Research Article

ESTIMATION OF GLUCOSE LEVELS IN BLOOD AND SALIVA-A COMPARATIVE STUDY

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A R T I C L E   I N F O

A B S T R A C T

BACKGROUND: Blood is the most common biological fluid used in investigatory projects but it is an invasive procedure, saliva is another biological fluid that can be used as an alternative to blood since it is less invasive and most of the biological parameters found using blood can also be identified in saliva

AIM: to estimate the glucose levels in blood and saliva and verify if there is a correlation between them.

OBJECTIVE: to compare the glucose levels in blood and saliva and estimate the level and justify that the levels in both are equal

METHOD: The study group comprised of 25 randomly selected patients. Blood collection: The samples were collected using the venipuncture methods. Values were calculated using a semi auto analyzer to estimate the random blood glucose levels. Saliva collection: Mostly only stimulated saliva was collected from the subjects. The saliva was collected by asking the participants to spit into the eppendorf, after rinsing their mouth. Statistical analysis: Pearson's correlation test was done on the data collected and it showed a negative correlation.

RESULT: When the statistical analysis was done it showed a negative correlation in the study, which means that if salivary glucose levels decreases the blood glucose levels increase.

CONCLUSION: The present study sheds some light on the importance of early diagnosis and preferment and utilization of non-invasive saliva analysis over the invasive blood analysis. Even though the present study shows a negative correlation more research should be conducted in this area.

INTRODUCTION

Diabetes mellitus is a clinically and genetically heterogeneousmetabolic disease characterized by hyperglycemia and deregulationof carbohydrate, protein, and lipid metabolism. The primary feature of diabetes mellitus is chronic hyperglycemia, resulting from either a defect in insulin secretion from pancreas or resistance of body's cells to insulin action or both (1).

The global prevalence of diabetes is 6.4% in adult population. Worldwide, the number of people with diabetes is expected to grow to 438 million by 2030, corresponding to 7.8% of the adult population.

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The crude prevalence rate of diabetes in urban areas is about 9% and in rural areas, has increased to around 3% of the total population (2).Type 2 diabetes mellitus is the fifth most common condition and the sixth leading cause of mortality amongst the elderly (3).

FalaceMarcheti in 1989 and Amer in 2001 reported similar results. But, Leach in 1970 and Ficara in 1975 did not find any significant relationship between blood glucose and salivary glucose level in diabetic patients (5).Owing to lack of sufficient diagnosis and treatment, diabetes is a major cause of death worldwide, more than half of the diabetics remain undiagnosed especially the patients with Type 2 diabetes. Monitoring people with diabetes by repeatedly estimating blood glucose and glycosylated hemoglobin levels is invasive which becomes appalling and expensive over time (3).

The need to monitor periodic blood glucose is present because it reveals the pattern of blood glucose change in individuals,

and helps in planning of meals, and also at what time of the day a patient has to take medication.The choice of blood as a diagnostic fluid for clinical testing is clear-cut considering its close relationship to the homeostasis of the body (4) .While the early diagnosis of diabetes is essential toprevent its devastating complications, the currentmethod of investigation needs the painful needleprickto withdraw blood, which may discouragethe individuals from the investigation (2).

Saliva fulfills several of the chief diagnostic concerns for a diagnostic bio fluid as it is obtained noninvasively, and its collection requires no special skill (4) Saliva acts as a mirror of the body and, hence, is a perfect medium to be explored for disease and health surveillance (6). This study was conducted to check if saliva can be used as an alternative bio-fluid for glucose estimation.

MATERIALS AND METHODS

- ➤ Sample size: The study group comprised of 25 randomly selected patients. Almost all the subjects were non diagnosed patients. The study comprised of 9 male participants and 16 female participants
- ➤ Age group: aged between 18 to 80 years.
  Sample collection:
- ➤ Blood collection: The samples were collected using the venipuncture methods. Values were calculated using a semi auto analyzer to estimate the random blood glucose levels. The method that was used to estimate the serum glucose level was Hexokinasemethod.
- ➤ Saliva collection: Mostly only stimulated saliva was collected from the subjects. The saliva was collected by asking the participants to spit into the eppendorf, after rinsing their mouth well. The random saliva glucose values were calculated using the glucose oxidase method and the values were calculated using a calorimeter.
- ➤ Statistical analysis: Pearson's correlation test was done on the data collected and it showed a negative correlation

RESULT

- ➤ The correlation coefficient of the following data is -0.1163187
- ➤ 3 people had elevated levels of blood glucose but their salivary glucose levels were relatively very low.
- ➤ The mean of blood glucose levels was 108.92 and that of saliva was 9.128, this showed a very high variance.
- ➤ When the statistical analysis was done it showed a negative correlation in the study, which means that if salivary glucose levels decreases the blood glucose levels increase.
- ➤ The salivary glucose levels are inversely proportional to each other and since it is giving a

negative value the results were insignificant for random BGL and SGL.

