DOI: https://doi.org/10.3329/medtoday.v37i2.83375

ORIGINAL ARTICLE OPEN ACCESS

Platelet Indices among Women with Pre-eclampsia attending at a Tertiary Care Hospital – A Case Control Study

Zinath Rehana[1], Mahe Jabeen[*2], Shohana Ashkari Sristi[3], Saifun Nahar Sumi[4], Md. Shabab Azmaeen[5], Mashiat Mumtahina[6], MA Salam[7], Israt Naznin[8], Farzana Kabir[9]

Abstract

Introduction: *Pre-eclampsia (PE) is a pregnancy-specific hypertensive disorder characterized by endothelial dysfunction, increased systemic vascular resistance, platelet activation, and coagulation abnormalities. These changes can lead to serious complications for both mother and fetus. Platelets play a key role in vascular repair and primary hemostasis, and platelet indices—including plateletcrit (PCT), mean platelet volume (MPV), platelet distribution width (PDW), and platelet-large cell ratio (P-LCR)—reflect changes in platelet morphology and activity. Alterations in these indices have been increasingly studied as potential early markers of pre-eclampsia. Typically, platelet count decreases while MPV and PDW increase, with more pronounced changes in PE than in normotensive pregnancies. These variations can appear 2–8 weeks before the clinical onset of PE.* ***Aim:*** *To compare platelet indices among women with pre-eclampsia and normotensive pregnant women to evaluate their potential as early indicators for the diagnosis of pre-eclampsia.* ***Materials and Methods:*** *This case-control study was conducted over 12 months (June 2023 to May 2024) in the Department of Gynecology & Obstetrics at the Institute of Child and Mother Health, following ethical approval. A total of 62 pregnant women were enrolled, including 31 women with pre-eclampsia (Group A) and 31 normotensive pregnant women (Group B) as controls. After informed consent, clinical data and laboratory values were collected using structured case-record forms and analyzed with SPSS version 26.* ***Results:*** *Most participants were aged 21–30 years (67.7% in cases vs. 58.1% in controls, p=0.632). Systolic and diastolic pressures were significantly higher in cases. Platelet indices showed significant differences: MPV (10.58 ± 1.48 vs. 8.42 ± 1.09 fl), PDW (12.84 ± 1.53 vs. 11.19 ± 1.38 fl), P-LCR (25.97 ± 4.00% vs. 22.19 ± 2.89%), and PCT (0.2485 ± 0.0360% vs. 0.2175 ± 0.0279%) were all elevated in pre-eclamptic women (p<0.05).* ***Conclusion:*** *Platelet indices-especially MPV, PDW, P-LCR, and PCT—were significantly elevated in women with pre-eclampsia compared to normotensive pregnant women. These markers may serve as early, cost-effective indicators for the prediction and monitoring of pre-eclampsia. Larger prospective studies are needed to validate these findings.*

Key words: *Pre-eclampsia, Platelet indices, Mean platelet volume (MPV), Platelet distribution width (PDW), Platelet crit (PCT), Platelet-large cell ratio (P-LCR), Hypertensive disorders.*

Number of Tables: 06; Number of References: 18; Number of Correspondences: 03.

1. Dr. Zinath Rehana
Medical Officer
Department of Obstetrics and Gynecology
Sir Salimullah Medical College Mitford Hospital
Dhaka, Bangladesh.

***2. Corresponding & Main Author:**
Dr. Mahe Jabeen
Associate Professor
Department of Obstetrics and Gynecology
Institute of Child and Mother Health (ICMH)
Matuail, Dhaka-1362, Bangladesh.
Mobile no. +8801763726444
E-mail: rinku.jabeen@gmail.com

3. Dr. Shohana Ashkari Sristi
Department of Obstetrics and Gynecology
Sir Salimullah Medical College Mitford Hospital
Dhaka, Bangladesh.

