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CORRELATION OF SALIVARY PH, INCIDENCE OF DENTAL CARIES AND PERIODONTAL STATUS IN DIABETES MELLITUS PATIENTS: A CROSS-SECTIONAL STUDY

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ABSTRACT This study evaluated the salivary pH and incidence of dental caries and periodontal status in diabetes mellitus compared to normal subjects. Sample consisted of 40 patients divided into 2 groups, group I - 20 known diabetes mellitus patients (study group) and group II - 20 non diabetic subjects (control group). Salivary pH was determined using a saliva- check and dental caries and periodontal status by DMFT and PDI indices respectively. There was a decrease in the mean salivary pH of 6.51 in the study group. The mean DMFT index was higher in the study group (8.10) when compared to that of control group (1.15). The mean PDI score was also higher in the study group (4.0) as compared to that of the control group (0.45). Thus significant relationship was noted with increased incidence of dental caries and periodontitis and a significant reduction in the salivary pH in study group.

KEYWORDS : Diabetes Mellitus, Dental Caries, Salivary biomarkers

INTRODUCTION

One of the global health challenge faced by the world today is Diabetes mellitus. China ranks First with 96.2 million people with diabetes in 2014 following by India which ranks Second with 66.8 million diabetics. Estimations by International Diabetes Federation showed that approximately more than 387 million people worldwide currently, have diabetes and it is estimated to increase to 592 million by 2035[1]. Being one of the common chronic metabolic disease with various oral consequences, Diabetes mellitus manifests in altering the salivary composition and its functions. This change in oral environment initiates pathogenic bacteria, damaging hard and soft tissues of the oral cavity leading to an increased cariogenic activity and periodontal lesions. Decreased saliva reduces protective effect were by resulting in development of dental caries [2].

Alterations in pH of saliva are often reported in diabetes mellitus patients. The pH changes in plaque and sugar clearance from saliva often showed correlation [3]. It was reported that low salivary pH provides an acidogenic environment for the growth of aciduric bacteria leading to dental caries which again further lowers the salivary pH leading to a vicious cycle. Diabetes promotes periodontitis through an exaggerated inflammatory response to the periodontal microflora [4].

AIM

The aim of this study was to evaluate pH of saliva in diabetes mellitus patients and to compare with that of normal subjects and also to evaluate the caries incidence and periodontal status of the diabetes mellitus patients and compare it with normal subjects.

MATERIALS AND METHODS

A cross-sectional study was conducted in the Department of Conservative Dentistry and Endodontics, KVG Dental College and Hospital, Sullia, where a total of 40 subjects were included after taking the institutional ethical clearance and informed consent from the subjects. The subjects were divided into two groups. Group I (study group) comprised of 20 known diabetic patients (6 males and 14 females), with a fasting blood glucose more than 121mg/dl, with minimum of two years of disease duration. Both the Type 1 and Type two diabetic patients were included in this group. Group II (control group) comprised of 20 non diabetic patients (4 males and 16 females), who were age and gender matched as that of the previous group. The exclusion criteria included subjects who did not give written informed consent, gestational diabetic patients and patients with the habit of smoking. A detailed history of the patient was taken including personal history, drug history, allergies. The patients were clinically examined and assessed for dental caries and periodontal status using the Decay, Missing, Filled, Treatment (DMFT) index and Periodontal Disease Index (PDI) respectively. The blood samples were collected to estimate the fasting and postprandial blood glucose levels. The unstimulated whole salivary samples were collected from subjects in both the groups using spitting method, after a waiting period of 10 minutes, so as to avoid sample dilution before collecting the subjects were asked to bend the head forward and accumulate the saliva in the floor of the mouth and expectorate it in a sterile container, every five minutes for15 minutes. The pH of the samples was immediately analysed u using a saliva- check (GC America inc).

RESULTS

In the present study, 20 diabetic (study group) and 20 non-diabetic (control group) subjects participated.

