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ORIGINAL ARTICLE

Comparison of Salivary pH in patients with Prevalence of Periodontitis with and without type 2 diabetes

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ABSTRACT

Background: Diabetes type 2 and periodontitis has bi-directional relationship not only diabetes is a risk factor for periodontitis but periodontitis could have negative effect on glycemic control. Poor glycemic control is associated with reduced salivary pH.
Aim: To compare the difference in salivary PH in patients with Periodontitis with or without Diabetes mellitus (Type 2).
Method: A total of 348 consenting subjects were recruited for this investigation. There were 116 with diabetes mellitus and periodontitis, 116 with periodontitis but not diabetes and 116 patients with no periodontitis and diabetes. Salivary PH strips were used to determine the PH levels in each participant and recorded.
Results: Participants with periodontitis and diabetes had decreased salivary PH of 6.16 ± 0.03 when compared with individuals with periodontitis who were not diabetic who had PH of 6.62 ± 0.04. The mean salivary PH was compared between the three groups (Control, Periodontitis and DM) where a statistically significant relationship was determined (P<0.05).
Conclusion: Our study concluded that the salivary PH of patients with DM and periodontitis is lower than that of the control group. The difference in mean PH value between group 1, group 2 and group3 was statistically significant (P<0.05).
Keywords: Periodontitis, Diabetes mellitus, salivary PH

INTRODUCTION

According to WHO global diabetes prevalence is anticipated to increase from 9.3% in 2019 to 10.2% in 2030 and 10.9 percent in 2045, according to a diabetes atlas published by the International Diabetes Federation. According to the Middle East and North Africa Organization, Pakistan is ranked second out of 21 nations in the Middle East and North Africa (MENA) region in the International Diabetes Federation's 2017 Diabetes Atlas[1]. Type 2 diabetes was found in 16.98 percent of Pakistan's population over 20 years old, according to the DPS-PAK survey conducted in 2017. According to the survey, this equates to an estimated 17.1 million cases. Diabetes type 1 (DM1) is the most common type of diabetes among diabetics in Pakistan[2].

Type 2 diabetes mellitus is a metabolic condition that occurs when the body is unable to properly utilise and synthesise the hormone insulin. It aids the body's ability to transport glucose from the bloodstream into cells, where it can be used for energy production. When insulin levels are low, glucose is unable to enter cells and instead accumulates in the bloodstream, leading to diabetes. Although there is no cure for diabetes, there are ways to manage the disease and maintain a healthy lifestyle in the interim[3]. Type 1 diabetes, type 2 diabetes, and gestational diabetes are the three most prevalent types of diabetes to be diagnosed. People with type 1 diabetes are unable to make insulin as a result of the immune system attacking and destroying the insulin-producing pancreatic cells in their bodies. Type 1 diabetes, on the other hand, is more commonly found in children and young adults than in any other age group. Type 1 diabetics need to take insulin on a daily basis in order to be fit and alive. Having insulin-resistant tissues is a hallmark of type 2 diabetes, which is distinguished by having a reduced ability to adapt to the disease's metabolic effects. Type 2 diabetes can occur at any point in a person's life. This type of diabetes is more common in people who are in their mid-to-late twenties and beyond. Type 2 diabetes is the most common type of diabetes, accounting for about half of all cases. When a woman is pregnant, she develops gestational diabetes, which is a condition that lasts until the baby is born. Polydipsia, polyphagia, and polyuria are only a handful of the many symptoms linked with diabetes, which can include other conditions as well. Neuropathy, cardiovascular disease, renal failure, and retinopathy are some of the potential complications[4]. Oral diseases, including gingivitis and periodontitis, are the most common types of illness in the mouth. Candidasis and dental caries are two further symptoms to look out for. In addition, alveolar bone loss is prevalent[5].

Periodontitis is a long-term condition that affects both the gums and the alveolar bone that develops as the supporting tissues of the teeth (gums and alveolar bone) degrade. This extremely common occurrence has been linked to a wide range of negative consequences for one's overall well-being, including depression and anxiety. According to epidemiological data, which supports this conclusion, periodontitis is more likely to develop in those who have diabetes[6].

Having diabetes increases the risk of periodontitis, and having periodontitis negatively influences glycemic control in the same manner. There is a two-way interaction between the two conditions[7]. An investigation of the influence of periodontitis on changes in haemoglobin A1c was conducted over a five-year (prospective) period with 2973 non-diabetic subjects. At the outset of the trial, HbA1c levels were five times greater in those who had advanced periodontitis at the outset of the trial than in those who did not have periodontitis. After 10 years of follow-up, there is still no definitive proof that HbA1c alterations related to periodontitis are associated with an increased risk of developing type 2 diabetes, but this is the first study to demonstrate such an association[8]. According to the findings of one study[9], there was a statistically significant difference (p=0.0005) between diabetics and non-diabetics with periodontitis. A low pH in the oral cavity encourages bacterial activity, which in turn produces an environment that is favourable for the pathogens that cause periodontitis to grow. When comparing diabetic patients to non-diabetic people, Seetha Lakshmi et al. discovered a statistically significant association between diabetes and periodontitis, with reduced levels of salivary PH in diabetic patients[10].

