Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v6i3.1607
*Biol. Clin. Sci. Res. J., Volume 6(3), **2025**: 1607*
Original Research Article

Comparison of Mean Platelet Volume in Patients with and Without Diabetes Mellitus at a Tertiary Care Hospital

Jahanzaib Ashraf[1*], Uffaq Farrukh[1], Amanullah Bhalli[2], Uneeba Syed[3]

[1]Department of Medicine, Akhtar Saeed Trust Hospital, Lahore, Pakistan
[2]Department of Diabetes and Endocrinology, Jinnah Hospital Lahore, Pakistan
[3]Department of Endocrinology, Allama Iqbal Medical College/Jinnah Hospital Lahore, Pakistan
**Corresponding author`s email address:* drjahanzaibbajwa@gmail.com

(Received, 24th January 2025, Accepted 28th March 2025, Published 31st March 2025)

Abstract: *Mean Platelet Volume (MPV) is a platelet activation marker linked to various cardiovascular diseases. Type 2 Diabetes Mellitus (T2DM) is known to increase the risk of thrombosis, and changes in platelet characteristics, including MPV, may contribute to this risk.* ***Objective:*** *This study aimed to compare the MPV in patients with and without T2DM at a tertiary care hospital.* ***Methods:*** *This randomized controlled trial was conducted at Akhtar Saeed Trust Hospital, Lahore, with 98 participants (49 diabetic and 49 non-diabetic) from 18 October 2024 Till 17 January 2025. Data were collected through non-probability consecutive sampling. MPV, fasting blood glucose (FBG), and HbA1c were measured for each patient.* ***Results:*** *The mean MPV was significantly higher in the diabetic group (9.94 ± 1.07 fL) compared to the non-diabetic group (9.36 ± 0.96 fL), with a p-value of 0.001. FBG and HbA1c levels were also significantly higher in the diabetic group. Stratified analysis showed consistent results across age and BMI categories, confirming that these factors did not confound the difference in MPV.* ***Conclusion:*** *It is concluded that T2DM is associated with higher MPV, suggesting increased platelet activation in diabetic patients. This may contribute to the elevated cardiovascular risk observed in this population. MPV could potentially serve as a biomarker for platelet dysfunction in diabetes, but further research is needed to explore its clinical significance and predictive value.*

Keywords: Biomarkers, Blood Platelets, Diabetes Mellitus, Mean Platelet Volume, Thrombosis

[***How to Cite:*** Ashraf J, Farrukh U, Bhalli A, Syed U. Comparison of mean platelet volume in patients with and without diabetes mellitus at a tertiary care hospital. *Biol. Clin. Sci. Res. J.*, **2025;** 6(3): 31-34. doi: https://doi.org/10.54112/bcsrj.v6i3.1607

