Biochemistry

CORRELATION OF MEAN PLATELET VOLUME WITH GLYCEMIC INDEX IN PATIENTS WITH TYPE II DIABETES MELLITUS – AN OBSERVATIONAL STUDY

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ABSTRACT Type II Diabetes mellitus (TII DM) is a major global health problem. TII DM is characterized by the prothrombotic state of platelets which owes to the persistent hyperglycemia and insulin resistance, causing injury to pericytes and endothelium. Increased platelet activity is believed to be associated with the development of vascular complications in TII DM. Mean Platelet Volume (MPV), a marker of platelet function which can be used to assess the vascular complications. This is an observational study including 150 TII DM patients attending Diabetology OPD in Coimbatore Medical College& Hospital. MPV, FBS, PPBS, HBA1c were significantly elevated in TII DM patients. Mean FBS, PPBS, HBA1c, MPV were 188.84±91.50mg/dL, 281.10±104.51mg/dL,8.56±2.25 %,9.66 ± 2.02fL, respectively. MPV showed a significant positive correlation with FBS, PPBS, HBA1c. MPV showed more strong correlation in patients with HBA1c >7% than in patients with HBA1c ≤7%. Our study showed that in Type II Diabetes Mellitus patients, Mean Platelet Volume (MPV) is increased. MPV is significantly increased in patients with high HBA1c level. Thus, MPV can be taken as a simple and a cost-effective parameter in assessing the Glycemic control in TII DM patients.

KEYWORDS : TII DM, MPV, HBA1c, FBS, PPBS.

INTRODUCTION:

Diabetes Mellitus (DM) is a metabolic disease which is increasing in prevalence worldwide due to multiple reasons like stress, lifestyle modification, and more. Currently there are >200 million diabetic cases and by 2030, >400 million will become diabetic[1] worldwide. Two types of DM are encountered. Type I which is due to insulin deficiency and more common in young age group, and Type II due to insulin resistance and more common in middle and old age groups[2]. Type II DM accounts for 80% of total DM population[3]. DM is a condition where there is a shift towards thrombogenic state which leads to lot of macro and micro vascular complications[4], patients develop vascular complications like myocardial infarction, stroke, retinopathy, neuropathy, nephropathy, and lot more. Platelets plays an important role in the thrombogenic activity[5].

Platelets are tiny, disc-shaped, non-nucleated, flattened structures, derived from megakaryocytes and are well influenced by the patient's general health and nutritional status. Mean Platelet Volume (MPV) is a measurement of the average size of platelets in the blood. Generally, the normal platelet count varies between 1, 50,000 and 4, 00,000/μl and normal platelet size varies between 2 to 5 microns. Mean Platelet Volume varies between 7.5 and 10.5 fl[6]. The size of the platelets depends largely on the density of granules present in them. The electron microscopy reveals the presence of glycogen in platelets. The major source of energy for platelets is glucose. It is already established that the value of glycated haemoglobin (HbA1c), a marker of long-term glycaemic control, should be kept below 7% in order to reduce the risk of micro-vascular and macro vascular complications in type II DM patients[7].

Derangement of platelet function is the most important factor to predict vascular complications in Type II DM and this can be assessed by measuring MPV, which is a part of complete blood count assay.

The aim of our study is to determine MPV, fasting blood sugar (FBS), Post prandial blood sugar (PPBS), Glycated Haemoglobin (HbA1c) in TII DM patients, and to correlate MPV with HbA1c, FBS, PPBS, and also to correlate MPV in patients with HbA1c ≤7% & Hb A1c >7%, respectively.

MATERIALS AND METHODS:

This is an observational study done in tertiary care medical college hospital in south India. 150 patients who were attending diabetology OPD with Type II DM were selected for this study with exclusion criteria being Anaemia, Thrombocytopenia, Myeloproliferative disorders, Malignancies, History of blood transfusion, pregnancy, history of intake of drugs causing bone marrow suppression, autoimmune disorders.

After getting Institutional ethics committee approval, blood samples were collected and were analysed for Fasting blood sugar (FBS), Post prandial blood sugar (PPBS), and HBA1c and MPV. FBS, PPBS were measured using Fully Automated clinical chemistry analyser XL 640 by Glucose oxidase peroxidase method. MPV was measured in H360 Automated Haematology Analyser & HBA1C in D10 High Performance Liquid Chromatography Analyser. Further mean was analysed for each parameter and MPV was correlated with FBS, PPBS, HbA1c.

To assess the relationship between glycemic control and platelet parameters, the subjects were divided into two groups according to their HbA1c levels as HbA1c ≤7% (n = 59) and with HbA1c levels >7% (n = 91). We selected this cut-off point because it is usually selected in clinical practice to discriminate between appropriate and inappropriate control. MPV values were compared between these groups. The statistical analysis of the results was performed by using the Statistical Package for Social Sciences (SPSS) for IBM version 20.0. Independent "t"-test was used for testing difference significance, P value < 0.05 considered statistically significant. For correlation coefficient person correlation were used.

