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Original Article

Biochemistry Section

A Comparative Study on Salivary Glucose Level in Diabetic Patients and Healthy Individuals

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ABSTRACT

Introduction: Diabetes mellitus is defined as metabolic disorder resulting from absolute or relative deficiency of insulin. Deficiency of insulin causes hyperglycaemia which leads to systemic complications. To prevent these complications frequent monitoring of glycaemic levels by non invasive methods is needed. Saliva is emerging as a non invasive diagnostic fluid. Few studies conducted on the saliva as an non invasive diagnostic fluid are having conflicting results.

Considering the existing controversies the present study was conducted to assess the role of salivary glucose level in monitoring glycaemic level in diabetic patients.

Aim: The aim of the present study is to find out the statistical significance of the difference in the salivary glucose level between diabetics and healthy individuals to establish its diagnostic role in monitoring the glycaemic level in diabetic patients.

Materials and Methods: Total 300 cases of Type II diabetes mellitus of the age ≥35 years were included in the study. Blood glucose level and salivary glucose level was determined by Gluocse oxidase-peroxidase method using semi autoanalyser.

Results: The blood glucose level and salivary glucose level were high in diabetic patients and the difference between the salivary glucose level of diabetic and healthy individuals was found to be statistically significant.

Conclusion: Our findings suggest that the significant difference in salivary glucose level makes the saliva as an upcoming diagnostic fluid for the monitoring of glycaemic level in diabetes mellitus.

Keywords: Metabolic syndrome, Saliva, Serum

INTRODUCTION

Diabetes Mellitus is a metabolic syndrome resulting either from deficiency of insulin secretion or resistance to its action causing increased blood glucose levels. Diabetes Mellitus is broadly classified into two categories: a) Type I Diabetes mellitus which results from β-cell destruction and usually leads to absolute insulin deficiency; b) Type II Diabetes mellitus resulting from progressive insulin secretory defect associated with insulin resistance.

The global prevalence of diabetes mellitus is 6.4% in adult population. Though, diabetes mellitus is a non communicable disorder, still the global population suffering from diabetes is expected to rise to 439 million (7.7%) by 2030 [1]. 70% of diabetic population belongs to developing nations in which India is the largest contributor of 50.8 million population followed by China [2]. By 2025 India will be having a population of approximately 57.2 million diabetic patients [3] this rise in diabetic population in India is a consequence of unprecedented rate of urbanisation and lifestyle changes [4].

Diabetes mellitus results in hyperglycaemia which if persists constantly for long time leads to structural changes in tissues [5,6]. In preventing the complication of chronic hyperglycaemia by maintaining the glycaemic control frequent monitoring of blood glucose plays a important role [7]. Blood circulates throughout all organs of the body to maintain a constant internal environment known as homeostasis. Because of its role in homeostasis blood is considered as a diagnostic fluid in clinical testing.

In routine diagnostic procedures blood and urine are commonly used fluids as compared to saliva [8]. The present method of blood sample collection is venipuncture, which is a skilled procedure done by trained person and is also painful and invasive to the patient which may discourage individuals. So there develops the need of non invasive technique for monitoring of glycaemic level in diabetic patients

Monitoring of urinary glucose to assess blood glucose level is a non invasive method but it is only approximate as the urine glucose level is restricted by the renal threshold which varies from patient to patient [9].

Now a days saliva is used to diagnose various endocrine disorders as well as autoimmune and infectious disease [10]. Previous studies shows differences in production and composition of saliva in diabetic and non diabetic individuals [11,12]. In India till now only few studies are carried out on salivary glucose levels which are having controversial results.

Considering the existing conflicts regarding the results of previous studies this study was conducted to assess the role of salivary glucose level in monitoring the glycaemic level in diabetic patients.

MATERIALS AND METHODS

This case-control study was conducted on three hundred Type II diabetic individual of the age ≥35 years with fasting blood sugar level ≥126 g/dL and post prandial blood sugar level ≥200 g/dL. Cases were recruited from the Medicine OPD of Varun Arjun Medical College, Banthra, Shahjahanpur (U.P), India, from November 2017 to March 2018. Diabetes was diagnosed according to criteria established by the expert committee on diagnosis and classification of Diabetes Mellitus in 1980 [13]. Exclusion criteria includes the presence of any other systemic disease severe diabetic complication any medication other than anti-diabetic drugs, salivary gland disorder, radiotherapy of head and neck. Three hundred age and sex matched healthy individuals were included as control. All cases and controls were entered in the study after their written informed consent was obtained and the study was approved by the ethical committee of the Varun Arjun Medical College Shahjahanpur (U.P).

All cases and controls were asked to visit the O.P.D. in the morning between 8.00 a.m to 10.00 a.m with empty stomach having 8 hours of fasting and 2 hours after meal for sample collection.

All the patients suffering from Type II diabetes, above the age of 35 years, with no history of systemic diseases or intake of drugs other than antidiabetics were included in the study.

Collection and Analysis of Sample

Serum: Under aseptic condition 2 mL of intravenous blood was obtained from median cubital vein of forearm. Centrifuged at 3500 RPM for 10 minutes. Obtained serum was analysed immediately or stored at -20°C.

Saliva: Patients were asked not to swallow the salvia for 5 minute after rinsing the mouth with water. Approximately 2mL of unstimulated whole saliva in post prandial stage was collected in a sterile tube by spitting over a period of 5 minute. The sample was centrifuged at 3000 RPM for 10 minutes. The supernatant was used for determination of glucose.