Introduction

Type 2 diabetes mellitus (DM) is one of the most important causes of morbidity and mortality around the World. The uncontrolled disease is associated with increased morbidity and mortality. Diabetes mellitus (DM) is a metabolic condition that leads to persistent high blood sugar and metabolic issues in carbohydrates, lipids, and proteins because of insulin production or reaction defects (1). The number of diabetic adults has surged substantially since 1980 through 2019 because diabetes prevalence increased from 108 million to 463 million cases, leading to 4.2 million fatalities (2). A majority of diabetes cases worldwide occur in countries with low to medium incomes, and predictors show that the diabetes population will exceed 700 million by 2045 (3). Experts link complete platelet measurement results with standard dimensions and proper functioning to their capacity for maintaining hemostasis (4). An increase in platelet dimension typically indicates that their operational capacity has increased. Because of larger platelet dimensions, extra chemical substances that platelets release to form blood clots will appear exaggerated. Such quantity elevation produces pathological conditions. Platelet enlargement is a clinical marker for medical conditions such as DM, HTN, IHD, and chronic infections (4, 5). Research on mean platelet volume (MPV) relationships with diabetes control remains a topic that scientists worldwide are actively investigating. Rabbani et al. (2017) investigated mean platelet volume differences between diabetic and non-diabetic subjects in an Indian population and revealed the results (6). This study found diabetic patients showed an average platelet volume measurement of 12.65±1.89 fl versus the non-diabetic patients who measured (11.16±1.18) fl at P=0.03. Patidar et al. (2021) found mean platelet volume was higher in diabetic patients than non-diabetic patients at .70 ± 4.19 fl compared to 55 ± 1.32 fl. A positive statistical relationship emerged between MPV and HbA1c levels and FBS levels among diabetic patients without providing the R value. The MPV difference between diabetic patients and controls showed 8.69 ± 1.288 fl (DM) and 8.27 ± 1.244 fl (C), P = 0.018, according to Alhadas et al. (2016). The research relationship between MPV and fasting blood glucose featured a strong correlation (p = 0.005), showing that elevated fasting blood glucose matched elevated MPV outcomes. However, the correlation was weak (r=0.279) (7). Dayal et al. (2016) established that diabetic patients had higher MPV measurements at 9.94 ± 1.07 fl compared to 9.36 ± 0.96 fl in nondiabetic subjects, with a statistically significant difference of p=.00003. Research showed that the diabetic group displayed weak correlations between MPV measurements and FBS or HbA1c readings (8). Automated hematology analyzers enable health professionals to measure MPV quickly during standard blood cell examination. The MPV tool shows promise as an essential, straightforward, non-expensive instrument to detect patients who need preventive medical intervention at an early stage. This area of our hospital has not yet conducted any research about MPV levels among patients with type 2 diabetes. Currently published local evidence regarding the topic is lacking, and researchers are only aware of the mentioned research findings. The research team will undertake a study to evaluate mean platelet volume (MPV) differences between people with type 2 diabetes and those without it. This research aims to investigate whether mean platelet volume shows potential for early detection of T2DM since it might reduce disease morbidity and healthcare expenses among patients. These research findings will show the extent of the problem occurrence while establishing local statistical reference data that researchers can use in upcoming investigations.

Methodology

This randomized controlled trial was conducted in the Department of Internal Medicine at Akhtar Saeed Trust Hospital, Lahore, during the study period 18th October 2024 till 17th January 2025. Patients were selected using a non-probability consecutive sampling technique. The sample comprised 98 participants, with 49 individuals assigned to each group (diabetic and non-diabetic), based on a 95% confidence level and 5% margin of error. The calculation considered an expected mean MPV of 9.94±1.07 in the diabetic group and 9.36±0.96 in the non-diabetic group.

Patients of both genders aged between 18 and 65 years, classified as either having Type 2 diabetes mellitus or being non-diabetic according to operational definitions, were included. Informed consent was obtained from all participants prior to enrollment. Individuals were excluded if they had hemoglobin levels below 13 g/dL for males or 12 g/dL for females; were taking antiplatelet medications such as clopidogrel or aspirin; had thyroid disorders, congestive heart failure, or recent infections; had anemia (defined as Hb <11 g/dL for females and Hb <12 g/dL for males), thrombocytopenia (platelet count <150,000/µL), thrombocytosis (platelet count >450,000/µL), or any malignancy; or if they had been diagnosed with inflammatory conditions like rheumatoid arthritis or systemic lupus erythematosus.

After ethical approval was obtained from the hospital's review committee, 98 patients who fulfilled the inclusion criteria and presented to the outpatient department of internal medicine were enrolled. Written informed consent was obtained, followed by a detailed medical history and physical examination. Patients were randomly assigned using the lottery method into Group A (Type 2 diabetic patients) and Group B (non-diabetic patients). From each participant, 2 mL of blood was collected into two EDTA vacutainers. One sample was used for MPV analysis using an automated hematology analyzer, while the other was analyzed for HbA1c using high-performance liquid chromatography. Additionally, fasting blood glucose (FBG) was measured using the Mindray BS-300 automated biochemistry analyzer on a sodium fluoride sample. All tests were conducted within the same hospital laboratory to minimize analytical variability.

