



**COMPARISON OF MEAN PLATELET VOLUME IN PATIENTS OF TYPE I DIABETES MELLITUS AND TYPE II DIABETES MELLITUS- A HOSPITAL BASED STUDY**

S. Tahseen Raza<sup>1</sup>, Seema Singh\*<sup>2</sup>, Nitin R. Gupta<sup>3</sup>, Arvind Kumar<sup>4</sup>, Alok Singh<sup>5</sup>, Pooja Singh<sup>6</sup>

<sup>1</sup>Department of Physiology Era's Lucknow Medical College and Hospital, Lucknow, U.P. India.

<sup>2</sup>Department of Physiology Era's Lucknow Medical College and Hospital, Lucknow, U.P. India.

<sup>3</sup>Department of Medicine, Integral University, Lucknow, U.P. India.

<sup>4</sup>Department of Medicine, Integral University, Lucknow, U.P. India.

<sup>5</sup>Department of Pathology, Era's Lucknow Medical College and Hospital, Lucknow, U.P. India.

<sup>6</sup>Department of Pathology, Era's Lucknow Medical College and Hospital, Lucknow, U.P. India.

\*Corresponding Author: Prof. (Dr.) Seema Singh (Professor)

Department of Physiology Era's Lucknow Medical College and Hospital, Lucknow, U.P. India.

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**ABSTRACT**

**Background:** Diabetes mellitus (DM) is a global complex and pandemic disease. Its characteristics are metabolic abnormalities, hyperglycaemia and long term micro-macrovascular abnormalities along with blood vessels, eyes, nerves and kidneys. Platelets act as key factor in development of its thrombogenic complications. Recent studies reported about the platelet parameter such as mean platelet volume (MPV) in diabetic patients, contributing to increased risk of vascular disease. This study was carried out to compare the mean platelet volume in type I and type II diabetes mellitus patients and also compare MPV in males and females in type I and type II DM.

**Objectives:** This study was conducted to compare the MPV in type I and II DM to predict it as simple and cost effective tool in this disease. **Methods:** This is a cross sectional hospital based study conducted in Integral Institute of Medical Sciences, Lucknow. Total 93 patients were included, in which 23 DM I and 70 DM II patients were included. MPV was measured by a 3 part differential hematology auto analyzer and data analyzed by 't' test.

**Result:** Mean MPV was significantly higher in the DM II patients in comparison to type I DM ( $9.95 \pm 1.50$  fl versus  $9.17 \pm 1.69$  fl.;  $p=0.039$ ) In female patients, in type I DM patients the mean platelet volume was found to be  $9.34 \pm 0.73$ . The mean platelet volume was found to be  $10.07 \pm 1.38$ . The total mean platelet volume was found to be  $9.96 \pm 1.32$ . In male patients, in type I diabetes mellitus patients, the mean platelet volume was found to be  $9.12 \pm 1.89$ . The mean platelet volume in type II DM patients was found to be  $9.86 \pm 1.59$ . The total mean platelet volume was found to be  $9.64 \pm 1.71$ . **Conclusion:** High MPV in DM II in comparison to type I DM along with higher MPV in males and females in type II DM rather than type I DM. Thus MPV play as cost effective test for monitoring the patients with chronic Diabetes mellitus disorder.

**KEYWORDS:** Diabetes Mellitus; Platelets; Mean platelet volume.

**INTRODUCTION**

Diabetes mellitus refers to a group of common endocrine disease distinguished by metabolic abnormalities, hyperglycemia along with long term complications. It belongs to two subclasses such as type I insulin dependent (IDDM) and type II insulin independent diabetes mellitus. The most common complications of diabetes mellitus are atherosclerosis, thrombosis and other vascular diseases.<sup>[1,2]</sup> Type I diabetes mellitus is the common metabolic disease among children, adolescents and young adults. Its incidence rate is still rapidly increasing<sup>[3]</sup> and it is a leading cause of mortality primarily, because of its greater risk to the cardiovascular system.<sup>[4]</sup> Diabetes mellitus II shows insulin resistance

and its higher incidence is found in adults. Type II DM have higher rate of mortality with lifelong disease.<sup>[5]</sup>

It increases the risk for stroke, peripheral arterial diseases and coronary heart diseases from twofold to fourfold.<sup>[6,7]</sup> These risk may be independent or linked to other risk factors of cardiovascular systems such as obesity, cigarette smoking, hypertension and albuminuria.<sup>[8,9]</sup>

Platelets are major role player in homeostasis. Mean platelet volume act as an important role in the measurement of platelet size hence, it is considered as a marker of platelet function. High MPV with larger platelets are hemostatically much reactive, results in higher level of prothrombotic factor thromboxane A2,

leads to thrombosis.<sup>[10]</sup> Platelets size act as an indirect representative of platelet activity and so it play a role of significant factor in micro and macrovascular diabetic problems.<sup>[11]</sup> MPV is considered as a marker of platelet function.<sup>[12]</sup> MPV is easy to measure with automated hematology analyzer during routine hematological analysis. Thus MPV emerges as an important, cost effective and simple marker for early diagnosis of these patients. Recent studies have demonstrated a significant increase in platelets –leukocyte aggregates in diabetes. The aim of the present study was to compare the MPV in DMI and DMII patients for early diagnostic of these patients. This study also checks the level of MPV in males and females in DMI and DMII.

