

DENTAL CARIES & DIABETES MELLITUS

¹SADIA IQBAL, M.Phil Oral Pathology

²FARHAT KAZMI, M.Phil Oral Pathology, PhD Trainee

³SAAD ASAD, FC.S (Orthodontics), Invisalign Certified Orthodontist

⁴MUHAMMAD MUMTAZ, MDS Oral Surgery, PhD Trainee

⁵AYYAZ ALI KHAN, MSc, PhD Community Dentistry

ABSTRACT

Diabetes Mellitus has been linked with increased incidence of dental caries. Aim of this study was to compare caries incidence between control group and diabetic patients and to assess whether there is any association between dental caries and salivary glucose level and salivary calcium levels. Study was conducted on 60 subjects; 30 control and 30 diabetics. DFT (Decayed Filled Teeth Score) was assessed for both the groups clinically. Then un-stimulated whole saliva samples from diabetics and control group were collected, stored and frozen at -20C. Saliva samples were then defrosted, centrifuged and their supernatant portion were analyzed by Dimension Clinical Chemistry System for Salivary glucose and calcium levels. SPSS 16.0 was used for statistical analysis. Results showed that DFT score was higher among the diabetic patients (2.49) when compared with the control group (0.53). It was also concluded that salivary glucose levels were higher and salivary calcium levels were lower in the diabetic patients as compared to control group

Key words: Salivary Glucose Level, Salivary Calcium Level, Diabetes Mellitus, Dental Caries

INTRODUCTION

Diabetes mellitus a common disease of 20th century has been linked with an increased risk of caries, gingivitis and periodontal disease.¹ Changed oral environment may cause increase in pathogenic bacteria and cause destruction of hard and soft tissues of mouth leading to cariogenic and gingival lesions.² Other common oral problems associated with diabetes include xerostomia, salivary gland dysfunction, increased susceptibility to bacterial, viral and fungal infection, periapical abscesses, loss of teeth, taste impairment, lichen planus, burning mouth syndrome and altered orthodontic tooth movements. These findings are associ-

ated with excessive loss of fluids due to polyuria, altered response to infection, altered connective tissue metabolism, micro vascular changes and impaired saliva.³

Saliva is a glandular secretion, vital for oral health and helps to maintain oral homeostasis.⁴ Saliva contains proteins, enzymes, glucose, inorganic constituents and hormones in various concentrations each of which has its significant functional importance. Salivary constituents are affected in various local & systemic conditions such as Diabetes Mellitus which in recent past lead to importance of assessment of salivary constituents as diagnostic & therapeutic tool.⁵

Correspondence: ¹Dr Sadia Iqbal, Assistant Professor, Department of Oral Pathology, Lahore Medical & Dental College, Lahore. E-mail: iqsadia@yahoo.com, Cell No: 0333-4308517

² Assistant Professor & Head of Oral Pathology, University College of Dentistry, The University of Lahore. E-mail: drfarhatkazmi@gmail.com, Cell No: 0321-8859705

³ Assistant Professor, Department of Orthodontics, Head of Oral Biology & Tooth Morphology, The University College of Dentistry, The University of Lahore. E-mail: saad2609@yahoo.com, Cell No: 0300-4079491

⁴ Assistant Professor Oral & Maxillofacial Surgery, University College of Dentistry, The University of Lahore. E-mail: maxfacmumtaz@gmail.com, Cell No: 0300-4554790

⁵ Professor & Head Department of Oral Health Sciences, Sheikh Zayed Postgraduate Medical Institute, Lahore. E-mail: ayyazk@brain.net.pk, Cell No: 03008454981

though salivary constituents are changed in diabetes but what is its impact on caries is not clearly explained.⁶

Dental caries and salivary factors have attracted less interest, and the results are divergent as to whether caries risk is different or salivary factors are affected in diabetic patients compared to controls. Equal caries rates in diabetic patients and controls have been reported in many studies.^{1,7,8} A higher caries risk among diabetic patients than healthy controls has also been demonstrated^{9,10}, but in contrast, some studies have found even less caries in diabetic patients than in controls.⁹

In Pakistan no studies on changes in salivary constituents in diabetic patients were available on search of literature. Thus there is need for an investigation focused on the assessment of salivary glucose and calcium levels in diabetics. Thus the present study has been aimed at assessing the salivary glucose & calcium levels in diabetic patients and their linkage with dental caries.

