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COMPARISON OF SERUM GLUCOSE AND SALIVARY GLUCOSE IN DIABETIC PATIENTS AT JAMMU AND KASHMIR

Dental Science

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ABSTRACT

Introduction: The importance of saliva for oral health is well known. Diabetes mellitus affects the salivary gland functioning and thus alters the salivary constituents. For many years the question of the presence of glucose in saliva has been a subject of debate and only few people found correlation between serum glucose and salivary glucose in diabetics. Hence, the purpose of this study was to estimate and correlate salivary glucose concentration and serum glucose concentration in diabetics and healthy controls.

Materials and Methods: 120 newly diagnosed diabetic patients and 120 control subjects were included in the study. Blood and saliva samples from both the groups were collected at least two hours after the breakfast. The samples were centrifuged and subjected to glucose analysis. For experimental group, the samples were collected again after the control of diabetes mellitus. The statistical comparisons were performed using paired and unpaired t-test.

Results: A highly significant correlation was found between salivary glucose and serum glucose before the treatment and also after the control of diabetes. The correlation between salivary glucose and serum glucose was also highly significant in controls. it has an added advantage of being non-invasive procedure with no need of special equipments and with fewer compliance problems as compared with collection of blood.

KEYWORDS

INTRODUCTION

Saliva can be whole saliva and gland specific saliva.[1] Saliva is a complex fluid, whose important role is to maintain the well-being of oral cavity.[2]The average daily flow of saliva varies between 1 and 1.5 l. About 99% of saliva is water. The remaining 1% consists of mostly of the large organic molecules (e.g.: proteins, glycoproteins and lipids), small organic molecules (e.g: glucose and urea) and electrolytes (e.g: sodium, calcium, chloride and phosphates etc.). Submandibular gland and sublingual gland produces more viscous fluid than parotid gland whereas Parotid glands produce a watery secretion.[3] well functioning of salivary glands for oral health is well known. Impaired flow rate, altered composition of saliva and increased oral microbial counts may increase the susceptibility to caries, periodontal disease and oral mucosal lesions.[4] The composition and secretion of saliva is influenced by local as well as systemic, neurochemical, hormonal, nutritional and metabolic factors.[1] One such factors is diabetes mellitus which is known to alter the constitution and flow of saliva. The extent of alteration and its clinical significance has been explored by some researchers.

Saliva offers some distinctive advantages. Whole saliva can be collected non-invasively and by individuals with limited training. No special equipment is needed for collection of the fluid. Diagnosis of disease via the analysis of saliva is potentially valuable for children and older adults. Collection of fluid is associated with fewer compliance problems as compared with the collection of blood. Analysis of saliva can provide a cost-effective approach for screening of large populations. Saliva can be useful in the monitoring of therapeutic drug levels and detection of illicit drug use.

A significant correlation between salivary glucose level and serum glucose level has been observed.[5-7] There is paucity of data on the utility of salivary glucose level during the treatment and monitoring of diabetes mellitus.[8] Hence, this study was undertaken to explore the utility of salivary glucose estimation during the treatment and monitoring of diabetes mellitus as it is a non-invasive method of monitoring when compared to serum glucose estimation.

MATERIALS AND METHODS

This study was conducted in the Department dentistry at medical college of jammu and kashmir and a Local Diabetic Care and Research Centre,jammu. Experimental group and controlled group comprised of 120 patients (74 males and 46 females in age group of 30-80) who were freshly diagnosed for diabetes mellitus. The subjects in the control group were matched for age and sex with those of experimental group [Table 1]. Newly diagnosed diabetic patients whose fasting glucose is more than 126 mg/dl or random blood glucose is more than 200 mg/dl were included in the study. Patients who are already taking treatment for diabetes and with other systemic diseases other than hypertension were excluded. Blood and saliva samples from both experimental and control groups were collected at least 1and half hour after the breakfast 1 ml of blood was drawn from anticubital vein. 1 ml of whole saliva was collected by draining method. Salivary and serum glucose was estimated by glucose oxidase peroxidase method using semiautoanalyzer-Biosystems BTS 310.

RESULTS

In control group the salivary glucose ranged from 0.7 to 1.3 mg% and the mean was 1.0 ± 0.1 mg%. In study group, before the treatment of diabetes, the salivary glucose ranged from 1.5 to 8.0 mg% and the mean was 3.10 ± 1.04 mg%. After the control of diabetes, the salivary glucose ranged from 0.6 to 1.8 mg% and the mean was 1.1 ± 0.2 mg%.

The comparison of salivary glucose before treatment and after control of diabetes was done by using paired t-test as same samples were examined twice and difference was statistically highly significant (P<0.001). Unpaired t-test was used to compare the diabetic and control groups and the difference was statistically significant (P<0.01). In control group the serum glucose ranged from 61 to 167 mg% and the mean was 105.7 ± 22.3 mg%.

