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Correlation of Blood Glucose Levels with Salivary Glucose Levels for Diagnosis in Diabetes

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Abstract: *The aim of these studies conducted is to find a correlation between the levels of glucose present in the blood which are presently used to test for diabetes with the salivary glucose levels to introduce new diagnostic methods.*

Keywords: *Blood Glucose, Salivary Glucose, Diabetes mellitus, Diagnosis, Insulin.*

I. INTRODUCTION

A partial or total lack of insulin secretion or resistance to the metabolic effects of insulin on target tissues are defining characteristics of diabetes mellitus (DM), a disease. Diabetes mellitus is classified into two main forms: type I, or insulin-dependent diabetes mellitus (IDDM), and type II, or noninsulin-dependent diabetes mellitus (NIDDM). Insulin resistance and an insulin secretory failure are combined to generate type II diabetes, which is the most common type of diabetes. Patients with type II diabetes have visible variations of glucose homeostasis, including hyperglycemia during fasting, but they also have some internal capacity to secrete insulin. [1]

The tiny molecule glucose readily diffuses across blood vessel membranes, travels via the gingival sulcus in the bloodstream to the gingival fluid, and eventually ends up in saliva.

Saliva is an organic fluid that can reveal changes in the body both locally and systemically. As a result, the components of saliva can provide information about a person's nutritional, immunological, neurological, hormonal, and metabolic health.

Being the "mirror of the body," saliva is a highly desirable biomedium for clinical diagnostics. Because of its special qualities, like non-intrusive accessibility and the availability of several illness biomarkers, which makes it more alluring for tracking and diagnosing illnesses. Numerous studies demonstrate the use of salivary glucose levels as a significant non-invasive blood glucose indication levels.[2]

II. MATERIALS AND METHODS

A case-control study was conducted on 75 uncontrolled type 2 diabetes mellitus (DM) patients, aged 40 years and above, diagnosed by a specialist and recruited from the Endocrinology Department of Imam Khomeini Hospital. Salivary samples (2cc) were collected from fasting patients 8 hours after their last meal, within the timeframe of 9-11 am, in a tranquil environment to avoid mental pressure on patients. The diabetic patients, though under pharmaceutical treatment, exhibited abnormal glucose levels, excluding those nearing normal levels.

Patients were on oral anti-diabetic medications, and after sample collection, the tubes were capped, placed in ice, and transferred to Pars Medical Diagnosis Laboratory. Salivary samples were centrifuged at 5000 rpm for 10 minutes, and the supernatant was stored at -20°C. Glucose levels were determined using the glucose oxidase method with a Glucose-oxidase assay kit (God, Sigma, USA) on an Auto Analyzer, capable of analysing 90 samples simultaneously.

Additionally, 5cc venous blood samples were collected, centrifuged at 2000 rpm for 10 minutes, and the serum was stored at -20°C until the experiment. Sigma kit was used for testing. The control group comprised 75 subjects without DM or any systemic disease, matched with the case group in terms of age and sex. All subjects were thoroughly informed about the study, and written informed consent was obtained. The study received approval from the university's Ethics Committee.

Blood glucose levels were measured in mg/dl with 0.1 precision using a device. Pearson's correlation coefficient was employed to assess the correlation between blood glucose and salivary glucose levels in both the case and control groups.[3]

III. RESULTS

In the case group, the mean age was 42 ± 4.2 years, and in the control group, it was 45 ± 3.7 years. Males constituted 38 (case) and 42 (control), while females were 32 (case) and 28 (control).

