

# Diagnostic Utility of Platelet Indices in Patients with Dengue Fever

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## ABSTRACT

**Introduction:** Dengue fever is currently spreading more rapidly than any other mosquito-borne viral illness globally. Thrombocytopenia is a common laboratory finding in dengue. Currently, novel platelet indices, especially Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), and Plateletcrit (PCT) have been evaluated as potential markers in dengue-positive patients.

**Objective:** To assess platelet parameters in dengue fever and investigate their correlation with platelet count.

**Methodology:** This prospective study included 100 confirmed dengue-positive patients from the Department of Pathology at RajaRajeswari Medical College and Hospital, Bangalore. 2ml of venous blood were collected in K3EDTA vials from patients diagnosed based on clinical symptoms and confirmed serology (NS1 antigen and/or IgM/IgG antibodies). Platelet counts and indices were analysed using the Sysmex XN-1000 auto-analyser.

**Results:** The study findings indicated that age and gender were not significantly associated with different platelet count groups. However, MPV, PDW, and PCT showed statistically significant correlations with platelet count categories.

**Conclusion:** This study highlights the diagnostic significance of platelet indices in dengue infection. A combination of low platelet count, decreased MPV and PCT, and elevated PDW can serve as useful predictive markers in the diagnosis and assessment of dengue severity.

**Keywords:** Dengue, Platelets, MPV, PDW, PCT, Thrombocytopenia

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## INTRODUCTION

Dengue fever is a widespread global public health challenge. According to the World Health Organization (WHO), over 7.6 million dengue cases were reported in 2024, including 3.4 million laboratory-confirmed cases, more than 16,000 severe cases, and over 3,000 deaths.<sup>1</sup>

Asia remains the most affected region, reporting around 50 million dengue cases and nearly 500,000 cases of DHF annually. India, a dengue-endemic country in the South-East Asian region, continues to experience recurrent outbreaks of both dengue fever (DF) and DHF.<sup>2</sup>

Dengue virus (DENV), a flavivirus with four serotypes (DENV-1 to DENV-4), is transmitted primarily by *Aedes aegypti* mosquitoes. Clinical manifestations vary widely, ranging from asymptomatic infections and mild febrile illness to severe dengue, characterised by plasma leakage, bleeding, and circulatory shock.<sup>3</sup>

Thrombocytopenia is a typical finding of dengue infection, defined as a platelet count  $<150 \times 10^9/L$ . This may be attributed to decreased platelet production in the bone marrow or enhanced peripheral destruction and clearance.<sup>4,5</sup>

The current study has focused on platelet indices such as MPV, PDW, and PCT as indicators of platelet activation and disease severity.<sup>5</sup> MPV reflects megakaryocytic activity—higher MPV suggests increased megakaryocytic activity, while lower MPV indicates marrow suppression.<sup>6</sup> PDW illustrates the variability in platelet size, and PCT represents the total platelet mass, calculated as the product of MPV and platelet count.<sup>7,8,9</sup>

These parameters are routinely available in automated CBC reports and may provide an inexpensive, accessible method to support dengue diagnosis and predict severity—potentially reducing the reliance on costly serological tests.<sup>10</sup>

## OBJECTIVE

To evaluate platelet parameters (MPV, PDW, PCT) in patients with dengue fever and determine their association with platelet count.

## METHODOLOGY

### Study Design:

A cross-sectional study was conducted over 3-months (April–June 2024) in the Department of Pathology, RajaRajeswari Medical College and Hospital, Bangalore.

### Inclusion Criteria:

This study included all patients exhibiting clinical symptoms and confirmed positive dengue via NS1 antigen and/or IgM/IgG antibodies.

### Exclusion Criteria:

1. Patients negative for dengue on serology.
2. Patients on antiplatelet therapy or medications known to induce thrombocytopenia.

