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BLOOD PLATELETS AN OBSERVABLE MARKER FOR GLYCOSURIA

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ABSTRACT: There are many reports on platelets reactivity in the case of diabetes however literature regarding the relationship between glycosuria and blood platelet count are scanty; glycosuria may be diabetic or non-diabetic. Less research has been done on indices such as platelet count (PLT), platelet mass (PM), or plateletcrit (PCT) in relation with glycosuria. In this study we have made an effort to see the relation between glycosuria and blood platelets. A total of 173 patients (95 males and 78 female) blood samples & urine sample were tested in the study, which was carried out at Saraswati Multispeciality Hospital & Trauma Centre, Bopal, Ahmedabad between Januarys to March 2023. Children between the ages of 0 to 5 having glycosuria were having highest platelet counts in comparison with age groups of older people both in the case of male and female. With the increase in glycosuria level in the different age groups of patients irrespective of male and female platelets count increases however the rate of this increase in platelets are not same in different age groups of patients in male and female. Increase in the urine glucose level affects the blood platelets concentration. Increase in platelets concentration decreases with age in the glycosuria patient's irrespective of male and female. Our result shows that glycosuria, is related to changes in platelet count and function. There also seems to be a connection between raised platelet number and urine glucose concentration. Increase in number of blood platelets acts as one of the marker for Glycosuria.

KEYWORDS: Thrombocytes, Megakaryocytes, Urine glucose, Diabetes, Platelets, Glycosuria

INTRODUCTION:

The presence of a small quantity of glucose in the urine is regarded as normal, but the word "glycosuria" is frequently used to refer to pathologic circumstances where there is more than 25 mg/dl of glucose in a fresh urine sample obtained at random. The normal glomerular filtrate contains less than 25 mg/dl of glucose after the renal tubule has almost totally reabsorbed it. An imbalance occurs when the amount of glucose that the glomeruli can filter out is greater than the amount that the renal tubules can absorb. When the tubule's capacity to absorb glucose is compromised, as in Fanconi syndrome, which also affects the absorption of phosphate and amino acids, it can occur as a result of high plasma glucose concentrations, as in diabetes mellitus. Glycosuria is one of the signs of acute tubule interstitial nephritis (ATIN), despite the fact that it can also be present in other renal conditions. In healthy individuals, the kidneys filter about 180 g of glucose every day. The glucose that entered the tubular system is reabsorbed together with the sections of the proximal convoluted tubule (PCT). More than 90% of glucose absorption occurs in the proximal tubule, which is regulated by the low-affinity/high capacity transporter SGLT2. The residual glucose will then be reabsorb by the distal sections of the proximal tubule via the high-affinity/low-capacity SGLT1 (1).

Increased platelet reactivity is related to diabetes (2). An estimated 1.5 million fatalities per year are caused by untreated or inadequately treated diabetes (3). According to Butkiewicz AM, et al. (2006), diabetic thrombocytopathy describes variations in platelet function between diabetes and nondiabetic people (4).

Early in the course of the disease, platelets from individuals with type 1 and type 2 diabetes demonstrate increased platelet aggregation activity, which may be a precursor to the onset of cardiovascular disease (5). Improved glycemic control has been associated with decreased blood platelet reactivity (6). Hyperglycemia can increase platelet reactivity because of the nonenzymatic glycation of proteins on the surface of the platelet. This kind of glycation decreases membrane fluidity and increases platelet activation propensity (7). Another way that hyperglycemia might increase platelet reactivity is by the osmotic action of glucose (8).

The mediator protein kinase C is essential for platelet activation. Diabetes is associated with greater expression levels of the surface glycoproteins I b and II b/III a (9). These glycoproteins mediate the adhesion and adherence of platelets. Therefore, it would be expected that increased expression will increase platelet functional activity in diabetic patients, if not reactivity. The expression of these adhesion proteins and the A1C test for hyperglycemia are connected. Megakaryocytes' higher production of glycoproteins during hyperglycemia seems to boost platelet activity. Platelet hyperactivity, which is linked to diabetes mellitus, raises the risk of morbidity and mortality from cardiovascular disease. Along with this, thromboxane (TX), an eicosanoid that promotes platelet aggregation, is present in higher amounts (10). Growing evidence points to thrombus formation and overactive platelets as crucial factors in the onset of DM micro- and macrovascular illness. Mean platelet volume was shown to be higher in diabetic patients than in healthy people (11, 12) and was substantially connected with poor glycaemic control (13). Less research has been done on other indices such platelet count (PLT), platelet mass (PM), or plateletcrit (PCT). Given that it co- factors both platelet production and activity, PCT is regarded as the most physiologically appropriate platelet index as a measure of PM and is therefore thought to be a more accurate assessment of in vivo platelet dynamics (4).

