

# A Case Control Study To Evaluate The Sensitivity Of Salivary Over Serum Glucose Levels In Patients With Controlled Type 2 Diabetes Mellitus

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## Abstract

**Background:** The primary objective of the study is to manage the level of “sensitivity of salivary over serum glucose” in patients who have been suffering from type 2 diabetes mellitus patients.

**Materials and Methods:** There are two groups have been selected for this study for the purpose of gathering samples. In that case, Group A includes individuals below 60 years, and also their health condition was checked before the selection as a sample. In addition, Group B incorporates 60 adults after observing their diabetes levels. In that case, it can be observed that Group B has successfully controlled their type2 of diabetes. In order to determine the glycosylated hemoglobin and serum glucose present in the blood, the blood samples (“1.5ml of venous Blood”) were gathered with the help of EDTA. In this context, it is required to use a sterile container to collect stimulated saliva from each of the groups. In this study, the “microcolumn method” has been used for the estimation of glucose of the subjected groups. In the next phase, the result can be obtained with the help of statistical analysis with “ANOVA” and “correlation test”.

**Results:** In every group, the level of salivary glucose has been enhanced and also observed after doing a proper comparison. The presence of HbA1Cc can enhance the percentage of glucose in a certain group. After doing the correlation Analysis, it can be found that a positive result ( $P < 0.001$ ) occurs between the two factors such as “salivary glucose level with HbA1c” and “serum glucose level”.

**Conclusion:** The study has depicted that, salivary glucose can be used as a form of “noninvasive diagnostic aid”. The term diabetes has been influenced by the function and composition of the salivary method.

**Keywords:** “Hyperglycemia”, “Insulin”, “Advanced Glycation End Product”

## INTRODUCTION

The disease diabetes mellitus is one of the commonly known disorders, that is related to endocrine metabolism. Due to the deficiency of insulin, hyperglycemia can be observed in the body of the patient. In this context, it can be observed that people of Indian origin may develop a high risk of the disorder diabetes. In this recent years, there are near about 40.9 million individuals have been suffering from diabetes. By the year, 2025 it can be predicted that near about 70 million individuals will be affected by the disease diabetes Mellitus. The disease prevalence rate in the Urban region is near about 9% and the diabetes prevention rate of the rural region has enhanced by about 3%.

The disease Diabetes Mellitus can be explained as the improper regulation of protein, carbohydrate and lipid metabolism. One of the fundamental characteristics of the disorder diabetes can elevate the level of blood glucose and is can be known as hyperglycemia. If, diabetes becomes untreated for the long term, it may affect several organs of individuals such as nerves, kidneys, eyes, and blood vessels of the body. As a result, the complications may lead to the ultimate mortality and morbidity of patients. In that case, the spread of the disease can be observed across the world. Diagnosticicians are required to enhance their knowledge from additional sources to treat the disease and also the reduction of the effect of diabetes on individuals. A proper medical care should be taken by health care practitioners to control diabetes. When affected by diabetes, generally the oral tissues are damaged and the characteristics of DM can be observed. Therefore, the chances of some other kind of disease can be seen, that includes “xerostomia”, “dental caries”, “abnormal taste”, “recurrent fungal infection”, and “burning mouth syndrome”.

The role of saliva is to manage the state of the oral cavity by secreting a unique type of fluid. The key medium of any individual's body is saliva, therefore it can be denoted as an appropriate medium for the exploration of any type of disease.

The components present in saliva also help to maintain oral health and additionally diagnosis of several diseases such as "oral cancer", "periodontal disease" and "candidiasis" must be possible. The disease diabetes Mellitus has the capacity to generate some complicated health disorders "nephropathy", "retinopathy", "microangiopathies", and "peripheral neuropathy". Therefore, the investigation should have to be accomplished properly in case of diagnosis and monitoring of the disorder. Healthcare practitioners should routinely investigate the blood sugar level of the patients on a daily basis.

However, these methods of investigation may lead to discomfort for diabetes-affected patients. In this regard, it is required to develop an alternative non-invasive method for the diagnosis of diabetes to make patients more comfortable. There are some different types of advantages that can be found after the utilisation of noninvasive methods for saliva collection. After acquiring limited training in saliva collection, diagnosticians can easily gather the saliva of patients at a limited cost. The study will further shed light on the role of saliva in this particular disease and the correction method of "serum glucose" and "salivary glucose" will be discussed in the next parts of the study.

