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Sweet Way to Analyze Sweetness

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Abstract

Introduction: Diabetes mellitus is the commonest endocrine metabolic disorder resulting in hyperglycemia either due to primary insulin deficiency or reduction in its biologic effectiveness or both. Asian Indians seem to be at a greater risk of developing this disorder.

In Diabetes Mellitus, an important aspect of glycaemic control is to regularly monitor glucose levels. Current methods employed, either require a blood sample or urine sample. These procedures usually cause pain and discomfort to the patient. The present study uses saliva as a medium to assess glucose concentration, which is a non-invasive technique.

Aim: The aim of the study is to determine the correlation between post prandial salivary & blood glucose concentrations in non diabetic healthy individuals & patients with type II diabetes mellitus.

Materials and Methods: 30 patients (Diabetes mellitus type II=20, non diabetic control=10) with age ranging from 25-45 years are considered. Blood & salivary samples are collected from these individuals during resting condition in clean sterile containers. Post prandial Serum & salivary glucose levels will be determined by the use of autoanalyser, (cobas c III,Germany) & semiautoanalyser,(Erba chem7,Germany) respectively.

Results and Conclusion: A significant correlation was found between glycosylated haemoglobin and serum glucose concentrations in both diabetic group and control group which suggests that diabetic group had average elevated blood glucose concentration over an extended time period. A significant correlation was found between post prandial blood glucose and post prandial salivary glucose and glycosylated haemoglobin for both diabetic and healthy control group supporting the use of saliva as a diagnostic fluid in type II diabetes.

Keywords: Diabetes mellitus Saliva, post prandial glucose and glycosylated hemoglobin.

Introduction

Diabetes mellitus is the commonest endocrine metabolic disorder resulting in hyperglycemia either due to primary insulin deficiency or reduction in its biologic effectiveness or both. Asian Indians seem to be at a greater risk of developing this disorder.

Currently we have 40.9 million people suffering from diabetes and the predicted estimate by the year 2025 is around 70 million. The crude prevalence rate of diabetes in urban areas is about 9% and in rural areas, has increased to around 3% of the total population.[1]

Glucose is a small molecule that diffuses easily through the membrane of the blood vessels, passing through the blood serum to the gingival fluid, by way of the gingival sulcus, and making its way to the saliva. Saliva is an organic fluid that is easy to collect by non-invasive methods and is not costly to preserve. These reasons prompt an interest in evaluating the possibility of using saliva as a diagnostic resource. [2]

In Diabetes Mellitus, an important aspect of glycaemic control is to regularly monitor glucose levels. Current methods employed, either require a blood sample or urine sample. These procedures usually cause pain and discomfort to the patient. The present study uses saliva as a medium to assess glucose concentration, which is a non-invasive technique. [3]

Aim of the Present Study

The aim of the study is to determine the correlation between post prandial salivary & blood glucose concentrations in non diabetic healthy individuals & patients with type II diabetes mellitus.

Materials and methods

The study was conducted at Basweshwara teaching and general hospital.

Study group: Age range-25-45 years.

Group I: Consisted of 10 normal healthy people without diabetes [control group]

Group II: Consisted of 20 people with type II diabetes mellitus.

Sample collection

Blood & salivary samples are collected from the study group during resting condition. The unstimulated saliva was collected from both diabetic and control group by the method of spitting the saliva. All the subjects were asked to thoroughly wash their mouth before collection of salivary samples.

The subject was asked to swallow the saliva present in the mouth and then to remain still without moving the tongue or swallowing the saliva for one minute. The subjects spat the saliva into clean sterile containers every 60 seconds for a total of five minutes until 5ml of saliva was collected. The samples were centrifuged at 4000 revolution per minute for 10 minutes and the supernatant was used for estimating glucose level by semiautoanalyser, (Erba chem7, Germany) [2]

Postprandial blood samples were obtained from both the diabetic and control group by venipuncture technique. Blood samples for HbA1c were collected in EDTA vacutainers and for postprandial blood glucose in fluoride vacutainers. Postprandial blood glucose and glycosylated haemoglobin (HbA1c) were determined by using autoanalyser, (cobas c III, Germany).

Statistical Analysis

Means and standard deviations (SDs) of postprandial serum glucose, salivary glucose and HbA1cs were calculated for the diabetic and control group. These were then compared using Pearson's correlation coefficient and independent Student's t-test. A P value <0.05 was accepted as significant.

