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PLASMA AND SALIVARY GLUCOSE IN DIABETICS ATTENDING TERTIARY HOSPITAL IN MAIDUGURI, NORTHEASTERN NIGERIA

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ABSTRACT

Aims: Diabetes mellitus is a metabolic disease with a surge in prevalence worldwide, the widely sample use is blood which is an invasive test hence the need to investigate if salivary glucose which is noninvasive and painless method can be used as an alternative to plasma glucose in the screening for diabetes mellitus. **Methodology**: One hundred (100) type 11 diabetic patients and fifty (50) non-diabetic controls age-matched were recruited for this study. The levels of plasma and salivary glucose were determined by glucose oxidase method. **Result**: The findings of this study revealed the mean fasting plasma and salivary glucose in diabetic were 8.43 ± 4.07 mmol/l and 0.78 ± 0.66 mmol/l respectively. In addition, the mean fasting plasma and salivary glucose in non-diabetic were 4.42 ± 0.95mmol/l and 0.23mmol/l ± 0.40 respectively. There is positive and significant correlation between plasma and salivary glucose in both diabetic and non-diabetic. **Conclusion:** salivary glucose may be used as potentially non-invasive tool for diabetes mellitus screening in large population, which may be easier than collection of blood sample.

KEYWORD: Plasma, salivary, glucose.

INTRODUCTION

Diabetes mellitus is an endocrine metabolic disorder characterized by a relative or absolute deficiency of insulin secretion and/or concomitant resistance to the metabolic action of insulin on target tissues.[1] The diagnosis and management of diabetes mellitus involves pricking, which is, an invasive method and could be painful, characterized by hazard of getting infections, complications in hemophiliac patients and various other disadvantages that may involve the invasive techniques.[2] There is increased interest towards non-invasive method to diagnose this disease, one of which is saliva. The importance of saliva for oral health has been reported.[3]

Diabetes mellitus affects the salivary gland functioning and thus alters salivary constituents. The composition and secretion of saliva is influence by local as well as systemic, neurochemical, hormonal, nutritional and metabolic factors such as in diabetes mellitus.[4]

Saliva can be collected non- invasively and by individuals with limited training and no special equipment is needed for collection of the fluid. Diagnosis of disease via the analysis of saliva is potentially valuable for children and older adults. Glucose is a small molecule that diffuses through semi-permeable membranes. Hence, large amounts of glucose become available in saliva when blood glucose levels are elevated as in diabetes. This is because there is alteration in basement membrane in diabetic. Although membrane abnormalities of parotid gland have been reported in diabetes.[3] Current projections suggest that the prevalence of diabetes will increase 20–30% of the population by 2050 (Boyle et al.[5] Thus, salivary glucose a non-invasive method may be used for screening of diabetes mellitus in this environment.

MATERIALS AND METHODS

One hundred (100) confirmed diabetic patients attending University of Maiduguri Teaching Hospital (UMTH) and fifty (50) apparently healthy individuals with age matched as controls were informed and consented to participate in this study. Patients with complain of xerostomia (abnormal dryness of the mouth) and other illnesses were excluded in this study. Ethics committee of University of Maiduguri Teaching Hospital, Borno State Nigeria, approved the study. After over night fast for 10-12 hours, 2mL venous blood was drawn aseptically from the antecubital fossae and delivered into a labelled sodium fluoride oxalate container. Samples were centrifuged at 4000 rpm for five minutes. The whole saliva was collected by spitting method; this involves generation of saliva in the mouth and spit into a sterile plastic universal container. The whole saliva was collected at one sitting, during a period of 1-2 minutes.

The samples were transferred into a labelled fluoride oxalate bottle and centrifuged at 4000 rpm for 5 minutes. The plasma and saliva samples were analyzed immediately using glucose oxidase method as described by Trinder.[6] Statistical analysis was done by PAWstatistic 18, a statistical package from SPSS California, USA. The data was analyzed by Student's t-test.the level of significant was set at 95% confidence interval, where p-value less than 0.05 ($p<0.05$) was considered as statistically significant. Correlation was done using Pearson's correlation. Graphs were done using Microsoft excel 2007 version.

RESULTS

A comparison of the mean values of fasting plasma glucose in diabetics and controls were significant (p=0.01) and fasting salivary glucose in control subjects and diabetics is statistically significant (p=0.01). There was a significant positive correlation between fasting plasma glucose and fasting salivary glucose in both the diabetic subjects (r=+0.774, p=0.001) and control subjects (r=+0.200, p=0.026).

