Research Article

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Correlation Between Salivary and Serum Glucose Levels in Type 2 Diabetic and Non-Diabetic Individuals

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ABSTRACT

Aim: The study aimed at determining the role of saliva as a diagnostic tool by correlating serum glucose and salivary glucose levels in the diabetes mellitus patients and non-diabetic individuals.

Materials & methods: The study comprised of group I with 60 diabetic individuals and group II with 60 non diabetic individuals of either sex. Random plasma and salivary glucose levels were collected from both the groups and estimation of glucose was done using GOD-POD method.

Results: Student 't' test, Pearson's correlation and Fisher test were used for analyzing the results. P value less than 0.05 was considered significant. There was significant correlation observed between salivary and serum glucose levels in both diabetic and non diabetic individuals.

Conclusion: Saliva can be used as an alternative for glucose measurement in diabetic individuals.

Keywords: Saliva, Diabetes mellitus, Random Plasma Glucose.

INTRODUCTION

Diabetes mellitus (DM) is a complex multisystemic metabolic disorder characterized by a relative or absolute insufficiency of insulin secretion and/or concomitant resistance to metabolic action of insulin on target tissues [1]. Globally the data on type 2 diabetes is alarming. The data suggests that 366 million people were affected worldwide in 2011 with diabetes. The data predicts that by 2030 this number is going to reach 552 million. India ranks second in the world after China in diabetes [2]. Diabetes mellitus is a metabolic disorder that effect different systems of the body like renal, retinal, vascular complications and have high morbidity and mortality rate if not diagnosed and controlled the condition at early stages [1]. It also have profound effects on oral cavity like gingivitis, abscess, periodontitis, median rhomboid glossitis, oral candidiasis, delayed wound healing, halitosis, dry mouth [3].

About one third of people with diabetes are undiagnosed. The average lag between the actual onset and the diagnosis of type 2 diabetes is 7 years. This delay in diagnosis is the main reason for the profound complications associated with diabetes.

Currently the diagnosis of diabetes is achieved by evaluating blood glucose levels.

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However monitoring blood glucose levels at frequent intervals causes unnecessary discomfort and mental trauma to the patients. As this procedure is invasive and painful hence is difficult to collect in very young patients and infants [2, 4]. This makes the necessity for developing a simple screening method which is non-invasive in nature and causes less psychological trauma to the patient. Other fluids like saliva, urine, GCF are also used for estimating glucose content. Of these available fluids saliva is one of the most abundant fluids available in the human body and with developing technology its role as diagnostic medium is illuminated [5].

Advantages of saliva as diagnostic medium are collection is non-invasive, easy, no necessary of special apparatus, no need of trained staff, can be used in children and older adults and in individuals suffering with blood dyscrasias [4]. The present study aimed to determine the role of saliva as a diagnostic tool by correlating serum glucose and salivary glucose in the diabetes mellitus patients and non-diabetic individuals.

MATERIALS AND METHODS

Source of Sample: The study comprised of individuals between age 35-65 years reporting to the Department of Oral Medicine & Radiology, Divya Jyoti College of Dental Sciences &Research, and to the Medical OPD of Divya Jyoti General Hospital. The individuals were divided in to 2 Groups; Group I (cases) comprising of 60 non-insulin dependent (type 2) diabetic individuals and Group II (controls) comprising of 60 non-diabetic individuals. Blood and saliva was collected from these 2 groups. Blood and salivary samples were processed at Department of Biochemistry, of Divya Jyoti General Hospital. Informed consent was obtained from each individual in the study and Institutional ethical committee approval was obtained. Individuals with type 1 diabetes, any systemic diseases, with habits of alcohol or smoking were excluded from the study.

Diagnostic criteria for Diabetes: Random plasma glucose (RPG) levels were measured using glucose-oxidase method. Individuals with RPG ≥ 200 mg/dl was diagnosed as diabetic, given by The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus [6].

The patients and control individuals were asked to have their breakfast and to abstain from eating for 2 hours before the collection of samples. For glucose estimation from the collected samples GOD-POD (glucose oxidase-peroxidase) method was used.

Collection of Blood: Under aseptic conditions using a sterile disposable 25 gauge needle, 2ml of intravenous blood was collected from the median vein in fluoride containing test tube for estimation of blood sugar.

Collection of Saliva: The patients was asked to wash their mouths with tap water and to spit two or three times, after which they was told to spit the saliva pooled in their mouths in a sterile container by asking the patient to expectorate into it gradually over a period of 5-10 minutes. Sample was transferred to a disposable test tube and centrifuged at 2000 rpm for 2-3 minutes and supernatant was separated.

STATISTICAL ANALYSIS: SPSS (version 21) was used for analyzing data. Mean and standard deviations (SDs) were computed for individual groups. These were then compared using student's t test, Pearson's correlation coefficient and Fisher's test. A P value < 0.005 was considered as significant and a value < 0.01 as highly significant.

RESULTS

In group I (cases), the mean random plasma glucose levels were 279.55 mg/dl with a SD of 41.50 and in group II (control) it was 98.70mg/dl with a SD of 19.10. When the difference was analyzed using the Independent t test, the difference between the two groups was found to be statistically highly significant ($p<0.001$) as shown in Table 1.

