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Assessment of Salivary Uric Acid and Glucose in Patient with Type II Diabetes Mellitus

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Abstract

Introduction: Serum is the standard body fluid for diagnosis of Diabetes Mellitus (DM) but saliva can offers an alternative to serum as a biological fluid for diagnostic purposes because it contains serum constituents. People wants to promote non invasive method for diagnosis of disease.

Background/Aim: To evaluate salivary uric acid and Glucose In type II diabetes mellitus (DM).

Materials and Methods: The study included 53 diabetic patients and 40 healthy subjects. Salivary glucose, blood glucose, and uric acid (UA) were determined by specific enzymatic methods.

Results: Salivary UA (3.12 vs. 1.89 mg/dL) were significantly higher (P < 0.001; r = 0.455,) in DM group (P <0.001, r = -0.431) compared to healthy controls. Spearman correlation analyses within the diabetic group showed a strong positive association between salivary glucose and blood glucose (P <0.001, r = 0.9)

Conclusion: Findings of this study, showing a strong correlation between salivary glucose and blood glucose as well as uric acid in the DM group. Suggest that saliva can be used for the diagnosis and management of DM.

Keywords: Diabetes Mellitus, Salivary Glucose, Blood Glucose, Uric Acid

Introduction

Diabetes mellitus (DM) in all its heterogeneity has taken the center stage as one of the ultimate medical challenges (1). Type 2 DM was first described as a component of metabolic syndrome in 1988. Type 2 DM (formerly known as non-insulin dependent DM) is the most common form of DM characterized by hyperglycemia, insulin resistance and relative insulin deficiency (2). Diabetes mellitus is a group of metabolic disorders that is characterized by hyperglycemia and insufficiency in production or action of insulin produced by the pancreas in the body(3) Chronic hyperglycemia leads to a number of complications such as cardiovascular, renal,

neurological, ocular and recurrent infections.(4) DM is characterized by chronic hyperglycemia, a result of defects in insulin secretion and/or insulin action that cause disturbances in carbohydrate, fat, and protein metabolism (5)

Studies have also shown that NO has influence on serum uric acid levels by interfering with action of xanthine oxidase enzyme.(6) Serum uric acid is produced from purine by xanthine oxidase enzyme. It is a strong reducing agent in human; over half of the antioxidant capacity of blood comes from serum uric acid increase in HbA1clevels indicating bell shaped relation. However, hyperuricemia found to be associated with insulin resistance and metabolic syndrome. It is also a predictor of cardiovascular disease in type 2 diabetes .(7)

The levels of serum uric acid are significantly reduced in diabetics in comparison to healthy individuals while they are significantly higher in prediabetics.[8] A positive relation between serum glucose and serum uric acid has been established by most researches upto a serum glucose level of 180mg/dl. At levels above this, the uricosuric effect of hyperglycemia leads to decreased serum uric acid levels.(9)

Serum uric acid levels have been used for regular monitoring of diabetic patients. Many salivary components reflect variations similar to that seen in serum. Since uric acid is present in saliva, its salivary estimation would be more acceptable by patients as it is a non-invasive procedure and easily reproducible.(10)

However very few studies have been conducted to compare serum and salivary uric acid levels

So we decided to conduct this study to determine levels of salivary uric acid and its correlation with serum uric acid in. the reevaluation of such changes in salivary components. The purpose of this study was to investigate the feasibility of a noninvasive approach by using saliva for routine monitoring of glucose in DM as well as antioxidant status in controlled and uncontrolled DM cases as compared to healthy subjects.

Material & Methods

Study consisted of 93 subjects from OPD/IPD Index Medical College & Research Center, INDORE, MADHYA PRADESH, India. The study groups were divided into Group I-53 DM patients (TypeII) and Group II-40 healthy subjects. The saliva and serum samples were collected from each subject and levels of different biochemical parameters were estimated.

Inclusion Criteria

1. Patients who were diagnosed as Type II Diabetes mellitus with no other systemic disease.
2. Healthy subjects with blood glucose within normal level for controls.

Exclusion criteria

1. Pregnancy.
2. Patients with salivary gland disorders and on treatment for salivary gland diseases.
3. Patients who had undergone surgery of the salivary glands.
4. Patients who had been exposed to chemotherapy/radiation for head and neck.

Sample Collection- Preparation Unstimulated fasting saliva from patient and control groups was collected between 0700 and 0800 hours by expectoration method. Individuals were asked to rinse their mouth thoroughly with water, bend their heads forward, and allow saliva to flow into an ice-chilled sterile polypropylene tube. The tubes were brought immediately to the laboratory from the collection site in chilled conditions. Saliva samples were checked for blood and phlegm and rejected if found to be contaminated. This was followed

by centrifugation at 4000 rpm for 15 min to remove any particulate matter. The supernatant was freeze-preserved or immediately used for analysis. Fasting blood samples from patients were collected on the same day as saliva collection by standard venipuncture by the hospital attendant and blood glucose was estimated in the hospital laboratory. These results were collected from the hospital documents. Some of the healthy volunteers were also asked to have their fasting blood glucose analyzed on the same day as saliva collection.