In order to maintain glucose homeostasis and avert hypoglycemia, a person's kidneys are essential. Gluconeogenesis, insulin clearance, and glucose reabsorption in the PCT are all part of the kidney's involvement in preserving glucose homeostasis (14). When the amount of filtered glucose surpasses the tubular system's capacity as a result of the rise in plasma glucose, glycosuria occurs in diabetic people. Increased blood platelet count is one indicator of diabetes and glycosuria.

MATERIALS AND METHODS:

The investigation was carried out at the Saraswati Multispeciality Hospital & Trauma Centre, Bopal, Ahmedabad, Gujarat 380058, India. Blood and urine samples from a total of 173 patients (95 men and 78 women) were examined between January and March 2023.

The samples were examined using conventional automatic instruments. The Mindray BC-700 Series, a haematology analyzer that does both complete blood count (CBC) and erythrocyte sedimentation rate (ESR) tests, was used to measure platelets. Automatic Abbott SD urometer 120 Analyzer was used to evaluate urine glucose. Positive samples were further confirmed by Benedict's test (15), Table No. 1.

Table No. 1: Colour of the Bendict's reagent after adding Urine

Colour	Blue Solution	Green / Yellow ppt	Orange Red ppt	Brick Red ppt
Remarks	None	Traces of Reducing Sugar	Moderate Reducing Sugar	High Reducing Sugar

The analysis of the results from the testing of blood and urine samples was done to determine the relationship between platelets and urine glucose/glycosuria concentration.

RESULT AND DISCUSSION:

To assess the results and spot any developing trends, the findings from this sample were grouped by age. Children with glycosuria between the ages of 0 to 5 had the highest platelet counts in comparisons with older age groups, as demonstrated in table no. 2 and 3 for both males and females. Although the rate of this increase in platelets is not the same in different age groups of patients in male and female, it rises along with the increase in glycosuria level in all patient groups, regardless of gender. Increased urine glucose levels have an impact on the concentration of blood platelets. Increase in platelets concentration decreases with age in the glycosuria patient's irrespective of male and female.

Table No. 2: Blood platelets and urine glucose level in the male patients tested for CBC

Patients age	Total Patients (n=95)	Platelets Count (X 10^9/L)	Urine Glucose level (mg/dl)
0 - 5	14	320	110
5 - 30	25	240	170
30 - 50	20	230	120
Above 50	36	220	90

Table No. 3: Blood platelets and urine glucose level in the female patients tested for CBC

Patients age	Total Patients (n=78)	Platelets Count (X 10^9/L)	Urine Glucose level (mg/dl)
0 - 5	11	300	115
5-30	13	270	160
30 - 50	30	260	114
Above 50	24	250	80

The urine glucose levels of patients between the ages of 5 to 30 were higher than those of patients in other age groups. This demonstrates that younger generations were more susceptible to glycosuria than elderly individuals and new-born. Among 173 patients studied, 21.34 percent (13 females and 25 males) of patients aged 5 to 30 years, 28.08 percent (30 female and 20 males) of patients aged 30 to 50 years, 14.04 percent (11 female and 14 male) of patients aged 0 to 5 years, and 33.7 percent of those aged over 50 years, had blood glucose levels of 160 and 170 mg/dl (female & male), 114 & 120 mg/dl (female & male), 115 & 110 mg/dl (female & male) and 80 & 90 mg/dl (female & male) respectively.

A one-way ANOVA was conducted to determine the effect of age group in male patients on platelet count and urine glucose level. The result indicates a significant effect [F = 46.99 or larger, p = 0]. Post Hoc tests were conducted using Tukey's pairwise multiple comparisons. The comparison reveals significance difference between platelet count & patient's age, urine glucose level & patient's age and urine glucose level & platelet count at 95% Tukey's interval. We therefore reject the null hypothesis that the different age groups in male have same effect on platelet count and urine glucose level / glycosuria.