RESULTS:

Table 1: Mean Values Of Parameters

PARAMETERS	SAMPLE SIZE	MEAN ± SD
AGE (YEARS)	150	58.23 ± 10.10
FASTING BLOOD SUGAR (mg/dL)		188.84 ± 91.23
POST PRANDIAL BLOOD SUGAR (mg/dL)		281.10 ± 104.20
HbA1c (%)		8.56 ± 2.55
MEAN PLATELET VOLUME (fL)		9.66 ± 2.02

Mean age of our study group is 58.23 ± 10.10 years, Mean FBS, PPBS, HbA1c and MPV are 188.84 ± 91.23 mg/dL, 281.10 ± 104.20 mg/dL, 8.56 ± 2.55 %, 9.66 ± 2.02 fL respectively.

Table 2: Correlation Of Mpv With Fbs, Ppbs And Hba1c

MPV	CORRELATION COEFFICIENT	P VALUE
FASTING BLOOD SUGAR	0.879	< 0.001 (S)
POSTPRANDIAL BLOOD SUGAR	0.763	< 0.001 (S)
HbA1c	0.660	< 0.001 (S)

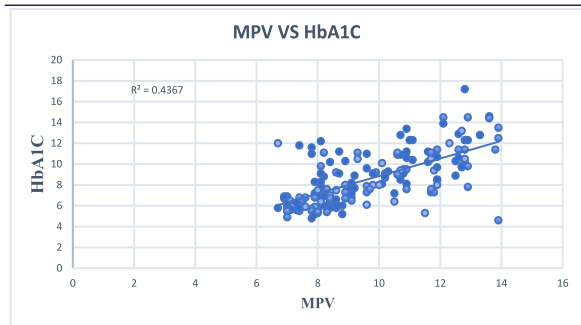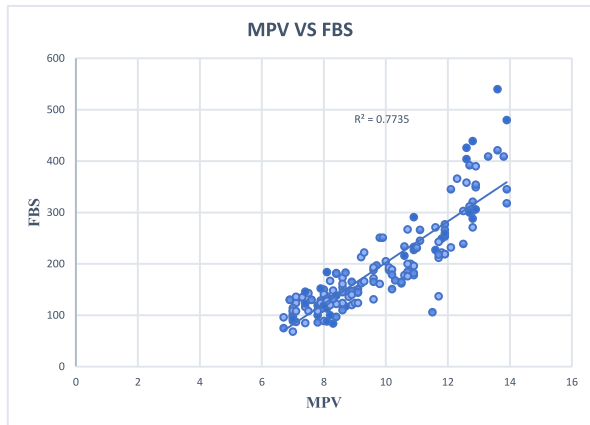**Figure 1: Correlation Of Mpv With Hba1c**

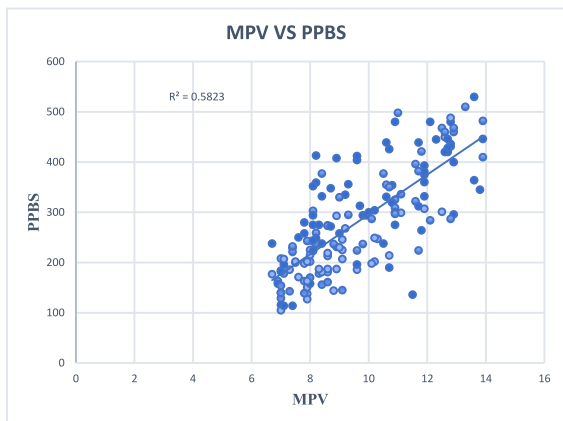**Figure 2: Correlation Of Mpv With Fbs**

Figure 3: Correlation Of Mpv With Ppbs

Correlation coefficient for MPV with FBS, PPBS and HbA1c are 0.879, 0.763, 0.660 respectively. This result shows positive correlation, that is when there is increase FBS, PPBS, HbA1c there is increase in MPV values.

