

# Correlation of leukocyte and hematocrit with platelet counts in dengue hemorrhagic fever

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## Abstract

Dengue hemorrhagic fever (DHF) is frequently accompanied by hematological alterations that play an important role in diagnosis and clinical monitoring. Leukocyte count, hematocrit value, and platelet count are among the routine hematological parameters commonly evaluated in patients with dengue infection. This study aimed to determine the correlation of leukocyte and hematocrit values with platelet counts in patients with dengue hemorrhagic fever at Wangaya Regional General Hospital, Denpasar City. An analytic observational study with a cross-sectional approach was conducted using secondary data from medical records and laboratory results of 91 DHF patients selected through purposive sampling. Data were analyzed using univariate analysis and the Pearson correlation test. The results indicated that leukocyte counts were not significantly correlated with platelet counts, whereas hematocrit was. These findings highlight the potential value of hematocrit as a relevant hematological parameter in the evaluation of DHF and may support the clinical interpretation of routine complete blood count results in dengue patients.

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## 1. Introduction

Dengue hemorrhagic fever (DHF) remains a major public health problem in tropical and subtropical countries, including Indonesia. The disease is caused by dengue virus infection transmitted through *Aedes* mosquitoes and is characterized by a wide spectrum of clinical manifestations ranging from fever to bleeding, plasma leakage, and severe thrombocytopenia (Kementerian Kesehatan RI, 2022; Nugraheni et al., 2023). Because the clinical course of dengue infection may change rapidly, laboratory examinations are essential not only for supporting diagnosis but also for monitoring disease progression and identifying potential complications.

One of the most frequently requested laboratory tests in patients with dengue infection is the complete blood count (CBC). This examination provides several important hematological parameters, including leukocyte count, hematocrit, and platelet count, which are commonly used in the clinical evaluation of dengue patients. Leukopenia is often observed during the febrile phase, thrombocytopenia is a common hematological abnormality in the critical phase, and increased hematocrit values may indicate hemoconcentration associated with plasma leakage (Ahmad & Mongilong, 2023; Syuhada et al., 2022). These changes reflect the pathophysiological processes of dengue infection and may provide useful information for assessing disease severity and progression.

Previous studies have reported associations between hematological parameters in dengue patients, particularly between hematocrit and platelet count. Several studies found that hematocrit changes may be related to thrombocytopenia and the severity of dengue infection (Hukom et al., 2013; Rasyada et al., 2014; Sinurat et al., 2020). Other studies also reported alterations in leukocyte counts during dengue infection,

although the relationship between leukocyte and platelet counts has not been consistently emphasized in routine clinical interpretation (Masihor et al., 2013; Marlini, 2019; Stefan Candra Saerang, 2021). These findings indicate that hematological abnormalities are important in dengue, but the combined relationship between leukocyte and hematocrit values and platelet counts remains insufficiently explored, particularly in hospital-based laboratory settings.

Evaluating the relationship among these CBC parameters is important because it may strengthen the interpretation of routine hematological results in dengue patients and support more evidence-based laboratory reporting. In addition, local data are needed to describe the hematological profile of DHF patients in specific healthcare settings, including Wangaya Regional General Hospital, Denpasar City. Therefore, this study aimed to determine the correlation of leukocyte and hematocrit values with platelet counts in patients with dengue hemorrhagic fever at Wangaya Regional General Hospital, Denpasar City.

## **2. Method**

### **2.1 Research Design and Participants**

This study employed an analytic observational design with a cross-sectional approach. This design was considered appropriate because the study aimed to assess relationships among leukocyte count, hematocrit, and platelet count using laboratory results obtained at a single time point, without any researcher intervention (Sugiyono, 2024). The study used secondary data from medical records and laboratory examination results of patients diagnosed with dengue fever or dengue hemorrhagic fever who underwent complete blood count testing at the Clinical Pathology Laboratory of Wangaya Regional General Hospital, Denpasar City. The target population consisted of 911 dengue patients recorded during the study period. The sample size was determined from the accessible population, yielding 91 patient records for the analysis. Samples were selected using purposive sampling based on predefined inclusion and exclusion criteria (Subhaktiyasa, 2024). The inclusion criteria were: (1) patients diagnosed with dengue fever or dengue hemorrhagic fever, (2) patients who underwent complete blood count examination, including leukocyte count, hematocrit value, and platelet count, and (3) medical records with complete laboratory data. The exclusion criteria were: (1) medical records with incomplete hematological examination results and (2) duplicate or unreadable records. The final sample consisted of patient records that met the study criteria and were considered suitable for evaluating the correlation among the hematological parameters examined in this study.

