

Characteristics of Leukocyte Count, Platelet Count, and Hematocrit Levels in Hospitalized Patients with Dengue Hemorrhagic Fever at Anutapura Regional General Hospital, Palu, 2024

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ARTICLE INFO	ABSTRACT
Article History: Received : 4 June 2026 Accepted : 17 June 2026 Published online	Background: Dengue Hemorrhagic Fever (DHF) is an endemic disease in Indonesia with a high incidence rate globally and nationally, including in Palu City and RSUD Anutapura Palu in 2024. Complete blood tests in dengue patients showed the main characteristics in the form of leukopenia, thrombocytopenia, and increased hematocrit as a plasma reveal and the severity of the disease. Therefore, this study aims to analyze the characteristics of leukocytes, platelets, and hematocrit in dengue patients at RSUD Anutapura Palu in 2024. Objective: To determine the characteristics of the number of leukocytes, platelets, and hematocrit in dengue hemorrhagic fever patients treated at RSUD Anutapura Palu in 2024. Methods: This type of research is quantitative research with a cross-sectional approach using secondary data as a reference. The sampling technique was carried out using the Non-Probability Sampling method with a total sampling technique. Data analysis was conducted using univariate analysis using the SPSS 30 program. Results: The demographic characteristics of dengue patients are mostly female, namely 55 people (52.4%) and the most age is found in the Late Adolescents: 17 - 25 years old, namely 51 sufferers (48.6%). The highest number of leukocytes was low leukocytes of 53 people (50.5%). Meanwhile, the highest number of platelets was low platelets of 70 people (66.7%). And most dengue patients had a low hematocrit value of 60 people (57.1%). Conclusion: This study shows that the demographic distribution of dengue patients at RSUD Anutapura Palu in 2024 is most common among women (52.4%) and late adolescents (48.6%). Based on laboratory examinations, most patients had low leukocyte counts (50.5%), low platelet counts (66.7%), and low hematocrit values (57.1%).
Keywords: Dengue Hemorrhagic Fever; Leukocytes; Platelets; Hematocrit; Age; This is an open access article under the  CC-BY-SA license.	

INTRODUCTION

Dengue hemorrhagic fever (DHF) is a mosquito-borne disease caused by the dengue virus and transmitted primarily by *Aedes aegypti* and *Aedes albopictus* mosquitoes. The clinical manifestations of DHF include epistaxis, gingival and oral bleeding, persistent epigastric pain, and the appearance of petechiae or ecchymosis on the skin. The dengue virus is predominantly distributed in tropical and subtropical regions. In Indonesia, the tropical climate provides favorable conditions for the breeding of *Aedes* mosquitoes, thereby increasing the risk of dengue transmission.¹

Globally, dengue transmission reached unprecedented levels in 2024. According to the World Health Organization (WHO), a total of 14,434,584 dengue cases were reported worldwide, including 7,718,585 laboratory-confirmed cases, 52,738 severe cases, and 11,201 deaths across the six WHO regions. Transmission increased markedly between February and May and remained elevated in several regions throughout the final quarter of the year.²

In Indonesia, the Ministry of Health reported approximately 242,000 dengue cases in 2024.³ In Central Sulawesi Province, 2,474 cases were recorded⁴. In Palu City, 377 dengue cases were reported during the 2022-2024 period.⁵ Furthermore, Anutapura Regional General Hospital (RSUD Anutapura) in Palu recorded 187 hospitalized DFH cases in 2024.⁶

A complete blood count (CBC) is an essential laboratory investigation in patients with dengue hemorrhagic fever (DHF), including the assessment of leukocyte count, platelet count, and hematocrit level. These hematological parameters are clinically important because leukopenia, thrombocytopenia, and hemoconcentration are characteristic findings that correlate with the clinical severity of DHF.⁷

Leukocytes, or white blood cells, play a crucial role in the body's immune defense by producing antibodies and eliminating invading pathogens through phagocytosis. Alterations in leukocyte count serve as important indicators of infectious diseases, inflammatory conditions,

autoimmune disorders, and allergic reactions. In DHF, leukopenia primarily results from bone marrow suppression caused by dengue virus infection, either through direct viral effects or indirectly via the production of pro-inflammatory cytokines. This hematological abnormality is an important diagnostic indicator of DHF and can help differentiate it from other febrile illnesses, thereby contributing to earlier diagnosis and reducing disease-related morbidity and mortality.⁸