**Sample Size:** 100 patients

### Method of data collection

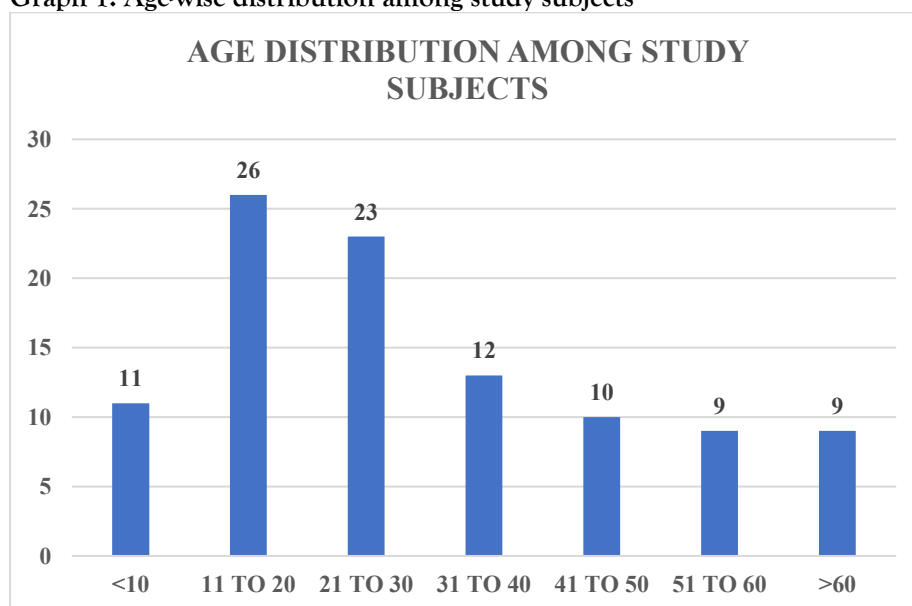
Ethical committee approval was obtained from the Institutional Ethical Committee. Written informed consent was taken from the study subjects before data collection. A detailed history was taken; physical examination was done, followed by blood sample collection. 2 ml aliquots of venous blood samples collected in K3EDTA were obtained from patients diagnosed with dengue, based on clinical symptoms and positive serology, which included NS1 antigen, and IgM/IgG antibody to the dengue virus. Platelet counts and indices were derived from the Sysmex XN-1000 auto-analyser.

### Statistical analysis:

Data collected was analysed using Descriptive statistics and Inferential statistics, with Statistical software SPSS v23 and MS Excel. Association between the parameters was done using the Chi-square test, ANOVA test and Z test and  $P < 0.05$  was considered significant.

