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Relationship between FBS, PPBS, HbA1c and Urine Glucose in the Type 2 Diabetes Mellitus patients having different levels of Serum Urea

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Abstract

A scientific study on the relationship between Fasting Blood Sugar (FBS), Post Prandial Blood Sugar (PPBS), Glycoslated Haemoglobin(HbA1c) , Urine Glucose (UG) , and Serum Urea(SU) was carried out in Type2 Diabetes mellitus patients of mongoloid race attended at the Endocrinology Department of JNIMS Hospital. A total of 151 T2DM patients ages between 30 to 70 years of both sexes were subjected to clinical tests on FBS, PPBS, HbA1c, Urine Glucose, and Serum Urea. The data on the parameters were statistically analysed using SPSS version 20. There was a positive co- relation between Urine Glucose (UG) and HbA1c ($r=0.252$, $n=151$, $p=0.002$), Urine Glucose and Fasting Blood Sugar ($r= 0.697$, $n=151$. $P<0.001$) and Urine Glucose and Post Prandial Blood Sugar ($r=0.774$, $n=151$, $p<0.001$).

Key words: Type2 diabetes mellitus (T2DM), Fasting Blood Sugar, Post Prandial Blood Sugar. Glycoslated Haemoglobin, Urine Glucose, Serum Urea.

Introduction

It is medically accepted that the appearance of glucose in urine is reflected in the concept of a renal threshold for glucose excretion. Study on the relation of the renal glucose excretion and the function of blood glucose in human is very scanty. Therefore, a retrospective scientific study on the relationship between the renal glucose excretion and the blood glucose level in the Type 2 diabetes mellitus patients was conducted considering the parameters on age

difference among the patients, sex difference, intensity of diabetes and the quantum of renal glucose excretion.

Rave et al. (2006) described in their studies that the appearance of glucose in urine is reflected in the concept of a renal threshold for glucose excretion. Any further increase in blood glucose results in the excretion of glucose in urine. In another study by Gerich (2009), it is also advocated that maintaining of glucose by the kidney was altered in Type 2diabetes mellitus (T2DM). It was observed that renal gluconeogenesis and renal glucose uptake are increased in both the post-absorptive and postprandial states, and renal glucose re-absorption is increased.

The findings of Triplitt (2012) showed that renal release of glucose in the circulation is the result of glycogenolysis and gluconeogenesis, respectively, involving the breaking down and formation of glucose-6-phosphate from precursors (e.g. lactate, glycerol, amino acids). With regard to renal re-absorption of glucose, the kidneys retrieve as much glucose as possible, rendering the urine virtually glucose free. The glomaruli filter from plasma approximately, 180 gm of D-glucose per day, all of which is reabsorbed through glucose transporter proteins that are present in cell membranes within the proximal tubules. If the capacity of these transporters is exceeded glucose appears in the urine.

Vijayakumar et al. (2018) mentions that glycaemic status of patient with Type 2 diabetes mellitus(T2DM) is widely assessed using Glycaeted haemoglobin (HbA1c). But there are reports of variations in HbA1c among different ethnic groups. These reports suggest that measurement of baseline HbA1c levels alone might not always provide a clear picture on glycaemic status of an individual. However, the information on the relationship between value of HbA1c of diabetic patients with Type 2 diabetes and the urine glucose level of the patients fall short.

Method

One hundred fifty one patients of mongoloid race (age 30-70 years) with Type2 diabetes mellitus (T2DM) were selected from a pool of patients attended at Jawaharlal Nehru Institute of Medical Sciences (JNIMS) Hospital, Imphal, who consented to participate in clinical studies conducted at the research unit of the Endocrinology Department. The clinical tests on Urine glucose(UG), Glycaeted Haemoglobin(HgA1c), Fasting Blood Sugar(FBS), Post Prandial Blood Sugar(PPBS) and Serum Urea(SU) of all 151 T2DM patients were taken before continuing any treatment. The baseline test of 151 patients revealed that urine glucose ranged from 0.3mg to 1.5 mg, HgA1c ranged from 5.6 % to 15.5 %, Fasting Blood Sugar(FBS) ranged from 60 mgs% to 519 mgs%, Post Prandial Blood Sugar (PPBS) ranged from 117 mgs% to 720 mgs%, and Serum Urea(SU) from 10mgs% to 65 mgs %. The data of the study was analysed using SPSS version 20. Two tailed Pearson's correlation method was applied.

Result

There was a positive co-relation between Urine Glucose (UG) and HbA1c (r=0.252, p=0.002), Urine Glucose and Fasting Blood Sugar (r= 0.697, P<0.001) and Urine Glucose and Post Prandial Blood Sugar (r=0.774, p<0.001). However, Serum Urea has no positive co-relation with Urine Glucose, HbA1c, FBS, and PPBS.