## MATERIALS AND METHODS

The study has been conducted between the years 2011 to 2012 on the "salivary over Serum glucose levels in patients with type 2 diabetes mellitus". The was arranged and planned by the "Department of Oral Medicine & Radiology", "Annamalai University" and "Raja Muthiah Dental College". For this study, the samples were collected from the out paties who have visited the department of "maxillofacial radiology" and "oral medicines". A total of 120 samples were selected between the age group of 25-60 years and then further divided into 60 individuals in each group. Group A consists of 60 healthy individuals of the same sex and age. Group B includes individuals with proper control of the disease Diabetes Mellitus. After the selection of the samples, a detailed study has been done after the clinical examination of type 2 diabetes patients. In this context, screening can be considered as obe of the best practices to monitor the controlled and uncontrolled situation of diabetes.

The research has been done on the basis of "serum glucose level". In order to obtain the ethical clearance to proceeding the study to get permission from the college committee. The patients were selected for this study and were also carefully asked questions depending on the condition of their oral cavity.

The particular study has included the special type of controlled cases of the disease "type 2 diabetes Mellitus". The exclusion criteria for this study are, patients with "smoking habits", "pregnancy", "chronic alcoholic", "protease inhibitor" and "diuretics" cannot participate in this study. Hence, detailed information on the patients who have been suffering from diabetes mellitus has been recorded with special references. Both data of the patients having "diabetes mellitus" and "type 2 diabetes Mellitus" was also recorded for the study. 2% good-grade citric acid was used to stimulate the saliva and that was also applied on the tip of the tough of each and every selected individual. After that those selected samples o patients were suggested to spit the saliva into a sterile container after 3 minutes. After the collection of saliva, the containers were placed carefully in the "ice carrier box". Each container contain a minimum of 2ml of saliva and is then sent it to the laboratory for accomplishing the experiment. In the case of the collection of samples, the blood serum of patients was collected (1.5) ml with the help of EDTA or heparin to detect the "Glycosylated hemoglobin". On the other hand, the venous blood of the patients was collected with the help of EDTA to find out the level of "Serum Glucose".

In this study, the GOD POD method has been utilised to evaluate the estimation of Glucose level of stimulated saliva.

$$\frac{\text{Sample (A)}}{\text{Standard (A)}} \times 100 (\text{Standard conc.}) = \text{mg/dL glucose in the sample}$$

## Conversion factor

The study has successfully estimated the "glycated hemoglobin serum" with the help of the micro-column method. The equipment centrifuges are also used to separate substances from blood serum through the ETDA method. In that case, 1.5 ml of blood was taken and the removal of plasma has been done within the centrifuge for at least 10 minutes. The hemoglobin present in the blood has been eliminated after the preparation of hemolysate. Then, the exchange of hemoglobin can be possible with the help of "retailed cationic exchange" methods. Then, Haemoglobin A1C is collected after giving it a proper wash and the quantified reading have been taken at 415nm.

## STATISTICAL ANALYSIS

For this study, the statistical comparison between the "serum glucose level" and "salivary glucose" successfully helped to evaluate the condition of patients. The SPSS version 13.0 can be considered one of the best analytical tools for this research. In order to evaluate the differences, one-way ANOVA had been done. On the other hand, "The person's correlation analysis" can be taken as another useful approach to detecting the relation between "serum glucose" and "salivary glucose".

## RESULTS INFERENCE STATISTICS

The Comparison Of Salivary Glucose Between Control And Patient Group Was Shown In [Table 1].

Group	Mean	SD	f-value	P-value
Control	6.73	1.73	15.92	0.000***
Patient	45.00	18.22		

Unpaired t test, SD-standard deviation; (\*\*\*)VHS= Very high significant  $P < 0.001$

Inference: On group comparison there is significant increased p value ( $P < 0.001$ ) seen in case group .

Comparisons Of Salivary Glucose By Serum Glucose Of Patient Was Shown In [Table 2].

Level of Serum Glucose	Salivary Glucose Mean	SD	f-value	P-value
Below 150 mg/dl	14.00	1.70	88.69	0.000***
150 - 200 mg/dl	30.78	6.60		
Above 200 mg/dl	57.28	10.59		

Anova test, SD-standard deviation; (\*\*\*)VHS= Very high significant  $P \leq 0.001$

Inference: On group comparison there is significant increased p value ( $P < 0.001$ ) seen in case group.

Comparison Of Salivary Glucose And Glycated Hemoglobin Of Patient Was Shown In [Table 3].