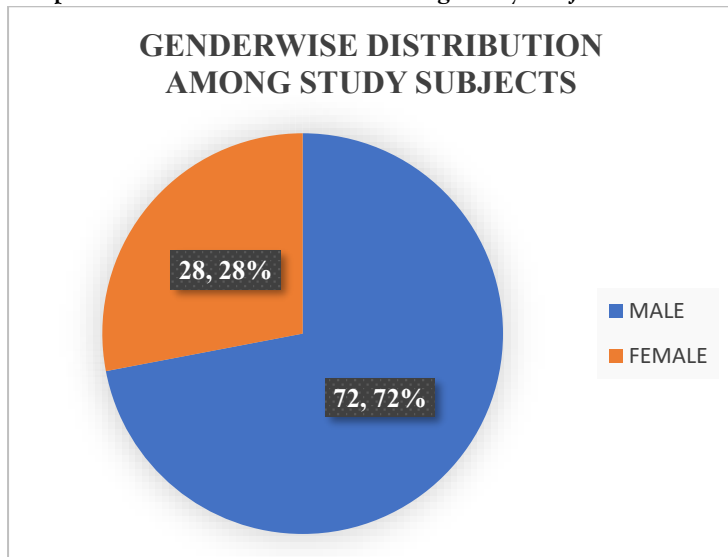
## RESULTS

**Graph 1: Age-wise distribution among study subjects**



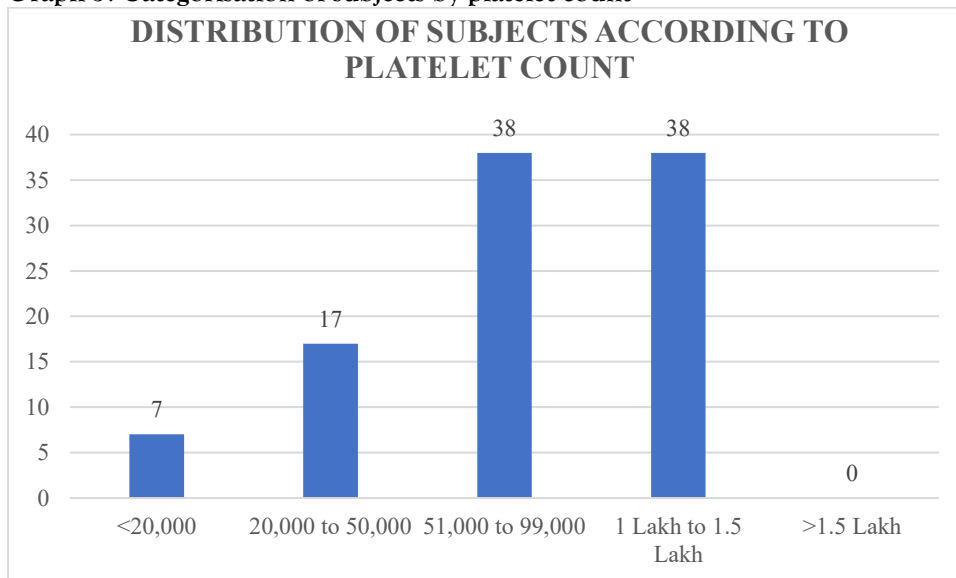
Graph 1 depicts the age demographics of the patients. The majority of patients, i.e., 26 (26%), belonged to the 11–20 years age group, followed by 23 (23%) in the 21–30 years age group.

**Graph 2: Gender distribution among study subjects**



Graph 2 reflects gender wise distribution of the patients. Male predominance was observed (72, 72%) compared to females (28, 28%).

**Graph 3: Categorisation of subjects by platelet count**



Most patients had platelet counts in the ranges of 1 lakh–1.5 lakh and 51,000–99,000, each accounting for 38 patients (38%). Additionally, 17 patients (17%) had counts between 20,000 to 50,000, while 7 patients (7%) had platelet counts below 20,000 (Graph 3).

**Table 1: Comparison of age across various platelet count groups**

Age(yrs)	Platelet Count				P value
	<20,000	20,000 to 50,000	51,000 to 99,000	1 Lakh to 1.5 Lakh	
<10	0	3	4	4	0.123 <sup>ns</sup>
11 to 20	1	7	10	8	
21 to 30	1	2	12	8	
31 to 40	1	2	3	6	
41 to 50	3	2	4	1	
51 to 60	1	0	4	4	
>60	0	1	1	7	
<b>Total</b>	<b>7</b>	<b>17</b>	<b>38</b>	<b>38</b>	

Mean±SD	12.1+3.5	35.1+7.8	77.8+12.4	122.2+12.4	-
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Data were expressed as mean±SD, frequencies, and percentages. Fisher's exact test and analysis of variance (ANOVA) were performed to compare between groups, ns=not significant.

**Table 2: Gender-wise Distribution across Platelet Count Categories**

Gender	Platelet Count				P value
	<20,000 (n=7)	20,000 to 50,000 (n=17)	51,000 to 99,000 (n=38)	1 Lakh to 1.5 Lakh (n=38)	
Male	5	12	24	31	0.358768 <sup>ns</sup>
Female	2	5	14	7	
Total	7	17	38	38	
Mean±SD	39.4±13.4	26.2±16.1	27.6±15.2	34.5±22.3	

The Chi-squared test ( $\chi^2$ ) was performed to analyse the data, ns=not significant.

It was found that age and gender were not significantly associated with different platelet groups ( $p>0.05$ ) (Table 1 & table 2).

**Table 3: Association of dengue infection with Gender**

Gender	No. of patients affected	Z test	P value
Males	72	6.225	0.00001 <sup>s</sup>
Female	28		

Dengue infection was significantly more among males compared to females ( $P<0.05$ ) (Table 3).

**Table 4: Evaluation of PDW, MPV, and PCT with stratified platelet count groups among study patients**

Platelet Indices	Platelet Count				P value
	<20,000 (n=7)	20,000 to 50,000 (n=17)	51,000 to 99,000 (n=38)	1 Lakh to 1.5 Lakh (n=38)	
PDW	15.3+3.3	14.9+4.0	12.9+2.7	12.4+2.4	0.0004 <sup>s</sup>
MPV	9.57+1.72	10.8+1.19	12.6+1.08	11.8+1.1	0.0239 <sup>s</sup>
PCT	0.012+0.004	0.04+0.008	0.08+0.015	0.129+0.016	0.00001 <sup>s</sup>

Data were expressed as mean ± SD. Analysis of variance (ANOVA) was performed to compare among groups, s=significant  
 PDW, MPV and PCT showed significant association with different platelet groups ( $p<0.05$ ) (Table 4).