A one-way ANOVA was also conducted to determine the effect of age group in female patients on platelet count and urine glucose level. The result indicates a significant effect [F = 95.57 or larger, p = 0]. Post Hoc tests were conducted using Tukey's pairwise multiple comparisons. The comparison reveals significance difference between platelet count & patient's age, urine glucose level & patient's age and urine glucose level & platelet count at 95% Tukey's interval. We therefore reject the null hypothesis that the different age groups in female have same effect on platelet count and urine glucose level/ glycosuria.

Analysis of the data in the form of graphs (Fig. 1, 2, 3, and 4) demonstrates the relationship between platelet level and urine glucose level in males and females, as well as the comparison of male and female patients' urine glucose and platelet counts across various age groups. Here, we observe that, for both male and female patients, children aged 0 to 5 had the greatest platelet counts compared to patients in other age groups, and that, as age goes on, platelet counts decrease. Similar results were observed by G. Sterner et. al. 1998 in diabetes mellitus patients (16). The amount of urine glucose in patients of various age groups is shown in Figs. 1 and 2. Glucose level in the urine is increasing in the age group of 5 to 30 as compared to other age groups patients in both male and female respectively. Urine glucose level of female in different age group was observed lower than the male of same age group respectively except in the case of 0 to 5 age group where the trend was reverse, female was observed of having higher concentration of glucose than respective male group (Fig.3).

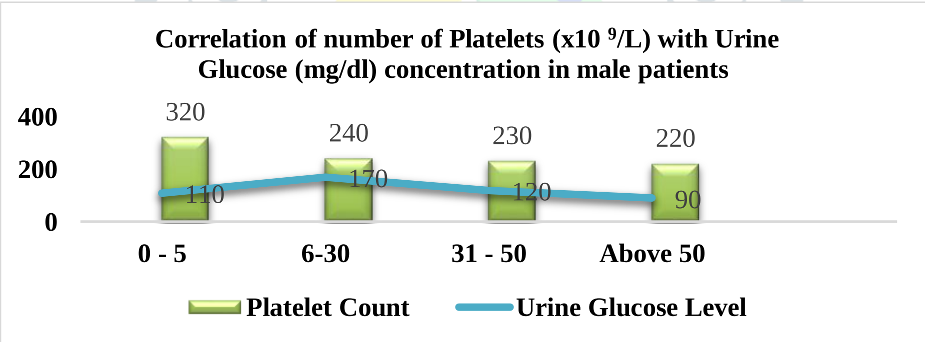

Figure 1: Bar diagram shows the number of platelets in different age group of male patients in correlation with concentration of urine glucose level of respective age groups.

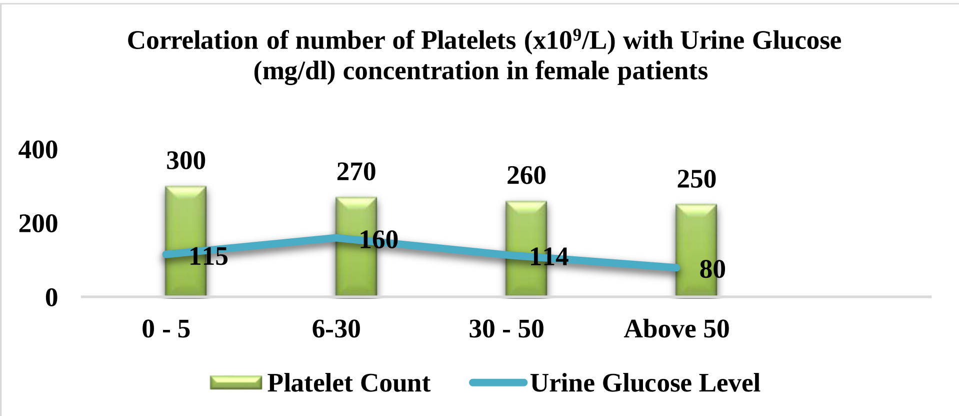

Figure 2: Bar diagram shows the number of platelets in different age group of female patients in correlation with concentration of urine glucose level of respective age groups.

Urine glucose level of female in different age group was observed lower than the male of same age group respectively except in the case of 0 to 5 age group where the trend was reverse, female was observed of having higher concentration of glucose than respective male group (Fig.3).