Table 1: Age and sex distribution in diabetics and controls

Age groups	Diabetics Males	Diabetics Females	Diabetics Total	Controls Males	Controls Females	Controls Total
<35	16	6	22	16	6	22
36-45	8	14	22	8	14	22
46-55	32	16	48	32	16	48
>55	18	10	28	18	10	28

Total	74	26	120	74	26	120
Mean ± SD	48.1 ± 10.5	47.4 ± 11.0		47.8 ± 13.6	48.0 ± 8.9	

In study group, before the treatment of diabetes, the serum glucose ranged from 205 to 480 mg% and the mean was 309.5 ± 68.2 mg%. After the control of diabetes, the serum glucose ranged from 71 to 167 mg% and the mean was 119.7 ± 27.5 mg%. The comparisons of serum glucose before treatment and after control of diabetes was done by using paired t-test the difference was statistically highly significant (P<0.001). Unpaired t-test was used to compare the diabetic and

control groups and the difference was statistically significant (P<0.01) [Table 2]. Unpaired t-test was used to compare the diabetic and control groups and the difference was statistically significant (P<0.01). The correlation coefficient (r) value for salivary and serum glucose in controls was +0.74. The value was found to be statistically highly significant (P<0.001). The correlation coefficient (r) value for salivary and serum glucose before the treatment of diabetes was +0.67 and r value for salivary and serum glucose after diabetes is brought under control was +0.66. The values were found to be statistically highly significant before the treatment of diabetes and also after the control of diabetes (P<0.001) .

Table 2: Comparison of salivary glucose and serum glucose between diabetics and controls

		Pre-treatment Range	Pre-treatment Mean ± SD	After control Range	After control Mean ± SD	Difference Mean difference	Difference t*	Difference P
Serum glucose	Diabetics	205-480	309.5 ± 68.2	71-167	119.7 ± 27.5	189.5	18.5	<0.001
	Controls			61-167	105.7 ± 22.3			
Salivary glucose	Diabetics	1.5-8.0	3.01 ± 1.04	0.6-1.8	1.1 ± 0.2	1.83	12.9	<0.001
	Controls			0.7-1.3	1.0 ± 0.1			

Salivary and serum glucose was correlated before the treatment of diabetes and after the control of diabetes and also in control group in different age groups. It was observed that there was no significant correlation between different age and sex groups and salivary and serum glucose (P<0.05).

DISCUSSION

A series of epidemiological studies in urban South Indians conducted by the Diabetes Research Centre, Madras showed increased prevalence of diabetes (type II diabetes). It has increased from 5.2% in 1983 to 8.2% in 1989 and 11.6% in 1995. With the rising trend in the prevalence of diabetes, the number of diabetic patients in India in 2000 was 31.7 millions. India had the largest number of diabetic patients in the world. The number of people with diabetes in India is expected to be more than double by the year 2030. Male predominance is seen, with male to female ratio of 2:1.[9,10] In our study, male predominance was observed. In present study, the salivary glucose values were higher among the diabetics than in controls and the difference was statistically highly significant (P<0.001). Mehrotra and Chawla,[11] Darwazeh et al.[9] and Anderson et al.[12] concluded that salivary sugar values were higher among diabetics than non-diabetics. However, Sharon et al.[8] found that the glucose concentration in whole saliva was similar in diabetics and in the controls whereas it was significantly higher in the parotid saliva of the diabetic patients. In this study, correlation between salivary glucose and serum glucose in diabetics and controls was carried out. There was correlation between salivary and serum glucose in diabetic patients before the treatment of diabetes and also after the control of diabetes. In controls too, correlation between salivary and serum glucose was found like in diabetic patients. The correlation between salivary glucose and serum glucose was strong in both diabetics as well as in controls. Hence, salivary glucose appears to be a reliable indicator of serum glucose concentrations, particularly in diabetes. Similar to current study, Darwazeh et al[9] and Amer et al.[7] too found a positive correlation between salivary glucose and serum glucose. Glucose is a small molecule which easily diffuses through semi-permeable membranes. Thus, large amounts of glucose become available to saliva when blood glucose levels are elevated as in diabetes. Factors other than elevated blood glucose may lead to elevated salivary glucose. Alterations in permeability occurring as a result of basement membrane changes in diabetes may be an additional explanation for the increased concentration of glucose in saliva.[17] Although membrane abnormalities of parotid gland have been reported in diabetes, there might also be other reasons for the increased salivary glucose content other than changes in glandular tissue. It is possible that part of the registered salivary glucose content originates from gingival fluid.

In the present study, no significant correlation was seen between age and salivary and serum glucose both in diabetic as well as control groups. It was observed that correlation values were less than one and as there was no increase in glucose levels with advancing age, no significant correlation was seen between age and salivary and serum glucose both in diabetic as well as control groups. Similar to our study, Darwazeh et al.[5] also could not find any significant difference in salivary glucose between either sex.

As a highly significant correlation coefficient was obtained in our study, a regression coefficient was calculated (41.5). Regression coefficient gives the amount of increase or decrease in the serum

glucose for a unit change in the salivary glucose. Hence, for a given value of salivary glucose, serum glucose can be predicted by using the regression equation. [Serum glucose = 186 + 41.5(Salivary glucose)]. The diagnostic validity of salivary glucose was predicted so that it can be used as an indicator of serum glucose concentration. The sensitivity was 100% and was found to be significantly high. The specificity was 78%. Positive predictive value was 82% which was found to be significant. Negative predictive value was 100% which was significantly high. Overall accuracy was also significant which was 89%. Salivary glucose concentration of 1 mg% was taken as the cut-off value. A concentration higher than 1 mg% would mean presence of diabetes mellitus, while concentrations less than or equal to this value would rule out diabetes.

CONCLUSION

Although statistically salivary glucose is proved to be a good indicator of presence or absence of diabetes, attention must once again be drawn to the fact that glucose in whole saliva may not be entirely derived from salivary glands. Studies in larger samples and in patients undergoing antidiabetic treatment would perhaps establish more definitively whether salivary glucose estimation would one day replace serum glucose estimation. Such an event would be in the interest of the patient, since collection of salivary samples is an easy, safe and non-invasive procedure. Our study involved a small sample size, therefore similar studies in larger populations would strengthen our results.

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