## DISCUSSION

Dengue fever has become more prevalent in India in recent years.<sup>11</sup> It has spread significantly in geographic locations in India over the last 2 decades (2000-2009 and 2010-2019), with repeated outbreaks and an 11-fold increase in the number of cases.<sup>12</sup>

Thrombocytopenia has consistently been one of the criteria used in WHO guidelines as a possible indicator of clinical severity.<sup>13,14,16</sup> Thrombocytopenia in dengue patients primarily results from two mechanisms: reduced platelet production in the bone marrow and/or increased platelet destruction and clearance from peripheral blood.<sup>4</sup> The early phase of infection, platelet activation, evidenced by marked upregulation of surface P-selectin along with enhanced apoptosis, which is marked by increased caspases and phosphatidylserine (PS) expression, plays a significant role. Furthermore, research has demonstrated that activation of complement factor C3 and subsequent binding of the C5b-9 complex to the platelet surface contribute notably to platelet destruction and the development of thrombocytopenia.<sup>14</sup>

This study was undertaken to investigate the relationship of platelet indices with the severity of dengue fever. A total of 100 patients were included. The majority of the patients, i.e., 26 (26%), belonged to the 2nd decade, followed by 23 (23%) who belonged to the 3rd decade of life. This finding is consistent with the study by Savargaonkar et al.,<sup>23</sup> in which the most commonly affected age group was 11-30 years. Specifically, 28.5% of cases were in individuals aged 11-20 years, and 29.4% were in the 21-30 years group.<sup>23</sup>

In this study, male predominance was observed (72, 72%) compared to females (28, 28%). In a study by Paul D et al.<sup>15</sup> male predominance was observed (65.8%), which was similar to this study. This is due to increased exposure to Aedes mosquito bites among working-age males and males in general, as they tend to engage in more outdoor activities during the day and also due to potential biological differences in immune response.<sup>20,21</sup>

In this study, the majority of the patients, 38(38%), had platelet count between 1 Lakh to 1.5 Lakh, and another 38 (38%) had count between 51,000 to 99,000, 17 (17%) had count 20,000 to 50,000 and 7 (7%) had platelet count <20,000. In a study by Paul D et al.,<sup>15</sup> maximum cases (36.9%) had platelet count between 51,000 to 100,000, and the minimum cases (5.8%) had platelet count less than 20,000, which was in concordance with this study.

It was found that age and gender were not significantly associated with different platelet groups ( $p>0.05$ ). This was similar to a study by Paul D et al.,<sup>15</sup> in which no significant difference in gender and age was observed among different platelet groups ( $p>0.05$ ).

In this study, PDW, MPV and PCT showed significant association with different platelet groups ( $p<0.05$ ). MPV and PCT were found to be low, whereas PDW was higher among the group with platelet count <20,000/cu.mm relative to other groups with higher platelet count in this study. Similar trends were reported by Mukker P et al.,<sup>14</sup> who observed low MPV and elevated PDW in patients with platelet counts below 20,000 compared to higher platelet count groups. Based on the case-control study by Bashir AB et al.,<sup>17</sup> revealed that PDW was significantly increased in dengue-positive cases compared to the control group. This outcome corroborates the results of the present study. A study by Navya et al.,<sup>18</sup> likewise demonstrated a significant difference between thrombocytopenia and disease severity (DF/DHF/DSS) (P value - 0.013).

However, our study results were contrary to a study by Sharma et al.,<sup>19</sup> who reported no significant difference in mean MPV between the time of minimal platelet count and at discharge. A study by Dewi et al.,<sup>20</sup> found no notable decline in mean MPV with severity of the disease, which was in contrast to this study.

## CONCLUSION

The study highlights the relevance of platelet parameters in patients with dengue infection. In the current research, it was observed that dengue infection was most commonly seen among the 2<sup>nd</sup> and 3<sup>rd</sup> decades of life.

It was significantly more common among males compared to females. It was found that age and gender did not show a statistically significant correlation with different platelet groups. In contrast, platelet count-derived indices-PDW, MPV and PCT show significant correlation with platelet count in dengue infection. Specifically, patients with a platelet count below 20,000/cu.mm exhibited significantly higher PDW and lower MPV and PCT values compared to those with higher platelet counts. Hence, we conclude that a combination of low platelet count, elevated PDW, and reduced MPV and PCT can be considered as potential predictive markers for evaluating disease severity and guiding clinical management.

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