ORIGINAL RESEARCH

Comparison of salivary glucose and blood glucose levels in diabetic and healthy subjects

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ABSTRACT
Background: Saliva has several diagnostic applications and is useful in both elderly and young patients. The present study was conducted to compare salivary glucose and blood glucose levels in diabetic and healthy subjects. **Materials & Methods:** 46 diabetes mellitus and healthy subjects were selected. 5 ml of venous blood was collected for estimation of plasma glucose, fasting blood sugar (FBS) and postprandial blood sugar (PPBS) level. Estimation of glucose levels from the serum and supernatant saliva was done by using the glucose oxidase-peroxidase method (GOD-POD method). **Results:** In group I males were 26 and females were 20 and in group II, male and females were 23 each. The mean FBS level in group I was 165.2 mg/dl and in group II was 76.4 mg/dl. The mean PPBS level I group I was 216.4 mg/dl and in group II was 86.2 mg/dl. The mean salivary glucose level in group I was 13.2 mg/dl and in group II was 5.8 mg/dl. The difference was significant (P< 0.05). **Conclusion:** There was increased salivary glucose levels in patients having diabetes mellitus. Salivary glucose levels could serve as a potentially non-invasive adjunct to monitor glycemic control in diabetic patients.
Key words: Saliva, Glucose, FBS

INTRODUCTION
Saliva has several diagnostic applications and is useful in both elderly and young patients. It is also beneficial in illness screening and epidemiology investigations. As a result, practitioners have begun to experiment with fluids other than blood and urine for diagnostic purposes, such as saliva, perspiration, and tears.[1] Saliva is mostly made up of water, electrolytes, glucose, amylase, glycoproteins, and antimicrobial enzymes. The majority of molecules found in blood or urine can also be found in salivary secretions, albeit at much lower concentrations than those found in blood. Saliva can be used to estimate glycemic control in diabetic individuals.[2]

Salivary glucose refers to the measurement of glucose levels in saliva, the watery substance produced by the salivary glands in the mouth. Glucose is a type of sugar that serves as a primary source of energy for the body's cells. It is commonly associated with blood sugar levels and is used as a key parameter in diagnosing and managing diabetes.[3]

Diabetes mellitus is characterized by relative or absolute insufficiency of insulin secretion and/or associated resistance to insulin's metabolic effect on target tissues. Diabetes mellitus has been linked to changes in salivary content and function. As a result, certain oral disorders, such as a higher prevalence of caries, periodontal disease, and candidiasis, are more common in people with diabetes mellitus.[4]The idea of measuring glucose levels in saliva has been explored as a potential non-invasive alternative to the traditional method of using blood samples to monitor glucose levels. This approach could offer benefits such as reduced pain and discomfort, as well as convenience. However, the accuracy and reliability of salivary glucose testing have been subjects of research and debate.[5]The present study was conducted to compare salivary glucose and blood glucose levels in diabetic and healthy subjects.

MATERIALS & METHODS
The present study consisted of 46 diabetes mellitus (either insulin dependent diabetes mellitus

[IDDM]/non-insulin dependent diabetes mellitus [NIDDM]) of both genders visiting the department of medicine, GRMC Gwalior. All gave their written consent to participate in the study. Equal number of healthy subjects were also enrolled.

Data such as name, age, gender etc. was recorded. Diabetics were put in group I and healthy subjects in group II. 5 ml of venous blood was collected for estimation of plasma glucose, fasting blood sugar (FBS) and postprandial blood sugar (PPBS) level. Patients were asked to spit 2 ml of saliva into the sterile plastic saliva collection container. The collected saliva and blood samples were stored frozen until use in glucose assay. The saliva and blood samples were centrifuged. Estimation of glucose levels from the serum and supernatant saliva was done by using the glucose oxidase-peroxidase method (GOD-POD method). Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Groups	Group I	Group II
Status	Diabetics	Control
M:F	26:20	23:23