METHODOLOGY

The study was conducted on 60 patients, out of whom 30 were diabetics (Fasting Blood Sugar Level >120mg/dl, HbA1c level > 7.0%), who were registered in the endocrinology department of Shaikh Zayed Medical Complex, Lahore and 30 were normal non-diabetics (Fasting Blood Sugar Level between 70-120mg/dl, HbA1c level < 7.0%), who were under treatment in dental / orthodontic department of Faculty of Dentistry, The University of Lahore. Un-cooperative patients, patients with any active systemic disease and patients with missing teeth were excluded from the study.

Un-stimulated whole saliva from diabetic and control group was collected in sterilized plastic jars through spitting method and stored in freezer at -20degree centigrade and then brought to the laboratory in a ice chilled box. Saliva samples were defrosted, centrifuged and its supernatant portion was used for analysis which was carried out by using auto analyzer (Dimension Clinical Chemistry System). Salivary glucose & Calcium levels were analyzed by using Dimension Clinical Chemistry System. The glucose method used on the Dimension® clinical chemistry system is an in vitro diagnostic test. The Glucose method is an adaptation of

the hexokinase-glucose-6-phosphate dehydrogenase method. The calcium method used on the dimension® clinical chemistry system is an in vitro diagnostic test. The calcium method is the modification of the calcium o-cresolphthalein complexone (OCPC) reaction.

Intra-oral examination was performed to assess the DFT in normal & diabetic patients with the aim that whether caries incidence was more in diabetics and whether there was any association of caries with salivary glucose and calcium levels.

SPSS 16.0 was used for statistical evaluation. Mean, Standard Deviation, Variance, Minimum & Maximum value and Range were calculated for each variable for each subject. Salivary Glucose & Calcium level for normal & diabetics was assessed and correlation with caries incidence was established

RESULTS

TABLE 1: COMPARISON OF SALIVARY GLUCOSE LEVELS AMONG STUDY GROUPS

| Study Groups | Salivary Glucose (mg/dl) | | | |
|--------------------------|--------------------------|--------------|-------|------|
| | Mini- mum | Maxi- mum | Mean | ± SD |
| Controls (n=30) | 3.0 | 9.0 | 7.33 | 1.36 |
| Diabetic Patients (n=30) | 10.50 | 19.50 | 15.60 | 2.48 |

Glucose concentration (mg/dl) in saliva in patients with diabetes mellitus was compared with healthy population. Glucose concentration in saliva of diabetic patients was significantly higher as compared to healthy population ($p = 0.001 < 0.05$).

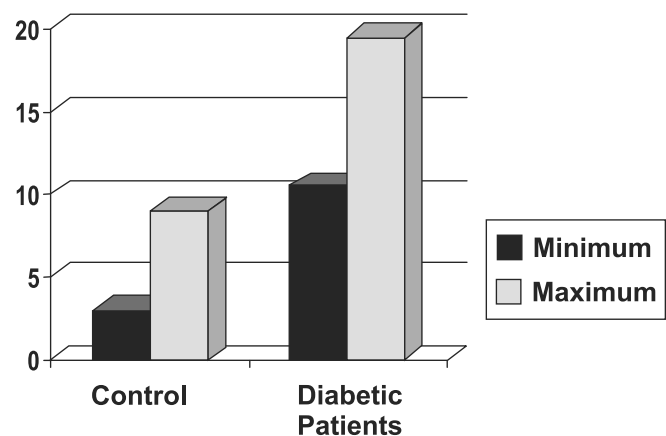


Fig 1: Comparison of Salivary Glucose levels (minimum & maximum) among study groups

TABLE 2: COMPARISON OF SALIVARY CALCIUM LEVELS AMONG STUDY GROUPS

| Study Groups | Salivary Calcium (mg/dl) | | | |
|--------------------------|--------------------------|--------------|-------|------|
| | Mini- mum | Maxi- mum | Mean | ± SD |
| Controls (n=30) | 8.50 | 12.50 | 10.40 | 1.14 |
| Diabetic Patients (n=30) | 1.80 | 5.70 | 3.73 | 1.01 |

Calcium levels (mg/dl) in saliva of patients with diabetes mellitus were compared with healthy controls and it was shown that their level was significantly low in cases as compared to the normal controls. ($p = 0.001 < 0.05$).

