*, 2016; Schmalz *et al.*, 2017). People with diabetes can also experience hyposalivation and may suffer from salivary dysfunction. Patients with diabetes have less saliva, so the person might feel extra thirsty or parched when compared to a normal person (Jawed *et al.*, 2012)

By contributing strength and perfection to the construction of teeth, the optimal concentration of calcium in saliva prevents dental cavities and promotes remineralization. Patients with diabetes mellitus frequently notice changes in saliva pH. There is frequently a link between plaque pH variations and salivary sugar clearance (Patel *et al.*, 2016). The study aims to assess the comparison on salivary pH in diabetic patients with periodontitis and without periodontitis

MATERIALS AND METHOD

A comparative study on salivary pH in diabetic patients with periodontitis and without periodontitis was done. The study was non-invasive and easy to perform without much inconvenience to patients. However the sample size was limited. Prior to the initiation of the study, clearance was obtained by the scientific review board with ethical approval number IHEC/SDC/BDS/1941/01.

Collection of sample

The participants were explained about the procedure and were able to sign on the informed consent. 6 samples were collected from normal patients (group 1), 6 samples from patients with diabetes and periodontitis(group 2), 6 from patients with diabetes and without periodontitis(group 3). The samples were stored in -20 until needed.

Patients were asked to check randomized blood sugar levels to categorize according to the respective groups. Salivary samples were collected from each subject. Unstimulated saliva was collected in an Eppendorf tube passively and following that pH meter was used to measure the salivary pH.

Statistics statistical analysis was performed using the SPSS (IBM SPSS Statistics for Windows, version 23.0, Armonk, NY: IBM Corp.Released 2015). The one-way ANOVA with the Tukey HSD post hoc test was used.

RESULTS

The mean of the salivary pH scores was taken individually for each group, and the data for all the values were analyzed using Anova with Tukey HSD post hoc test.

The salivary pH values of subjects in group 1 ranged from 7.0 to 7.5 with a mean of 7.3 ± 0.08. Similarly, salivary pH values of subjects in group 2 ranged from 5.5 to 7.0 with a mean of 6.0 ± 0.43, and salivary pH values of subjects in group 3 ranged from 6.5 to 7.5 with a mean of 6.9 ± 0.27 (table 1). The mean salivary pH value was calculated at 6.07 for group 2 and 7.35 for cases in group 1. The difference in mean pH value between group 1, group 2, group 3 was highly significant ($p>0.05$) shown in table 2. The mean pH-value, 6.07 for group 2 was significantly less than that of group 1 and group 3 (figure 1). Sample size: 6 in each group (group 1, group 2, group 3). Figure 2 shows the error percentage of group 1, group 2 and group 3 which was 33.33% respectively.

Thus salivary pH value was significantly at a much lower level for periodontitis patients with diabetes. Therefore, as per results, salivary pH value became acidic as the disease state progressed from non-periodontitis to periodontitis

Table 1: Mean and standard deviation of salivary pH in group 1, 2 and 3

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Normal	6	7.3467	.08756	.03575	7.2548	7.4386	7.20	7.45
DM with Periodontitis	6	6.0733	.43408	.17721	5.6178	6.5289	5.54	6.75
DM without periodontitis	6	6.9233	.27164	.11090	6.6383	7.2084	6.61	7.41
Total	18	6.7811	.61336	.14457	6.4761	7.0861	5.54	7.45

Table 2: Tukey test to determine the difference in salivary pH between the groups

Dependent Variable: pH

	(I) Saliva	(J) Saliva	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	Normal	DM with Periodontitis	1.27333*	.17317	.000	.8235	1.7231
		DM without periodontitis	.42333	.17317	.067	-.0265	.8731
	DM with Periodontitis	Normal	-1.27333*	.17317	.000	-1.7231	-.8235
		DM without periodontitis	-.85000*	.17317	.001	-1.2998	-.4002
	DM without periodontitis	Normal	-.42333	.17317	.067	-.8731	.0265
		DM with Periodontitis	.85000*	.17317	.001	.4002	1.2998