4. Dr. Saifun Nahar Sumi
Consultant, Department of Laboratory Medicine
Ibn Sina Diagnostic & Consultation Center (Badda)
Dhaka, Bangladesh.

5. Md. Shabab Azmaeen
5th Year (Student)
Holy Family Red Crescent Medical College
Dhaka, Bangladesh.

6. Mashiat Mumtahina
Student, Shaheed Police Smrity College, Dhaka, Bangladesh.

7. Dr. MA Salam, MBBS, DGO, MCPS
Department of Obstetrics and Gynecology
Darus Salam Clinic, Meherpur, Bangladesh.

8. Dr. Israt Naznin
Medical Officer
Chest Disease Clinic, Jashore, Bangladesh.

9. Dr. Farzana Kabir, MBBS (AFMC)
FCPS Part-2 trainee (Obs & Gynae), Ex-Medical Officer
Alok General Hospital, Dhaka, Bangladesh.

Received: *30 March 2025* ***Accepted revised version:*** *02 June 2025*

Introduction:

Pre-eclampsia (PE) is a pregnancy-specific multisystem disorder characterized by new-onset hypertension and proteinuria after 20 weeks of gestation. It is a major contributor to maternal and perinatal morbidity and mortality worldwide, complicating 2–8% of all pregnancies[1,2]. Despite improvements in prenatal care in developed countries, PE remains a significant challenge in low- and middle-income regions, where it contributes disproportionately to maternal and neonatal deaths. Globally, it is estimated to cause over 76,000 maternal and 500,000 perinatal deaths annually[3,4].

The pathophysiology of PE is complex and not entirely understood. It is believed to originate from abnormal placental development due to defective trophoblastic invasion and inadequate remodeling of spiral arteries. This leads to placental ischemia, oxidative stress, and widespread endothelial dysfunction[5]. The resulting inflammatory response increases vascular permeability and systemic vasoconstriction, triggering a cascade of events involving platelet activation, coagulation system dysregulation, and multi-organ involvement[6].

Among the hematological changes observed in PE, thrombocytopenia is the most common and clinically significant. The disease is associated with increased platelet activation, turnover, and consumption due to endothelial injury[7,8]. Platelets play a central role in maintaining vascular integrity and initiating coagulation. When activated, they undergo morphological changes that can be measured as part of routine complete blood count testing.

Platelet indices—such as platelet count (PC), mean platelet volume (MPV), platelet distribution width (PDW), plateletcrit (PCT), and platelet-large cell ratio (P-LCR)—reflect platelet function, size variability, and activation status. These indices are cost-effective, easily accessible, and increasingly recognized as potential early markers of PE[5,9]. Studies have shown that while platelet count tends to decrease in PE, MPV, PDW, and P-LCR tend to increase. These alterations may precede the clinical manifestations of PE by several weeks and correlate with disease severity[10].

Advanced biochemical markers, such as the sFlt-1/PlGF ratio and soluble endoglin (sEng), have been studied for early detection and severity assessment of PE. However, their high cost and limited availability make them impractical for routine use in low-resource settings[11,12]. In contrast, platelet indices are part of standard hematology panels and can serve as practical alternatives for early screening and monitoring of high-risk pregnancies.

Given the rising burden of PE and the limitations in current diagnostic tools, there is a need to explore affordable, accessible, and reliable markers. This study aims to compare platelet indices in women with pre-eclampsia and normotensive pregnant women to assess their clinical utility in predicting and evaluating pre-eclampsia.