Platelets play a critical role in the hemostatic process, and thrombocytopenia is one of the principal factors contributing to spontaneous bleeding in patients with dengue hemorrhagic fever (DHF). However, hemorrhagic manifestations in DHF are not solely attributable to low platelet counts. The coagulation system also plays a significant role in the pathogenesis of bleeding, and the severity of hemorrhagic symptoms does not always correlate with the degree of thrombocytopenia. This suggests the involvement of additional mechanisms, including coagulopathy, vasculopathy, and platelet dysfunction (thrombocytopathy). In patients with DHF, multiple abnormalities affecting the coagulation cascade have been reported, including disseminated intravascular coagulation, increased capillary damage, and impaired platelet function.⁹

Hematocrit is an important indicator of vascular permeability in patients with DHF. An elevated hematocrit level reflects hemoconcentration, which is a key marker of plasma leakage and disease severity. Therefore, close monitoring of hematocrit levels is essential during the clinical course of DHF. Hematocrit values typically increase around the third day of illness as a result of plasma leakage into the extravascular compartment, which may subsequently lead to hypovolemic shock if not recognized and managed promptly.¹⁰

Based on the aforementioned considerations, this study aimed to describe the characteristics of leukocyte count, platelet count, and hematocrit levels among patients with dengue hemorrhagic fever hospitalized at Anutapura Regional General Hospital (RSUD Anutapura), Palu, in 2024.

MATERIAL AND METHOD

This study employed a quantitative descriptive design with a cross-sectional approach using secondary data obtained from medical records. The study population consisted of all patients diagnosed with dengue hemorrhagic fever (DHF) who were hospitalized at Anutapura Regional General Hospital (RSUD Anutapura), Palu, between January and December 2024. A total sampling technique was applied, yielding an initial sample of 187 patients.

The inclusion criteria were patients aged 17 years or older with a confirmed diagnosis of DHF and complete hematological examination results, including leukocyte count, platelet count, and hematocrit level. The exclusion criteria included patients with incomplete laboratory data and those diagnosed with other concurrent infectious diseases, such as tuberculosis, human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), and typhoid fever.

After applying the inclusion and exclusion criteria, 105 patients were eligible for analysis. Data were extracted from medical records and included demographic characteristics (sex and age) as well as hematological parameters (leukocyte count, platelet count, and hematocrit level). Data were analyzed using univariate statistical analysis to generate frequency distributions and percentages. Statistical analyses were performed using IBM SPSS Statistics version 30.0.

RESULTS

Table 1. Demographic Characteristics of Patients with Dengue Hemorrhagic Fever Hospitalized at Anutapura Regional General Hospital (RSUD Anutapura), Palu, 2024

Respondent Characteristics	Number of Patients (n)	Percentage (%)
Sex		
Male	50	47.6
Female	55	52.4

Age Group		
Late Adolescence (17-25 Years)	51	48.6
Early Adulthood (26-35 Years)	22	21.0
Late Adulthood (36-45 Years)	9	8.6
Early Older Adulthood (46-55 Years)	16	15.2
Late Older Adulthood (56-65 Years)	3	2.9
Elderly (>65 Years)	4	3.8
Total	105	100.0

Table 2. Distribution of Leukocyte Count Among Patients with Dengue Hemorrhagic Fever Hospitalized at Anutapura Regional General Hospital (RSUD Anutapura), Palu, 2024

Leukocyte Count	Number of Patients (n)	Percentage (%)
Low (<5.000 Cells/mm ³)	53	50.5
Normal (5.000-10.000 Cells/mm ³)	48	45.7
High (>10.000 Cells/mm ³)	4	3.8
Total	105	100.0

Table 3. Distribution of Platelet Count Among Patients with Dengue Hemorrhagic Fever Hospitalized at Anutapura Regional General Hospital (RSUD Anutapura), Palu, 2024

Platelet Count	Number of Patients (n)	Percentage (%)
Low (<150.000 Cells/ μ L)	70	66.7
Normal (150.000-450.000 Cells/ μ L)	35	33.3
High (>450.000 Cells/ μ L)	0	0.0
Total	105	100.0

Table 4. Distribution of Hematocrit Levels Among Patients with Dengue Hemorrhagic Fever Hospitalized at Anutapura Regional General Hospital (RSUD Anutapura), Palu, 2024

Hematocrit Level	Number of Patients (n)	Percentage (%)
Low (<40%)	60	57.1
Normal (40-54%)	40	38.1
High (>54%)	5	4.8
Total	105	100.0