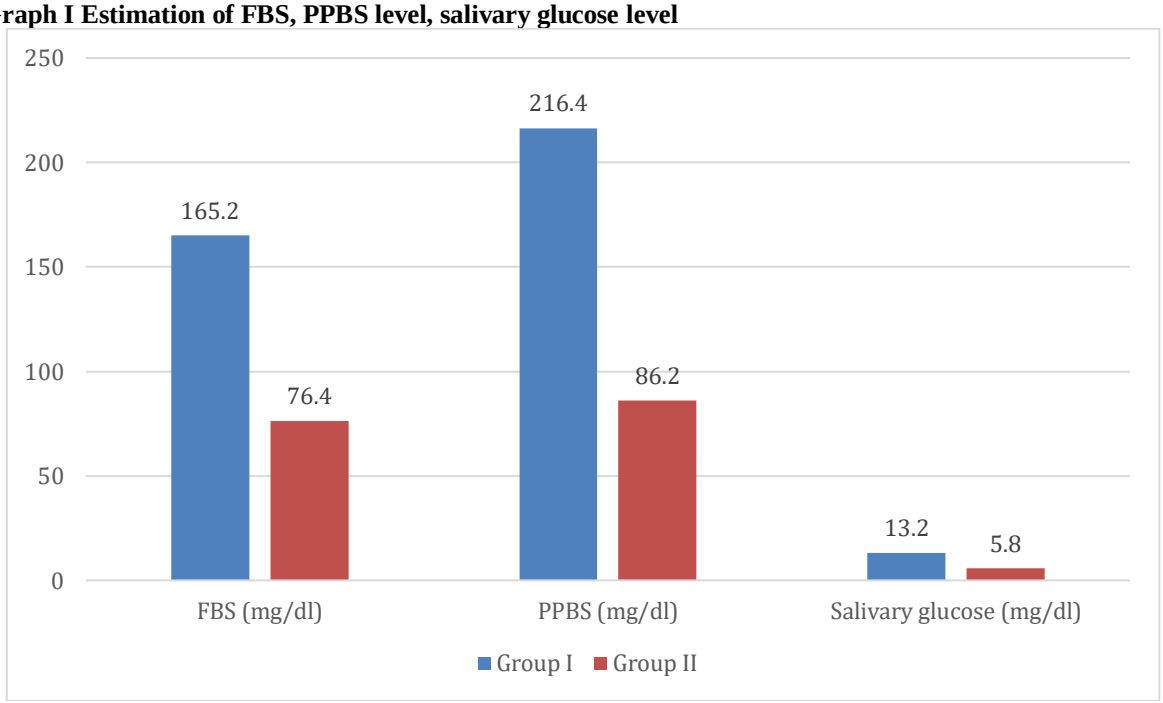
Table I shows that in group I males were 26 and females were 20 and in group II, male and females were 23 each.

Table II Estimation of FBS, PPBS level, salivary glucose level

Parameters	Group I	Group II	P value
FBS (mg/dl)	165.2	76.4	0.02
PPBS (mg/dl)	216.4	86.2	0.01
Salivary glucose (mg/dl)	13.2	5.8	0.05

Table II, graph I shows that mean FBS level in group I was 165.2 mg/dl and in group II was 76.4 mg/dl. The mean PPBS level I group I was 216.4 mg/dl and in group II was 86.2 mg/dl. The mean salivary glucose level in group I was 13.2 mg/dl and in group II was 5.8 mg/dl. The difference was significant (P< 0.05).

Graph I Estimation of FBS, PPBS level, salivary glucose level



DISCUSSION

Diabetes mellitus is a group of complex multisystem metabolic disorders characterized by relative or absolute insufficiency of insulin secretion and/or concomitant resistance to the metabolic action of insulin on target tissues.[6,7] To reduce the risk of problems connected with this disease, diabetic patients' glucose levels must be monitored on a regular basis. The need of frequent monitoring of blood glucose levels in glycemic management cannot be overstated. Blood and urine are two biofluids that are used to measure glucose levels.[8]Given the body's strong relationship to homeostasis, the choice of blood as a diagnostic fluid for clinical testing is obvious. Because blood travels through all organs, its chemical composition is a synthesis of practically all metabolic

processes that occur in the individual.[9] However, blood collection is an invasive procedure that causes minor discomfort to the subject. As a result, a non-invasive technique for monitoring glucose control in diabetics is required.[10,11] The present study was conducted to compare salivary glucose and blood glucose levels in diabetic and healthy subjects.

We found that in group I males were 26 and females were 20 and in group II, male and females were 23 each. Patel et al[12]compared salivary glucose with plasma glucose level and postprandial blood sugar (PPBS) and fasting blood sugar (FBS) in diabetic and non-diabetic subjects. A total of 100 patients were participated in this study. They were divided into two groups, each group consist of 50 patients. Un-stimulated saliva and blood were collected and investigated for glucose levels. FBS, PPBS, plasma glucose levels and salivary glucose levels were higher in diabetic patients than healthy controls. FBS, PPBS, plasma glucose level and salivary glucose levels were significantly correlated with each other in diabetic patients