Materials and Method:

This case-control study was conducted over a 12-month period (June 2023 to May 2024) in the Department of Gynecology & Obstetrics at the Institute of Child and Mother Health, Matuail, Dhaka. A total of 62 pregnant women were recruited using purposive sampling, with 31 pre-eclamptic women assigned to the case group and 31 normotensive pregnant women to the control group. Inclusion criteria for cases included age >16 years, gestational age >20 weeks, blood pressure ≥140/90 mmHg, and clinical signs of pre-eclampsia including proteinuria, organ dysfunction, or fetal growth restriction. Controls were healthy pregnant women >16 years of age with gestational age ≥20 weeks and normal blood pressure. Exclusion criteria included multiple gestations, chronic hypertension, diabetes, cardiovascular or liver diseases, steroid use, and autoimmune or inflammatory disorders. After obtaining informed written consent, clinical examinations and interviews were conducted using a structured questionnaire. Blood pressure was measured using a mercury sphygmomanometer under standardized conditions. Venous blood samples were collected aseptically from the left antecubital vein, and platelet indices—including platelet count, mean platelet volume (MPV), plateletcrit (PCT), platelet distribution width (PDW), and platelet large cell ratio (P-LCR)—were analyzed within one hour using the SYSMEX XN-550 automated hematology analyzer. Midstream urine samples were collected in sterile test tubes and tested for proteinuria using the heat coagulation method. All data were collected by the principal investigator using a checklist to ensure accuracy and consistency, with participants informed of their right to withdraw at any stage.

Statistical Analysis:

Data were entered, cleaned, and analyzed using SPSS version 26 (IBM Corp., Armonk, NY). Descriptive statistics were used to summarize the variables: frequencies and percentages for categorical data, and mean ± standard deviation for continuous data. The independent samples t-test was applied to compare normally distributed continuous variables between groups, while Chi-square or Fisher's exact test was used for categorical variables. A p-value <0.05 was considered statistically significant. Results were presented in tables and figures to illustrate key findings effectively.

Results:

Table-I: Socio-demographic and obstetric characteristics of study participants in Group A and Group B (n=62)

Variables	Group A (n=31) n (%)	Group B (n=31) n (%)	p-value
Age distribution			
18-20	6 (19.4)	10 (32.3)	0.632
21-25	13 (41.9)	14 (45.2)	
26-30	8 (25.8)	4 (12.9)	
31-35	3 (9.7)	2 (6.5)	
36-40	1 (3.2)	1 (3.2)	
Education			
Primary	5(16.1)	5(16.1)	0.921
Secondary	22(71)	23(74.2)	
Graduate or above	4(12.9)	3(9.7)	

Income			
<10000	1(3.2)	2(6.5)	
10000-20000	5(16.1)	4(12.9)	0.894
20000-40000	21(67.7)	22(71)	
>40000	4(12.9)	3(9.7)	

Group A: Pregnant mother with pre-eclampsia

Group B: Normotensive Pregnant mother

* Chi-squared Test (χ^2) was performed.

Table-II: Gravida of the study participants (n=62)

Gravida	Group A (n=31) n (%)	Group B (n=31) n (%)	p-value*
Primigravida	14 (45.2)	11 (35.5)	0.437
Multigravida	17(54.8)	20(64.5)	

Group A: Pregnant mother with pre-eclampsia

Group B: Normotensive Pregnant mother.

* Chi-squared Test (χ^2) was performed.

The participants of group A and B were multigravida (54.8% vs 64.5%) followed by primigravida (45.2% vs 35.5%). There was no significant difference between groups (p>0.05).

Table-III: Symptoms of the study participants (n=62)

Gravida	Group A (n=31) n (%)	Group B (n=31) n (%)	p-value*
Symptoms	14(45.2)	9(29)	0.189
Leg edema	13(41.9)	9(29)	0.288
Headache	10(32.3)	7(22.6)	0.393
Vomiting	7(22.6)	6(19.4)	0.755
Blurring of vision	7(22.6)	5(16.1)	0.520
Epigastric pain			

Group A: Pregnant mother with pre-eclampsia

Group B: Normotensive Pregnant mother.

* Chi-squared Test (χ^2) was performed.

Majority of the study participants complaints off leg edema (45.2% vs 29%), followed by headache (41.9% vs 29%), vomiting (32.3% vs 22.9%), blurring of vision (22.6% vs 19.4%), and epigastric pain (22.6% vs 16.1%). There was no significant difference between groups (p>0.05).

