Original Research Article

The correlation between blood - Salivary glucose levels in diabetic and non-diabetics

Rajesh Kadam[1], Swati Rathod[2*], Jitendra Rathod[3]

{[1]Assistant Professor, Department of Pharmacology} {[2]Assistant Professor, Department of Dentistry} {[3]Assistant Professor, Department of ENT} MGM Medical College and Hospital, Aurangabad, Maharashtra, INDIA.
Email: drswatirathod30@gmail.com

Abstract

Background: Diabetes is a leading chronic disease globally. Additionally, it is a significant risk factor for cardiovascular diseases, which increases its morbidity and mortality. There is alarming rise in number of people with diabetes mellitus over these years. Saliva can offer a great value to detect the diabetes mellitus at an early stage if we are able to establish the positive correlation between blood and salivary glucose levels. **Aims:** This is a cross-sectional study undertaken with the aim to assess the correlation of salivary glucose level with blood glucose level. **Methods and Material:** For investigations, 2 sets of samples of people with diabetes and the age and sex matched non-diabetic subjects were recruited. The blood glucose level and salivary glucose levels in unstimulated whole saliva samples were analyzed using glucose oxidase method. **Statistical analysis:** Pearson's correlation coefficient test was applied to assess the correlation between salivary glucose level and blood glucose level. **Results:** The significant ($P<0.05$) positive correlation of salivary glucose level and fasting blood glucose level was observed in people with diabetes in both the sets of samples. **Conclusions:** Although study suggests some potential for saliva as a marker in monitoring of diabetes mellitus, there are many aspects that need clarification before we reach to a conclusion.

Keywords: diabetes mellitus; glucose oxidase method.

***Address for Correspondence:**
Dr Swati Rathod, Assistant Professor, Department of Dentistry, MGM Medical college and hospital, Aurangabad, Maharashtra, INDIA.
Email: drswatirathod30@gmail.com

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INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder characterized by the presence of chronic hyperglycemia accompanied by greater or lesser impairment in the metabolism of carbohydrates, lipids and proteins. The origin and etiology of DM can vary greatly but always include defects in either insulin secretion or response or in both at some point in the course of disease.[1] Diabetes has become a worldwide epidemic affecting both developing and developed countries. The global incidence of DM was 366 million cases in 2011. In India alone there were around 61.3 million cases of DM and it is predicted that this may increase to double in next 10 years.[2] Glucose is a small molecule capable of moving easily through the membranes of blood vessels, passing from the blood plasma to the gingival fluid, via the gingival sulcus, reaching the saliva.[3] The increase in blood glucose in the diabetic patient could cause higher levels of salivary glucose with the consequent loss of homeostasis and greater susceptibility to diseases like caries, gingivitis, periodontitis and candidiasis in the oral cavity.[4-6] With the rapidly increasing incidence of DM quick diagnosis and early management is necessary . Collection of saliva is a non-invasive procedure and can be collected with person with modest training or standard equipment. Hence saliva may provide a cost effective approach for quick screening of a large populations. [7-9] Thus, the study was undertaken in an attempt to compare and correlate glucose levels in saliva and blood of patients with diabetes mellitus and non diabetic healthy individual and to determine the efficacy of saliva as a diagnostic aid.

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MATERIALS AND METHODS

The study was conducted in the department pharmacology, M.G.M. Medical College and hospital, Aurangabad. The patient participated in this study consisted of 75 subjects with diabetes and control group is consisted of 75 subject in the age group of 30 to 60 yrs [Table 1]. The patients were explained about the blood and saliva collection procedures in detail and written informed consent was taken. The patients who were agreed to undergo the procedure were called in the next morning. The patients with pregnancy, lactation, chronic illness or taking any medications were not considered for the study. The patients were instructed to be fasting overnight. For the collection of blood patient was asked to sit in chair with comfortable position with extended arm. Under all aseptic measures approximately 2ml of blood was collected from medial cubital vein. The collected blood was then transferred to sodium fluoride bulb by slowly pushing down the piston. The anticoagulant and blood was mixed by holding the bulb in the palm and rotating it. The collected blood sample was then stored at cool place at 2°-8°C. The collected blood sample was centrifuged at 3,000 rpm for 20min and clear supernatants were processed immediately for glucose estimation.[10] The salivary sample collection was performed in morning between 8.00am-11.00am with the patients sitting upright in a comfortable position. Patients were asked to rinse mouth with normal saline and asked to swallow or split the saliva which already present in the mouth. The samples collected in initial 30 seconds were discarded. The samples were collected in a disposable plastic glass by expectoration method for 5-10min till approximately 2ml of saliva was collected. Then sample was transferred to a disposable test tube and centrifuged at 2000rpm for 2-3 minutes and supernatant was separated. Thus the unstimulated saliva was collected. [11-14] The collected saliva was stored at 2-8°C until used in glucose assay. Blood and Salivary glucose estimation were performed by GOD-POD method (Glucose GOD – PAP Biolab Diagnostics kit) ™. The results were calculated and values were expressed as milligrams per decilitre (mg/dl).

