

Correlation between Salivary Glucose Level and Gingivitis in Patients with Diabetes

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Abstract:

Introduction: Type 1 Diabetes has been linked with an increased risk of gingivitis and periodontal disease. Patients with periodontal disease and/or diabetes show differences in the profile of constituents in whole saliva. This profile reflects the nature and amplitude of the host response to a periodontal microbial challenge and /or response to diabetes mellitus.

Objectives: To compare gingival health between control group and patients with type I Diabetes and to assess whether there is any association between gingivitis/periodontitis and salivary glucose level.

Patients & Methods: Study was conducted on 90 subjects; 30 control and 60 diabetics. Gingival and periodontal status was assessed for both the groups clinically. Then un-stimulated whole saliva samples from diabetics and control group were collected stored and frozen at -20° C. Saliva samples were then thawed, centrifuged and its supernatant portion was analyzed by Dimension Clinical Chemistry System for Salivary glucose levels. SPSS 17.0 was used for statistical analysis.

Results: Results showed that gingivitis was statistically significantly higher among the type I diabetic patients when compared with the control group $p < 0.05$.

Conclusion: It was concluded that gingival health was compromised in diabetic children. It was also concluded that salivary glucose levels were higher in the patients with type I as compared to control group

Key Words: salivary glucose level, type I Diabetes, gingivitis, periodontitis

Introduction

Diabetes mellitus (DM) is a common disease and has been linked with an increased risk of oral diseases.¹ Changed oral environment in diabetes causes increase in colonization of pathogenic bacteria which leads to destruction of hard and soft tissues of mouth. Oral lesions associated to diabetes thus include gingivitis and periodontal disease, xerostomia and salivary gland dysfunction, increased susceptibility to bacterial, viral and fungal infections, dental caries, and

periapical abscesses, loss of teeth, taste impairment, lichen planus and burning mouth syndrome.² These findings are associated with excessive loss of fluids due to polyuria, altered response to infection, altered connective tissue metabolism, micro vascular changes and impaired saliva.³ Gingivitis has been rated as sixth most common complication of diabetes mellitus. It is the most common oral complication associated with diabetes. Firatli et al found that clinical attachment loss is more common in diabetic children and adolescents than in controls.⁴ Bridges RB et al in their study concluded that diabetic men have poorer periodontal status than non-diabetic men.⁵ Young diabetic patients have been reported to have significantly higher gingival inflammation scores than controls.⁶⁻⁸ Diabetic patients aged 40-49 have more periodontal pockets ≥ 6 mm and more extensive alveolar bone loss than non-diabetic patients in the same age-group.⁹ There is more attachment loss among subjects with type I diabetes with poor metabolic balance and/or multiple complications, and probed pocket depth ≥ 4 mm often re-occurs faster after periodontal therapy.¹⁰ Few studies however, have reported gingival inflammation & periodontal destruction to be equal in diabetic patients and controls.¹¹ The inconsistency in the results of these studies may be due to the differences in metabolic control, duration of diabetes and age of subjects between different study populations.¹²

There are several possible mechanisms involved in diabetes that mediate the increased risk for periodontal diseases. A prolonged hyperglycemic condition leads to no enzymatic formation of advanced glycation end products (AGEs), which affects the structure of many cells and tissue proteins, including collagen, predisposing the person to macro- and micro vascular complications. There are reports of decreased collagen synthesis and increased collagen degradation, i.e. increased collagenase activity.¹³ The host response to local infection is inefficient in diabetic patients. Disorders in neutrophil function together with AGE-related activation of inflammatory cells change the profile of cytokines and tissue growth factors. Consequently, the inflammation response and tissue homeostasis are altered.¹⁴⁻¹⁶ Two-way relationship between periodontal disease and diabetes

mellitus has been postulated by Davies et al.¹⁷ Thus, periodontitis, as a chronic infection, may impair metabolic control and increase the need for insulin and hence have an influence on the systemic level. On the whole, knowledge is currently insufficient regarding the ability of periodontal therapy to improve the metabolic control of diabetes.¹⁸

Diagnosis and monitoring of DM is based on serum glucose concentration or glycosylated hemoglobin concentration however in the recent past because of chances of cross infection, assessment of other body fluids as diagnostic tool has also increased.¹⁹ Saliva has gained importance as a diagnostic tool because it is readily available; collection requires non-invasive approach, no chances of cross infection and above all being the representative of various changes occurring in the body.²⁰ If diabetic patients could be screened by saliva with same level of accuracy as is assessed with blood or urine then it would be advantageous for not only dental patients but also for all diabetic patients.^{21,22} Moreover researchers have gained interest in establishing the relationship between gingival health and salivary sugar levels: whether with increase in salivary sugar level the gingival health deteriorates or not?

Present study has been aimed at comparing gingival health between control groups and type 1 diabetic patient and to assess whether there is any association between gingivitis / periodontitis and salivary glucose level in the subjects under study.

