



SALIVARY GLUCOSE – A NON-INVASIVE BIOCHEMICAL PROTOCOL USING COLORIMETER.

Dental Science

- Dr. S. Prasanna*** MDS (Oral Pathology), MHSc(Public Health), PGDHS(Tobacco Control),UCFO, Senior Lecturer, Department Of Oral Pathology, Tagore Dental College & Hospital, Chennai – 600 127. *Corresponding Author
- Dr.A.Ramesh Kumar** MDS (oral Pathology), Professor, Department Of Oral And Maxillofacial Pathology, SRM Dental College & Hospital, Ramapuram, Chennai – 89.
- Dr. S. Dinesh,** MPT(Ortho), MHSc(Applied Ergonomics), PG Dip.(E&TC), Assistant Professor, Sumandeep College Of Physiotherapy, Sumandeep Vidyapeeth, Vadodara, Gujarat.

ABSTRACT

Diabetes, the most prevailing non-communicable disease worldwide affecting mostly the developing nations. Blood is used for glucose estimation being an invasive and painful method, demanding for an alternative technique to be used. Aim & Methods: Estimation of fasting and post prandial salivary glucose levels in 180 subjects who were divided into healthy subjects and diabetic subjects as controlled and uncontrolled diabetics. Results: Positive correlation of fasting salivary glucose in all groups – I, II & III. There was a positive correlation in post prandial serum glucose between group II, III but no significant in case of post prandial salivary glucose.: Positive correlation present in fasting salivary glucose in group I, II and III but post prandial serum glucose correlated between group II and III but post prandial salivary glucose did not correlate well. Conclusion In spite of limitations, saliva serves as a good alternate medium in biochemical analysis of glucose instead of serum.

KEYWORDS

Salivary glucose, Colorimeter, Diabetes, Saliva, Biochemical analysis.

INTRODUCTION:

Diabetes mellitus is a disease state of endocrine changes occurring due to decrease in insulin production resulting in the alteration of assimilation process. It is generally subdivided into two types namely: Type I diabetes mellitus resulting because of destruction of beta cells of pancreas leading to absolute deficiency of insulin and Type II occurring due to cellular dysfunction leading to insulin resistance by tissues.^{1,2,3}

Saliva is an organic secretion that can reflect the local and systemic changes by way of presence of each constituent of the saliva and which can be related to hormonal, immunological, nutritional, metabolic and neurological changes.⁴

Glucose is a monosaccharide molecule, smaller molecular in size that can easily permeate through the blood vessels and get transported from serum to gingival sulcus, then from gingival fluid and finally into the saliva reaching the oral cavity.⁵ Literatures have reported that the salivary glucose closely reflects the serum glucose, projecting it as a good alternative diagnostic technique which is non-invasive facilitating multiple sampling. The salivary glucose level has been reported to closely reflect blood glucose level prompting it to be used as a diagnostic resource as it offers a distinctive advantage of being a non-invasive procedure allowing multiple sampling.⁶

So the present study aimed at the estimation of salivary glucose in diabetics and comparing it with the healthy subjects.

MATERIALS AND METHODS:

The study comprised of 180 subjects with three groups namely Healthy subjects (Group I) and with diabetics divided into controlled (Group II- HbA1c value: 6.5 to 7.9 %) and uncontrolled diabetics (Group III HbA1c value \geq 8 %) based on their HbA1C values. Informed consent from the study subjects was obtained and the study was approved by Institutional Review Board.

2 ml of fasting blood sample was collected from healthy and diabetic subjects. Separately 2 ml of blood was collected for HbA1c estimation from diabetic subjects only. Similarly saliva samples were collected from healthy and diabetic subjects after asking the subjects to rinse the mouth with tap water. The collected samples were labelled with patient details for proper records.

Estimation of serum and salivary glucose was carried out according to GOD-POD principle. The collected samples were centrifuged at 3000 rpm for about 10 minutes. The serum and supernatant saliva was used

for biochemical investigation. Three test tubes were used namely B (Blank), S (Standard) and T (Test) test tubes generally used for serum glucose analysis. After the incubation period of 10 min, the values are read in a colorimeter and HbA1C values were recorded using WB / Iron – Exchange HPLC method. The data are then subjected to statistical analysis.

RESULTS:

(Table 1: Group – I: Fasting Serum and Salivary Glucose Levels)

Variables	Range (mg/dl)	Mean (mg/dl)	SD (\pm)	r-value
Serum Glucose	64 – 138	91.35	13.76	0.1668 (P < 0.05)
Salivary Glucose	10 – 49	21.6333	8.02	

(Table 2: Group – II: Fasting Serum and Salivary glucose levels)

Variables	Range (mg/dl)	Mean (mg/dl)	SD (\pm)	r-value
Serum Glucose (F)	86 – 354	141.5	53.56	0.0942 (P < 0.05)
Salivary Glucose (F)	13 – 54	24.9	7.00	

(Table 3: Group – III: Fasting Serum and Salivary Glucose Levels)

Variables	Range (mg/dl)	Mean (mg/dl)	SD (\pm)	r-value
Serum Glucose (F)	95 – 368	197.18	56.81	0.3299 (P < 0.05)
Salivary Glucose (F)	15 – 41	25.7	5.52	

(Table 4: Comparison between Group I & II - Fasting Serum Glucose)

Variables	Mean (mg/dl)	SD (\pm)	t-value
Group I	91.35	13.76	-7.0242 (p < 0.05)
Group II	141.5	53.56	

Fasting serum glucose in group I: mean value of 91.35 and standard deviation of 13.76. Fasting serum glucose in group II: mean value was 141.5 and standard deviation of 53.56. The t – test value: -7.0242, statistically significant as shown in table 4.

