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Original Research Article

# Association of Mean Platelet Volume with That of the Diabetic Status of Patients with T2DM

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**Abstract:**

**Introduction:** Diabetes mellitus (DM) affects about 10% of the world's population and is developing quickly. Chronic hyperglycemia in DM affects endothelial function and arteries. Controlling blood sugar affects microvascular (nephropathy, retinopathy) and macrovascular (heart disease). MPV might be a biomarker for DM-related vascular issues. Cardiovascular events, excluding DM, had elevated MPV.

**Aims and objectives:** This study evaluates the correlation between "Mean Platelet Volume (MPV)" and the state of "Type 2 Diabetes Mellitus (T2DM)".

**Method:** A cross-sectional research was undertaken at American international institute of medical sciences, Bedwas Udaipur From September 2022 to August 2023. Non-purposive sampling determined the sample size. Diabetes Mellitus patients and matched controls without diabetes or vascular problems were the main groups. Anticoagulant and vascular concomitant users were omitted. Diabetes patients had extra tests (Fasting Blood Sugar, HbA1C, Complete Blood Count with MPV).

**Result:** Table 1 shows MPV and diabetes management parameters. Longer diabetes and higher HbA1C levels are associated with greater MPV (r = 0.389** and r = 0.578**, respectively). A slight correlation (r = 0.486**) between MPV and FBS. In Figure 1, diabetics (58.2 years) and nondiabetics (57.88 years) had minimal age differences. Figure 2 shows diabetics and nondiabetics without vascular problems with a little difference in MPV. MPV discrepancies among diabetics with microvascular and macrovascular issues are seen in Figures 3 and 4. MPV may be useful for evaluating complications in Figure 5.

**Conclusion:** MPV is significant in diabetes and its repercussions, according to our study. More study is needed to evaluate whether glycemic control may correct platelet dysfunction.

**Keywords:** "Type 2 Diabetes Mellitus (T2DM)". "Mean Platelet Volume (MPV)" , Diabetes Mellitus patients.



## Introduction

Diabetes mellitus (DM), a condition caused by difficulty relating to the release of insulin and how it affects the body, is a rapidly spreading global health concern. By the end of the next decade, it is predicted to affect more than 10% of the population, the majority of whom are still ignorant of their diagnosis [1]. Diabetes affects three out of every four people who reside within low- to middle-income nations even though DM was once thought to be a lifestyle illness in the wealthy world. Chronic hyperglycemia, a defining feature of DM and a consequence of insulin shortage or dysfunction is deleterious to endothelial function and arterial architecture over the long run [2]. Microvascular and macrovascular issues associated with type 2 diabetes have both been linked to patients' ability to regulate their blood sugar levels [3]. Microvascular problems In contrast to the fact that diabetes mellitus causes blindness worldwide and that atherosclerosis constitutes one of the primary causes of early mortality, nephropathy & retinopathy are substantial contributions to chronic renal disease this condition [4].

All nations' healthcare systems, especially those in emerging nations like India, are heavily burdened by these issues. By creating the major platelet plug, blood cells termed platelets play a crucial part in hemostasis. in turn, causes thrombus to develop. Greater thrombosis and a greater procoagulant impact are produced by larger platelets because they are more active & contain more dense granules [5]. Consequently, the vascular problems found in type 2 DM may have a causal link with the average platelet volume (MPV). However, due to the quick

destruction of tiny platelets and the bone marrow's hurried manufacture of reticulated platelets, MPV may increase as a result of thrombotic events. In any event, MPV might be a biomarker for type 2 DM vascular problems [6]. This may be useful for a type 2 diabetes prognosis marker in resource-constrained environments. An increased MPV is also observed in several cardiovascular and cerebrovascular events, as well as intestinal disorders including Crohn's disease, aside from diabetes mellitus [7]. Similar to this, Additionally, a low MPV was noted as a sign in many cancers, ulcerative colitis, and TB. A higher platelet count and a lower MPV are comparable under physiological conditions [8]. However, in inflammatory diseases, there is a considerable rise in the production of thrombopoietin with megakaryocytes are activated by cytokines like IL-6, leading to large platelets in addition to a lot of platelets. Since thrombotic events are caused by enhanced platelet activity in vulnerable people, MPV has been proposed as a predictive marker in a variety of cardiovascular and cerebrovascular disease conditions illnesses [9].