RESULTS

All statistical were performed using Microsoft Excel 2007 and SPSS (Statistical Procedure for Social Services) – version 16 statistical software programme. Comparison of control and study groups with respect to Fasting Blood Glucose levels and Fasting salivary Glucose level was done by unpaired t test. The data were expressed as mean (standard deviation [SD] and in the entire tests P (probability) value < 0.05 was taken to be statistically significant. The present study comprised of 75 control and 75 diagnosed diabetics in the age group of 30 -60. Out of a total of 75 samples in control group, 56.67% are males and 43.33% are females. The mean age of samples in control group is 45.03±8.16, in which male mean age is 45.29±8.44 and females is 44.69±8.10. Similarly out of a total of 75 samples in study group, in which 52.00% are males and 48.00% are females. The mean age of samples in study group is 44.84±8.45, in which male mean age is 45.67±8.62 and females is 43.94±8.29. The fasting blood glucose level in control group is 95.40±9.91 and in study group is 165.72±17.12. Fasting salivary glucose levels in control group is 10.04±3.32 and in study group 19.61±3.02. The results of distribution of blood glucose level and salivary glucose level in two sample groups are shown on [Table 2]. The significant positive correlation between salivary glucose levels and the fasting blood glucose levels was seen.

DISCUSSION

Saliva is a clear, slightly acidic mucoseruos exocrine secretion. Whole saliva is a complex mix of fluids composed of variety of electrolytes, including sodium, potassium, calcium, magnesium, biocarbonate, and phosphate. Immunoglobulins, proteins, enzymes, mucins are also present in saliva. [15] The constituents present in blood can also express through the saliva, hence can be utilized for diagnosis and monitoring of many systemic diseases and understanding of their oral manifestations.[16] The present study was undertaken to find out correlation between the blood and salivary glucose levels. There was significant increase in salivary glucose levels in the patient with diabetes when compared to control group. Mussavira S.*et al.* and kavitha *et al.* also found the positive correlation between the blood and salivary glucose levels.[17, 18] Mata *et al.*. also reported alterations of salivary composition in diabetic patients.[19] Belazi *et al.*. showed higher salivary and serum glucose concentrations in children with insulin dependent diabetes mellitus.[20] Wang B *et al.*. found a significant correlation between blood glucose level and parotid saliva glucose level. However there were no significant differences in the glucose levels in mixed saliva from diabetes patients and healthy controls.[21] In diabetic patients, salivary gland secretions undergoes qualitative as well as quantitative changes which lead to oral hard and soft tissue changes and increase incidence of caries and periodontal diseases.[22] In the present study, the correlation between blood glucose levels and salivary glucose levels has been established. Hence saliva can be used as screening method to detect diabetes as it can be collected non-invasively with modest training and without use of any sophisticated equipment and it is readily acceptable by patient.

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Table 1: Distribution of the groups studied according to sex and age the patients

	Experimental group	SD	Control group	SD
Male	39	45.67±8.62	39	45.29±8.44
Female	36	43.94±8.29	36	44.69±8.10

Table 2: General characteristics of the groups studied

	Experimental groups	Control groups	P value
Fasting blood glucose level	165.72±17.12	95.40±9.91	0.00001
Fasting salivary glucose level	19.61±3.02	10.04±3.32	0.00001

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