Table-IV: Comparison of blood pressure in study groups (n=62)

Blood pressure	Group A (n=21) Mean±SD	Group B (n=21) Mean±SD	p-value*
Systolic pressure (mm/Hg)	153.06±5.43	111.94±6.15	<0.001
Diastolic pressure (mm/Hg)	95.48±3.73	74.51±4.35	<0.001

Group A: Pregnant mother with pre-eclampsia

Group B: Normotensive Pregnant mother.

*p-value was determined by independent t-test

The mean of systolic blood pressure of group A was 153.06±5.43mmHg and group B was 111.94±6.15 mmHg. The mean diastolic pressure was 95.48±3.73 mmHg and 74.51±4.35mmHg in group A and group B. Blood pressure had statistically significance difference between groups (p<0.05).

Table- V: Comparison of platelet indices in study groups (n=62)

Platelate Indices	Group A (n=21) Mean±SD	Group B (n=21) Mean±SD	p-value*
Platelet count $X10^9$/L	235.06 ± 11.20	258.48 ± 6.03	<0.001
MPV/fl	10.58 ± 1.48	8.42 ± 1.09	<0.001
PDW/fl	12.84 ± 1.53	11.19 ± 1.38	<0.001
P-LCR%	25.97 ± 4.00	22.19 ± 2.89	<0.001
PCT%	0.2485 ± 0.0360	0.2175 ± 0.0279	<0.001

Group A: Pregnant mother with pre-eclampsia

Group B: Normotensive Pregnant mother.

*p-value was determined by independent t-test

(MPV- mean platelet volume, PDW- platelet distribution width, P-LCR- platelet large cell ratio, PCT- platelet-crit.)

It was observed that the mean total platelet count was 235.06 ± 11.20 $X10^9$/L in case group and 258.48±6.03 $X10^9$/L in control group. The mean of MPV was 10.58 ± 1.48 fl in case group and 8.42±1.09 fl in control group. The mean of PDW was 12.84± 1.53 fl in case group and 11.19±1.38 fl in control group. The mean P-LCR was 25.97±4.00% in case group and 22.19 ± 2.89% in control group. The mean PCT was 0.2485 ± 0.0360 % in case group and 0.2175 ± 0.0279 % in control group The difference of platelet indices were statistically significant (p<0.05) between two groups.

Table VI: presence of protein-uria in the study participants (n=62)

Proteinuria	Group A (n=31) n (%)	Group B (n=31) n (%)	p-value*
Positive	31(100)	0(0)	<0.001
Negative	0(0)	31(100)	

Group A: Pregnant mother with pre-eclampsia

Group B: Normotensive Pregnant mother

* Chi-squared Test (□2) was performed.

All participants of preeclampsia group had positive proteinuria while all participants of group B had negative proteinuria , and it was statistically significant (p<0.001)

Discussion:

Pre-eclampsia (PE) is a multisystem disorder characterized by endothelial dysfunction, platelet activation, and hemostatic abnormalities, leading to serious maternal and fetal complications. It is associated with abnormal placental vascular response, increased systemic vascular resistance, and activation of the coagulation cascade. These changes are driven by inflammatory responses that induce vasoconstriction and platelet aggregation, playing a central

role in the disease's pathophysiology[5].

Platelet indices—including plateletcrit (PCT), mean platelet volume (MPV), platelet distribution width (PDW), and platelet-large cell ratio (P-LCR)—reflect changes in platelet morphology and production kinetics. These parameters have gained attention for their potential utility in the early detection and monitoring of hypertensive disorders in pregnancy. In PE, platelet count tends to decrease while MPV and PDW increase, often preceding clinical onset by 2–8 weeks and progressing with disease severity[5].

In the current study, the majority of participants across both groups were aged 21–25 years, followed by those aged 18–20 years, with no statistically significant difference in age distribution. This demographic pattern is consistent with findings from Gogoi et al.[13], who reported similar mean ages among pre-eclamptic and normotensive groups.