Results

TABLE I and TABLE II shows the results of both control and diabetic group. Table III shows the comparison between standard reference values and values observed in our study. TABLE IV shows mean and standard deviation for control group and diabetic group. TABLE V shows comparison of glucose values with student's t test between control group and diabetic group.

In our study a significant correlation was found between glycosylated haemoglobin and serum glucose concentrations in both diabetic group and control group which suggests that diabetic group had average elevated blood glucose concentration over an extended time period. A significant correlation was found between post prandial blood glucose and post prandial salivary glucose and glycosylated haemoglobin for both diabetic and healthy control group supporting the use of saliva as a diagnostic fluid in type II diabetes.

Table I

Control Group I (N=10)			
SL. NO	PPBG(Mg/Dl)	PPSG(Mg/Dl)	Hba1c (%)
1	118	4.7	4.6
2	106	4.3	4.9
3	120	4.2	5.1
4	93	3.8	3.7
5	86	3.5	3.4
6	102	4	3.7
7	127	3.8	4
8	163	4.9	4.9
9	156	4.7	5.4
10	138	5.1	5.2

PPBS: post prandial blood sugar; PPSG: postprandial salivary glucose

Table II

Diabetic Group II(n=20)			
SL.NO	PPBG(mg/dl)	PPSG(mg/dl)	HbA1C (%)
1.	256	20.5	7.6
2.	302	23.9	8.5
3	178	16	7.2
4.	295	19	12.4
5.	375	29	10.7
6.	375	27	10.1
7.	228	17.4	5.6
8.	146	15.3	6.8
9.	197	14.1	6.3
10.	201	15.7	5.7
11.	210	19.7	6.1
12.	191	13	4.9
13.	205	11	4.8
14.	150	13.6	5.5
15.	263	22.7	7.8
16.	289	23.6	8.1
17.	210	18.6	6.2
18.	198	15.2	7.4
19.	300	22.8	8.1
20.	211	20.1	5.1

Table III: Reference Values

	Standard reference range	Average range observed in our study Control	Diabetic
PPBG (mg/dl)	120-140	86-163	146-375
PPSG (mg/dl)	12.5 to 20.0	3.5-5.1	11.0-29.0
HbA1c(%)	3.5-5.5	3.4-5.4	4.8-12.4

Table IV: Mean and standard deviation for control group and diabetic group

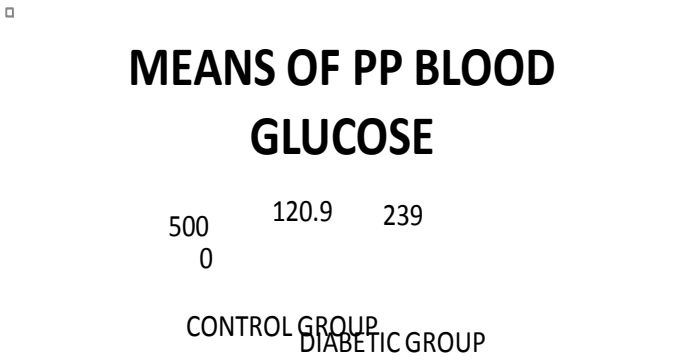
Mean			Standard Deviation	
	Control	Diabetic	Control	Diabetic
PPBG	120.9	239	24.33	64.19
PPSG	4.3	18.91	0.51	4.72
HbA1c	4.65	7.25	0.74	1.97

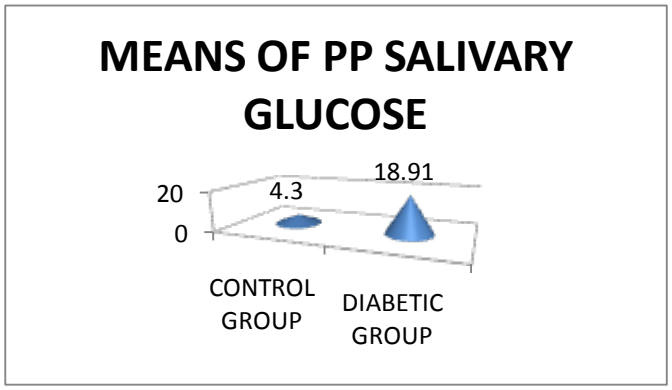
Table V: Comparison of glucose values with student's t test between control group and diabetic group

PP Blood Glucose	PP Salivary Glucose	HBA1C
5.43	9.44	4.14

Conclusion

T VALUES SHOWS SIGNIFACANT DIFFERENCE BETWEEN CONTROL GROUP AND DIABETIC GROUP IN PP BLOOD GLUCOSE, PP SALIVARY GLUCOSE AND HBA1C FOR P<0.05