We found that mean FBS level in group I was 165.2 mg/dl and in group II was 76.4 mg/dl. The mean PPBS level I group I was 216.4 mg/dl and in group II was 86.2 mg/dl. The mean salivary glucose level in group I was 13.2 mg/dl and in group II was 5.8 mg/dl. Gupta et al[13] estimated the glucose levels of saliva, to assess if any significant correlation existed between the serum and salivary glucose levels, and to correlate salivary glucose levels with regard to duration of diabetes, age, and gender. In this study, serum and salivary glucose levels of 200 subjects (100 diabetic subjects and 100 nondiabetic subjects) were estimated by glucose oxidase method. Glycosylatedhemoglobin levels were also measured in randomly selected 40 diabetic subjects. The findings of this study revealed a significant correlation between salivary and serum glucose levels in both diabetic and nondiabetic subjects. No significant relationship was observed between salivary glucose levels and gender or age in both diabetics and nondiabetics and between salivary glucose levels and duration of diabetes in diabetics.

Balan et al[14] assessed glucose levels using the glucose oxidase method in blood and unstimulated saliva in 90 subjects who were divided into 3 equal groups of controlled type 2 diabetes, uncontrolled type 2 diabetes and those without diabetes. Salivary glucose levels were significantly higher in patients with diabetes than controls. There was a significant positive correlation between salivary and plasma glucose levels in patients with diabetes.

The limitation the study is small sample size.

CONCLUSION

Authors found that there was increased salivary glucose levels in patients having diabetes mellitus. Salivary glucose levels could serve as a potentially non-invasive adjunct to monitor glycemic control in diabetic patients.

REFERENCES

1. Karjalainen KM, Knuuttila ML, Käär ML. Salivary factors in children and adolescents with insulin-dependent diabetes mellitus. Pediatr Dent 1996;18(4):306-11.
2. Darwazeh AM, MacFarlane TW, McCuish A, Lamey PJ. Mixed salivary glucose levels and candidal carriage in patients with diabetes mellitus. J Oral Pathol Med 1991;20:280-3.
3. Amer S, Yousuf M, Siddqiui PQ, Alam J. Salivary glucose concentrations in patients with diabetes mellitus – A minimally invasive technique for monitoring blood glucose levels. Pak J PharmSci 2001;14(1):33-7.
4. Soares MS, Batista-Filho MM, Pimentel MJ, Passos IA, Chimenos- Küstner E. Determination of salivary glucose in healthy adults. Med Oral Patol Oral Cir Bucal 2009;14(10):510-3.
5. Takai N, Yoshida Y, Kakudo Y. Secretion and re-absorption of glucose in rat submandibular and sublingual saliva. J Dent Res 1983;62(10):1022-5.
6. López ME, Colloca ME, Páez RG, Schallmach JN, Koss MA, Chervonagura A. Salivary characteristics of diabetic children. Braz Dent J 2003;14(1):26-31.
7. Abikshyeet P, Ramesh V, Oza N. Glucose estimation in the salivary secretion of diabetes mellitus patients. Diabetes MetabSyndrObes 2012;5:149-54.
8. de Almeida Pdel V, Grégio AM, Machado MA, de Lima AA, Azevedo LR. Saliva composition and functions: A comprehensive review. J Contemp Dent Pract 2008;9(3):72-80.
9. Panchbhai AS, Degwekar SS, Bhowte RR. Estimation of salivary glucose, salivary amylase, salivary total protein and salivary flow rate in diabetics in India. J Oral Sci 2010;52(3):359-68.
10. Reuterving CO, Reuterving G, Hägg E, Ericson T. Salivary flow rate and salivary glucose concentration in patients with diabetes mellitus influence of severity of diabetes. DiabeteMetab 1987;13(4):457-62.
11. Dodds MW, Yeh CK, Johnson DA. Salivary alterations in type 2 (non-insulin-dependent) diabetes mellitus and hypertension. Community Dent Oral Epidemiol 2000;28(5):373-81.
12. Patel BJ, Dave B, Dave D, Karmakar P, Shah M, Sarvaiya B. Comparison and correlation of glucose levels in serum and saliva of both diabetic and non-diabetic patients. Journal of international oral health: JIOH. 2015 Aug;7(8):70.
13. Gupta S, Sandhu SV, Bansal H, Sharma D. Comparison of salivary and serum glucose levels in diabetic patients. Journal of diabetes science and technology. 2014 Oct 7;9(1):91-6.
14. Balan P, Babu SG, Sucheta KN, Shetty SR, Rangare AL, Castelino RL, et al. Can saliva offer an advantage in monitoring of diabetes mellitus? – A case control study. J Clin Exp Dent. 2014;6(4):335-8.