## MATERIALS AND METHODS

This hospital based study was carried out in Integral Institute of Medical Sciences, Hospital (IIMS & R, Hospital, Lucknow from January 2017 to June 2017 for a period of six month.

### Subjects

Patients (males and females) were selected from the IIMS&R, Hospital, who possessed the criteria of American Diabetes Association (ADA) for DM. Before starting the study, ethical clearance was obtained from the Ethics committee of IIMS&R Hospital. Patients have also given their informed consent before clinical examinations.

The inclusion and exclusion criteria of the study is given below:

#### Inclusion criteria

- Patients who gave consent
- Confirmed cases of DMI
- Confirmed cases of DMII

#### Exclusion criteria

- Patients with abnormal counts (thrombocytosis/thrombocytopenia) and who was on anti-platelets medicines (aspirin, clopidogrel)
- Gestational diabetic females.
- Alcoholic cases

### Procedure

This was hospital based cross-sectional study carried out in 93 patients including both type I and type 2 DM patients, out of which 70 patients were type 2DM and 23 patients were type I DM. In both the DMI and DMII groups of diabetic patients, 5 ml of venous blood was collected in K2 – EDTA filled plastic vacutainer tubes under aseptic conditions. Blood was tested within 1 hour of collection to minimize variations due to sample aging. Samples were maintained at room temperature. MPV was measured in both group who had advised complete blood count, by using an automatic blood counter (Beckman Coulter Act5Diff).

### Statistical Analysis

The statistical analysis of the results was done via using the Statistical Package for Social Sciences (SPSS) software. Arithmetic mean and standard deviation was calculated from our data. Then mean values of patients were compared using student t-test. Spearman–Pearson correlation test has revealed the correlation between variables.  $P < 0.05$  with 95% confidence interval was considered significant.

## RESULTS

Over a period of six months from, data of patients were collected in IIMS & R Hospital. The total sample size was 93 in which 23 cases DMI and 70 cases of DMII have taken in this study. (Table 1) The data analysis are given below:

According to table 1, in a total of 93 patients Type I diabetic patients were 23(24.7%) and type 2 diabetic patient were 70 (75.3%). MPV was in type II DM patients observed to be  $9.95 \pm 1.50$  fl while in type I DM, it was found to be  $9.17 \pm 1.69$  fl. The difference in average MPV between type I and type II DM was statistically significant ( $p = 0.039$ ) (Table II). It can be inferred from Table III that in female patients, in type I DM patients the mean platelet volume was found to be  $9.34 \pm 0.73$ . The mean platelet volume was found to be  $10.07 \pm 1.38$ . The total mean platelet volume was found to be  $9.96 \pm 1.32$ . It can be inferred from Table IV that in male patients, in type I diabetes mellitus patients, the mean platelet volume was found to be  $9.12 \pm 1.89$ . The mean platelet volume in type II DM patients was found to be  $9.86 \pm 1.59$ . The total mean platelet volume was found to be  $9.64 \pm 1.71$ .

**Table I:**

Age (Year)	DMI – No./Sex	DMI	Percentage of DMI	DMII	DMII	Percentage of DMII
13-30	12/M,4/F	16	23 CASES(24.7%)	0M/1F	1	70 CASES (75.3%)
31-50	6/M/,1/F	7		14M/17F	31	
50-80	NIL	NIL		26M/12F	38	

**Table II: Association of MPV with type of Diabetes.**

	type	N	Mean	Std. Deviation	t Test	p-value
MPV (fl)	Type I	23	9.170	1.6937	2.093	0.039
	Type 2	70	9.949	1.4993		

Table III: MPV summaries in female patients.

Type	Mean MPV (fl)	SD ofMPV(fl)
Type I	9.34	0.73
Type II	10.07	1.38
Total	9.96	1.32

Table IV: MPV summaries in male patients.

Type	Mean MPV (fl)	SD ofMPV(fl)
Type I	9.12	1.89
Type II	9.86	1.59
Total	9.64	1.71

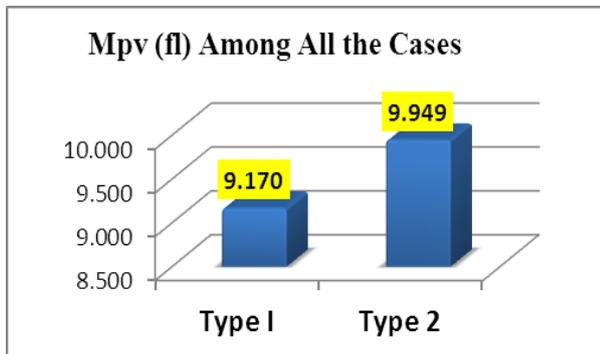


Fig. I: Association of MPV with type of Diabetes.