Serum and salivary glucose were assayed by Glucose oxidase-peroxidase method using ERBA CHEM 7 semi autoanalyser.

STATISTICAL ANALYSIS

Data were analysed by using SPSS 20.0 version and statistically significance was measured by Student-t test and it was considered significant when the p-value was <0.05.

RESULTS

The study was conducted on 300 diabetic cases and 300 age, sex matched healthy individuals were involved as controls.

[Table/Fig-1] shows the distribution of cases according to age group. The result shows maximum number of cases in the age group of 51-65 years (46%) followed by 30% in age group of 35-50 years, while the least 24% were in age group of >65 years.

Age Group (Years)	No. of Patients	Percentage
35-50	90	30%
51-65	138	46%
>65	72	24%
Total	300	100%

[Table/Fig-1]: Distribution of cases according to age.

The mean fasting blood glucose level in diabetic individuals was found to be 157.35±53.20 in the age group of 35-50 years, 163.72±57.10 in the age group of 51-65 years and 167.93±63.24 in the age group of >65 years [Table/Fig-2], where as post prandial blood glucose level was found to be 246.32±89, 263.42±76, 276±89 in the age group of 35-50 years, 51-65 years and >65 years respectively. It is found that blood gluose level rise considerably with advancement of age.

Salivary glucose level in diabetic individuals was 10.13±5.03, 11.26±6.13 and 13.14±4.11 in the age group of 35-50 years, 51-65 years and >65 years respectively. On calculating average blood glucose level in condition of fasting and postprandial the observed values are 163±57.8 in fasting and 261.9±84.6 in postprandial condition, which is statistically significant when compared with normal individuals. Similarly statistically significant data was observed when average salivary glucose level of diabetic (11.5±5.1) was compared with the normal individuals [Table/Fig-2].

	Cases				Controls	p -value
Age Group	35-50 years	51-65 years	>65 years	Average Blood Glucose Level		
Fasting Blood Sugar	157.35 ± 53.20	163.72 ± 57.10	167.93 ± 63.24	163 ± 57.8	105.63 ± 19.17	p <0.001
Post Prandial Blood Sugar	246.32 ± 89	263.42 ± 76	276 ± 89	261.9 ± 84.6	137.25 ± 21.25	p <0.001
Salivary Sugar Level	10.13 ± 5.03	11.26 ± 6.13	13.14 ± 4.11	11.5 ± 5.1	6.94 ± 2.35	p <0.001

[Table/Fig-2]: Mean blood and salivary glucose level in cases and controls.
Note-Statistical significance measured by Student-t test

DISCUSSION

In order to elucidate the significance of the high salivary glucose level in diagnosis of diabetes mellitus this study was

conducted as there is lack of consensus among different authors on the utility of high glucose level in diabetes mellitus in previous studies.

The relative or absolute deficiency of insulin secretion in diabetes mellitus may be associated with resistance to metabolic action of insulin on target tissue.[14]. Alteration in composition and function of saliva is usually found in diabetes mellitus [15].

In the present study, the glucose level in blood and saliva of diabetic patients and healthy controls were measured in fasting and postprandial stages. We found that the blood and salivary glucose level were higher in diabetic patients in both fasting and postprandial conditions in all age groups along with the average blood glucose level as compared to healthy controls. This difference was statistically significant. Similar differences between salivary glucose level of diabetic and healthy individual was also found to be statistically significant. The results of our study are in accordance with the other studies who found statistically significant increased level of glucose in saliva of diabetic patients [16-20].

In contrast to our study Sharon A et al., didn't find any significant difference in diabetic and control [21]. Similarly studies conducted by Bakianian Vaziri P et al., and Hegde A et al., also found no significant difference in salivary glucose concentration between diabetics and non diabetics [22,23].

The increase in salivary glucose level is multifactorial among which one is alteration in hormonal and neuronal regulation of filtration of blood glucose by salivary glands according to Lopez ME et al., [24]. Another is increased leakage of glucose from ductal cells of salivary gland increases salivary glucose level in diabetic patients according to Qureshi A et al., [25]. Microvascular changes in blood vessels and change in the basement membrane also leads to increased leakage [26]. Chronic hyperglycaemia leads to formation of sorbitol, diacylglycerol and fructose-6-phosphate which also increases the permeability of glucose from blood to saliva [26] [Table/Fig-3].

Salivary Glucose (mg/dL)	Present Study	Gupta S et al., [27]	Kumar KP et al., [28]	Patel BJ et al., [29]
Cases (Mean±SD)	11.5 ± 5.1	19.48 ± 5.511	9.98 ± 3.0	13.96 ± 7.09
Controls (Mean±SD)	6.94 ± 2.35	7.82 ± 2.423	7.56 ± 1.37	4.61 ± 2.15

[Table/Fig-3]: Comparison between the findings of present study with other similar studies.

LIMITATION

Main limitation in this study was duration of diabetes, condition of oral cavity, method and type of saliva collection, duration of preservation of saliva.

CONCLUSION

Chronic hyperglycaemia leads to complication in diabetes mellitus. To prevent this it requires frequent monitoring of blood glucose level. This needs a non invasive and painless technique for the monitoring of blood glucose level. Role of saliva as a non invasive diagnostic tool remains controversial because of the conflicting results in the previous studies. From above study we reach to the conclusion that salivary glucose level is significantly increased in diabetic patients. It can be considered as a non invasive diagnostic tool in monitoring the glycaemic level. But as the increase in salivary glucose level is multifactorial it requires further studies on factors like age, gender, duration of disease and on any correlation with blood glucose level should also be studied.

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