



MEAN PLATELET VOLUME (MPV) AS AN EARLY MARKER OF INFLAMMATION AND INSULIN RESISTANCE IN GESTATIONAL DIABETES MELLITUS

Dr. Rohitash Kularia

Professor, Dept. of General Medicine, S. P. Medical College & PBM Hospital, Bikaner, India

Dr. Anita Sharma

Associate Professor, Dept. of Obstetrics and Gynaecology, S. P. Medical College & PBM Hospital, Bikaner, India

Dr. Pooja Rami*

Resident, Dept. of General Medicine, S. P. Medical College, Bikaner, India*Corresponding Author

Dr. Abhishek Jhahhria

Resident, Dept. of General Medicine, S. P. Medical College, Bikaner, India

ABSTRACT

Background: Gestational Diabetes Mellitus (GDM) is a state of low-grade chronic inflammation and insulin resistance, which increases the risk of maternal and fetal complications. Mean Platelet Volume (MPV), a marker of platelet size and activation, is an emerging inflammatory indicator. Regional data regarding MPV in GDM pregnancies in Northwestern Rajasthan remain limited. **Objective:** To evaluate the association between MPV, inflammation, and insulin resistance in women diagnosed with GDM compared to healthy pregnant controls in a tertiary care hospital in Northwestern Rajasthan. **Methods:** A hospital-based case-control study was conducted over 12 months, enrolling 150 pregnant women (75 with GDM and 75 healthy controls) aged 20–40 years. Clinical examination, obstetric history, glycemic profile (FBS, PPBS, HbA1c), and platelet indices (MPV) were evaluated. Statistical analysis was performed using SPSS v25.0. **Results:** The mean MPV was significantly higher in the GDM group (10.8 ± 1.2 fL) compared to the control group (8.9 ± 0.9 fL; $p < 0.001$). MPV showed a positive correlation with Fasting Blood Sugar ($r = 0.45$, $p < 0.01$) and post-prandial glucose levels ($r = 0.58$, $p < 0.01$). Inflammatory markers were elevated in the GDM group. **Conclusion:** MPV is significantly elevated in GDM and correlates with glycemic control. It can serve as a simple, cost-effective early marker for inflammation and insulin resistance in pregnancy.

KEYWORDS : Gestational Diabetes Mellitus, Mean Platelet Volume, Inflammation, Insulin Resistance, Northwestern Rajasthan.

INTRODUCTION

Gestational Diabetes Mellitus (GDM) is defined as carbohydrate intolerance of variable severity with onset or first recognition during pregnancy. It is a growing health concern in India, paralleling the rise in Type 2 Diabetes Mellitus. Pathophysiologically, GDM is characterized by increased insulin resistance and a state of chronic low-grade inflammation.^{1,2} This inflammatory state leads to endothelial dysfunction and platelet hyperactivity.

Mean Platelet Volume (MPV) is a simple, automated measure of platelet size; larger platelets are metabolically more active and pro-thrombotic, releasing more thromboxane A₂ and pro-inflammatory cytokines.³ While various expensive markers (e.g., IL-6, TNF-alpha) exist for inflammation, MPV is a cost-effective parameter available in routine Complete Blood Counts (CBC). However, regional data—particularly from Northwestern Rajasthan—correlating MPV specifically with GDM severity are lacking.⁴ This study aims to explore the diagnostic utility of MPV as a surrogate marker for inflammation and insulin resistance in this population.

Materials and Methods

Study Design and Setting: A hospital-based case-control study was conducted in the Departments of General Medicine and Obstetrics & Gynaecology at S. P. Medical College and PBM Hospital, Bikaner, from January to December 2025. The study was approved by the Institutional Ethics Committee.

Inclusion Criteria:

- Pregnant women aged 20–40 years.
- Gestational age 24–28 weeks.
- Group A (Cases): Diagnosed with GDM based on DIPSI criteria (2-hour plasma glucose ≥ 140 mg/dL).
- Group B (Controls): Healthy pregnant women with normal glucose tolerance matched for age and gestational age.