The mean blood glucose levels were 247 ± 24.2 mg/dl, and salivary glucose levels were 1.4 ± 0.2 in the case group. The overall correlation coefficient between blood glucose in diabetic and normal subjects and salivary glucose was 0.67 ($P=0.02$), signifying a significant positive correlation. Essentially, salivary glucose levels were indicative of approximately 50% of blood glucose alterations.[3]

For the diabetic group, the correlation coefficient between blood and salivary glucose levels was remarkably high at $r=0.90$, indicating a very close correlation. This implies that salivary glucose levels closely estimate actual blood glucose values, with a correlation coefficient of $r=0.90$ demonstrating that salivary glucose can predict 90% of blood glucose levels in the diabetic group. (Diagram 1)

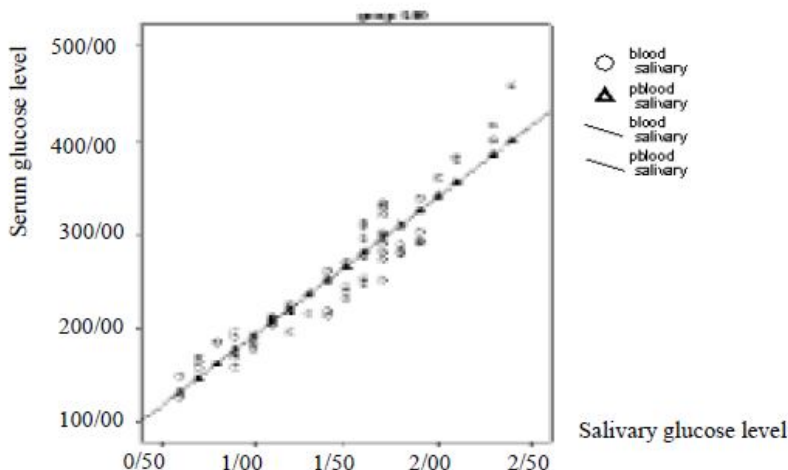


Diagram 1-Estimating blood glucose levels in diabetes patients using their salivary glucose levels.

In the control group, the mean blood glucose was 84.97 ± 15.8 mg/dl, and the mean salivary glucose was 1.09 ± 0.12 . The correlation coefficient between blood and salivary glucose levels in the control group ($r=0.18$) indicated no significant correlation between these parameters in healthy subjects. Diagram 2 visually supports this finding, highlighting the absence of a significant correlation between blood and salivary glucose levels in healthy control subjects. With a correlation coefficient of $r=0.18$, it is evident that salivary glucose levels do not reliably estimate blood glucose levels in healthy individuals.[3]

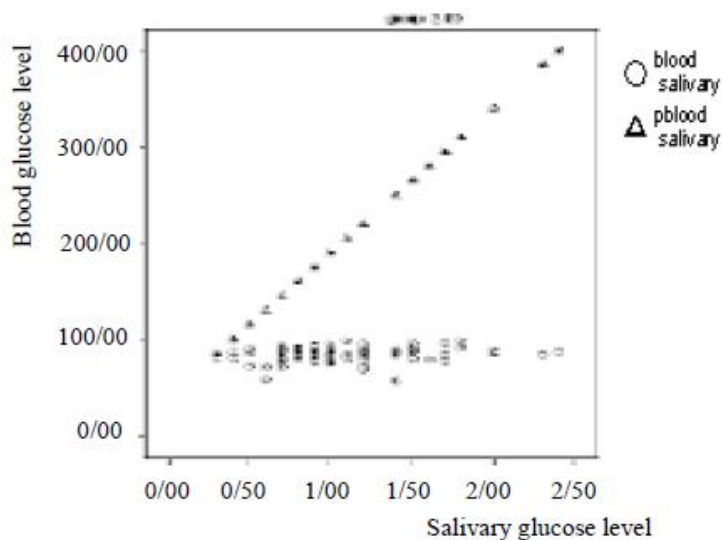


Diagram 2 Estimating blood glucose levels in healthy controls using their salivary glucose levels.



IV. CONCLUSIONS

The studies conducted show that there is a very high correlation between the glucose levels found in blood with the glucose levels present in the saliva. The salivary glucose levels are increased in diabetic patients [4] which indicates that it can be used to diagnose this disease instead of blood glucose levels which is a painful method.

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