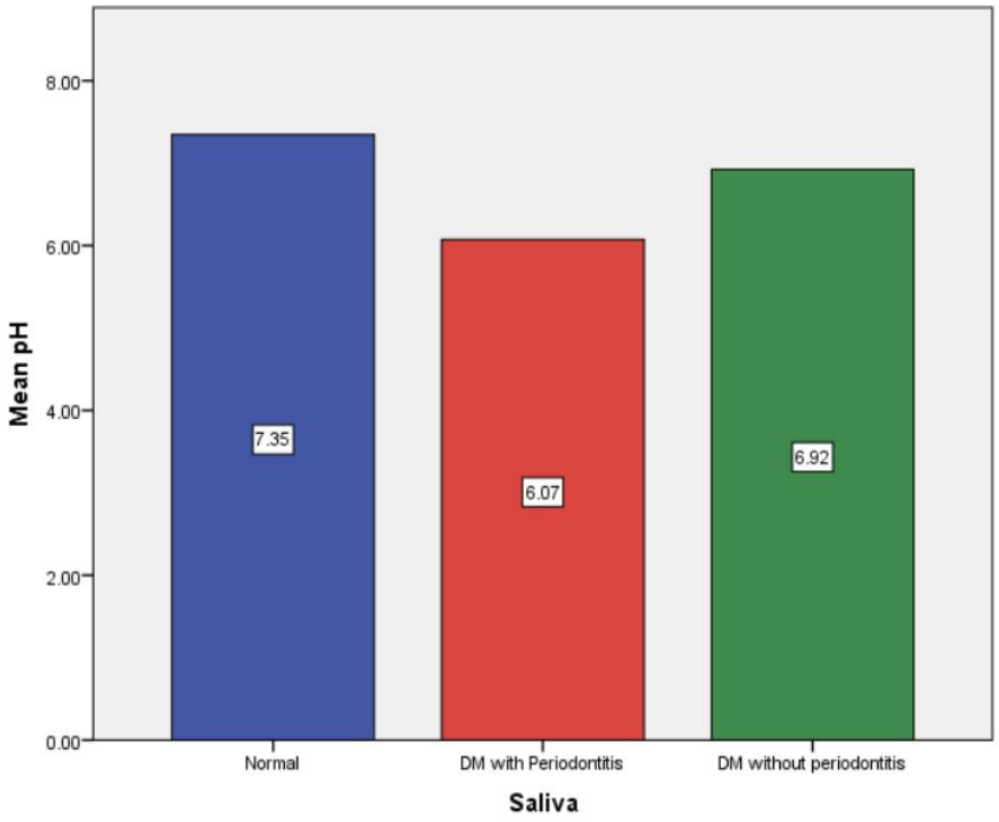

Figure 1: Bar graph showing mean salivary pH in group 1(normal patients), group 2(patients with periodontitis), and group 3(patients without periodontitis).X axis represents group 1 (normal patients), group 2(patients with periodontitis), and group 3(patients without periodontitis and y axis represents mean salivary ph. Blue colour denotes the ph value of normal patients (7.35) red colour denotes the ph value of patients with periodontitis (6.07) and green colour denotes the ph value of patients without periodontitis (6.92)

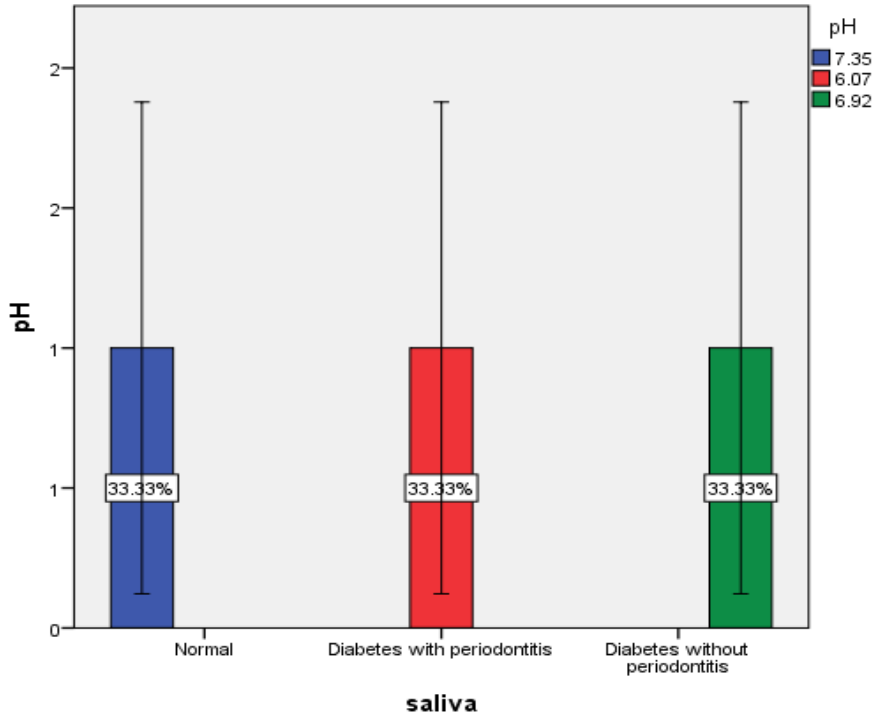

Figure 2: Error graph showing mean salivary pH in group 1(normal patients), group 2(patients with periodontitis), and group 3(patients without periodontitis).X axis represents group 1 (normal patients), group 2(patients with periodontitis), and group 3(patients without periodontitis and Y axis represents error in salivary pH. Blue colour denotes the error percentage of normal patients (33.33%) red colour denotes the error percentage of patients with periodontitis (33.33%) and green colour denotes the error percentage of patients without periodontitis (33.33%).