PATIENT	BLOOG(G) (mg/dl)	SALIVA(G) (mg/dl)
P1	94	51.51
P2	87	27.27
P3	85	3.03
P4	117	45.45
P5	96	3.03
P6	97	3.03
P7	116	3.03
P8	98	27.27
P9	90	0
P10	97	6.06
P11	96	3.03
P12	93	12.12
P13	256	0
P14	82	0
P15	83	3.03
P16	105	9.09
P17	134	0
P18	190	12.12
P19	113	9.09
P20	87	3.03
P21	67	2
P22	106	0
P23	145	4
P24	80	1
P25	109	0

plotting of the correlation
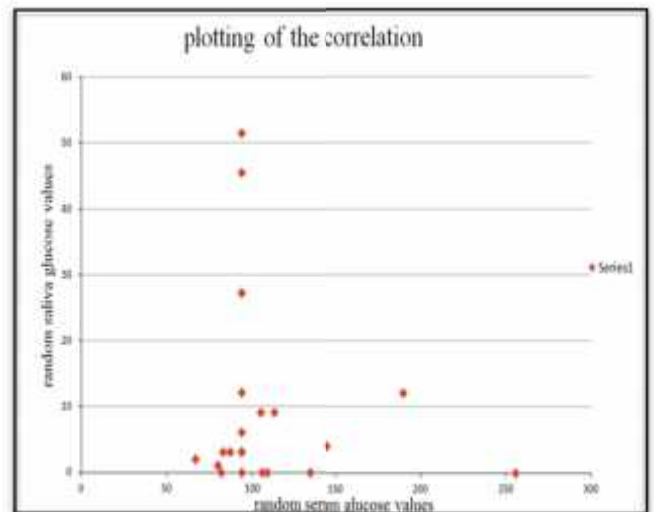
DISCUSSION

- ➤ From the data collected it was observed that 3 individuals had elevated blood glucose levels but their their salivary glucose level was relatively low, this was because of the negative correlation and so the salivary and blood glucose levels were inversely proportion to each other. Patient number 13 had a blood glucose value of 256 mg/dl where as he had a salivary glucose value of 0 mg/dl showing the

inverse proportionality. In this study, one of the main reason that there was a negative correlation is because the sample Size was less also another reason that the results were negative was that there are microbes in the mouth that feed on the salivary glucose making the value calculation harder. If the sample size was increased their could be a positive correlation.

➢ Data indicates that in 2011, 366 million people worldwide were affected by diabetes and the number is continuing to climb steeply.By 2030, predictions suggest that the number of people with diabetes will reach 552 million (7).The correlation between SGL and BGL is supported by various studies .whilst other study outcomes were in contradiction to this few researches have studied correlation between SGL and BGL, suggesting the paucity of literature on this aspect (2). Diabetes mellitus is certain to be one of the fundamental challenges that is faced by any health care professional in the present day. The two key aspects of diabetic management are normalization of blood glucose level and its judicious monitoring; both of these need the patient's regular compliance. It is utmost important for diabetics to maintain the blood glucose level to normal throughout their lifespan as that indeed has impact on the risk of development of complications (2).

➢ The present method of blood glucose estimation needs the venepuncture, which is highly traumatic to the patients at times, especially to the children. Apart from physical trauma, process also renders mental trauma and anxiety about the procedure to discourage the patients further. (2) Regarding the SG

➢ Concentrations, the results obtained in different studies are varied due to diversity of selection criteria / sampling / study population. (3) The study found no correlation between salivary glucose and sex. It is high time that is problem comes to light and some solution has to been found soon so as to make the estimation of glucose levels more easy so that patients will not hamper their regular visit to diabetic clinic.

➢ Saliva is said to be the ultra-filtrate of blood. Glucose is one of the blood components that are transferable across the salivary gland epithelium in proportion to its concentration in blood. Secondly, whole saliva is the biologic fluid that is simple to collect. The correlation between SGL and BGL cannot be justified until the salivary glucose estimation is authenticated. There should be homogeny in the methodology used plus the study samplings need to be standardized to have the study outcomes which will be comparable and sustainable. (2)

➢ There have been varying reports on the salivary glucose levels based on gender. Darwazeh et al found higher levels of salivary glucose in males as compared to females, and Soares et al did not find any significant relationship with gender (4).FalaceMarcheti in 1989 and Amer in 2001 reported similar results. But, Leach in 1970 and Ficara in 1975 did not find any significant relationship between blood glucose and salivary glucose level in diabetic patients.(5)Statistically non-significant correlations between blood and salivary glucose in the study and control groups were obtained by Tenovuo et al.,Aryeh et al., and Vaziri et al., This variation in result might have been because of the small sample size.(6) Englander et al expressed doubt regarding replacement of plasma with parotid secretion in the diagnosis of diabetes mellitus, because of its lower levels of glucose concentration(7) A study carried out in last few years revealed that the salivary samples of the non-diabetic control subjects did not show the presence of glucose even in the slightest concentrations.(8)

➢ There is still hope and lot of research has been going on to find an alternative to blood for diagnostic investigations. If saliva is soon proven to be an excellent bio-fluid for diagnostics tests then it would be less expensive noninvasive and simple to collect as well this would be easierfor juveniles with diabetes.Moreover, it will be possible for the people with diabetes to self-monitor themselves with method that is easier and not painful (2). The present study sheds some light on the importance of early diagnosis and preferment and utilization of non-invasive saliva analysis over the invasive blood analysis.

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