Exclusion Criteria:

- Pre-gestational diabetes.
- Hypertensive disorders of pregnancy (Preeclampsia/Eclampsia).
- Anemia (Hb < 8 g/dL) or hemoglobinopathies.
- History of anti-platelet medication use.
- Chronic systemic illnesses.

Sample Size: Assuming a significant difference in MPV means between groups with 95% confidence and 80% power, a sample size of 150 was determined (75 cases, 75 controls).⁷

Data Collection:

- Sociodemographic details (Age, BMI, Parity).
- Glycemic Profile: Fasting Blood Sugar (FBS), 2-hr Post-Prandial Blood Sugar (PPBS), HbA1c.
- Platelet Indices: MPV measured using an automated hematology analyzer (EDTA sample).

Statistical Analysis: SPSS v25.0 was used. Continuous variables (MPV, Blood Glucose) were compared via Student's t-test. Pearson's correlation coefficient was used to assess the relationship between MPV and glycemic parameters. $p < 0.05$ was considered significant.

RESULTS

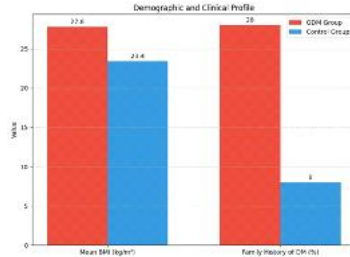
Baseline Characteristics The study included 150 women. The GDM group had a significantly higher mean Body Mass Index (BMI) compared to controls, though age distribution was similar.

Table 1: Demographic and Clinical Profile

Parameter	GDM Group (n=75)	Control Group (n=75)	P-value
Mean Age (years)	28.5 ± 4.2	27.9 ± 3.8	0.21 (NS)
Mean BMI (kg/m ²)	27.8 ± 3.5	23.4 ± 2.9	< 0.001

Family History of DM	21 (28.0%)	6 (8.0%)	<0.001
----------------------	------------	----------	--------

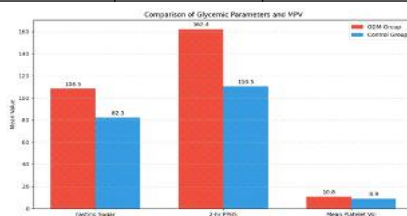
(NS = Non-significant)



Comparison of Glycemic Parameters and MPV As expected, glycemic parameters were higher in the GDM group. Notably, Mean Platelet Volume was significantly elevated in the GDM group, indicating increased platelet activity.

Table 2: Comparison of Biochemical Parameters

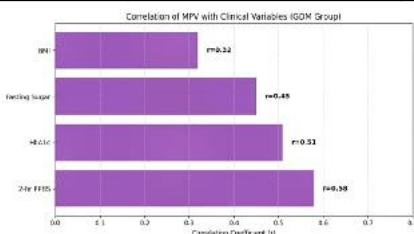
Parameter	GDM Group (n=75)	Control Group (n=75)	P-value
Fasting Blood Sugar (mg/dL)	108.5 ± 12.4	82.3 ± 7.6	<0.001
2-hr PPBS (mg/dL)	162.4 ± 18.2	110.5 ± 9.8	<0.001
HbA1c (%)	6.2 ± 0.6	5.1 ± 0.4	<0.001
Mean Platelet Volume (fL)	10.8 ± 1.2	8.9 ± 0.9	<0.001
Platelet Count (x10 ³ /μL)	245 ± 55	258 ± 48	0.06 (NS)



Correlation Analysis Pearson's correlation analysis revealed a significant positive correlation between MPV and 2-hour Post-Prandial Blood Sugar levels in the GDM group, suggesting that MPV rises with worsening insulin resistance.⁵

Table 3: Correlation of MPV with Clinical Variables in GDM Group

Variable	Correlation Coefficient (r)	P-value
BMI	0.32	<0.05
Fasting Blood Sugar	0.45	<0.01
2-hr PPBS	0.58	<0.001
HbA1c	0.51	<0.001