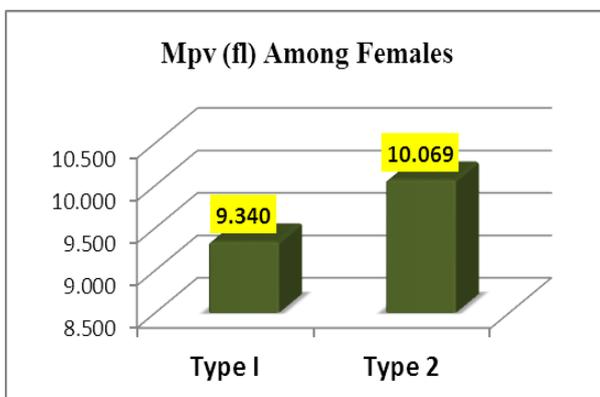


Fig. II: MPV Summaries in female patients.

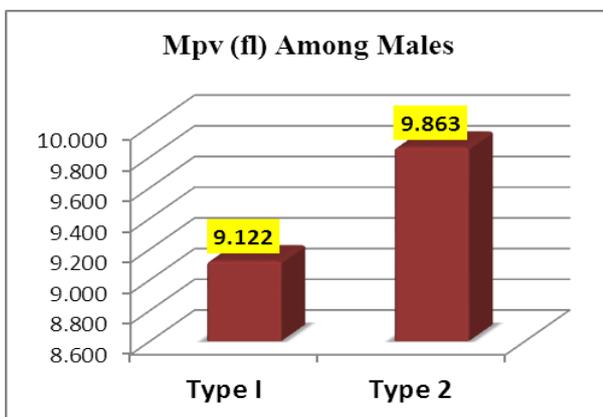


Fig. III: MPV summaries in male patients.

## DISCUSSION

Diabetes mellitus is a complex metabolic syndrome. Vascular complications of this disease occur due to increase activity of platelets.<sup>[13]</sup> MPV act as major tool in

the monitoring of DM. Many studies revealed high level of MPV as a major risk factor for vascular complications of DM like thromboembolism, myocardial infarction and stroke.<sup>[14,18]</sup> In addition to other studies our study<sup>[19,20]</sup> also reported higher MPV in DM. Osmotic swelling is one mechanism due to increase of MPV in DM. Osmotic swelling occur due to high blood glucose level and its metabolite, short life span of platelets in diabetes and also due to younger platelets and increase in turnover of platelets.<sup>[21,22]</sup> In DM, correlation of MPV with reticulate platelets and megakaryocyte ploidy occur due to increased platelets turnover. In response to stimulus, platelets activation and aggregation also alters signaling pathways in DM.<sup>[23]</sup>

In our study of 93 patients, Type I Diabetic patients were 23(24.7%) and type II diabetic patients were 70 (75.3%). Mean platelet volume was higher in type II DM patient than type I DM and it was observed to be  $9.95 \pm 1.50$  fl while in type I DM, it was  $9.17 \pm 1.69$  fl. The difference in average MPV between type I and type II DM was statistically significant ( $p=0.039$ ).

In our study, MPV was higher than that of normal that was similar to the studies done by Hekimsoy et al.<sup>[24]</sup> Demirtunc et al.<sup>[25]</sup> Zuberi et.al.<sup>[26]</sup> Hekimsoy et al. in their study reported the same result in comparison of MPV of diabetics with that of healthy individuals ( $10.62 \pm 1.71$  fl vs.  $9.51 \pm 0.86$  fl;  $p < 0.001$ ) It have been also noted that MPV was higher in males and females in type II DM in comparison to type I DM. Other studies observed the opposite finding with lower platelet volume in the diabetic groups compared with non-diabetic healthy subjects. Hence the platelet count is dependent on several variables that is mean platelet survival, platelet production rate and turnover rate in diabetes mellitus. In our study, the diabetic group had significantly higher MPV in both type I DM and type II DM patients. This was supported by the findings of other studies done by Hekimsoy et al. Papanas et al. Demirtunc et al. Zuberi et.al. Atea et al. Jindal et al.<sup>[24,27,25,26,28,29]</sup>

Higher values of MPV were observed in diabetic objects with microvascular complications such as retinopathy and microalbuminuria but were not statistically significant. Higher values were also seen in the studies done by Papanas et al.<sup>[27]</sup> and Ates et al.<sup>[28]</sup> This suggested a role for the increased platelet activity in the

pathogenesis of vascular complications. On the other hand studies done by Hekimsoy et al and Demirtunc et al. MPV was not significantly different in subjects with diabetic neuropathy/retinopathy from that of diabetes without those complications. This possible explanation was centered on the rapid consumption of activated platelets in diabetes with complications.<sup>[24,25]</sup>

## CONCLUSION

This study shows significantly high increase in MPV in type II IN comparison to type II Diabetes mellitus. Thus it has established MPV to play as a simple, significant and cost effective tool for monitoring diabetic patients. But for the conclusion to be applicable for the population, there is an urgent need to do the study with a larger sample size to validate the results of this study.

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