Table: 1. Comparison of fasting plasma glucose and fasting salivary glucose in diabetics and control subjects

Parameter	Diabetics	controls	p=value
FPG (mmol/L)	8.43 ± 4.07	4.42 ± 0.25	p=0.011
FSG (mmol/L)	0.78 ± 0.66	0.23 ± 0.40	p=0.010

KEY
P<0.01= significant
p>0.01= not significant
FPG = fasting plasma glucose
FSG = fasting salivary glucose

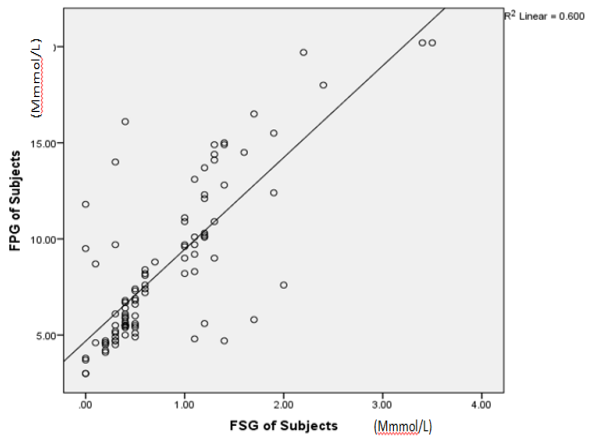

Fig: 1. Correlation plot between fasting plasma glucose and fasting salivary glucose in diabetics (r =+0.774 ,p=0.001).

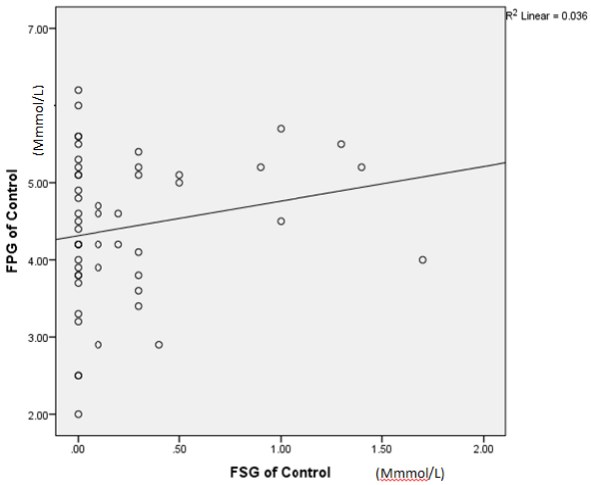

Fig: 2. Correlation plot between fasting plasma glucose and fasting salivary glucose in control groups (r =+0.200, p=<0.026).

DISCUSSION

Salivary glands hypo functions and increased susceptibility to oral infections such as caries have long been recognised features of diabetes mellitus, especially in dehydration and inadequate blood glucose control. Glucose is a small molecule capable of moving easily through the membranes of blood vessels, passing from the blood plasma to the gingival sulcus, reaching the saliva. The increase in blood glucose in diabetic patient could cause higher levels of salivary glucose with the consequent loss of homeostasis.[7]

In this study, the mean levels of both plasma and salivary glucose were significantly higher in type 2 diabetics when compared with controls (non diabetics). The high level of glucose in the saliva of diabetics probably reflects the high blood glucose concentrations[8], and this may be due to diabetic membranopathy, which may lead to raised percolation of glucose from blood to saliva and alter salivary composition in diabetes mellitus.[9] Belazi *et al*[10] stated that increased permeability of basement membrane in insulin-dependent diabetes mellitus may lead to enhanced leakage of serum-derived components in whole saliva via gingival crevices. The small glucose molecule can easily diffuse via the semi permeable basement membrane, resulting in increased salivary glucose levels.

This study agrees with the findings of Abikshyeet *et al*[11] and Englander *et al*[12] who reported increase in salivary glucose levels in diabetes mellitus patients in comparison to non-diabetics. A research conducted by Carlson and Ryan reported an increase in salivary glucose levels in diabetes mellitus patients in comparison to non-diabetics.[13] The increased levels of glucose in saliva of the diabetics is reflective of the increased levels of plasma glucose concentration in these patients.

However, our study disagree with the findings of (Forbat *et al*[14] who reported that salivary glucose levels did not reflect blood glucose levels. There were also significant positive correlations between fasting plasma glucose and fasting salivary glucose in both diabetics and non diabetics. Although the correlation is stronger in diabetics than non-diabetics. This finding is similar to the observations made by kumar *et al*[15] who reported weak correlation of plasma glucose and salivary glucose in non- diabetics. karjalainen *et al*[16] stated that salivary glucose is augmented only when the concentration of glucose in blood is elevated.The limitation of this study is that we did not classified the diabetics into good and poorly control diabetics, this would have given us a clearer picture.

In conclusion, salivary glucose levels in this study reflects plasma level in both diabetics and controls (non-diabetics) subjects, therefore salivary glucose may be used for screening of diabetes mellitus in a community, where they may not be willing to give their blood for analysis due to some believes. In addition, collection of salivary sample is non- invasive, simple and painless. Thus, may be used as an index of diabetes mellitus.

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Conflict of interest= NILL

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