The platelet counts are high in every age groups of patient's male or female however the count of female patients is higher as compared to the respective male age groups patients except in the age group of 0 to 5 where female was having lower concentration of platelets than respective male (Fig. 4).

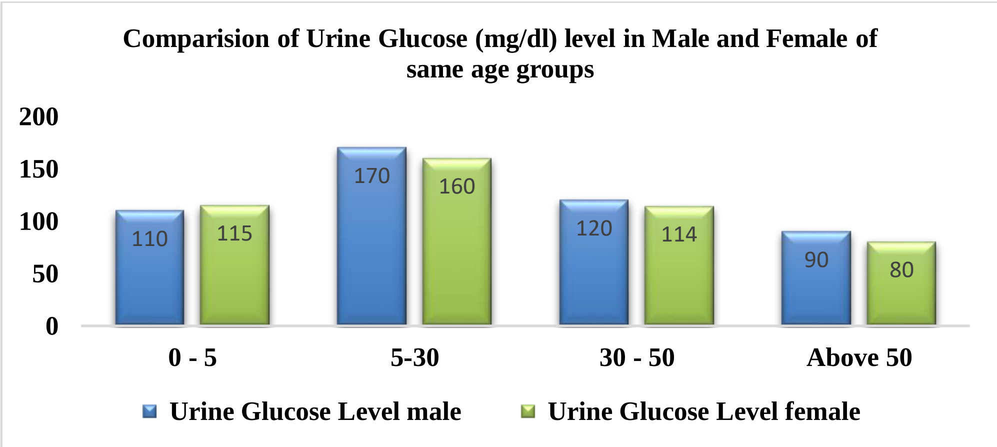

Figure 3: Bar diagram shows the difference in urine glucose concentration in male and female of same age groups.

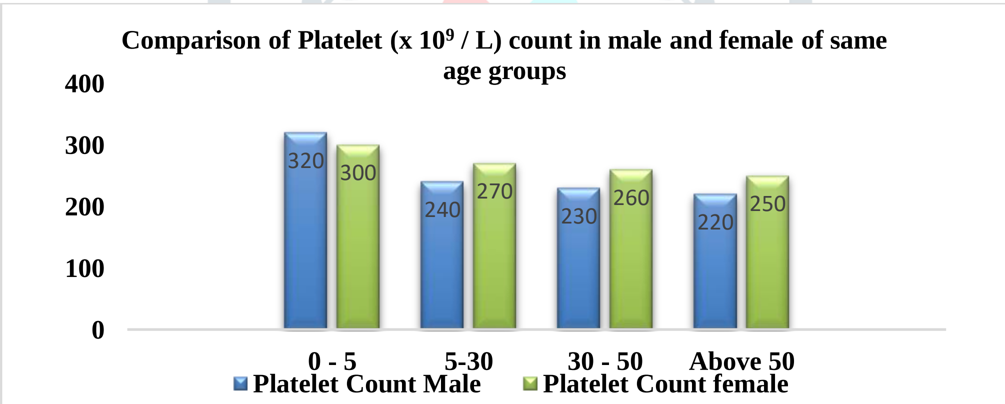

Figure 4: Bar diagram shows the difference in platelet count in male and female of same age groups.

This demonstrates that regardless of gender or age group, the number of platelets generally increases with an increase in urine glucose. However, the pace at which platelets grow in response to urine glucose concentration varies in male and female age groups. So, we suggest that this rise in platelet count serves as a key indicator of glycosuria.

Elderly folks often have greater insulin and blood sugar levels than younger people. A high glucose level in the patient's urine therefore ultimately indicates diabetes, albeit it can also occur in non-diabetic situations. An increased tendency for both spontaneous and adrenaline-induced platelet aggregation in whole blood has been associated with diabetic complications (17, 18).

There is no reported correlation between platelet count and the degree of glycosuria. The duration of diabetic disease did also affect the result, although signs of nephropathy seemed a more important factor. Increasing age of the patients does not explain increasing platelet levels in glycosuria; on the contrary, a slight decrease with age could be seen in both males and females in the different age groups.

SUMMARY AND CONCLUSION:

In conclusion, it is obvious that glycosuria, is related to changes in platelet count and function. There also seems to be a connection between raised platelet number and urine glucose concentration. Increase in number of blood platelets acts as one of the marker for Glycosuria.

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