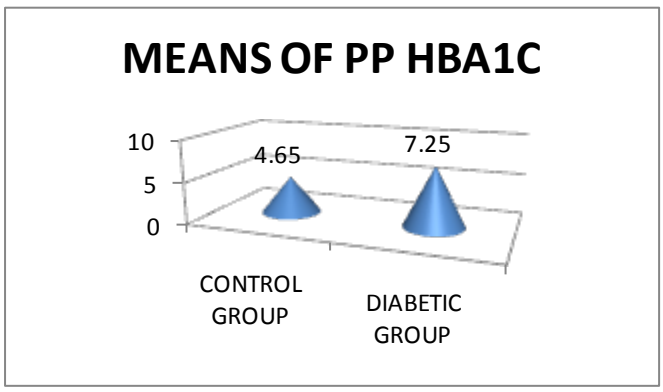


Table VI: Correlation between Postprandial Blood Glucose, Postprandial Salivary Glucose and Hba1c for Control Group and Diabetic Group

Correlation Coefficient Between	Control Group	Diabetic Group
PPBG & PPSG	0.78	0.88
PPBG & HBA1C	0.76	0.78
PPSG & HBA1C	0.84	0.68

CORRELATION COEFFICIENT VALUES SHOWS THAT THERE IS SIGNIFICANT POSITIVE CORRELATION BETWEEN PP BLOOD GLUCOSE AND PP SALIVARY GLUCOSE, PP BLOOD GLUCOSE AND HBA1C, PP SALIVARY GLUCOSE AND HBA1C FOR P<0.05

Discussion

One of the most common metabolic disorders encountered routinely in the world is Diabetes mellitus. With the changing lifestyle and food habits the prevalence of diabetes has been constantly on the rise. [4]

Management of diabetes has always been a challenge to health professionals. Judicious monitoring of the glucose levels to normalize blood glucose levels and patient's regular compliance are the two main aspects in management of diabetes. Major health complications like renal, retinal and vascular complications can be avoided if regular monitoring of diabetic patients is undertaken throughout their life span. [5]

In laboratories procedure routinely employed for glucose monitoring are invasive, hence a need for a non invasive method which helps in day to day monitoring of glucose levels arises. Saliva is a most useful non invasive, diagnostic fluid available for examination. The advantage for usage of saliva is, firstly it is a biologic fluid that can be collected easily. Secondly, Saliva is considered to be an ultra filtrate of blood. [5]

As the glycemic level increases glucose molecule diffuses easily through the semi permeable membrane and thus can be readily detected in saliva. Several studies have been

conducted on biochemical changes in saliva of diabetic patients with debatable results. The salivary glucose concentrations seem to correlate with the serum glucose concentrations in the patients of type II diabetes mellitus.[6,7]

Similar to our study, five studies [8-12] have found a positive correlation between salivary glucose and serum glucose. However, in contrast to our study, three other trials [13-15] could not establish a correlation between salivary and serum glucose. Forbat et al [14] concluded that salivary glucose levels did not reflect blood glucose levels. Similarly, Carda et al [15] concluded that the salivary glucose levels of 76.4% of diabetic patients were in the normal range.

Even Englander et al [16] expressed doubt regarding replacement of plasma with parotid secretion in the diagnosis of diabetes mellitus, because of its lower levels of glucose concentration. However, Mitsumori et al [17] manufactured a saliva analyzing system using a glucose sensor and performed in vivo evaluations, concluding that their salivary glucose level measurement system could be used as an indicator of blood glucose level.

Studies done by Nagalaxmi and Priyanka have considered salivary glucose as a reliable indicator for estimation of glucose concentration in diabetes patients. According to their studies they found a significant correlation between salivary and serum glucose levels. Similar observation was made by Twetsman S et al, Bowen WH, Thorstensson Het al, Harrison R, Marchetti P et al, Karjalainen KM, Belazi MA et al and Darwazeh AMG. [4]

Similar to our studies, studies done by abhikshyeet et al have resulted in highly significant correlation coefficient of r= 0.7686 for P<0.01 between serum and salivary glucose levels in diabetic group. They also concluded with highly significant correlation coefficient of r=0.5662 forP<0.001 between HbA1c and salivary glucose levels. [19].Different methodologies have been proposed over years to detect glycemic levels in saliva but need for an improvised and precise methodology always remains. Saliva can be considered as a substitute for serum if saliva reflects the serum parameters and disease state. [18]

Conclusion

In our study a significant positive correlation was found between glycosylated haemoglobin and serum glucose concentrations in both diabetic group and control group which suggests that diabetic group had average elevated blood glucose concentration over an extended time period.