Patients & Methods

The study was conducted on 90 children (3-14 years), out of whom 60 were diabetics (Fasting Blood Sugar Level >120mg/dl)²³⁻²⁵, 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), 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. Consent was taken from the patients/parents and also control group.

Un-stimulated whole saliva from diabetic and control group was collected in sterilized plastic jars through spitting method and stored in freezer at -20°C and then brought to the laboratory in an ice chilled box. Saliva samples were thawed, centrifuged and its supernatant portion was used for analysis which was carried out by using auto analyzer (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. For cases and controls percentage of subjects with reference to their gingival status was computed

based on full mouth examination.

Study Groups	Salivary Glucose Level Mean ± SD
Control (n=30) Fasting Blood Sugar Level between 70-120mg/dl	7.33 ± 1.36
Patients (n=60) Fasting Blood Sugar Level >120mg/dl	15.26 ± 2.52

Oral hygiene status	Controls (n=30) N (%)	Cases (n=60) N (%)	p value
Healthy	16 (53.3%)	13 (21.7%)	p < 0.05
Gingivitis with or without Calculus	14 (46.7%)	47 (78.3%)	p < 0.05

	Gingivitis status	
	Good (Healthy)	Gingivitis/calculus
Salivary glucose	14.02 ± 1.73 (mg/dl)	17.6 ± 1.23 (mg/dl)

SPSS 17.0 was used for statistical evaluation. Descriptive Statistics were calculated for each variable for each subject. Chi-square test was applied to show the association of diabetes with the oral hygiene condition and p value was calculated. P value of < 0.05 was taken as statistically significant. Student's t-test was applied to show the difference between salivary glucose level for normal & diabetics was assessed and co-relation with gingivitis incidence was established.

Results

Glucose concentration (mg/dl) in saliva in patients with diabetes mellitus was compared with healthy population. As shown in table 1 the mean salivary glucose level in diabetic cases was 15.26 ± 2.52 ranging from 10.5 to 20.0 mg/dl and that of control was 7.33 ± 1.36 ranging from 3.0 to 9.0 mg/dl. Comparison of gingival status among study groups showed that glucose concentration in saliva of diabetic patients was significantly higher as compared to healthy population (t =16.11, p = 0.001 < 0.05). It was also observed that there was a significant difference between case and control subjects in regard to gingival status. (table 2)

Table 3 shows that mean salivary glucose level among cases having good oral hygienic condition (healthy) was 14.02 ± 1.73, while mean salivary glucose level among cases having poor oral health (Gingivitis/ calculus) was 17.6 ± 1.23. It was also observed that salivary glucose was significantly

higher in cases having poor hygiene status than having good oral health ($p = 0.021 < 0.05$).

Discussion

Present study revealed that glucose levels in the unstimulated whole saliva of type 1 diabetic group were higher than in healthy subjects. The mean salivary glucose level in diabetic patients was 15.26 ± 2.52 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.²⁶

In one of the studies, 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 Kjellman et al and Thorstensson et al^{27,28} 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 relationship exists.²⁹

DM and periodontitis are common multigenic and multifactorial chronic diseases. Both of the morbidities negatively affect periodontal health and systemic health, thus affecting the quality of life. An abundance of recent evidence has consolidated a bidirectional correlation between diabetes and periodontitis. While diabetes is an independent risk factor for periodontitis, periodontitis as a chronic inflammation has a negative impact on the metabolic control of diabetes. In particular, periodontitis ranks sixth among all complications of diabetes. The present study shows that there was a significant difference between case and control subjects in regard to healthy gums, gingivitis and calculus. There is a significant level ($p < 0.05$) of marginal gingivitis observed amongst diabetic children (78.3%). However, the percentage of calculus in diabetic children is comparable to that of healthy children and is not of much significant difference ($p > 0.5$). These results were supported by a previous study in which gingival health (bleeding on probing) and oral hygiene (plaque percent) were assessed in 2 groups of children and adolescents with insulin-dependent diabetes mellitus.³⁰ In another study, diabetic children with poor metabolic control showed a clear tendency towards higher gingival index scores than non-diabetics.³¹ In present study calculus among normal control and that of diabetic show no association. This is in contrast to the study which indicates that children with type 1 DM are more prone to calculus accumulation which seemed to be a predisposing factor in development of gingivitis in these individuals.³² Thus an increase in gingivitis in association with hyperglycemia suggests that hyperglycemia-associated biological alterations, which

lower host resistance towards plaque, have apparently taken place.³³⁻³⁵

Conclusion

It was concluded that salivary glucose levels were higher in the patients with type I diabetes as compared to control group and gingival health is compromised in diabetic children. Though not all cases of gingivitis proceed into a destructive periodontal disease, prevention of plaque-induced gingival inflammation should be emphasized, particularly in children and adolescents with poorly controlled diabetes.

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