Table-1- Comparison of mean salivary pH, DMFT and PDI between Diabetic and Non- Diabetic Patients.

Parameter	Group	N	Mean	Std. Deviation	t- value	p-value
SALIVA pH*	DM*	20	6.46	0.717	7.94	0.00
	NDM*	20	7.87	0.279		
DMFT*	DM*	20	8.12	5.874	5.12	0.00
	NDM*	20	1.14	1.461		
PDI*	DM*	20	4.01	1.589	9.32	0.00
	NDM*	20	0.44	0.604		

*Independence Samples t-test, ($p<0.05$ – Statistically significant)

[Table/Fig-1] depicts the comparison of mean salivary pH, DMFT and PDI among diabetic patients and non-diabetic patients, the salivary pH was low (6.5) among the study group compared to the control group (7.89) and the mean DMFT (8.1) and PDI (4) score were high in diabetic patients than non-diabetic patients whose DMFT and PDI score were 1.15 and 0.45 respectively. Independent sample t-test showed that there was a highly significant difference in the mean score between the study group and the control group, with a p-valve of <0.05, which was statistically significant.

Table-2- Correlation between salivary pH with DMFT and PDI among Diabetic Patients.

Diabetic Patients	DMFT*	PDI*
Saliva pH*	-0.518	-0.086

*Pearsons correlation ($p<0.05$)

[Table/Fig-2] depicts the correlation between the salivary pH, DMFT and PDI among the study group, a significant negative correlation ($r = -0.52$) was observed between the salivary pH and DMFT among diabetic patients.

Table-3- Correlation between salivary pH with DMFT and PDI among Non Diabetic Patients.

Non – Diabetic Patients	DMFT*	PDI*
Saliva pH*	-0.064	-0.338

*Pearsons correlation ($p<0.05$)

[Table/Fig-3] depicts the correlation between the salivary pH, DMFT and PDI among the control group, no significant correlation observed

between the salivary pH, DMFT and PDI among non-diabetic patients.

DISCUSSION

One of the widely seen common chronic metabolic diseases with numerous oral and systemic manifestations is Diabetes Mellitus. Dental carries, gingivitis, periodontics, salivary dysfunction, oral mucosal and other infections, taste and neurosensory disorders are the oral infections of Diabetes Mellitus. Evaluation of Salivary pH ,incidence of dental carries and periodontal status of diabetes Mellitus patients and comparison with normal subjects is done through this study.[5]

The normal pH range of saliva is 6.2 -7.6 with an average of 6.7. Saliva maintains pH near neutrality in the oral cavity (6.7 - 7.3). It is done by two mechanisms mainly, (1) Elimination of carbohydrates which could be metamobilised by the bacteria by flow of saliva, hence the acid produced by the bacteria is removed, (2) Saliva neutralizes the acidity formed from food and drinks as well as from microbial activity by its buffering actions.[6]

For determining the salivary pH in this study, un-stimulated saliva samples were collected from diabetes and non diabetes patients as the composition and pH may alter in stimulated salivary samples. Comparison of the mean salivary pH was done between diabetic and non- diabetic. When compared to controlled group, Diabetes Mellitus subjects had decreased salivary pH (Table/Fig 1). This acidic pH may be attributed to the metabolic changes in diabetes Mellitus patients. Reduction in the level of bicarbonates in all body fluids which leads to metabolic acidosis of all body fluids is found in diabetes.[7-9]

Increased DMFT score was also found in diabetes Mellitus when compared by control group. Loss of protective mechanism of saliva in diabetics is the reason for the same. This will also result in impaired cleansing and buffering action of saliva.[11] The growth of aciduric bacteria which allows the acidogenic bacteria to proliferate creating an inhospitable environment for the protective oral bacteria is being promoted by low salivary pH. This further lowers the salivary pH and allow for a shift in the oral environment balance to favor cariogenic bacteria and the cycle continues. In acidic environment carcinogenic bacteria are likely to be thrived. Increased blood glucose levels, reduced salivary flow rate, reduced buffering capacity, poor dietary control are the other risk factors which increases the risk of dental carries in Diabetes Mellitus patients.[12-15]

