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Original Research

Salivary pH and Dental Caries in Diabetes Mellitus

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Abstract

Background: Diabetes Mellitus is a major health care problem in which reduced secretion of saliva may occur due to pronounced polyuria in non-regulated and inadequately regulated cases. **Aim**: To determine salivary pH in diabetic and non-diabetic subjects and to compare the prevalence of dental caries among them. **Materials and Methods**: The study involved 150 subjects, distributed in three groups; (1) 50 non-diabetic subjects (25 females and 25 males) (2) 50 controlled diabetic subjects (25 females and 25 males) and (3) 50 uncontrolled diabetic subjects (25 females and 25 males). Fasting blood glucose level and salivary pH for each subject were measured with the help of biochemical analyser and digital pH meter, respectively. Caries index was recorded using DMFT index. **Results**: The results showed decreased salivary pH and increased incidence of dental caries in Uncontrolled Diabetics as compared to Non-diabetics and Controlled diabetics and also decreased salivary pH and decreased incidence of caries in Controlled diabetics as compared to Non-diabetics. **Conclusion**: Diabetes mellitus may have a direct effect on salivary pH reducing it from normal levels irrespective of diet.

Key words: Dental Caries; Diabetes; Tooth Demineralisation; Salivary pH; Tooth Disease; Biochemical.

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Introduction

Diabetes mellitus is a common chronic disease and has emerged as a major health care problem. There was an estimation of 40 million people with diabetes in India in 2007 and this number is predicted to rise to almost 70 million people by 2025. According to Diabetes Atlas published by the International Diabetes Federation (IDF), every fifth person with diabetes will be an Indian by 2025. Diabetes causes many complications in various organs.[1,2,3] Oral complications include dental caries, periodontal disease, and tooth mobility which is influenced by saliva. Xerostomia or hypo-salivation is prevalent in patients with Diabetes Mellitus. Diabetes Mellitus has also been associated with higher numbers of oral pathogens in the saliva.[4,5]

Various studies have reported increased, decreased, or similar caries incidence in individuals suffering from diabetes mellitus. The literature, therefore, does not describe a consistent relationship between diabetes and dental caries. Similarly its relation to salivary pH is not clearly understood. Hence the aim of the present study was to evaluate the correlation between salivary pH and caries prevalence in non-diabetics, controlled and uncontrolled diabetics patients. Significance of our study is that the proper measures can be taken to prevent the dental caries in these patients at early level and therefore proper prophylactic treatment can be done in these patients.

The study was undertaken at M.M College of Medical Sciences and Research, Mullana, Ambala, Haryana with the aims and objectives:

1. To evaluate and compare the salivary pH in controlled diabetics, uncontrolled diabetics and in non-diabetic population.
2. To evaluate and compare the DMFT score in all the three groups.
3. To compare the relationship between salivary pH and DMFT score in all the three groups.

Materials and Methods

A total 150 subjects were examined. The subjects were divided into three groups: Group I (Control group) comprised of 50 non-diabetic subjects (25 females and 25 males) with no known history of diabetes mellitus and a fasting plasma glucose level less than 100mg/dl. Group II comprised of 50 controlled diabetic subjects (25 females and 25 males) who had a known history of diabetes with fasting plasma glucose levels less than 126mg/dl and were under

medication (Insulin intake). Group III comprised of 50 uncontrolled diabetic subjects (25 females and 25 males) with a known history of diabetes with fasting plasma glucose levels greater than 126mg/dl and were also under medication (Insulin intake). So only those diabetics who were under medication of insulin were considered (controlled and uncontrolled).

Fasting venous blood was collected for the measurement of plasma glucose levels in all the three groups. Plasma glucose levels were estimated by using an automated biochemical analyser (RAYTO-RT 1904C, Shekou, Shenzhey, China). Fasting unstimulated 2ml salivary samples from the subjects of all the three groups were collected by spitting method for about 5 minutes (morning) in the test tube. Plasma glucose levels were evaluated and after evaluation the uncontrolled diabetics were referred to the department of General Medicine for prophylactic treatment. Salivary pH was measured immediately by Digital pH meter.

Dental caries for each subject was assessed using DMFT index (WHO 1986 caries modified index). The mean of salivary pH scores and DMFT scores were taken individually for each group and the data for all the values were skewed (not normally distributed) and non parametric tests (NPar Tests Mann-Whitney Tests) were applied.

Results

The fasting blood glucose levels in non-diabetic group ranged from 82mg/dl to 98mg/dl with a mean of 96.21± 12.26 mg/dl, in controlled diabetic group ranged from 110mg/dl to 125mg/dl with a mean of 123.9 ± 11.40 mg/dl and in the uncontrolled diabetic group ranged from 170mg/dl to 350mg/dl with a mean of 254.74 ± 88.42 mg/dl. The salivary pH levels in non-diabetic group ranged from 6.5 to 8 with a mean of 7.55± 0.45., in controlled diabetic group ranged from 6.3 to 7.8 with a mean of 7.32 ± 0.35 and in uncontrolled diabetic group ranged from 5.5 to 7.2 with a mean of 6.82 ± 0.84.