DISCUSSION

Based on Table 1, the demographic characteristics showed that the majority of patients were female (52.4%). This finding is consistent with epidemiological reports from the World Health Organization (WHO) (2023-2024), which indicate that dengue hemorrhagic fever (DHF) generally does not exhibit substantial differences in incidence between males and females. The primary determinants of dengue infection are related to vector exposure, population density, and environmental conditions, rather than biological differences between the sexes.¹¹

Similarly, Kurniawan et al. (2022) reported a higher proportion of female patients (54.3%) than male patients among adults with DHF. This observation was attributed to daily activity patterns and domestic roles that may increase exposure to *Aedes aegypti* mosquitoes within the household environment.¹²

In contrast, Rahman et al. (2024) found a higher prevalence of DHF among males, which was associated with more frequent outdoor activities and increased exposure to mosquito bites.¹³

Furthermore, Lee et al. (2023) and the WHO (2024) reported that both males and females have a relatively similar risk of developing DHF, suggesting that the differences observed across studies are more likely attributable to environmental exposure and behavioral factors than to intrinsic biological sex differences.¹⁴

Based on the age distribution presented in Table 1, the majority of patients with dengue hemorrhagic fever (DHF) were in the late adolescence age group (17–25 years), accounting for 48.6% of the study population. This finding indicates that most patients belonged to the productive age group, which is consistent with the World Health Organization (WHO) (2023) report describing a shift in the epidemiology of dengue in several endemic countries. In recent years, dengue cases have become increasingly common among adolescents and young adults, rather than being predominantly confined to children.¹⁵

Similarly, Sari et al. (2022) reported that individuals aged 15–25 years represented the age group with the highest incidence of DHF in a regional referral hospital. This pattern was attributed to greater mobility, increased social activities, and more frequent interactions with outdoor environments, all of which increase exposure to *Aedes* mosquito vectors.¹⁶ Likewise, Nguyen et al. (2024) found that younger individuals experience higher levels of dengue exposure because of educational and occupational activities, particularly in densely populated urban settings.¹⁷

The age distribution observed in the present study suggests that DHF cases treated at Anutapura Regional General Hospital (RSUD Anutapura), Palu, in 2024 predominantly affected late adolescents and young adults. This

pattern is likely associated with increased mobility, population density, and the evolving epidemiology of dengue, which is no longer primarily limited to the pediatric population. Consequently, dengue prevention and health education programs should target not only school-aged children but also adolescents and other productive-age populations, whose higher levels of social interaction and mobility place them at greater risk of dengue infection.¹⁸

Based on Table 2, the distribution of leukocyte counts showed that the majority of patients had low leukocyte counts (50.5%). This finding is consistent with the study by Marpaung et al. (2024), which reported that 66.1% of patients with dengue hemorrhagic fever (DHF) presented with leukopenia. The reduction in leukocyte count among patients with DHF can be explained by the underlying pathophysiological mechanisms. Dengue virus infection and the host immune response may induce the destruction or suppression of white blood cells through the release of pro-inflammatory cytokines, particularly affecting neutrophils during the early phase of infection. In addition, leukopenia may reflect the redistribution of leukocytes into peripheral tissues as well as transient suppression of bone marrow activity.¹⁹

Similarly, Gupta et al. (2025) reported that leukopenia in dengue infection primarily results from bone marrow suppression caused by the dengue virus, leading to reduced production of white blood cells. Furthermore, leukocyte counts decline due to peripheral destruction mediated by the immune response, particularly through pro-inflammatory cytokines such as tumor necrosis factor-alpha (TNF- α) and interleukin-6 (IL-6), as well as sequestration of leukocytes within the reticuloendothelial system, especially the spleen. Because leukopenia is a common hematological manifestation of dengue infection, leukocyte count is considered an important laboratory parameter for the clinical monitoring and assessment of patients with DHF.²⁰

Based on Table 3, the distribution of platelet counts showed that the majority of patients had thrombocytopenia (66.7%). This finding is consistent with the study by Jenny et al. (2023), which reported that thrombocytopenia is a common hematological abnormality in patients

with dengue hemorrhagic fever (DHF) and may develop as a consequence of plasma leakage during dengue infection. The decline in platelet count is associated with both functional impairment and quantitative reduction of platelets, resulting from the formation of immune complexes as part of the host immune response to dengue viral antigens. This condition is further exacerbated by bone marrow suppression, increased peripheral platelet destruction, and a shortened platelet lifespan.²¹