(Table 5: Comparison between Group I & II - Fasting Salivary glucose)

Variables	Mean (mg/dl)	SD (\pm)	t-value
Group I	21.6333	8.02	-2.3778 (p < 0.05)
Group II	24.9	7.00	

Fasting salivary glucose of group I: mean value of 21.6333 and standard deviation value of 8.02. Fasting salivary glucose of group II: mean value of 24.9 and standard deviation value of 7.00. The t – test value: -2.3778, statistically significant as shown in table 5.

Table 6: Comparison between Group I & III - Fasting Serum glucose

Variables	Mean (mg/dl)	SD (±)	t-value
Group I	91.35	13.76	-13.5285 (p < 0.05)
Group III	197.18	56.81	

Fasting serum glucose of group I: mean value of 91.35 and standard deviation of 13.76. Fasting serum glucose of group III: mean value of 197.18 and standard deviation of 56.81. The t – test value: -13.5285, which was statistically significant as in table 6.

Table 7: Comparison between Group I & III - Fasting Salivary glucose

Variables	Mean (mg/dl)	SD (±)	t-value
Group I	21.6333	8.02	-3.2366 (p 0.05)
Group III	25.7	5.52	

Fasting salivary glucose of group I: mean value of 21.6333 and standard deviation value of 8.02. Fasting salivary glucose of group III: mean value of 25.7 and standard deviation value of 5.52. The t – test value: -3.2366, statistically significant as in table 7.

Table 8: Comparison between Group II & III – Fasting serum glucose

Variables	Mean (mg/dl)	SD (±)	t-value
Group I	141.5	53.56	-5.5239 (p < 0.05)
Group III	197.18	56.81	

Fasting serum glucose of group II: mean value of 141.5 and standard deviation of 53.56. Fasting serum glucose of group III: mean value was 197.18 and standard deviation of 56.81. The t – test value: -5.5239, statistically significant as in table 8.

Table 9: Comparison between Group II & III – Fasting salivary glucose

Variables	Mean (mg/dl)	SD (±)	t-value
Group II	24.9	7.00	0.6950 (p > 0.05)
Group III	25.7	5.52	

Fasting salivary glucose of group II: mean value of 24.9 and standard deviation value of 7.00. Fasting salivary glucose of group III: mean value of 25.7 and standard deviation value of 5.52. The t – test value: 0.6950, statistically not significant as in table 9.

Table 10: Comparison between Group II & III – Post prandial serum glucose

Variables	Mean (mg/dl)	SD (±)	t-value
Group II	213.2	76.47	-6.4613 (p > 0.05)
Group III	304.18	77.77	

Post prandial serum glucose of group II: mean value of 213.2 and standard deviation of 76.47. Post prandial serum glucose of group III: mean value was 304.18 and standard deviation of 77.77. The t – test value: -6.4613, which was statistically significant as in table 10.

Table 11: Comparison between Group II & III – Post prandial salivary glucose

Variables	Mean (mg/dl)	SD (±)	t-value
Group II	35.08	8.57	-0.9735 (p > 0.05)
Group III	36.52	7.53	

Post prandial salivary glucose of group II: mean value of 35.08 and standard deviation value of 8.57. Post prandial salivary glucose of group III: mean value of 36.52 and standard deviation value of 7.53. The t – test value: -0.9735, statistically not significant as in table 11.

DISCUSSION:

At the present scenario, the investigators and clinicians are more towards employing more of non-invasive techniques and in developing home based diagnostic investigations and also on collection of samples at home or work place. Generally investigations are carried out with blood or urine and less frequently with saliva, sweat or tears.⁷

Saliva's role as a diagnostic fluid in the field of biochemical analysis has been a constant field of research which is still continuing.^{8,9} This research on saliva is challenging as it can reflect various physiological alterations occurring in the body which is similar to those reflected by other body fluids mainly blood.^{10,11}

In the present study, comparing the fasting salivary glucose level in group I and group II, significantly higher values were seen in group II than group I. Our study results were in accordance with Dr.Lekaa.M.Ibrahem et al (2007)¹².

On comparing the fasting salivary glucose level between group I and III, significantly higher values were seen in group III than group I. Our study was in accordance with those of Dr.Lekaa.M.Ibrahem et al (2007)¹², Preethi Balan et al (2014)⁶.

Fasting salivary glucose was significantly higher in group II and group III than in group I and this was in accordance with other studies like those of Dr.Lekaa.M.Ibrahem et al (2007)¹², Preethi Balan et al (2014)⁶, Tervonen.T et al (1986)¹³ and Harrison et al (1987)¹⁴.

Similar to our study, only few estimated postprandial salivary glucose level like those of Veena V. Naiket al (2011)¹⁵ and Dr.Seema Hallikerimath (2011)¹⁶ but did not subdivide there diabetic groups as done in present study. The present study showed a statistically significant result between post prandial serum glucose in group II and group III but no significant results with regards to post prandial salivary glucose in group II and III. Our results pertaining to correlation coefficient were in accordance with that of Veena V. Naiket al (2011)¹⁵ and in discordance with that of Sharon M.P et al (2015)⁷.

CONCLUSION:

To decrease the complication occurring because of diabetics, the patient needs to be under review requiring frequent glucose estimation. So a technique which is non-invasive, painless can be employed at this juncture. So the observations of this study is that saliva can be used as a non-invasive diagnostic tool in monitoring the diabetic status.

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