DISCUSSION

Our study demonstrates a significantly higher Mean Platelet Volume (MPV) in women with Gestational Diabetes Mellitus compared to healthy controls (10.8 fL vs. 8.9 fL, $p < 0.001$) in the Northwestern Rajasthan population. These findings align with global literature suggesting that hyperglycemia induces osmotic swelling of platelets and stimulates megakaryocytes to produce larger, more reactive platelets.^{2,3} The increased MPV in our GDM group serves as a surrogate marker for the pro-inflammatory and pro-thrombotic state inherent in insulin resistance.⁶

We observed a strong positive correlation between MPV and post-prandial blood glucose ($r = 0.58$). This suggests that MPV tracks closely with the degree of glucose intolerance.⁵ Unlike expensive inflammatory markers, MPV is routinely available, making it a valuable tool in resource-limited settings like district hospitals in Rajasthan.

CONCLUSION

MPV is significantly elevated in GDM pregnancies and correlates with the severity of insulin resistance. It represents a simple, cost-effective, and widely available biomarker that can aid in the early identification of women at risk for inflammatory and thrombotic complications associated with GDM.

Acknowledgment

The authors gratefully acknowledge the cooperation of the Department of Obstetrics and Gynecology and laboratory staff of S. P. Medical College and PBM Hospital, Bikaner, for their support during the study.

Conflict of Interest

The authors declare no conflict of interest.

REFERENCES

- Ren Z, Lin L, Li Z, Sun XP, Yang K, Yang HX. Mean platelet volume in the first trimester as a predictor of gestational diabetes mellitus. *Chin Med J (Engl)*. 2020 Jun 5;133(11):1364-1365. doi: 10.1097/CM9.0000000000000825. PMID: 32398521; PMCID: PMC7289289.
- Iyidir OT, Degertekin CK, Yilmaz BA, Toruner FB, Akturk M, Arslan M. Elevated mean platelet volume is associated with gestational diabetes mellitus. *Gynecol Endocrinol*. 2014 Sep;30(9):640-3. doi: 10.3109/09513590.2014.922946. Epub 2014 Jun 5. PMID: 24898134.
- Ding Q, Wang F, Guo X, Liang M. The relationship between mean platelet volume and metabolic syndrome in patients with type 2 diabetes mellitus: A retrospective study. *Medicine (Baltimore)*. 2021 Apr 2;100(13):e25303. doi: 10.1097/MD.00000000000025303. PMID: 33787620; PMCID: PMC8021380.
- Zhou Z, Chen H, Sun M, Ju H. Mean Platelet Volume and Gestational Diabetes Mellitus: A Systematic Review and Meta-Analysis. *J Diabetes Res*. 2018 May 2;2018:1985026. doi: 10.1155/2018/1985026. PMID: 29854818; PMCID: PMC5954880.
- Dev A, R NK, K A, Sivan G, Rajesh Lenin R, Kumar JS. Correlation of Mean Platelet Volume and Red Cell Distribution Width With HbA1c and Its Association With Microvascular Complications in Type 2 Diabetes Mellitus: A Cross-Sectional Study at a Tertiary Hospital in India. *Cureus*. 2024 Aug 4;16(8):e66139. doi: 10.7759/cureus.66139. PMID: 39233994; PMCID: PMC11371466.
- Erikci AA, Muhcu M, Dundar O, Ozturk A. Could mean platelet volume be a predictive marker for gestational diabetes mellitus? *Hematology*. 2008 Feb;13(1):46-8. doi: 10.1179/102453308X315825. PMID: 18534066.
- Mohan, Viswanathan & Deepa, Mohan & Tandon, Nikhil & Pradeepa, R. Guha & Subashini, Radhakrishnan & Lungkar, Janeline & Ramakrishnan, Lakshmy & Bajaj, Sarita & Dash, Kalpana & Adhikari, Prabha & John, Mary & Ram, Uma & Sagili, Haritha & Sriram, Usha & Chandhiok, Nomita & Das, Ashok & Unnikrishnan, Ranjit & Bhatnagar, Shinjini & Joshi, Sadhana & Anjana, Ranjit. (2025). Prevalence of gestational diabetes mellitus in India: The ICMR-INDIAB national study (ICMR-INDIAB-24). *The Indian Journal of Medical Research*. 162. 460-469. 10.25259/IJMR_1874_2025.