Kits for glucose, protein and UA assays were procured from Accurex Biomedical Pvt. Ltd. (Thane, India). All chemicals were of analytical grade. UA was assayed using the Infinite Uric Acid Liquid Kit (Accurex Biomedical). Glucose was assayed using the Eco-Pak Glucose Kit (Accurex Biomedical.

Statistical Analysis

Statistical analysis was performed using GraphPad Prism 5 (GraphPad Software, Inc., San Diego, CA, USA) (17). Analysis of variance (ANOVA) and the Spearman correlation test were used. $P < 0.05$ was considered significant.

Results

Samples from 93 subjects were included in the study, out of which 53 were diabetic patients and 40 were healthy controls. The diabetic patients were divided into 2 groups: controlled DM (fasting blood glucose of <140 mg/dL) and uncontrolled DM (fasting blood glucose of ≥140 mg/dL) (Table 1). A significant increase in the mean salivary glucose concentration ($P < 0.001$) was observed in the diabetic group when compared to healthy control. Mean UA was approximately 1.7 times higher in diabetic patients than in healthy controls. Salivary total protein was found to be almost 2. times higher in the uncontrolled group and about 1.5 times higher in the controlled DM group (mean: approximately 1.8 times). Table 2 compares the mean values of the salivary parameters analyzed.

Spearman correlation analysis -In order to determine whether the differences observed could be linked to glycemia, the parameters recorded in the diabetic group were compared to salivary glucose levels. Fasting salivary glucose showed strong positive correlation with fasting blood glucose (all diabetic patients: $r = 0.9$, $P < 0.001$; controlled cases: $r = 0.9$, $P < 0.001$; uncontrolled cases: $r = 0.922$, $P < 0.001$). Association between UA and salivary glucose in the diabetic group was found to be positive.

Table 1: Study Group Details- Controlled Blood glucose <140 mg/dl; uncontrolled DM blood Glucose >140mg/dl

Group	Number	Age ,Years	Fasting Blood Glucose Mean +SD mg/dl
Healthy Controls Male -18 Female -22	40	53.50 10.67 34-71	86.30 4.8 80-102
Diabetic Patients Male -32 Female -21	53	61.96 13.5 33-84	160.64 73 80-340
Diabetic Patients	27	63.29 14.3	109 15.9

controlled Cases		33-84	80-140
Diabetic Patients Uncontrolled Cases	26	60.63 13 43-84	211.85 70.62 140-340

Table 2: Mean Value Of Salivary Uric Acid and Glucose

SN-	All Diabetic Patients	Uncontrolled cases	Controlled cases	Healthy individuals	P value between healthy subjects and all diabetic patients
UA	3.12(.21)	3.26(.3)	3.03(.2)	1.89(.1)	<.001(.455)
Salivary Glucose	5.83(.5)	8.34(.8)	3.41(.1)	2.07(.1)	<.0001(.515)

*: Significant, S: salivary, B: blood. Controlled DM: blood glucose of <140 mg/dL; uncontrolled DM: blood glucose of ≥140 mg/dL.

Table 3: Correlations observed between various salivary parameters studied in the diabetic group.

Correlations		All Diabetic Patient	Uncontrolled Cases	Controlled Cases
B-glucose – S-glucose	r value = p Value=	.<.009 <.001	.922 <.001	.9 >.001
UA-S-Glucose	r value = p Value=	.258 .079	.409 .072	.038 .847

Discussion

The present study demonstrates that glucose and antioxidant levels in saliva from diabetic patients exhibit significant differences compared to control samples. There was a remarkable increase in fasting salivary glucose levels in the diabetic group. Another significant observation was a parallel increase in fasting salivary glucose with fasting blood glucose levels, which coincides with previous observations made by Hegde et al.(11) To analyze the potential of saliva in reflecting the glycemic picture, correlation analysis between salivary glucose and blood glucose levels was carried out. A value of $P < 0.001$ supports the suitability of saliva as a substitute for blood for monitoring the glycemic status.(12)

UA is a strong antioxidant in a hydrophilic environment (13). An increase in UA concentration, which corroborates with earlier findings (14), was observed in the saliva of diabetic patients in the present study. It showed a positive correlation with salivary glucose. Uncontrolled diabetic patients had higher levels, suggesting its association with severity of this disease. This supports the compensatory antioxidant defense by UA in saliva. However, the defense role of UA is controversial. Recently it was shown that under selected circumstances, the original antioxidant properties of UA paradoxically become prooxidant (15). It is worth noting that hyperuricemia has been found to be associated with obesity, metabolic syndrome, and insulin resistance and consequently with type 2 DM (16).

Present study shows the significant correlation between serum and saliva UA and glucose, so saliva can be used as diagnostic fluid in diabetic patient. Findings of this study, showing a strong correlation between salivary glucose and blood glucose and this can leads to changes

in antioxidant components in the DM group which we can study for authenticity, suggest that saliva can be used for the diagnosis and management of DM.

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