It is stressed that the heightened platelet activity contributes to the vascular consequences of this metabolic condition. Haematology analyzers assess Platelet volume as measured by the average volume of platelets (MPV), a metric of platelet activity & functionality [10]. Platelets may be involved in certain conditions because of their changed shape and function in the development of micro-&macrovascular conditions in diabetics. the process of hemostasis and thrombosis are platelets [11]. When vascular damage activates platelets, they release a variety of chemicals that are essential in mediating coagulation, thrombosis, inflammation, and atherosclerosis. Therefore, it is crucial to assess platelet hyperactivity [12]. Direct assessment of platelet activity is not feasible in everyday practice due to the ideal platelet testing procedure's complexity and equipment requirements. The metabolic & enzymatic activity of giant platelets is typically higher than that of tiny platelets [13]. A popular biological indicator Mean platelet volume (MPV) is a gauge of platelet function and activity used frequently. Using a computerised most hospitals have a blood cell counter that is easily accessible, MPV may be tested quickly and affordably. A higher likelihood of has been linked to greater MPV heart disease, myocardial infarction, or atherosclerosis [14].

Patients who have an underlying illness, such as hypertension, or dyslipidemia, or Those who have diabetes type 2 are more likely to get cardiovascular disease. A metabolic illness called diabetes type 2 mellitus has a major impact on the emergence of cardiovascular disease [15]. The two main characteristics of its pathogenesis are a malfunction of the pancreatic beta cells and insulin resistance. diabetes mellitus type 2 symptoms linked to hyperglycemia include microvascular consequences macrovascular issues (ischemic heart disease, peripheral arterial disease, and cerebrovascular disease) and microvascular issues (retinopathy, nephropathy, and neuropathy) [18]. Patients with metabolic diseases, including obesity9 as well as MPV is elevated in type 2 diabetes even though it is not yet known if there is a larger MPV during the beginning stages of type 2 diabetes, these investigations only revealed increased MPV in individuals having diabetes type 2 diseases [19]. To the best of According to our knowledge, no research has looked into whether a rise in MPV is linked to atherosclerosis in people with type 2 diabetes [20].

## Method

### Research Design

A comparative cross-sectional study was undertaken at the Hematopathology Laboratory of our hospital, from September 2022 to August 2023. Participants were non-purposive sampled. A normal distribution algorithm was used to calculate the sample size for comparing two mean sections. The study has two main groups: Diabetes Mellitus patients and Age- and sex-matched controls without diabetes symptoms test results or vascular problems. The research excluded patients with vascular comorbidities or anticoagulant medicines, and all subjects gave permission. Unlike the control group, diabetes patients underwent Fasting Blood Sugar, HbA1C, and Complete Blood Count (including MPV). Clinical exams and medical history confirmed diabetes and vascular problems. Diabetics were divided into two groups based on HbA1C levels, with a cut-off point of <7% and >7%, according to American Diabetes Association standards, to evaluate the correlation between glycaemic management and MPV. Diabetic patients were split into two groups based on duration: those with diabetes <5 years and those with diabetes >5 years. MPV, HbA1C, and Fasting Blood Sugar samples were collected under aseptic conditions in 2 mL EDTA vacutainers and 5 mL plain vacutainers. The right lab equipment processed and evaluated samples in hours.

### Inclusion and Exclusion Criteria

### Inclusion

- People with Type 2 Diabetes.
- Participants without diabetic symptoms or lab results.
- Participants in the control group should not have diabetes.
- Controls must have sought hospitalization for reasons other than diabetes or vascular problems.
- All participants must provide informed permission for the research.

**Exclusion**

- Anticoagulant users and individuals with vascular comorbidities were excluded from the trial.
- Control group members with diabetes symptoms or test results were eliminated.
- Vascular problems unrelated to diabetes were excluded.
- Clinicians with incomplete exams were excluded.
- The research eliminated non-consenters.

**Statistical analysis**

Means and variances were obtained using SPSS 20 for data analysis. MPV and variable associations and correlations were assessed using Independent Student T-tests and Pearson's Coefficient of Correlation (r-value). A significance threshold of p < 0.05 was used to evaluate relationships, and a positive "r" value indicated a positive correlation in the research.