Our research, which has the goal of establishing a definitive link between diabetes and periodontitis, is a significant step forward in the endeavour to better understand these two diseases, which have a significant impact on lives of people of the world.

METHODOLOGY

The Islamic International Dental Hospital G-7/4 in Islamabad, Pakistan, undertook a prospective cohort study to determine the

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effectiveness of dental implants. The information was gathered between September 2019 and February 2020. By unanimous decision, the university's ethical review board has given its approval for this project. The sample size was estimated using the World Health Organization's sample size calculator. Using a convenience sampling strategy, the researchers were able to recruit 348 participants for a total sample size of 348. Participants in this study had to be at least 35 years old, and they might be either males or females, depending on their gender. In addition, individuals had to meet all of the other requirements for participation in the study. Individuals in Groups 1 and 2 did not have diabetes and did not have periodontitis, but patients in Group 3 did not have periodontitis but did have diabetic complications. Patients under the age of 35 who were also smokers were not permitted to take part in the research. As the study's goal was described in detail to the participants, they signed a consent form to confirm their participation.

BSR findings were obtained at the Periodontology Department after a brief medical history was taken, and patients were then separated into groups based on their BSR results. When each participant supplied an unstimulated saliva sample in a disposable cup, the pH of their saliva was determined immediately using pH strips.

Statistical analysis: The information gathered was analyzed with the help of the statistical package SPSS version 24, which was developed by IBM. The mean and standard deviation were used to characterize the descriptive statistics, and the ANOVA with Tukey HSD post HOC test and the chi-square test were used to analyze the multivariate data, which was characterized by the mean and standard deviation. The Chi-square test, which is a statistical tool, was used to examine the relationship between gender and periodontitis and diabetes mellitus.

RESULTS

The salivary pH values of Subjects in group 1(Normal) ranged from 6.0 to 7.0 with a mean of 6.90 ± 0.02 Similarly, Salivary pH values of subjects (With Periodontitis only) in group 2 ranged from 6.0 to 7.0 with a mean of 6.62± 0.04 while the salivary pH values of subjects in Group 3 (With Periodontitis and Diabetes) ranged from 6.0 to 7.0 with a mean of 6.16±0.03 (Table 1). In group 1, 82 out of 116 were males white 34 were females. In group 2, Male participants were 80 and female 36 and in group 3, 73 were males and 43 were females. Homogeneity has been seen with respect to gender and diabetes and periodontitis as no significant association was found using chi square test (p-0.8).

Table 1:Description analysis between three groups

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Normal	116	6.9052	.29425	.02732	6.8511	6.9593	6.00	7.00
with Periodontitis only	116	6.6293	.48508	.04504	6.5401	6.7185	6.00	7.00
with Periodontitis and Diabetes	116	6.1638	.37169	.03451	6.0954	6.2322	6.00	7.00
Total	348	6.5661	.49633	.02661	6.5138	6.6184	6.00	7.00

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

(I) What is patient health status?	(J) What is patient health status?	Mean Difference (I-J)	Std. Error	Sig.
Normal	with Periodontitis only	.27586*	.05142	.000
	with Periodontitis and Diabetes	.74138*	.05142	.000
with Periodontitis only	Normal	-.27586*	.05142	.000
	with Periodontitis and Diabetes	.46552*	.05142	.000
with Periodontitis and Diabetes	Normal	-.74138*	.05142	.000
	with Periodontitis only	-.46552*	.05142	.000

*The mean difference is significant at the 0.05 level.

DISCUSSION

Chronic periodontitis is characterised by inflammation of the supporting tissues that surround the teeth, which causes the teeth to become loose and eventually fall off. Periodontitis manifests itself in a variety of ways, the most frequent of which are the resorption of alveolar bone, tissue injury, and tooth loss. Regardless of how quickly or slowly periodontitis progresses, the loss of bone and gum tissue that occurs after the disease has begun is virtually impossible to reverse. Adults with severe gum disease are at risk of losing their teeth, while individuals with intermediate gum disease are at risk of losing their teeth for 40-60% of the population, according to the American Dental Association. Additionally, smoking, as well as other local factors, such as nutritional deficiencies and other systemic disorders, such as diabetes, are also substantial risk factors for periodontal disease[11].

A common metabolic condition, diabetes mellitus (DM), affects around 90% of the world's population, with type 2 diabetes being the most prevalent kind. The presence of one or more of the following conditions is required in order to be diagnosed with T2DM: the body's inability to correctly utilise insulin; a defect in insulin secretion; a deficiency in insulin action; or all three conditions[3].

A large number of systematic reviews and epidemiological research have indicated a clear bidirectional association between type 2 diabetes and periodontitis, as seen in the figure.

The sixth and seventh positions are vacant. The American Dental Association (ADA) recognised in 2003 that gum disease can have a deleterious impact on glycemic management, despite the fact that diabetes and periodontitis have been connected for many years. When compared to healthy people, diabetics are three times more likely to develop periodontitis. Periodontitis, which is recognised as the sixth consequence of the disease and identified as the sixth complication of diabetes, can be exacerbated by diabetes. Diabetes is associated with an increased risk of periodontitis[12]. All of these conditions are associated with diabetes; therefore, accurate prediction of these conditions is dependent on the level of glycemic control in the patient's bloodstream[8].