Level of Glycated Hemoglobin	Salivary Glucose Mean	SD	f-value	p-value
Below 8%	31.60	7.13	4.67**	0.000***
8% - 9%	45.06	20.74		
Above 9%	52.33	13.37		

Anovatest ,SD-standard deviation; (\*\*\*)VHS= Very high significant  $P \leq 0.001$

Inference: On group comparison f-value shows statistically significant difference between salivary glucose and glycated hemoglobin and there is increase in the salivary glucose level with an increase in HbA1cpercentage

## CAUSAL ANALYSIS

Correlation Between Comparison Of Salivary And Serum Glucose Levels Was Shown In [Table 4].

	Serum Glucose	Salivary Glucose	Glycated Hemoglobin
Serum Glucose	1.000	-	-
Salivary Glucose	$r = 0.854^{**}$ $P = 0.000$ PC; VHS	1.000	-
Glycated Hemoglobin	$r = 0.499^{**}$ $P = 0.000$ PC; VHS	$r = 0.43^{**}$ $P = 0.000$ PC; VHS	1.000

\*\*\* VHS - Very High statistically significant  $P < 0.001$

PC; Positive correlation

NC: Negative correlation

Inference: On performing Pearson's Correlation analysis a significant positive correlation was found between serum and saliva groups.

Regression Analysis On Salivary Glucose And Serum Glucose Was Shown In [Table 5]

'a' value	'b' value	R <sup>2</sup>	t value	P value
1.058	.03204	0.74	13.02	0.000**

\*\*\* VHS - Very High statistically significant  $P < 0.001$  and P value found to be very high statistically significant.

## DISCUSSION

The major characteristics of the disease diabetes mellitus are the abnormal metabolism properties of the protein, fats, and carbohydrates. Due to the reduction of insulin levels in the body, it may lead to the formation of acute and chronic complications [4].

In these recent years, it can be observed that Diabetes Mellitus is spreading just as an epidemic in many parts of India. There are enormous complications that can be observed and as a result, it leads to the ultimate morbidity and mortality of the patients [14, 15]. After being affected by the disease diabetes, individuals may pose some family and healthcare burdens. Nowadays, diabetes is a worrying factor because complications can be detected at a younger age. By the year 2000, there were near about 31.7 million people affected by DM in India [5]. Additionally, the reports showed that from the country China there were near about 20.8 million people were affected by Diabetes Mellitus.

There are different types of advanced diseases can be detected during the oral manifestation, that includes “sialosis”, “periodontal disease”, “xerostomia”, “burning mouth syndrome”, “abnormal taste” and “dental caries”. All these manifestations have the capacity to destroy the dental structure [2]. On the other hand, it may give rise to clinical opportunities such as screening the oral cavity of the patients.

In this way, it can be stated that the disease Diabetes mellitus required routine monitoring activities on the patients. Hence, the serum glucose investigation method is one of the best approaches to monitoring Diabetes Mellitus [6]. The result can be easily achieved with the help of repeated sampling of intravenous blood. In order to lessen the unnecessary mental trauma of those patients, it is required to use the noninvasive technique [13].

The saliva of individuals has some different kinds of advantages in comparison with the other parts of the body. The key advantage of this method is, with limited training individuals can collect samples by a non-invasive method [7]. For the detection of the level of salivary glucose, the non-invasive method has been selected and it can be done with the help of minimum equipment. Other reports from the previous study help to know that the “blood glucose level” and “salivary glucose level” have some correlation.

The study depicted that the salivary glucose level has increased ( $P < 0.001$ ) in the case groups in the comparison with the control groups [12].

There are various hypotheses have been used in the literature part of the study regarding the increased concentration of glucose. This incident may improve the permeability of the membrane in the case of “insulin-dependent diabetes mellitus” [8,9]. As a result, the leakage of saliva occurs via gingival crevices, and the diffusion of glucose molecules can be observed via a permeable basement membrane.

Therefore the changes in the blood vessels can be observed after occurring persistent hyperglycemia. On the other hand, the leakage of glucose happens due to endothelial dysfunction and in this way, the glucose content generally increases in saliva [10].

According to Kumar et al. further measurement of diabetes can be possible after analysing the level of saliva and the non-invasive technique can be considered as one of the best approaches for this study [11].

In contrast, Anjali Gupta et al. concluded that the reflection of salivary glucose did not alter by the blood glucose level. After the screening process, salivary glucose shows different characteristics as a high level of plasma in children.

## CONCLUSION

It can be concluded from the present study, that salivary glucose level can be used as a noninvasive diagnostic, as well as a monitoring tool to assess the glycemic status of diabetes mellitus patients. Future researches on larger populations and in different geographic areas are needed to establish salivary glucose estimation as a diagnostic aid as well as a monitoring tool for diabetes mellitus.

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