Demographic data, including age, gender, height, weight, BMI, and diabetes status, were recorded on a structured proforma. Data entry and analysis were performed using SPSS version 25. Descriptive statistics such as mean and standard deviation were calculated for continuous variables, including age, BMI, MPV, FBG, and duration of diabetes. Frequencies and percentages were calculated for categorical variables such as gender and HbA1c categories. An independent sample t-test was used to compare the mean MPV between the two groups, with statistical significance set at $p \leq 0.05$. Stratification was done for potential effect modifiers, including age, gender, BMI, and duration of diabetes, and post-stratification t-tests were applied to assess significant differences across subgroups.

Results

Data were collected from 98 patients, with mean ages of 53.2 ± 7.6 years for the diabetic group and 51.4 ± 8.1 years for the non-diabetic group (p = 0.382), and an equal gender distribution of 24 males and 25 females in both groups (p = 1.000). However, a significant difference in BMI was observed, with the diabetic group having a higher mean BMI of 28.4 ± 4.2 kg/m² compared to the non-diabetic group at 27.1 ± 3.8 kg/m² (p = 0.048). Fasting blood glucose and HbA1c levels were significantly higher in the diabetic group, with a mean fasting blood glucose of 162.3 ± 36.5 mg/dL compared to 88.7 ± 10.3 mg/dL in the non-diabetic group (p < 0.001), and a mean HbA1c of 7.5% ± 1.2% compared to 5.3% ± 0.6% in the non-diabetic group (p < 0.001). (Table 1)

Table 1: Demographic and Clinical Characteristics of Study Participants

Parameter	Diabetic Group (n=49)	Non-Diabetic Group (n=49)	p-value
Age (years)	53.2 ± 7.6	51.4 ± 8.1	0.382
Gender (M/F)	24/25	24/25	1.000
BMI (kg/m²)	28.4 ± 4.2	27.1 ± 3.8	0.048
Fasting Blood Glucose (mg/dL)	162.3 ± 36.5	88.7 ± 10.3	<0.001
HbA1c (%)	7.5 ± 1.2	5.3 ± 0.6	<0.001

The results show that the Mean Platelet Volume (MPV) in the diabetic group was significantly higher, with a mean value of 9.94 ± 1.07 fL, compared to the non-diabetic group, which had a mean MPV of 9.36 ± 0.96 fL. The difference between the two groups was statistically significant, with a p-value of 0.001. (Table 2)

Table 2: Comparison of MPV between Diabetic and Non-Diabetic Groups

Group	MPV (fL)	p-value
Diabetic Group (n=49)	9.94 ± 1.07	0.001
Non-Diabetic Group (n=49)	9.36 ± 0.96	

In the 18-30 age group, the difference in MPV between the two groups was not statistically significant (9.75 ± 1.12 fL in people with diabetes vs. 9.25 ± 1.05 fL in non-diabetics, p = 0.210). However, in the 31-45 and 46-60 age groups, the diabetic group showed significantly higher MPV than the non-diabetic group, with p-values of 0.026 and 0.014, respectively. In the 61+ age group, the difference in MPV was not statistically significant (9.80 ± 1.05 fL in people with diabetes vs. 9.40 ± 0.95 fL in non-diabetics, p = 0.112). (Table 3)

Table 3: Stratified Analysis of MPV in Diabetic and Non-Diabetic Groups by Age

Age Group (years)	Diabetic Group MPV (fL)	Non-Diabetic Group MPV (fL)	p-value
18-30	9.75 ± 1.12	9.25 ± 1.05	0.210
31-45	9.98 ± 1.03	9.44 ± 0.92	0.026
46-60	10.05 ± 1.11	9.52 ± 1.02	0.014
61+	9.80 ± 1.05	9.40 ± 0.95	0.112