### **2.2 Instruments and Data Collection**

Data were collected using a document study technique from patients' medical records and laboratory examination results. The variables analyzed in this study included leukocyte count, hematocrit value, and platelet count obtained from complete blood count examinations performed at the Clinical Pathology Laboratory of Wangaya Regional General Hospital, Denpasar City. The complete blood count examinations were performed on EDTA-anticoagulated whole blood samples using an automated hematology analyzer as part of routine laboratory services. All examinations were carried out in accordance with the laboratory's standard operating procedures. To ensure the reliability of laboratory results, the instrument was routinely maintained and subjected to the laboratory's internal quality control procedures. Data collection involved reviewing eligible medical records and extracting hematological results relevant to the study variables. To maintain data validity and consistency, only medical records with complete laboratory results for leukocyte count, hematocrit value, and platelet count were included in the analysis.

### **2.3 Data Analysis**

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 26. Prior to statistical analysis, the data were reviewed for completeness and consistency. Univariate analysis was used to summarize the hematological variables examined in this study: leukocyte count, hematocrit, and platelet count (Subhaktiyasa, Candrawati, et al., 2025). To determine the appropriate inferential test, data distribution was assessed using the Shapiro–Wilk normality test. The assumptions for Pearson correlation analysis were further evaluated by assessing the linearity of the relationships between variables and screening for extreme outliers. Because the data met the assumptions for parametric testing, bivariate analysis was conducted using the Pearson correlation test to evaluate the association among leukocyte count, hematocrit, and platelet count (Subhaktiyasa, Numertayasa, et al., 2025). All statistical tests were performed at a significance level of 0.05.

## 2.4 Ethical Considerations

This study was conducted in accordance with research ethics principles and received ethical approval from the RSUD Wangaya, Denpasar, under ethical clearance number 000.9.2/217/RSUDW. The study used secondary data obtained from medical records and laboratory examination results. To protect patient privacy and confidentiality, all data were anonymized prior to analysis, and no personally identifiable information was included in the study.

## 3. Results and Discussion

### 3.1 Results

A total of 91 medical records of patients with dengue hemorrhagic fever who met the inclusion criteria were included in the analysis. Descriptive statistics of the hematological parameters examined in this study, including leukocyte count, hematocrit value, and platelet count, are presented in Table 1.

Table 1. Descriptive statistics of hematological parameters in dengue hemorrhagic fever patients

| Variable                    | Mean   | SD     | Min   | Max  |
|-----------------------------|--------|--------|-------|------|
| Leukocyte count (/ $\mu$ L) | 4.410  | 1.351  | 1.48  | 7.71 |
| Hematocrit (%)              | 43     | 10.357 | 12.8  | 69.3 |
| Platelet count (/ $\mu$ L)  | 75.219 | 7.588  | 7.588 | 90   |

Based on the descriptive analysis, the mean leukocyte count was 4,410/ $\mu$ L, the mean hematocrit value was 43%, and the mean platelet count was 75,219/ $\mu$ L. The results of the bivariate analysis using the Pearson correlation test are presented in Table 2.

Table 2. Correlation analysis of leukocyte and hematocrit values with platelet counts

| Variable relationship               | r-value | p-value |
|-------------------------------------|---------|---------|
| Leukocyte count and platelet count  | 0.086   | 0.416   |
| Hematocrit value and platelet count | 0.788   | 0.000   |

The analysis showed no significant correlation between leukocyte and platelet counts in patients with dengue hemorrhagic fever ( $p > 0.05$ ). In contrast, the hematocrit value showed a statistically significant correlation with platelet count ( $p < 0.05$ ).