**Result**

Table 1 shows how Mean Platelet Volume (MPV) affects diabetes management factors. MPV is positively correlated with diabetes duration (r = 0.389**) and HbA1C levels (r = 0.578**), showing that MPV increases with diabetes duration and HbA1C levels. MPV and FBS have a modest positive connection (r = 0.486**). These results suggest that increased MPV readings may affect diabetes development and control, making MPV a valuable biomarker for diabetes treatment and monitoring. The 130-person sample's p-values (Sig. (2-tailed)) are all zero, showing statistically significant associations.

**Table 1: Correlation of MPV with duration of diabetes, HbA1C & FBS**

| | | Duration of Diabetes (years) | Mean Platelet Volume | Fasting Blood Sugar | HbA1C |
|---|---|---|---|---|---|
| Mean Platelet Volume | Pearson Correlation | .389** | 1 | .486** | .578** |
| | Sig. (2-tailed) | 0 | | 0 | 0 |
| | N | 130 | 130 | 130 | 130 |

Figure 1 shows the age distribution of diabetic and nondiabetic subjects. Patients with diabetes average 58.2 years old, whereas those without diabetes average 57.88 years old. This little variation in average age shows that the two groups have comparable age profiles. While sample size and age distribution within each group are important, this figure suggests that age may not be a major distinguishing factor between the two groups, which might be useful for examining age and diabetes risk or results.

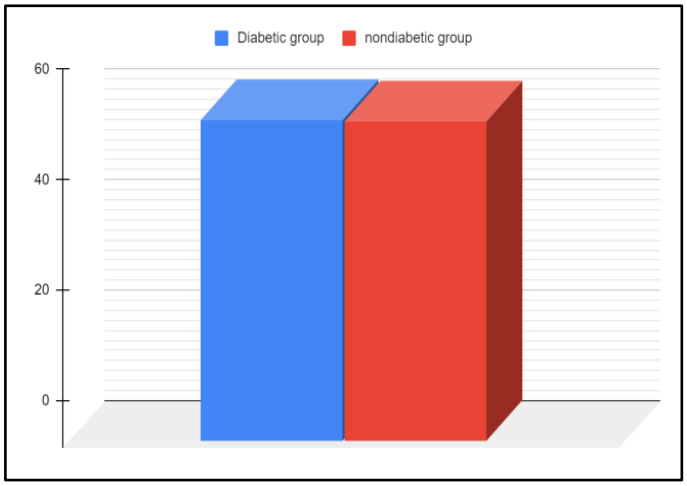


**Figure 1: Age distribution of participants**

Figure 2 seems to show mean platelet volume in diabetic and nondiabetic patients without vascular problems. Diabetics have 12.88 mean platelet volume, whereas nondiabetics have 13.01. Interestingly, nondiabetics with minimal vascular problems had somewhat greater mean platelet volumes than diabetics. This shows that mean platelet volume may not distinguish the two groups' vascular problems. Further research is required to determine how platelet volume affects this situation.

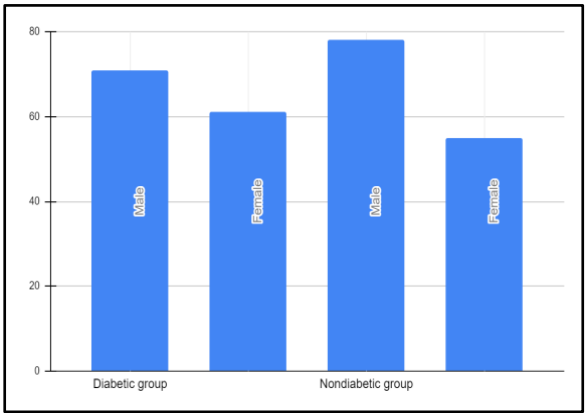


**Figure 2: Gender distribution of participants**

Figure 3 compares MPV between groups. Without vascular problems, the diabetic group had an MPV of 12.88 and the nondiabetic group 13.01. This implies that non-diabetics without problems have somewhat greater MPV. Comparing diabetics with and without problems does not specify complications. However, diabetes consequences demonstrate a missing MPV. Extra evidence is needed to determine how problems affect MPV in diabetics. This shows the necessity for adequate data to measure MPV and diabetic consequences.