The DMFT score in non-diabetic group ranged from 6 to 7 with a mean of 6.26 ± 3.7, in controlled diabetic group ranged from 4 to 5 with a mean of 4.52± 1.56 and in uncontrolled diabetic group ranged from 7 to 9 with a mean of 8.6 ± 4.01. On comparing controlled with non-diabetic subjects (Table 1), a statistically significant decrease in salivary pH levels was seen in controlled diabetics (p value < 0.001). On comparing DMFT scores , there was significant decrease in dental caries score in controlled diabetes with (p value of 0.025).On comparing uncontrolled with non-diabetic subjects (Table 1), a statistically significant decrease in salivary pH levels was seen in uncontrolled diabetics with a p value < 0.001. On comparing DMFT scores there was significant increase in dental caries score in uncontrolled diabetes with a p value of 0.002. On comparing controlled were compared with uncontrolled diabetic subjects (Table 1), a statistically significant decrease in salivary pH levels were seen in uncontrolled diabetics (p value of 0.002). On comparing DMFT scores there was significant increase in dental caries score in uncontrolled diabetes with a p value < 0.001. Dental caries was found to be minimum in controlled diabetics and maximum in uncontrolled diabetics and salivary pH became acidic as diabetes progressed from non-diabetics to uncontrolled diabetics.

Groups	Mean fasting blood glucose level (mg/dl)± S.D	Mean salivary pH± S.D	Mean DMFT score ± S.D
Controls	96.21± 12.27	7.55± 0.45	6.26± 3.72
Controlled diabetic	123.9± 11.40	7.32± 0.35	4.52± 1.56
Uncontrolled diabetic	254.74± 88.42	6.82± 0.84	8.6± 4.01

Table 1: The mean levels of fasting blood glucose levels, salivary pH and DMFT score in all the three groups.

Discussion

Diabetes mellitus is a metabolic disease with numerous systemic manifestations which are also noticeable in the oral cavity as first described by Seifert in 1862. Manifestations in the oral cavity include abnormal development of dentition, increased frequency and intensity of caries, pathologies of the oral mucosa, xerostomia as well as atrophic changes in the alveolar process.[6]

In the present study, fasting and salivary blood samples were taken, since dental caries and salivary pH are affected by diet. To avoid the affect of diet, fasting samples from venous blood were taken for blood glucose level and unstimulated saliva of

subjects was collected for monitoring of salivary pH. DMFT index was done in order to measure the dental caries in these patients. Few studies like this have been performed and published in national and international literature.[11,12]

The present study demonstrated that when the uncontrolled diabetics were compared with the non-diabetics, the uncontrolled diabetics had a decreased salivary pH and increased DMFT score. This may be attributed to the changes in the metabolic process of the uncontrolled diabetics resulting in acidic pH and thus increased incidence of dental caries. In uncontrolled diabetics due to changes in the metabolic process it leads to decrease in pH level and this decrease in pH level or acidic pH together with poor dietary control of the patient's leads to the increase of dental caries in these patients. Our study was found to be in accordance to study done by Karjalainen et al. in 1997 concluded from their study that poor control of diabetes was found to be associated with caries.[7]

The present study also demonstrated that controlled diabetics when compared with non-diabetics showed decreased salivary pH and a decreased DMFT score. These subjects showed a significantly lower salivary pH than non- diabetics and this can be due to the change in the metabolism leading to the decrease in pH level but due to good dietary control of the patients in this category dental caries was found to be low in these patients. This may suggest the influence of diabetes mellitus on salivary pH leading to decrease in dental caries but influence of dietary control on dental caries leading to decrease in dental caries. The decrease in DMFT scores in controlled diabetic subjects may be due changes in the dietary habits of the patients. Our study was found to be in accordance with study done by Siudikiene et al. [8] who reported that diabetics had fewer caries and plaque, lower salivary flow rates and buffer effect, and more frequent growth of yeasts than their non-diabetic controls. Well-to-moderately controlled diabetics had fewer decayed surfaces and lower counts of mutans streptococci and yeasts than poorly controlled diabetics, but the level of metabolic control of diabetes had no influence on salivary flow rates and buffer effect.[8]

The present study also demonstrated that when the uncontrolled diabetics were compared with the controlled diabetics in there salivary pH and DMFT score; the uncontrolled diabetics had a decreased salivary pH and increased DMFT score. This may be attributed to the changes in the metabolic process of the uncontrolled diabetics due to higher glucose levels, resulting in a more acidic pH and thus increased incidence of dental caries. The decrease in DMFT scores in controlled diabetic subjects may be due changes in the dietary habits of the patients.