The studies done by Deepak Goyal et Al, cigar et Al, Rai K et Al, Elfakri et Al is in accordance with this study reporting decreased salivary pH and increased dental carries among diabetes Mellitus patients. In contrast, studies by Collin HL et Al and Alves C et al reported no difference found in DMFT score among diabetics and non diabetics.

Increased occurrence of gingivitis and periodontitis was found in patients with Diabetes Mellitus than the non diabetic control group when the periodontal status was compared. The risk of gingivitis and periodontitis is increased by diabetes. Change in microvascular integrity is one of the major complications in Diabetes. Chronic and prolonged hyperglycemia leads to high levels of accumulation of irreversibly glycated proteins called advanced glycation end products.(AGEs) in the tissues including periodontium in Diabetes Mellitus. Altered immune function and variation in collature stature and accumulation of AGEs in the the periodontium causes impaired polymorphonuclear leukocyte function which may facilitate bacterial persistence in the tissues. Increased production of proinflammatory cytokinines such as 1L-1-Beta and TNF- Alpha which leads to an increase in collagenase activity and reduction in collagen synthesis which effects the collagen metabolism is lead by the interactions between AGEs and inflammatory cells. Compromised wound healing and increased periodontal tissue destruction in diabetes Mellitus an be attributed to this reason[16-20].

This study is also in accordance with the study done by Poplawaska-Kita A et al who reported that there was an increased risk of periodontia in patients with Diabetes Mellitus. Reduction in salivary pH which was evident in our study may increase the growth of periodontal pathogens as per study of Takahashi et al , Fujikawa et al and Galgut. When pH of saliva is decreased (acidic),there is increased incidence of dental caries which suggests a negative correlation between salivary pH and DMFT and between salivary pH and PDI.(Table2).Study of Michelle Hurlburt et al who also reported that low salivary pH promotes cariogenic lesions in the oral activity is in accordance with this study. pH of saliva in patients with periodontis is more acidic than control group is similar to study done by Sharmila Baliga et Al.She has reported that patients with chronic generalized periodontis has more acidic saliva than that of control group .Microorganism which are responsible for periodontis have a favourable environment for growth in an acidic pH such as P gingivalis grows at a pH of 6.5- 7.Intermedia grows at pH of 5-7 and F nucleatum grows at a pH of 5.5 - 7.7.This can be explained in accordance with study of Takahashi et al.[21-26]

CONCLUSION

From this present study it can be concluded that,

1. Patients with diabetes mellitus have reduced salivary pH, increased incidence of caries and periodontitis when compared to the control group.
2. The pH of the saliva in patients with an increased DMFT and PDI score was more acidic than the patients with low DMFT and PDI score.