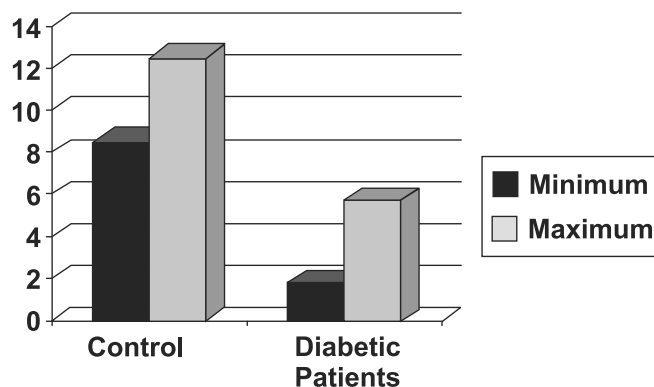


Fig 2: Comparison of Salivary Calcium levels (minimum & maximum) among study groups

TABLE 3: DECAYED FILLED PERMANENT DENTITION

| | D (decayed) | F (filled) | DFT |
|-------------------|-------------|------------|------|
| Control | 0.4 | 0.13 | .53 |
| Diabetic Patients | 2.31 | 0.14 | 2.49 |

It can be observed that in diabetic patients DFT score was higher (2.49) as compared to control group (0.53).

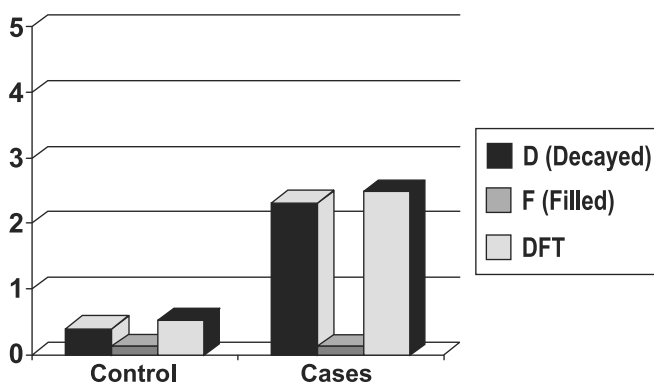


Fig 3: Comparison of decayed filled permanent dentition in Control group & diabetic patients

TABLE 4: CO-RELATION BETWEEN SALIVARY GLUCOSE LEVEL AND DFT AMONG DIABETIC PATIENTS

| Teeth Decayed /Filled | |
|------------------------|--------|
| Salivary Glucose mg/dl | 0.385* |

Salivary glucose level was correlated with the destruction of permanent teeth among diabetics and it was shown that mean glucose level increased with the increase in number of decayed teeth.

TABLE 5: CO-RELATION BETWEEN SALIVARY CALCIUM LEVEL AND DFT AMONG DIABETIC PATIENTS

| Teeth Decayed /Filled | |
|------------------------|---------|
| Salivary Calcium mg/dl | -0.287* |

Mean salivary calcium level was calculated in all diabetic subjects having permanent/ decayed teeth. Statistically significant co-relation was found between salivary calcium level and the number of permanent teeth decayed / filled.

DISCUSSION

Present study revealed that glucose levels in the un-stimulated whole saliva of IDDM group were higher than in healthy subjects. The mean salivary glucose level in diabetic patients was 15.60 ± 2.48 and that of control was 7.33 ± 1.36 mg/dl., so glucose concentration in saliva of diabetic patients was significantly higher as compared to healthy population ($p = 0.001 < 0.05$). These results are in agreement with reports of other researchers who found the same increased correlated levels of glucose in the saliva.^{11,12} In one of the study mean and standard deviation of glucose level in diabetic children was found to be 2.05 ± 1.63 where as in non-diabetic children was 1.03 ± 1.03 , indicating that salivary glucose level was higher in diabetics.⁵ Kjellman¹³ and Thorstensson *et al*¹⁴ reported significantly higher values of glucose in whole saliva in diabetics than in healthy controls. In contrast, other studies of diabetics and healthy individuals indicate that no such relationships exist.^{15,16}