Table 3: Mean Values Of Hba1c In ≤7% & >7% Groups

HbA1c	N (%)	MEAN ± SD	t VALUE	P VALUE
≤ 7%	59 (39%)	5.99 ± 0.59	14.23	< 0.001 (S)
> 7%	91 (61%)	9.95 ± 2.09		

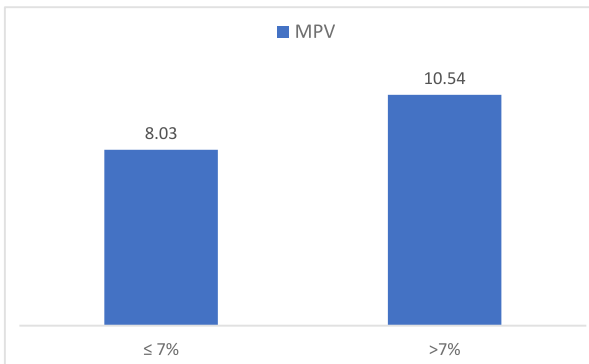**Figure 4: Mean Values Of Hba1c In ≤7% & >7% Groups**
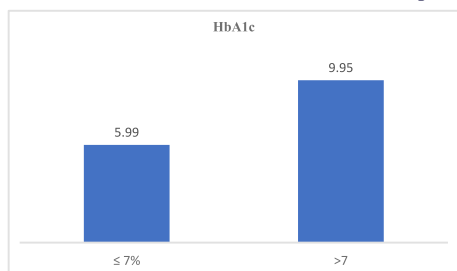
Mean values of HbA1c ≤7% and >7% groups are 5.99 ± 0.59 and 9.95 ± 2.09 respectively.

Table 4: Mean Values Of Mpv In Hba1c ≤7% And >7% Groups

HbA1c	N	MPV MEAN ± SD	t VALUE	P VALUE
≤7%	59 (39%)	8.03 ± 1.18	9.72	< 0.001 (S)
> 7%	91 (61%)	10.54 ± 1.78		

Figure 5: Mean Values Of Mpv In Hba1c ≤7% And >7% Groups

Mean value of MPV in HbA1c ≤ 7% and >7% groups are 8.03 ± 1.18 fL and 10.54 ± 1.78fL respectively. This clearly shows there is increase in MPV values when there is poor glycemic control.

DISCUSSION:
Our study was conducted in 150 subjects with type II Diabetes Mellitus with mean age of 58.23 ± 10.10 years, mean fasting blood sugar and post prandial blood sugar was 188.84 ± 91.23 mg/dL and 281.10 ± 104.20 mg/dL respectively, mean MPV and HbA1c was 9.66 ± 2.02 fL and 8.56 ± 2.55 % respectively (Table 1).

Our study showed correlation coefficient of Fasting Blood Sugar (FBS), Postprandial Blood Sugar (PPBS) and HbA1c with MPV as 0.879, 0.763, 0.660 respectively. This result was statistically significant which showed positive correlation of MPV with FBS, PPBS, and HbA1c. This result was similar to study done by Damira Kadic et[8] all who also demonstrated significant positive correlation of MPV with glycemic indices especially with FBS and HbA1c.

As we divided our patients into 2 groups based on HbA1c levels ≤7% and >7%, the mean HbA1c levels were 5.99 ± 0.59% and 9.95 ± 2.09% respectively (Table 3). This was done to see if there is any change in MPV values with poor glycemic control. The mean MPV in HbA1c ≤ 7% & >7% were 8.03 ± 1.18 fL and 10.54 ± 1.78 fL respectively which was statistically significant (Table 4). The same results were observed in study done by Anandhalakshmi Swaminathan et al[9] and Kodiatte et al[10] who also demonstrated MPV was higher in patients with HbA1c >7%.

When platelets are larger, they are more active hemostatically and enzymatically, as they contain more prothrombotic molecules, such as platelet factor 4, serotonin, and platelet-derived growth factor, and possess greater aggregability in response to ADP[11]. Increased MPV may lead to a prothrombotic condition with increased thromboxane A2 (TXA2) and B2 and adhesion molecule expression, such as P-selectin and glycoprotein IIb/IIIa, and β-thromboglobulin release[12]. Hyperreactive platelets are seen in diabetes patients, characterized by dysregulation of several signalling pathways which leads to increased adhesion, activation, and aggregation[13]. There are several mechanisms which increases platelet activity in diabetes. The glycation of platelet surface proteins reduces membrane fluidity and increases platelet adhesion, causing incorporation of glycated proteins into the thrombi. Hyperglycemia can increase platelet reactivity by inducing nonenzymatic glycation of proteins on the surface of the platelet, by the osmotic effect of glucose and activation of protein kinase C[10].

As there is increase in vascular complications with increase in duration of type II Diabetes patients, the MPV value also indicates duration of diabetes as there is increase in MPV with increase in duration of diabetes[9].

MPV was significantly decreased at the 3-month follow-up period, compared to baseline MPV, in diabetic patients who achieved improved glycemic control[14]. Significant positive correlation between

the reduction in thrombus formation and the reduction in HbA1c is seen in lot of studies[15]. These findings suggested that platelet activity was recovered through improved glycaemic control, i.e. glycemic control decreases the platelet reactivity and thus may prevent or delay possible long term vascular complications.

Poor glycemic control is clearly associated with multiple complications which includes microvascular and macrovascular complications. This indicates the importance of platelet function in Diabetes patients where platelets are the important marker for thrombus formation. So MPV can be used as a simple marker of platelet activity and vascular complications in Type II Diabetes patients.

CONCLUSION:
Our study shows that MPV can be used as a cost-effective tool to assess the vascular complications and their prognosis in Type II Diabetes patients.

Conflict of Interest: NIL

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