Similarly, Gupta et al. (2025) reported that thrombocytopenia in dengue infection results from multiple pathophysiological mechanisms. These include impaired megakaryocyte production, immune-mediated platelet destruction through antiplatelet antibodies and complement activation, and platelet activation induced by dengue non-structural protein 1 (NS1) via Toll-like receptor 4 (TLR4), which promotes platelet aggregation and subsequent clearance from the circulation. In addition, inflammatory mediators and disseminated intravascular coagulation (DIC) contribute to increased platelet consumption, thereby further aggravating thrombocytopenia.²²

Based on Table 4, the distribution of hematocrit levels showed that the majority of patients had low hematocrit values (57.1%). This finding differs from that reported by Eifiariza et al. (2024), who found that most patients had hematocrit values within the normal range across all age groups. For example, among patients aged 12–18 years, 62.5% had normal hematocrit levels.²³ In contrast, Hossain et al. (2025) reported that 61% of patients had thrombocytopenia, and 79% of these patients also exhibited elevated hematocrit levels. Hemoconcentration in dengue results from plasma leakage caused by endothelial dysfunction triggered by dengue virus infection. An increase in hematocrit of $\geq 20\%$ above baseline is considered an important indicator of hemoconcentration and marks the critical phase of dengue, which may progress to hypovolemia, pleural effusion, ascites, and dengue shock if left untreated.²⁴

The predominance of low hematocrit levels observed in the present study may be explained by several factors. Consistent with the findings of Marpaung et al. (2024), many

patients may have presented to the hospital during the early phase of dengue infection, before plasma leakage had progressed sufficiently to produce significant hemoconcentration.²⁵

Furthermore, Anutapura Regional General Hospital (RSUD Anutapura) serves as an advanced referral healthcare facility, where many patients are likely to have received intravenous fluid therapy either at primary healthcare centers or during hospitalization before hematological evaluation. Fluid resuscitation can result in hemodilution, thereby lowering hematocrit values despite the presence of plasma leakage.²⁶

In patients with dengue hemorrhagic fever (DHF), hemodilution commonly occurs following intravenous fluid administration during clinical management. A decrease in hematocrit of more than 20% after fluid therapy may indicate that hemoconcentration had previously occurred as a consequence of plasma leakage. Additionally, pre-existing anemia or bleeding complications developing during the course of dengue infection may further contribute to reduced hematocrit levels, resulting in hematocrit values lower than those typically expected during the critical phase of the disease.²⁷

In addition, hematocrit measurements obtained at a single time point, without comparison to the patient's baseline hematocrit value, may fail to detect the relative increase that indicates hemoconcentration. Likewise, blood samples collected outside the critical phase of dengue infection may not accurately reflect the plasma leakage process. Consequently, the predominance of low hematocrit level observed in this study should not be interpreted as evidence against the presence of plasma leakage. Rather, hematocrit values are likely influenced by the stage of disease, the effects of fluid therapy, and the clinical characteristics of the study population.²⁸

CONCLUSION AND RECOMMENDATION

This study found that among patients with dengue hemorrhagic fever (DHF) hospitalized at Anutapura Regional General Hospital (RSUD Anutapura), Palu, between January and

December 2024, the majority were female (n = 55), with most patients belonging to the late adolescence age group (17–25 years; n = 51). Hematological examination revealed that 53 patients had leukopenia, 70 had thrombocytopenia, and 60 had low hematocrit levels.

These findings demonstrate that patients with DHF commonly experience hematological abnormalities characterized by decreased leukocyte counts, decreased platelet counts, and altered hematocrit levels. Accordingly, strengthening integrated dengue education programs and ensuring continuous monitoring of dengue warning signs are essential to support early diagnosis and timely clinical management. Future research should employ multivariate analytical methods to identify the independent factors associated with changes in leukocyte count, platelet count, and hematocrit levels in patients with DHF.

AUTHOR CONTRIBUTIONS

Conceptualization, V.T.P., S., A.I.M.; Methodology, V.T.P.; Validation, S., A.I.M.; Formal Analysis, V.T.P.; Investigation, V.T.P., Resources, V.T.P.; Data Curation, V.T.P.; Writing-Original Draft Preparation, V.T.P., S. and A.I.M.; Visualization, V.T.P. All authors have read and agreed to the published version of the manuscript.

CONFLICTS OF INTEREST

The Author declares no Conflicts of Interest

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