Table 1: Relationship reports of Urine glucose, Serum Urea, HbA1c, Fasting Blood Sugar(FBS) and Post Prandial Blood Sugar(PPBS): Correlations and Descriptive Statistics (N = 151)

Variable	Urine glucose	Urea	HbA1c	FBS	PPBS
Urine Glucose	-				
Urea	0.098	-			
HbA1c	0.252**	0.128	-		
FBS	.697**	0.075	.285**	-	
PPBS	.774**	-0.013	.373**	.793**	-

*$p < .05$ **$p < .01$ ***$p < .001$

Table-2: Mean and SD of Urine Glucose, Urea, HbA1c, Fasting Blood Sugar(FBS) and Post Prandial Blood Sugar(PPBS)

Variables	Urine glucose	Urea	HbA1c	FBS	PPBS
Mean	0.86	31.03	8.46	181.87	292.98
SD	0.35	10.37	1.81	86.86	132.20

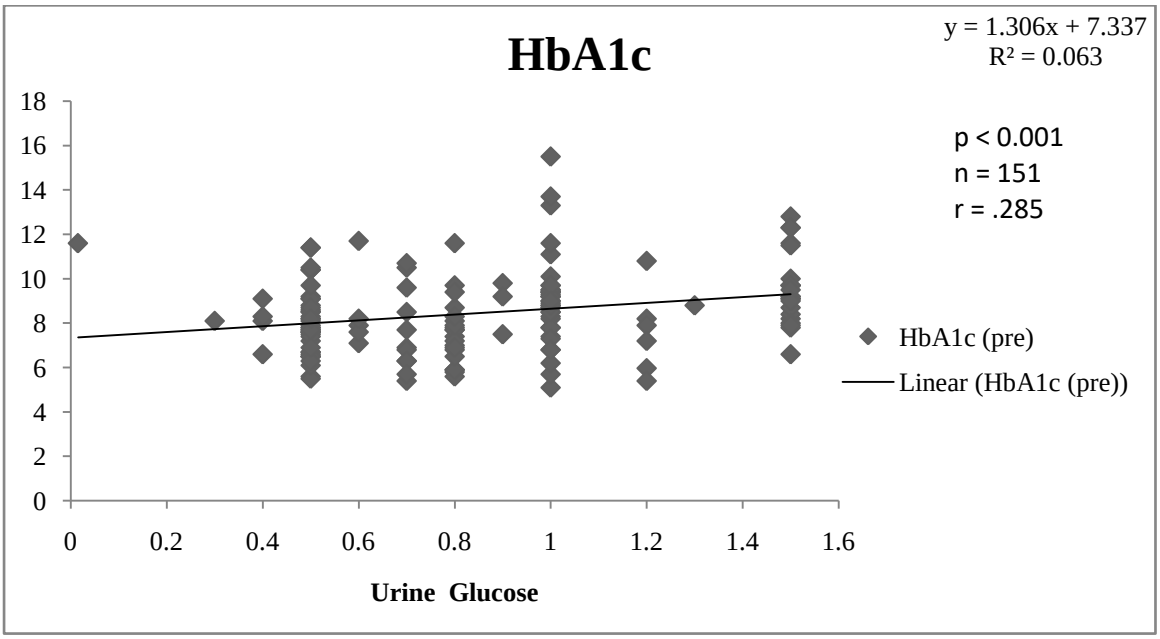

Fig. 1 Relation between HbA1c and Urine Glucose

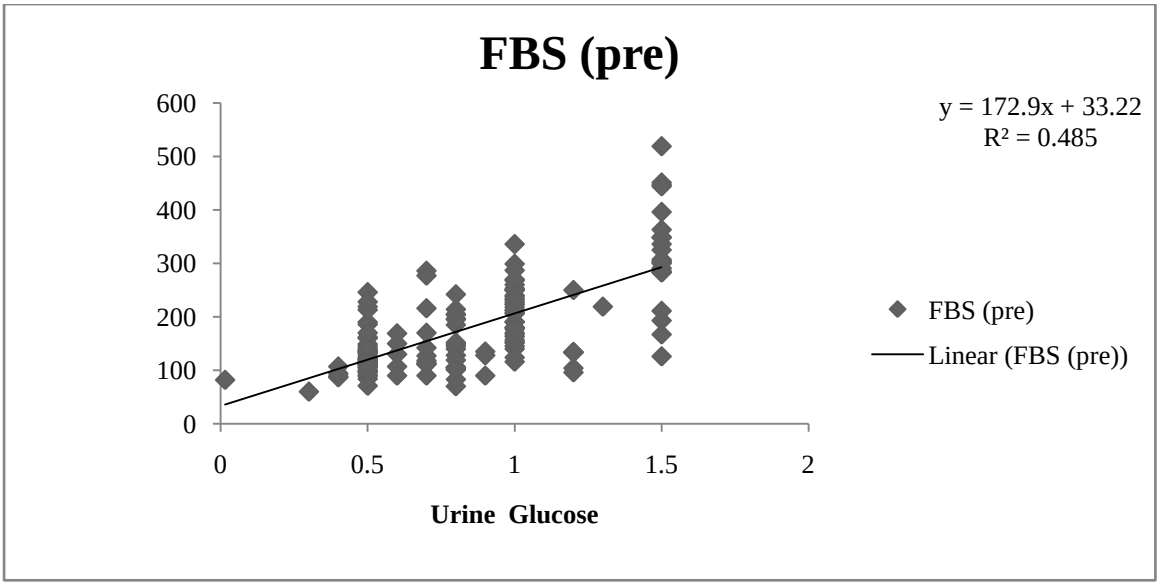

Fig. 2 Relation between FBS(pre) and Urine Glucose

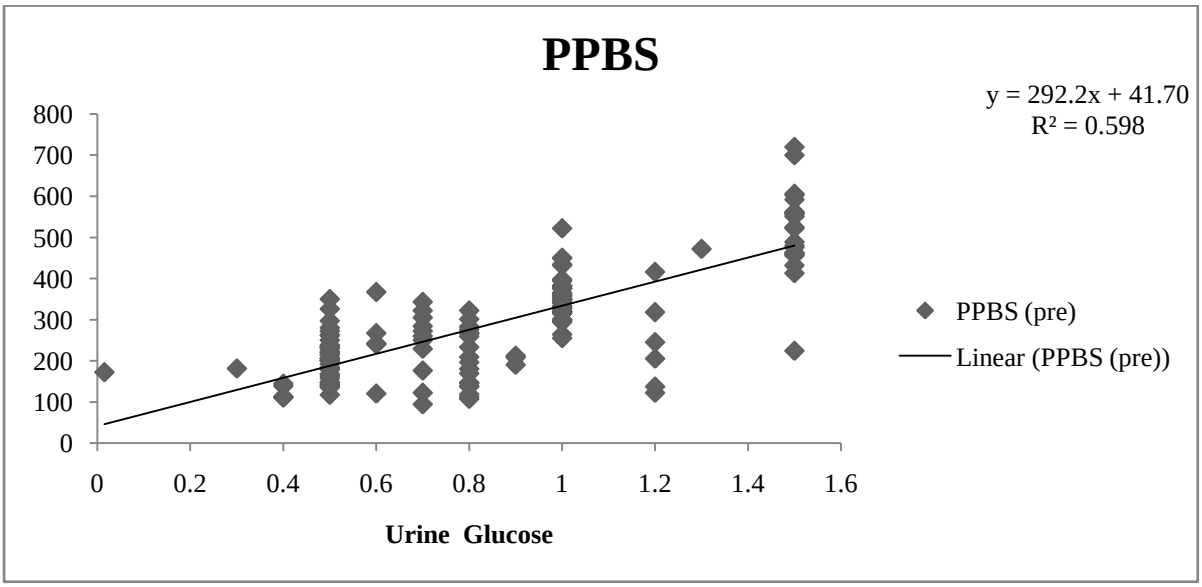

Fig. 3 Relation between PPBS and Urine Glucose

Discussion: The baseline clinical study of 151 mongoloid race patients with T2DM clearly indicates the positive co-relations between Urine Glucose (UG) and Glycaeted Haemoglobin(HbA1c), Urine Glucose (UG) and Fasting Blood Sugar(FBS) and Post Prandial Blood Sugar(PPBS). However, Serum Urea (SU) has no relation with urine glucose, HbA1c, FBS, and PPBS.

The findings of previous work by (Rave et al.2006; Gerich, 2009; Triplitt, 2012), advocated that there was a trend of increasing the renal glucose excretion in case of hyperglycaemia of type 2 diabetes mellitus. However, there is ample evidence that kidneys play a role of maintaining plasma glucose homeostasis by renal glucose re-absorption process. The present retrospective study also shows the similar results with the findings of the previous workers. Vijaykumar et al. (2018) opined in their accepted paper that measurements of baseline

glycaeted haemoglobin (HbA1c) levels which are used widely in assessing the glycaemic status of type 2 diabetes patients may not always provide a clear picture on glycaemic status of a diabetic patient. Of course, the present study shows a positive co-relation with HbA1c and FBS and PPBS. Further in depth studies covering relevant parameters in this regard will add more reliable and valid results.

Conclusion: It may be inferred from the findings of the present study that increase in the fasting blood sugar and post prandial blood sugar will increase the sugar level of urine. Further, it is also observed that higher the rate of Glycoslated haemoglobin (HbA1c) in the diabetic patient shows the increase in the amount of sugar in urine. The study indicated that there is no positive relationship between Serum Urea, and FBS, PPBS, and HbA1c. The present study also inferred that the different level of serum urea in the human body has no much important role in assessing the glycaemic status of T2DM patients.

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Conflict of Interest

None declared.

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