A significant positive correlation was found between post prandial blood glucose and post prandial salivary glucose and glycosylated haemoglobin for both diabetic and healthy control group supporting the use of saliva as a diagnostic fluid in type II diabetes.

However further studies on larger populations and in different geographic areas are required to establish salivary glucose estimation as a diagnostic tool in assessing glucose levels in diabetes mellitus.

References

1. Anupama Hegde et al. Alternative markers of glycemic status in diabetes mellitus. Biomedical Research 2010; 21 (3): 252-25.
2. Maria-Sueli-Marques Soares, Mário-Márcio-Vasconcelos Batista-Filho, Marcele Jardim Pimentel, Isabela-Albuquerque Passos, Eduardo Chimenos-Küstner. Determination of salivary glucose in healthy adults. Med Oral Patol Oral Cir Bucal. 2009 Oct 1;14 (10):e510-3.
3. Naik Veena V, Satpathy Yasmin, Pilli Ganga S, N. Mishra and Mithilesh. Comparison and correlation of glucose levels in serum and saliva of patients with diabetes mellitus Indian Journal of Public Health Research & Development Year : 2011, Volume : 2, Issue : 1

4. V Nagalaxmi, V Priyanka. Can Saliva be a Marker for Predicting Type 1Diabetes Mellitus?—A Pilot Study. Journal of Indian Academy of Oral Medicine and Radiology, October-December 2011;23(4):579-582
5. Panchbhai AS. Correlation of Salivary Glucose Level with Blood Glucose Level in Diabetes Mellitus. J Oral Maxillofac Res 2012;3(3):e3
6. Darwazeh A.M.,Macfarlane T.W.(1991). Mixed salivary glucose levels and candidal carriage in patients with diabetes mellitus. JOPM 20(6):280-83.
7. Swanljung O., Meurman J.K., Torkko H., Sandholm L., Kaprio E., Maenpaa J. (1992). Caries and saliva in 12-18 years old diabetics and controls. Scand J Dent Res. 100(6):310-313. Pediatr Dent. 14(3):184-188.
8. 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. Diabete Metab. 1987;13(4):457–462. [PubMed]
9. Belazi MA, Galli-Tsinopoulou A, Drakoulakos D, Fleva A, Papanayiotou PH. Salivary alterations in insulin-dependent diabetes mellitus. Int J Paediatr Dent. 1998;8(1):29–33. [PubMed]
10. 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 Pharm Sci. 2001;14(1):33–37. [PubMed]
11. Sreedevi, Shashikanth MC, Shambulingappa P. Comparison of serum glucose and salivary glucose in diabetic patients. Journal of Indian Academy of Oral Medicine and Radiology. 2008;20(1):9–13.
12. Jurysta C, Bulur N, Oguzhan B, et al. Salivary glucose concentration and excretion in normal and diabetic subjects. J Biomed Biotechnol. 2009;2009:430426. [PMC free article] [PubMed]
13. Ben-Aryeh H, Cohen M, Kanter Y, Szargel R, Laufer D. Salivary composition in diabetic patients. J Diabet Complications. 1988;2(2):96–99. [PubMed]
14. Forbat LN, Collins RE, Maskell GK, Sönksen PH. Glucose concentrations in parotid fluid and venous blood of patients attending a diabetic clinic. J R Soc Med. 1981;74(10):725–728. [PMC free article] [PubMed]
15. Carda C, Mosquera-Lloreda N, Salom L, Gomez de Ferraris ME, Peydró A. Structural and functional salivary disorders in type 2 diabetic patients. Med Oral Patol Oral Cir Bucal. 2006;11(4):E309–314. English and Spanish. [PubMed]
16. Englander HR, Jeffay AI, Fuller JB, Chauncey HH. Glucose concentrations in blood plasma and parotid saliva of individuals with and without diabetes mellitus. J Dent Res. 1963;42:1246. [PubMed]
17. Mitsumori M, Yamaguchi M, Kano Y. A new approach to noninvasive measurement of blood glucose using saliva analyzing system. Conf Proc IEEE Eng Med Biol Soc. 1998;4:1767–1770.
18. 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(2):45–48.
19. Abikshyeet, Panda, Venkatapathy Ramesh, and Nirima Oza. "Glucose estimation in the salivary secretion of diabetes mellitus patients." Diabetes, metabolic syndrome and obesity: targets and therapy 5 (2012): 149