DISCUSSION

Diabetes mellitus also known as hyperglycemia is a common chronic disease. This hyperglycemic state affects multiple systems which are due to impaired insulin secretion. Diabetes mellitus manifests in altering the salivary composition and its functions(Seethalakshmi, 2016). Periodontitis is a serious gum infection that destroys the soft tissues and can eventually destroy the bone that supports the teeth if left untreated. Type I diabetes, often known as juvenile diabetes, begins when the body's insulin production is impaired. Insulin-dependent people with type I diabetes require daily injections of artificial insulin to stay alive. A shift in the way the body uses insulin is the hallmark of type 2 diabetes. Unlike type I diabetes, the body still produces insulin, but the cells in the body do not respond to it as well as they once did.According to the National Institute of Diabetes and Digestive and Kidney Diseases, this is the most frequent kind of diabetes, and it has a significant link to obesity. Gestational diabetes arises when a woman's body becomes less sensitive to insulin during pregnancy. Gestational diabetes does not affect all women and normally goes away after the baby is born.

Periodontitis can cause loosening of the tooth or loss of a tooth. It is common but largely preventable. It's usually the result of poor oral hygiene. This study evaluates the comparison of salivary pH in diabetic patients with periodontitis and without periodontitis. The pH is maintained by saliva by two mechanisms. First, elimination of carbohydrate by the flow of saliva which could be metabolized by bacteria and hence the acid produced by the bacteria is removed and secondly, saliva has a buffering activity which can neutralize the acidity formed from foods and drinks as well as from the microbial activity. ((‘Expression of VEGF in Periodontal Tissues of Type II Diabetes Mellitus Patients with Chronic Periodontitis -an Immunohistochemical Study’, 2014; Rathod *et al.*, 2016). In the present study, unstimulated saliva samples were collected from normal healthy patients and diabetic patients with periodontitis and without periodontitis as the pH may alter in stimulated salivary samples for determining salivary pH.

In our study, the mean salivary pH was compared in diabetic patients with periodontitis and without periodontitis(Alhnnan, Elmoniem Alhnnan and Alawad, no date). Normally diabetic patients have decreased pH when compared to healthy patients. Generally, patients with diabetes have an increased risk of having periodontal disease when compared to non-diabetic patients. Subjects with diabetes and periodontitis have decreased pH to that of the control group (‘Expression of VEGF in Periodontal Tissues of Type II Diabetes Mellitus Patients with Chronic

Periodontitis -an Immunohistochemical Study', 2014). This may be due to metabolic changes in diabetic patients which leads to acidic pH. In diabetes, the level of bicarbonates in all body fluids is reduced which leads to metabolic acidosis. This shows the acidic nature of the saliva in patients with diabetes mellitus. Individuals with diabetes and without periodontitis show comparatively higher pH.

The salivary pH values of subjects in group 1 ranged from 7.0 to 7.5 with a mean of 7.3±0.08. Similarly, salivary pH values of subjects in group 2 ranged from 5.5 to 7.0 with a mean of 6.0±0.43, and salivary pH values of subjects in group 3 ranged from 6.5 to 7.5 with a mean of 6.9±0.27 (table 1)Mean salivary pH value was calculated 6.07 for group 2 and 7.35 for cases in group 1. The difference in mean pH value between group 1, group 2, group 3 was highly significant (p=0.0005)(table 2). The mean pH-value, 6.07 for group 2 was significantly less than that of group 1 and group 3 (graph1)

The salivary pH values of subjects in group 1 ranged from 7 - 7.5. Similarly, salivary pH values of subjects in group 2 ranged from 5.5 - 7 and salivary pH values of group 3 ranged from 6.5 - 7. But when compared to (Trivedi *et al.*, 2019), The salivary pH values of subjects in Group I ranged from 8.6 to 5.9. Similarly, salivary pH values of subjects in Group II ranged from 6.5 to 4.5, and salivary pH values of subjects in Group III ranged from 3.8 to 5.2. There is a slight change in pH value. According to(Alhnnan, Elmoniem Alhnnan and Alawad, no date; Ugale, 2015). The study showed that salivary pH is affected in diabetic individuals of longer duration irrespective of control state. The pH is more affected in poorly controlled diabetes than controlled diabetes. According to (Cortelli *et al.*, 2014) diabetes, status influences salivary glucose levels and flow rate. Diabetic participants did not have a greater frequency of periodontitis, nor did diabetic people have a higher frequency of periodontal pathogens than their paired controls, even when the severity of chronic periodontitis was the same.

Since periodontitis showed decreased pH, the present study emphasizes that periodontitis has a direct effect on salivary pH reducing its normal levels irrespective of diet that influences the oral cavity. The study contains only limited samples and therefore more samples can be used in future studies for better results. Despite the limitation, we were able to find the difference between diabetic patients with and without periodontitis.

CONCLUSION

The present study concludes that diabetic patients with periodontitis have reduced pH when compared to patients without periodontitis. Diabetic Mellitus has been consistently documented to be associated with altered salivary composition and function which disrupts the homeostasis of the oral cavity. This predisposes them to various oral ailments including dental caries and periodontitis.

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CONFLICT OF INTEREST

The author declares that there were no conflicts of interests in the present study.

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