REFERENCES

1. International Diabetes Federation. IDF diabetes atlas update poster, 6th edn. brussels, belgium: international diabetes federation, 2014. Available from www.idf.org/diabetesatlas.
2. Devi TJ. Saliva-A Potential Diagnostic Tool. IOSR Journal of Dental and Medical Sciences. 2014;13(2):52-57.
3. Baliga S, Mugilkar S, Kale R. Salivary pH: A diagnostic biomarker. J Indian Soc Periodontol. 2013;17(4):461-65.
4. Lamster IB, Lalla E, Borgnakke WS, Taylor GW. The relationship between oral health and diabetes mellitus. J Am Dent Assoc. 2008;139(10 suppl):19S-24S.
5. Bangash RY, Khan AU, Tariq KM, Yousaf A. Oral aspects and complications in type 2 diabetes mellitus – a study. Pakistan Oral & Dental Journal. 2012;32(2):296-99.
6. Schipper R, Loof A, de Groot J, Harthoorn L, van Heerde W, Dransfield E. Salivary protein/peptide profiling with SELDI-TOF-MS. Ann N Y Acad Sci. 2007;1098:498–503.
7. Prathibha KM, et al. Evaluation of salivary profile among adult type 2 diabetes mellitus patients in South India, Journal of Clinical and Diagnostic Research. 2013;7(8):1592-95.
8. Goyal D, Kaur H, Jawanda MK, et al. Salivary pH and dental caries in diabetes mellitus. International Journal of Oral & Maxillofacial Pathology. 2012;3(4):13-16.
9. Ciglar.I,Sutalo.J,Sjaljac-Staudt G, Bozikov J. Saliva as a risk factor for caries in diabetic patients. Acta Stomatol Croat. 1991;25(3);143-49.
10. Rai K, Hegde AM, Kamath A, Shetty S. Dental Caries and salivary alterations I Type 1 Diabetes. J Clin Pediatr Dent. 2011;36(2):18-24.
11. Elkafri IH, Mashlah A, Shaqifa A. Relationship between blood glucose levels and salivary pH and buffering capacity in type II diabetes patients. East Mediterr Health J. 2014;20(2):139-45.
12. Iqbal S, Kazmi F, Asad S, Mumtaz M, Khan AA. Dental Caries & Diabetes mellitus. Pakistan Oral & Dental Journal. 2011;31(1).
13. Jawed M, Shahid SM, Qader SA, Azhar A. Dental caries in diabetes mellitus: role of salivary flow rate and minerals. J Diabetes Complications. 2011;25(3):183- 86.
14. Akpata ES , Alomari Q, Mojiminiyi OA, Al-Sanae H. Caries experience among children with type 1 diabetes in Kuwait. Pediatr Dent. 2012;34(7):468-72.
15. Collin HL, Uusitupa M, Niskanen L, Koivisto AM, Markkanen H, Meurman JH. Caries in patients with non-insulin- dependent diabetes mellitus. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1998;85(6);680-85.
16. Alves C , Menezes R, Brandão M. Salivary flow and dental caries in Brazilian youth with type 1 diabetes mellitus. Indian J Dent Res. 2012;23(6):758-62.
17. Duarte PM, Bezerra JP, Miranda TS, Feres M, Chambrone L, Shaddox LM. Local levels of inflammatory mediators in uncontrolled type 2 diabetic subjects with chronic periodontitis. J Clin Periodontol. 2014;41:11–18.
18. Pietropaoli D, Tatone C, D'Alessandro AM, Monaco A. Possible involvement of advanced glycation end products in periodontal diseases. Int J Immunopathol Pharmacol. 2010;23(3):683-91.
19. Kim J, Amar S. Periodontal disease and systemic conditions: a bidirectional relationship. Odontology. 2006;94(1):10–21.
20. Al-Maskari AY, Al-Maskari MY, Al-Sudairy S. Oral Manifestations and complications of diabetes mellitus A review. SQU Med J. 2011;11(2):179-86.
21. Popławska-Kita A, Siewko K, Szpak P, Król B, Telejko B, Klimiuk PA, et al. Association between type 1 diabetes and periodontal health. Adv Med Sci. 2014;59(1):126-31.
22. Takahashi N, Schachtele CF. Effect of pH on the growth and proteolytic activity of Porphyromonas gingivalis and Bacteroides intermedius. J Dent Res. 1990;69:1266–69.
23. 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;12:323–28.
24. 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 Shishubyo Gakkai Kaishi. 1989;31:241–48.
25. Galgut PN. The relevance of pH to gingivitis and periodontitis. J Int Acad Periodontol. 2001;3:61–67.
26. Hurlbutt M, Novy B, Young D. Dental Caries: A pH-mediated disease. Canadian Dental Hygienists' Association. Winter 2010.