Gravidity distribution showed a higher proportion of multigravida women in both groups, though the difference was not statistically significant. This contrasts with studies by Kamath and Gomathy[14] and Hassan et al.[15], which observed a higher prevalence of primigravida women among PE cases. Such differences may reflect demographic variations or regional obstetric patterns.

Common symptoms such as leg edema, headache, vomiting, blurred vision, and epigastric pain were more frequently observed in the PE group. However, these differences were not statistically significant, suggesting limited diagnostic specificity for these clinical features in distinguishing PE from normotensive pregnancy.

Significant differences were noted in systolic and diastolic blood pressure between the two groups. Mean systolic and diastolic pressures were substantially higher in the PE group (153.06±5.43 mmHg and 95.48±3.73 mmHg) compared to the normotensive group (111.94±6.15 mmHg and 74.51±4.35 mmHg), which aligns with findings reported by Edwin Obiorah et al[16].

Regarding hematologic parameters, total platelet count was significantly lower in PE patients, while MPV, PDW, P-LCR, and PCT values were significantly elevated. These results are in agreement with studies conducted by Dadhich et al.[7], Piazze et al.[17], and Mondal et al.[18], which highlight increased platelet activation and consumption in PE due to endothelial injury and systemic inflammation. Moreover, all PE participants exhibited positive proteinuria, in contrast to the control group, where no proteinuria was detected ($p<0.001$). This finding supports the clinical diagnosis and reinforces proteinuria as a key diagnostic criterion for PE. Overall, the study supports the relevance of platelet indices as accessible and cost-effective markers for early detection and monitoring of pre-eclampsia, especially in resource-limited settings.

Conclusion:

This study evaluated platelet indices in women with pre-eclampsia and compared them with those of normotensive pregnant women. The findings demonstrated significantly elevated levels of mean platelet volume (MPV), platelet distribution width (PDW), platelet-large cell ratio (P-LCR), and plateletcrit (PCT) among women with pre-eclampsia. These results suggest that platelet indices, which are readily available through routine complete blood counts, may serve as simple, cost-effective tools for early detection and monitoring of pre-eclampsia during antenatal care. However, to validate these findings and establish clinical utility, further multicenter, longitudinal studies with larger sample sizes and extended follow-up periods are recommended.

References:

1. Thalor N, Singh K, Pujani M, Chauhan V, Agarwal C, Ahuja R. A correlation between platelet indices and preeclampsia. Hematol Transfus Cell Ther. 2019;41(2):129-133.
https://doi.org/10.1016/j.htct.2018.08.008
PMid:31084762 PMCid:PMC6517612

2. Khan B, Allah Yar R, Khakwani A, Khan K, Karim S, Arslan Ali H. Preeclampsia incidence and its maternal and neonatal outcomes with associated risk factors. Cureus. 2022;14(11): 1-6.
https://doi.org/10.7759/cureus.31143
PMid:36483900 PMCid:PMC9723483

3. Peres GM, Mariana M, Cairrão E. Pre-eclampsia and eclampsia: An update on the pharmacological treatment applied in Portugal. J Cardiovasc Dev Dis. 2018;5(1):1-3.
https://doi.org/10.3390/jcdd5010003
PMid:29367581 PMCid:PMC5872351

4. Balogun OA, Khanagura RK, Kregel HR, Amro FH, Sibai BM, Chauhan SP. Preterm preeclampsia with severe features: Composite maternal and neonatal morbidities associated with fetal growth restriction. Am J Perinatol. 2018;35(8):785-790.
https://doi.org/10.1055/s-0037-1617456
PMid:29298455

5. Helmo FR, Lopes AMM, Carneiro ACDM, Campos CG, Silva PB, Monteiro MLG, et al. Angiogenic and antiangiogenic factors in preeclampsia. Pathol Res Pract. 2018;214(1):7-14.
https://doi.org/10.1016/j.prp.2017.10.021
PMid:29174227