Our study was found to be in accordance with Ciglar et al. It was concluded from their study that in all diabetic patients, a significantly lower salivary pH was recorded as compared to normal subjects. Increased growth of acidogenic substrate and ultimately additional plaque formation play prominent role in developing various oral complications in these patients.[9] Moreira et al. conducted the study on flow rate, pH and calcium concentration of saliva of children and adolescents with type 1 diabetes mellitus. They supported the view that an appropriate evaluation of salivary clinical parameters, such as salivary flow rate and buffer capacity, is recommended when assisting diabetic children. According to them, salivary parameters favoring caries such as low saliva pH and unstimulated salivary flow rate were observed in Type 1 diabetes mellitus individuals.[10] Sampaio N et al conducted a study on Dental caries-associated risk factors and type 1 diabetes mellitus. They suggested that although patients with uncontrolled T1DM and poor oral hygiene may present increased prevalence of dental caries, the literature does not describe a consistent relationship between T1DM and dental caries.[11]

So finally the decayed, missing, filled surfaces index is higher in both insulin dependent and non-insulin dependent diabetics as compared to normal subjects. This effect could be secondary to decreased salivary flow and pH which leads to series of caries risk in diabetics especially in inadequately regulated and non-regulated cases of the disease. Uncontrolled levels of blood glucose levels affect the salivary factors such as flow rate, buffer capacity, glucose content and the level of acidogenic bacteria. Increased glucose concentration in saliva and GCF may contribute in declining

in pH of saliva resulting in acidogenic bacterial substrate and plaque formation.[12]

Conclusion

Since both controlled and uncontrolled diabetics showed decrease in salivary pH, the present study suggests that diabetes mellitus may have a direct effect on salivary pH reducing it from normal levels irrespective of diet. The lower incidence of caries in controlled diabetics than in normal subjects in this study suggests that diet plays an important role in caries incidence. Thus the process of diabetes mellitus may affect saliva and further influence the oral environment.

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References

1. Neville, Damm, Allen, Bouquot. Oral & Maxillofacial Pathology. Haematological disorders. 2nd Edition. Philadelphia: Saunders Elsevier; 2002. 5055-08p.
2. Shafer's Hine Levy. A Text book of Oral Pathology. Diseases of blood and blood forming units. 4th Edition. Philadelphia: Saunders Elsevier; 2006. 1058-65p.
3. Regezi JA, Sciuba JJ, Jordan RCK. Oral Pathology. Clinical Pathologic Correlation. Ulcerative conditions. 5th Edition. USA: Saunders Elsevier Science; 2003. 47-8p.
4. Khovidhunkit SP, Suwantuntula T, Thaweboon S, Mitrirattanakul S, Chomkhakhai U, Khovidhunkit W. Xerostomia, hypo salivation, and oral micro biota in type 2 diabetic patients: a preliminary study. J Med Assoc Thai 2009;92(9):1220-8.
5. Newman MG, Takei H, Carranza FA, Klokkevold PR. Clinical Periodontology. 10th ed. Philadelphia: Saunders Elsevier; 2003. 113-31p.
6. Qureshi A, Qureshi A, Qureshi H, Khan AA. Blood Glucose Level, Salivary pH and Oral Bacterial Count in Type 1 Diabetic Children. Infect Dis J 2007;16:45-8.
7. Karjalainen KM, Knuuttila ML, Kaar ML. Relationship between caries and level of metabolic balance in children and adolescents with insulin-dependent diabetes mellitus. Caries Res 1997;31:13-8.
8. Siudikiene J, Machiulskiene V, Nyvad B, Tenovuo J, Nedzelskiene I. Dental caries and salivary status in children with type 1 diabetes mellitus, related to the metabolic control of the disease. Eur J Oral Sci 2006;114: 8-14.
9. Ciglar I, Sutalo J, Sjaljac-Staudt G, Bozikov J. Saliva as a risk factor for caries in diabetic patients. Acta Stomata Croat. 1991;25:143-9.
10. Moreira AR, Passos IA, Sampaio FC, Soares MSM, Oliveira RJ. Flow rate, pH and calcium concentration of saliva of children and adolescents with type 1 diabetes mellitus. Br J Med Biol Res 2009;42:707-11.
11. Sampaio N, Mello S, Alves C. Dental caries-associated risk factors and type 1 diabetes mellitus. Pediatric Endocrinology, Diabetes and Metabolism 2011;17(3):152-7.
12. Chuang SF, Sung JM, Kuo SC, Huang JJ, Lee SY. Oral and dental manifestations in diabetic and non diabetic uremic patients receiving hemodialysis. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2005;99:689-95.

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