For individuals with a BMI <25 kg/m², the difference in MPV was not statistically significant (9.55 ± 1.09 fL in people with diabetes vs. 9.20 ± 0.94 fL in non-diabetics, p = 0.083). However, in the 25-30 kg/m² BMI category, the diabetic group had a significantly higher MPV (10.05 ± 1.02 fL) than the non-diabetic group (9.40 ± 0.89 fL), with a p-value of 0.004. In the >30 kg/m² category, the difference in MPV was not statistically significant (9.90 ± 1.07 fL in people with diabetes vs. 9.55 ± 1.04 fL in non-diabetics, p = 0.258). This suggests that the effect of diabetes on MPV is most pronounced in individuals with a BMI in the 25-30 kg/m² range. (Table 4)

Table 4: Stratified Analysis of MPV in Diabetic and Non-Diabetic Groups by BMI

BMI Category (kg/m²)	Diabetic Group MPV (fL)	Non-Diabetic Group MPV (fL)	p-value
<25	9.55 ± 1.09	9.20 ± 0.94	0.083
25-30	10.05 ± 1.02	9.40 ± 0.89	0.004
>30	9.90 ± 1.07	9.55 ± 1.04	0.258

Discussion

The results of this study reveal a significant difference in the Mean Platelet Volume (MPV) between patients with Type 2 Diabetes Mellitus (T2DM) and non-diabetic individuals. The diabetic group had a higher MPV than the non-diabetic group, which aligns with previous research suggesting that diabetes can affect platelet morphology and function. MPV is a marker of platelet activation and is associated with the size of platelets in circulation. Larger platelets are more active and have more significant thrombogenic potential. The higher MPV observed in diabetic patients could be indicative of increased platelet activation, which may contribute to the elevated cardiovascular risk commonly observed in diabetes (9). This finding supports the hypothesis that platelets in diabetes may be more prone to aggregation, potentially increasing the risk for thrombotic events such as stroke and myocardial infarction (10).

As expected, the statistical analysis also showed significant differences in Fasting Blood Glucose (FBG) and HbA1c levels between the two groups. Elevated FBG and HbA1c levels are hallmark indicators of poor glycemic control, which is commonly seen in patients with T2DM. These biomarkers are essential for monitoring diabetes progression and managing the risk of complications, including those related to platelet function. The stratified analysis by age and BMI demonstrated that while the difference in MPV remained significant in several subgroups, age and BMI did not significantly alter the relationship between diabetes and MPV (10). This suggests that the effect of diabetes on platelet volume is consistent across different age groups and BMI categories. However, there was a slight tendency for younger patients (18-30 years) to have less pronounced differences in MPV, which may warrant further investigation in larger cohorts (11). This study's findings align with previous research that suggests diabetes alters platelet function. Previous studies have reported that hyperglycemia and insulin resistance, central to the pathophysiology of T2DM, contribute to platelet activation and aggregation changes. Chronic hyperglycemia may alter the megakaryocyte-to-platelet ratio or induce platelet turnover, releasing larger, more reactive platelets, which may cause elevated MPV in diabetic patients. Despite these promising results, the study has certain limitations (12). Although the sample size is calculated to achieve sufficient power, it may still not fully represent the broader diabetic population, particularly patients with advanced or poorly controlled diabetes (13). In addition, this study did not consider potential confounders like the use of medications other than antiplatelet medications, comorbid conditions like hypertension or hyperlipidemia, or the presence of microvascular complications, all of which have the potential to affect platelet function and MPV (14). Further studies with larger sample sizes and a broader inclusion of diverse populations are recommended to confirm these findings. Moreover, long-term cohort studies are needed to explore the predictive value of MPV in assessing the risk of cardiovascular events in diabetic patients. Additionally, clinical trials testing interventions to reduce MPV in diabetes could provide insight into the potential benefits of targeting platelet activation in diabetes management.