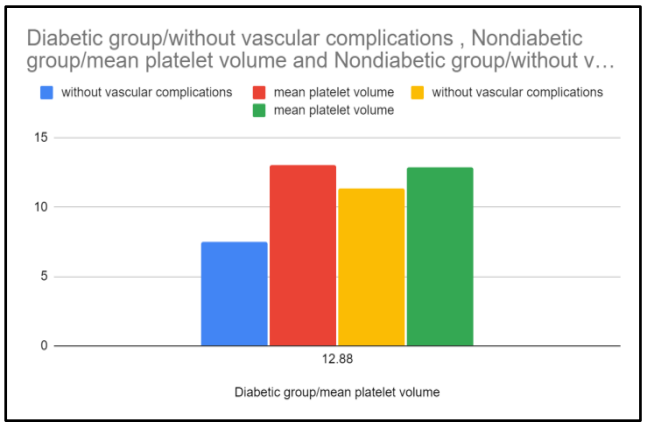


**Figure 3: Comparing mean platelet volume in diabetes patients with non-diabetic controls, as well as diabetic patients with and without complications.**

Figure 4 compares the MPV of people with diabetes and various microvascular problems, including nephropathy, retinopathy, and neuropathy. There are two values given for each complication: one when the complication is present and another when it is not. The data demonstrates that the MPV is consistently greater in people with each of these problems (nephropathy, retinopathy, and neuropathy) than in those without them (11.89, 11.92, and 11.98). This may have consequences for the identification and treatment of diabetics with microvascular problems, since increased MPV may be linked to their occurrence.

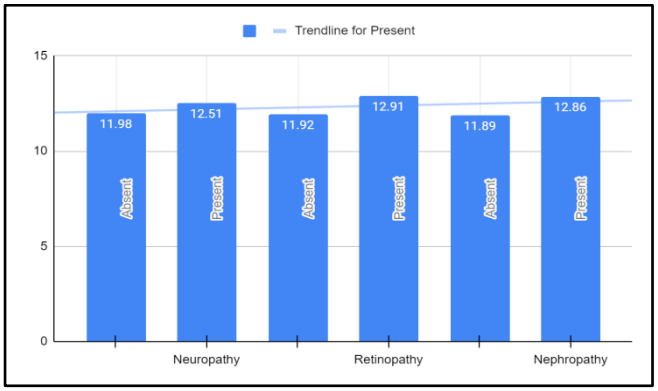


**Figure 4: Mean platelet volume comparison in diabetic individuals with microvascular complications.**

Figure 5 compares diabetic individuals with CAD, PAD, and Diabetic Foot to assess their mean platelet volume (MPV). Two values are shown for each complication: present and absence. When CAD, PAD, and Diabetic Foot are present, the MPV is consistently higher (12.05, 12.98, and 13.5) than when they are absent (11.81, 11.91, and 12.01). This suggests a relationship between increased MPV and macrovascular problems in diabetes individuals, which might help evaluate risk and manage these illnesses.

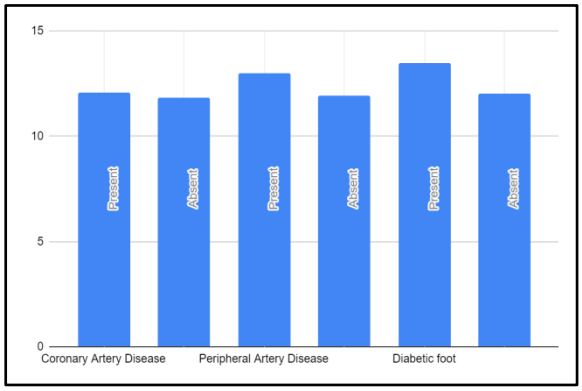


**Figure 5: Diabetic patients with macrovascular complications: comparison of mean platelet volume.**

## Discussion

Over 10% of adults are expected to get diabetes mellitus (DM), a worldwide health issue, over the next 10 years. The main cause of death and morbidity among diabetics is vascular problems. The prognostic indicator[21]. The vascular consequences of mean platelet volume (MPV), a gauge of platelet activity, may be important in diabetes mellitus [22]. We have made an effort to research the relationship between MPV and the glycemic status, length, and occurrence of vascular problems in diabetics. In a hospital with tertiary care, a cross-sectional investigation of 300 type 2 DM patients under the age of 18 who were taken into the inpatient division of medicine was conducted [23]. After patients were divided into subgroups according to their MPV and glycemic status, the relationship among microvascular and macrovascular problems was investigated. A high MPV was connected with inadequate glycemic control, having diabetes for a longer period, and having more vascular problems. Consequently, MPV may be utilised as a low-cost diagnostic to anticipate vascular problems in people with type 2 diabetes [24].