Those who have diabetes type 2 are more likely than those who are not to develop periodontitis, according to a study of Pima Indians who were not diabetic[13]. There were 187 type 1 diabetic children and adolescents (6 to 18 years of age) in the study, and 178 control volunteers who did not have the disease were also included. A higher percentage of periodontitis was found in those who had diabetes, and the percentage changed based on the severity of gingival inflammation, the duration of the condition, and the type of metabolic therapy used. Gingival inflammation and periodontal tissue destruction are more common in diabetic youth, and periodontal tissues are destroyed more frequently[14].

According to reliable epidemiological statistics, men are more prone than women to suffering from periodontitis[15]. According to the findings of one study, gender differences may have a role in the pathogenesis of periodontitis, potentially altering the microbial aetiology as well as the human immune response to the disease[16]. Researchers revealed in 2010 that sex dimorphism may play a role in the aetiology of periodontitis (gum disease)[17] Periodontal disease appears to affect men at a higher rate than it does females. In our sample, males were more likely than females to have periodontitis, which is consistent with the findings of a previous study. According to the findings of a study including 517 people, diabetic patients had a lower degree of periodontal health

than their non-diabetic counterparts (171 non-diabetics, 205 type 2 diabetics on oral diabetic medication, and 141 diabetics on insulin therapy). Male diabetics who took oral medication had poorer periodontal health, whereas female diabetics who took insulin and oral medication had the same level of periodontal tissue degradation as male diabetics who took oral medication[18].

The alteration of the acid–base balance of the body fluids caused by diabetes has long been known, and it can result in metabolic acidosis, which can be fatal (acidification of the blood). This explains why diabetics' saliva has a more acidic pH than healthy people's[19]. Participants with diabetes had decreased salivary PH levels, which had an impact on the ability of saliva to buffer and cleanse the mouth and throat. Those with periodontitis alone had somewhat lower pH levels than those with diabetes alone. However, those with diabetes and periodontitis together had much lower pH levels than those with diabetes alone. Having a low salivary pH encourages the growth of acidic bacteria, which in turn creates an environment that is not conducive to the establishment of oral bacteria that provide defence. It is the bacteria that create aciduric acid that are responsible for further depleting the pH of saliva, causing the cycle to repeat endlessly. Individuals with diabetes who have had their blood glucose levels elevated for an extended length of time are more likely than others to have advanced glycation end proteins (AGEs), which are irreversibly glycated proteins in the gingival tissue and periodontal ligament. A compromised polymorph nuclear leukocyte response, which results in alterations in collagen structure, an altered immune response, and an accumulation of advanced glycation end products (AGE) in the periodontal ligament, allows microorganisms to persist in tissues. Increased production of interleukin-1-B and tumour necrosis factor (TNF) is a result of these events, which in turn lead to an increase in collagenase activity and a decrease in collagen creation, all of which have a detrimental impact on the metabolism of the connective tissue of the skin. Those suffering from diabetes experience poorer wound healing and worse periodontal tissue degradation as a result of their condition[20,21]. Furthermore, we discovered that the longer the patients had been diabetic, the greater the pH drop and the greater the degree of periodontal degeneration were determined to be People with diabetes, according to Poplawaska-Kita et al., have a higher chance of acquiring periodontitis than patients without diabetes[22]. In comparison to the findings of the Takahashi et al. study, our findings indicate that salivary pH has been reduced. This reduction in acidic settings may cause periodontal microorganisms that thrive in acidic environments to produce more, such as P. gingivalis, P. intermedia, and F nucleatum. In the presence of any of these germs, periodontitis is inflamed and worsens as more bacteria build in the mouth, exacerbating and aggravating the condition. On the other hand[23,24], diabetes has been associated with abnormalities in salivary and taste functioning, as well as fungal and bacterial infections, in addition to xerostomia and a diminished ability to heal wounds[4].

Both type 1 and type 2 diabetes have been associated with xerostomia at various times in the past. Some studies have also suggested that diabetic people have lower salivary flow as compared to non-diabetic people. Damage to the gland parenchyma, altered salivary gland microcirculation, dehydration, and abnormalities in glycemic control are all possible causes of these disorders[25,26].

It is easier for plaque to accumulate when salivary flow is reduced, and the buffering ability of the saliva is reduced in response to this drop. Plaque is the primary cause of both dental caries and periodontal disease, yet it is also the most preventable. Increased plaque accumulation, xerostomia, and lower salivary pH levels are all factors that contribute to the development of periodontitis in patients with diabetes[23].

CONCLUSION

Our study concluded that the salivary PH of patients with DM and periodontitis is lower than that of the control group. The difference in mean PH value between group 1, group 2 and group3 was statistically significant (P<0.05).

Limitations: We had to rely on patients to provide accurate information which is not always as truthful as stated by the patient. We did not consider medication as a confounding variable.

Conflict of interest: Nil

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