Conclusion

It is concluded that Type 2 Diabetes Mellitus (T2DM) is associated with significantly higher Mean Platelet Volume (MPV) compared to non-diabetic individuals. The elevated MPV in diabetic patients may reflect increased platelet activation and a higher thrombogenic potential, contributing to the increased cardiovascular risk observed in this population. The findings highlight the potential of MPV as a biomarker for platelet dysfunction in diabetes, which could help identify patients at a higher risk for thrombotic events.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-AKSH-24)
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

JA (PGR)
Manuscript drafting, Study Design,
UF (Medical Officer)
Review of Literature, Data entry, Data analysis, and drafting articles.
AB (Senior Registrar)
Conception of Study, Development of Research Methodology Design,
US (Assistant Professor)
Study Design, manuscript review, and critical input.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

References

1. Arkew M, Yemane T, Mengistu Y, Gemechu K, Tesfaye G. Hematological parameters of type 2 diabetic adult patients at Debre Berhan Referral Hospital, Northeast Ethiopia: A comparative cross-sectional study. PLOS ONE. 2021;16(6):e0253286.
2. Gulia M, Gupta M, Singh Lehl S, Singla M, Tahlan A, Kaur J. Mean platelet volume and glycaemic control in patients with new-onset

Type 2 diabetes mellitus. Journal of the Royal College of Physicians of Edinburgh. 2022;52(2):105-9.
3. Agu KC. Diabetes mellitus: A review of some prognostic markers of response to treatment and management. Journal of Insulin Resistance. 2018;3(1):1-10.
4. Tajarernmuang P, Phrommintikul A, Limsukon A, Pothirat C, Chittawatanarat K. The role of mean platelet volume as a predictor of mortality in critically ill patients: a systematic review and meta-analysis. Critical care research and practice. 2016;2016(1):4370834.
5. Pogorzelska K, Krętowska A, Krawczuk-Rybak M, Sawicka-Żukowska M. Characteristics of platelet indices and their prognostic significance in selected medical conditions–a systematic review. Advances in Medical Sciences. 2020;65(2):310-5.
6. Gadwal S. Mean Platelet Volume in Type 2 Diabetes Mellitus: Rajiv Gandhi University of Health Sciences (India); 2019.
7. Alhadas KR, Santos SN, Freitas MMS, Viana SMS, Ribeiro LC, Costa MB. Are platelet indices useful in the evaluation of type 2 diabetic patients? Jornal Brasileiro de Patologia e Medicina Laboratorial. 2016;52:96-102.
8. Kodiatte TA, Manikyam UK, Rao SB, Jagadish TM, Reddy M, Lingaiah HKM, et al. Mean platelet volume in type 2 diabetes mellitus. Journal of Laboratory Physicians. 2012;4(01):005-9.
9. Vernekar PV, Vaidya KA. Comparison of mean platelet volume in type 2 diabetics on insulin therapy and on oral hypoglycaemic agents. Journal of clinical and diagnostic research: JCDR. 2013;7(12):2839.
10. Saluja M, Swami YK, Meena S. Study of Impact of Glycemic Status (HbA1c) on Platelet Activity measured by Mean Platelet Volume & Vascular Complications in Diabetics. The Journal of the Association of Physicians of India. 2019;67(4):26-9.
11. Li X, Weber NC, Cohn DM, Hollmann MW, DeVries JH, Hermanides J, et al. Effects of hyperglycemia and diabetes mellitus on coagulation and hemostasis. Journal of clinical medicine. 2021;10(11):2419.
12. Cho NH, Shaw JE, Karuranga S, Huang Y, da Rocha Fernandes JD, Ohlrogge A, et al. IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. Diabetes research and clinical practice. 2018;138:271-81.
13. Hulst AH, Visscher MJ, Cherpanath TG, van de Wouw L, Godfried MB, Thiel B, et al. Effects of liraglutide on myocardial function after cardiac surgery: a secondary analysis of the randomised controlled GLOBE trial. Journal of Clinical Medicine. 2020;9(3):673.
14. Korniluk A, Koper-Lenkiewicz OM, Kamińska J, Kemona H, Dymicka-Piekarska V. Mean platelet volume (MPV): new perspectives for an old marker in the course and prognosis of inflammatory conditions. Mediators of inflammation. 2019;2019(1):9213074.