In group I (cases) the mean salivary glucose levels were 6.56 mg/dl with a SD of 1.81 and in group II (control) it was 1.63 mg/dl with a SD of 0.43. When the difference was analyzed using the Independent t test, the difference between the two groups was found to be statistically highly significant ($p<0.001$) as shown in Table 2.

The correlation coefficient between random plasma and salivary glucose levels was calculated in diabetics (group I) and r value was 0.758, which was statistically highly significant

Table 1: Comparison Of Random Plasma Glucose Levels Between Cases (I) And Control (II) Groups.

Groups	N	Mean	Std. Deviation	T value	P value	Significance
Group I (Diabetic)	60	279.55	41.50	30.658	**0.001**	Significant
Group II (Control)	60	98.70	19.10			

Table 2: Comparison Of Salivary Glucose Levels Between Cases (I) And Control (II) Groups.

Groups	N	Mean	Std. Deviation	T value	P value	Significance
Group I (Diabetic)	60	6.56	1.81	20.465	**0.001**	Significance
Group II (Control)	60	1.63	0.43			

Table 3: Correlation Between Random Plasma Glucose Levels And Salivary Glucose Levels In The Group I (Cases).

	Random Plasma Glucose Value (mg/dl)	Salivary Glucose Value_(mg/dl)	P value	Significance
	Correlation Coefficient (r)	Correlation Coefficient (r)		
Random Plasma Glucose Value	1.00	0.758	0.001	Significant
Salivary Glucose Value	0.758	1.00		

Table 4: Correlation Between Random Plasma Glucose Levels And Salivary Glucose Levels In The Group II(Control)

	Random Plasma Glucose Value (mg/dl)	Salivary Glucose Value (mg/dl)	P value	Significance
	Correlation Coefficient (r)	Correlation Coefficient (r)		
Random Plasma Glucose Value	1.00	0.557	0.001	Significant
Salivary Glucose Value	0.557	1.00		

Table 5: Comparison of Random Plasma Glucose Levels by Salivary Glucose Leevels.

Random Plasma Glucose (mg/dl)	Salivary Glucose levels (mg/dl)		F value	P value	Significance
	Mean	Standard Deviation			
200-250	4.82	1.32	30.565	0.001	Significant
251-300	6.36	1.01			
>301	8.62	1.73			

($p<0.001$) and r value in control (group II) was 0.557, which was also statistically highly significant ($p<0.001$) as shown in Table 3 & 4.

The diabetic group was divided into three subgroups depending upon their plasma glucose levels, as shown in Table5. The salivary glucose levels of the three subgroups were analysed using an f-test and the difference was found to be highly significant ($p< 0.001$).

DISCUSSION

Diabetes mellitus is an endocrine disease characterized by a deficit in the production of insulin with consequent alteration of the process of assimilation, metabolism and balance of blood glucose concentration [7]. Due to its high morbidity and mortality it affects the health of individuals and society all over the world causing infections and effecting the eyes, renal system, heart and blood vessels [8].

Early prevention of the diabetes and its complications was helpful to control the disease. Currently blood is used for diagnosing the diabetes which is an invasive technique and causes physical and psychological trauma to the individuals. There is a necessity in developing a simple and non-invasive technique like estimation of glucose from saliva.

In our study we found that salivary glucose levels were higher in diabetic individuals than controls and the difference was highly significant ($p<0.001$). Our result was similar to the studies done by Ryan [9], Abikshyeet [2], Radhika S [10] and other authors [11, 12] who reported the presence of increased salivary glucose in diabetics when compared to non-diabetics. In our study we found positive correlation between plasma glucose and salivary glucose values in both diabetics and control groups which was statistically significant. Hence, saliva can be used for estimating glucose levels in diabetic patients.

However authors like Forbat et al [13], Carda et al [14] reported that they did not found any correlation between plasma glucose and salivary glucose levels. The mechanism of glucose secretion in saliva is still unknown. Several authors proposed different mechanisms of glucose secretion in saliva. Murrah et al [15] suggested that leakage in the basement membrane of the glands, especially parotid, when plasma glucose levels increase beyond a threshold value. Qureshi et al [16] stated that due to hypoglycemia there are changes in the peripheral capillary system and alteration of basement membrane in salivary glands which causes increased leakage of glucose from ductal system leading to high amounts of glucose in saliva.

Thus on reviewing the literature and analyzing the results of the present study, it can be inferred that saliva be used as a potentially useful non-invasive tool in the diagnosis of diabetes mellitus as well as in monitoring of glycemic control in diabetic patients.

CONCLUSION

Seeing the present prevalence of diabetes mellitus on such a large scale globally, we can definitely say that analysis of saliva can offer a cost-effective approach for the screening of large populations, and thus can prevent the morbidity and mortality associated with this dreadful condition which seems to be attacking people with all age groups, genders, and economic status. We recommend the further studies with large sample size and in different geographic locations considering different parameters of saliva collection.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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