Calcium levels in the present study were low in diabetics as compared to controls. Mean calcium level in controls was 10.40 mg/dl and that of diabetics were 3.73 mg/dl. ($p = 0.001 < 0.05$). Previous study by Maria

EL. supports the results of this study, also having low calcium value in diabetics that is mean of salivary calcium in diabetic was 2.93mg/dl and in non-diabetic 3.44mg/dl. In contrast to this, another study shows that there is no significant difference of calcium in saliva between the two groups.¹⁷⁻¹⁹

The findings of the present study suggest that beside the clinical examinations, the determination of the possible alterations in the composition of whole saliva might also be helpful in understanding the increased severity of dental caries in diabetic patients.

An increase in dental caries in permanent teeth was observed among diabetics. DFT in diabetic patients was 2.49 where as in control group DFT was 0.53. One more study shows that diabetics have higher DMFT values as compared to the control group children⁵.

REFERENCES

- 1 National diabetes educational program. Oral health and Diabetes. Available from, www.ndep.nih.gov/diabetes.
- 2 Aren G et al. Periodontal health, salivary status and metabolic control in children with type1 diabetes mellitus. *J Periodontol*. 2003; 74:1789-95.
- 3 WHO/International diabetes federation. Launch of diabetes action now. 5th May 2004, Geneva, Switzerland.
- 4 Herenia P Lawrence. Salivary Markers of Systemic Disease: Non invasive Diagnosis and Monitoring of General Health. *J Can Dent Assoc* 2002; 68:170-74.
- 5 Lopez M E et al. A. Salivary characteristics of diabetic children: Brazilian Dental Journal. June 2003;14:1.
- 6 Vernillo A T. Dental consideration for the treatment of patients with diabetes mellitus. *Journal of American Dental Association* 2003; 134:24S-33S.
- 7 Ben-Aryeh H, Cohen M, Kanter Y, Szargel R, Laufer D. Salivary composition in diabetic patients. *J Diabet Complications* 1988;2: 96-99.
- 8 Belazi MA, Galli-Tsinopoulou A, Drakoulakos D, Fleva A, Papanayiotou PH. Salivary alterations in insulin-dependent diabetes mellitus. *Int J Paediatr Dent* 1998; 8: 29-33.
- 9 Twetman S et al. Two-year longitudinal observations of salivary status and dental caries in children with insulin-dependent diabetes mellitus. *Pediatr Dent* 1992;14: 184-88.
- 10 Tenovuo J et al. Oral health of patients with insulin-dependent diabetes mellitus. *Scand J Dent Res* 1986; 94: 338-46.
- 11 Darwazeh AMG et al. Mixed salivary glucose levels and candidal carriage in patients with diabetes mellitus. *J Oral Pathol Med* 1991; 20: 280-83.
- 12 Camp Bell MJA. Glucose in the saliva of the non diabetic and the diabetic patient. *Archive of Oral Biology* 1965; 10:197-205.
- 13 Kjellman O. The presence of glucose in gingival exudates and resting saliva of subjects with insulin-treated diabetes mellitus. *Swede Dent J* 1970; 63: 11-19.
- 14 Thorstensson H et al. Some salivary factors in insulin-dependent diabetics. *Acta Odontol Scand* 1989; 47: 175-83.
- 15 Hara K et al. Carbohydrate components of the gingival exudates. *J Periodontal Res* 1969; 4: 202-07.
- 16 Karjalainen KM et al. Salivary factors in children and adolescents with insulin dependent diabetes mellitus. *Pied Dent* 1996; 18:306-11.
- 17 Twetman S et al. Mutans streptococci and lactobacilli in saliva from children with insulin-dependent diabetes mellitus. *Oral Microbiol Immunol* 1989; 4:165-68.
- 18 Marchisio O, Esposito MR, Genovesi A. Salivary pH level and bacterial plaque evaluation in orthodontic patients treated with Recaldent products. *Int J Dent Hyg*. 2010 Aug;8(3): 232-36
- 19 Jawed M, Shahid SM, Qader SA, Azhar A. Dental Carries in diabetes mellitus: Role of Salivary flow rate & minerals. *J Diabetes Complications* 2010;25(3):183-86.