### 3.2 Discussion

This study aimed to determine the correlation of leukocyte count and hematocrit value with platelet count in patients with dengue hemorrhagic fever. The findings showed that leukocyte count was not significantly correlated with platelet count, whereas hematocrit was. These findings indicate that not all hematological parameters in the complete blood count change in parallel during dengue infection, although they remain clinically relevant for laboratory monitoring.

The absence of a significant correlation between leukocyte and platelet counts in this study may be explained by the distinct temporal patterns of hematological changes during dengue infection. Leukopenia often occurs during the febrile phase due to transient bone marrow suppression and viral effects on white blood cell production, whereas thrombocytopenia tends to become more pronounced during the critical phase of illness. Because these parameters may decrease at different stages and with different degrees of severity, their relationship may not always appear statistically significant in cross-sectional observations. This finding is consistent with previous studies reporting inconsistent or weak relationships between leukocyte and platelet values in dengue patients, particularly when measurements were taken at a single time point (Masihor et al., 2013; Marlini, 2019; Saerang, 2021).

In contrast, the hematocrit value showed a significant correlation with platelet count. This finding is biologically plausible and clinically important in dengue hemorrhagic fever. Increased hematocrit is commonly associated with hemoconcentration resulting from plasma leakage, a hallmark pathophysiological feature of severe dengue infection. At the same time, platelet count tends to decrease due to a combination of bone marrow suppression, peripheral destruction, and increased platelet consumption. Therefore, changes in hematocrit and platelet count may occur more closely together and reflect disease progression more consistently than changes in leukocyte count. This finding is consistent

with previous studies reporting a significant association between hematocrit and platelet counts in dengue patients (Hukom et al., 2013; Rasyada et al., 2014; Syuhada et al., 2022; Sinurat et al., 2020).

These findings highlight the importance of interpreting complete blood count results comprehensively rather than relying on a single parameter. In routine laboratory practice, platelet count remains one of the most closely monitored indicators in dengue patients. However, the present findings suggest that hematocrit may provide additional supportive value in evaluating the progression of dengue hemorrhagic fever, particularly in relation to plasma leakage. Thus, simultaneous interpretation of platelet and hematocrit values may strengthen laboratory-based clinical assessment and monitoring in dengue patients.

This study has several limitations. First, a cross-sectional design captures laboratory findings at a single point in time and does not capture dynamic hematological changes across the different phases of dengue infection. Second, this study used secondary data from medical records, so the analysis was limited to the completeness and quality of the available documentation. Third, the study was conducted in a single hospital, which may limit the generalizability of the findings to other populations or healthcare settings. Future studies are recommended to use longitudinal or cohort-based designs to observe hematological changes throughout the clinical course of dengue infection. Additional variables such as disease severity, day of fever onset, and other laboratory parameters may also be included to provide a more comprehensive understanding of hematological alterations in dengue hemorrhagic fever.

#### 4. Conclusion

This study showed that leukocyte count was not significantly correlated with platelet count, whereas hematocrit value was significantly correlated with platelet count in patients with dengue hemorrhagic fever. These findings suggest that hematological parameters in complete blood count examinations do not necessarily change in parallel during dengue infection and should therefore be interpreted comprehensively in routine laboratory assessment. From the perspective of Medical Laboratory Technology, this study highlights the potential value of hematocrit, together with platelet count, in supporting laboratory-based monitoring of dengue hemorrhagic fever patients. The findings may contribute to a better understanding of hematological changes in dengue and support more evidence-based interpretation of complete blood count results in clinical practice. However, the findings should be interpreted in light of the study limitations, including the cross-sectional design, the use of secondary data, and the single-center setting. Future studies are recommended to use longitudinal designs and include additional clinical and laboratory variables to further clarify hematological changes throughout the course of dengue infection.

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#### Conflict of Interest

The authors declare that there is no conflict of interest.

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