Vascular thrombotic & atherosclerotic problems are common in diabetes people. Changes in platelet size are linked to atherosclerosis problems in diabetic individuals. The current study's objective is to ascertain the association between among those mean platelet volume (MPV) in type 2 diabetes and microvascular diabetic complications. In our investigation, we found that the type 2 diabetes group's mean MPV levels were considerably higher than those of the control group [23]. Additionally, we found that diabetic patients having nephropathy, neuropathy, and retinopathy had higher MPV levels than healthy individuals. Even though MPV is frequently employed as a measure of platelet activity, individuals Those who have type 2 diabetes may increase their chance of developing microvascular problems if their MPV levels are excessive [25].

According to a 2013 estimate, type 2 diabetes mellitus (T2DM) prevalence has risen to epidemic levels, affecting more than 382 million people worldwide. By the year 2035, 471 million people worldwide are predicted to develop diabetes, making up about 10% of the global population. Diabetes patients frequently have insulin resistance, low-grade inflammation, oxidative stress, aberrant metabolism, and poor glycemic control. They become susceptible to atherothrombosis due to the vascular dysfunction brought on by these disorders. In the current study, we looked at the average platelet volume (MPV) is possibly at risk for developing type 2 diabetes-related ischemic heart disease or cerebrovascular stroke [26]. Compared to healthy controls, MPV was greater in those diabetes type 2 sufferers. Those who have type 2 diabetes also macrovascular problems had MPV that was considerably greater. Regarding MPV, there was no discernible difference between patients with and without hypertension. Regarding MPV, there was no discernible difference between the obese and lean participants. In T2DM, there was a substantial positive connection between MPV and glycemic control markers [27].

One of the most prevalent illnesses in the world that results in blindness is diabetic retinopathy (DR), and the majority of patients have been in an advanced state. In recent years, several research suggested that mean platelet volume (MPV) could be related to the emergence of DR, but no conclusive finding was made. The study showed that an elevated MPV level

and the onset of DR had a strong correlation that may be used to gauge how severe DR was, allowing for the clinical monitoring of DR development and progression [28].

The majority of earlier research showing a link among Cross-sectional methods was utilised to study mean platelet volume (MPV), and the probability of having type 2 diabetes (T2DM), and produced mixed findings. We sought to investigate the association of a middle-aged and senior Chinese population of the current prospective study between MPV and incident T2DM risk cohort research. Higher MPV levels were independently linked to a higher incidence of a middle-aged to older Chinese population's risk of T2DM [29].

As a biological indication of platelet activity, the mean platelet volume (MPV) function that is often employed. An elevated likelihood of cardiovascular disease and faster thrombopoiesis are linked to increased MPV. The development among Japanese individuals with type 2 diabetes and diabetic macrovascular issues may be influenced by greater MPV, however, this is unknown. Therefore, among Japanese people with type 2 diabetes and people with prediabetes, we investigated MPV and its relationship to atherosclerosis. These results imply that MPV was markedly elevated in type 2 diabetes early stages. We discovered a significant correlation between MPV and type 2 diabetes in Japanese people's overall HbA1c levels as well as between MPV and vascular stiffness [30-33].

## Conclusion

In conclusion, our research shows that differences in mean platelet volume (MPV) are strongly related to diabetes and its consequences. For individuals with type 2 diabetes, MPV appears as a promising, cost-effective, and conveniently accessible marker for recognizing thromboembolic events and reducing vascular harm. More extensive studies with longer follow-up periods and bigger sample sizes are required to determine whether or not platelet dysfunction may be reversed with glycemic control. Our results raise the possibility that people with diabetes for longer durations have higher MPV levels. Although we learned a lot, we were unable to fully explore the link between platelet dysfunction and glycemic control because of time limits, which was a major weakness of our research.

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