6. Umezuluike BS, Anikwe CC, Nnachi OC, Iwe BCA, Ifemelumma CC, Dimejesi IBO. Correlation of platelet parameters with adverse maternal and neonatal outcomes in severe preeclampsia: A case-control study. Heliyon. 2021;7(12):e_.
https://doi.org/10.1016/j.heliyon.2021.e08484
PMid:34917795 PMCid:PMC8645439

7. Dadhich S, Agrawal S, Soni M, Choudhary R, Jain R, Sharma S, et al. Predictive value of platelet indices in development of preeclampsia. J SAFOG. 2012;4(1):17-21.
https://doi.org/10.5005/jp-journals-10006-1164

8. Gernsheimer T, James AH, Stasi R. How I treat thrombocytopenia in pregnancy. Blood. 2013;121(1):38-47.
https://doi.org/10.1182/blood-2012-08-448944
PMid:23149846

9. Alkholy EAM, Farag EA, Behery MA, Ibrahim MM. The significance of platelet count, mean platelet volume and platelet width distribution in preeclampsia. Am Acad Med J. 2013;11(1):200-214.

10. Yadav BS, Jain SK, Toppo NA, Dehariya C. A case control study on s. uric acid and s. creatinine level in pre-eclampsia patients of a tertiary care hospital in Jabalpur district of Central India. Int J Res Med Sci. 2018;6(5):1519-1523.
https://doi.org/10.18203/2320-6012.ijrms20181451

11. von Dadelszen P, Menzies JM, Payne B, Magee LA; PRE-Eclampsia I.E. of R.S. Predicting adverse outcomes in women with severe pre-eclampsia. Semin Perinatol. 2009;33(3):152-157.
https://doi.org/10.1053/j.semperi.2009.02.009
PMid:19464505

12. Ukah UV, De Silva DA, Payne B, Magee LA, Hutcheon JA, Brown H, et al. Prediction of adverse maternal outcomes from pre-eclampsia and other hypertensive disorders of pregnancy: A systematic review. Pregnancy Hypertens. 2018;11:115-123.
https://doi.org/10.1016/j.preghy.2017.11.006
PMid:29198742

13. Gogoi P, Sinha P, Gupta B, Firmal P, Rajaram S. Neutrophil-to-lymphocyte ratio and platelet indices in pre-eclampsia. Int J Gynecol Obstet. 2019;144(1):16-20.
https://doi.org/10.1002/ijgo.12701
PMid:30362112

14. Kamath K, Gomathy E. Platelet indices in preeclampsia and normotensive pregnancy in a tertiary care centre: A cross-sectional study. J Clin Diagn Res. 2021;15(5):1-5.
https://doi.org/10.7860/JCDR/2021/49091.15493

15. Hassan HES, Azzam H, Othman M, Hassan M, Selim T. Soluble E-selectin, platelet count and mean platelet volume as biomarkers for pre-eclampsia. Pregnancy Hypertens. 2019;17:1-4.
https://doi.org/10.1016/j.preghy.2019.04.008
PMid:31487622

16. Obiorah EO, Nneoma QM, Ogbonna AO. Comparative evaluation of platelet indices in preeclamptic and non-preeclamptic patients in the Enugu Metropolis. Open J Trop Med. 2023;7(1):001-005.
https://doi.org/10.17352/ojtm.000023

17. Piazze J, Gioia S, Maranghi L, Anceschi M. Mean platelet and red blood cell volume measurements to estimate the severity of hypertension in pregnancy. J Perinat Med. 2006;34(3):246-247.
https://doi.org/10.1515/JPM.2006.044
PMid:16602847

18. Mondal B, Paul D, Sultana T, Rahman Q, Ahmed S, Fatema K, et al. Assessment of platelet count and platelet indices in preeclampsia and eclampsia. Am J Innov Res Appl Sci. 2015;1(3):80-84.