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Correlation between Hematocrit and Platelet Counts in Dengue Hemorrhagic Fever Patients: A Study at Emanuel Hospital, Banjarnegara

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Abstract

Background: Dengue Hemorrhagic Fever (DHF) is an infectious disease caused by the dengue virus and transmitted by Aedes aegypti mosquitoes. Without prompt management, DHF can lead to severe complications and death. The World Health Organization (WHO) identifies thrombocytopenia and increased hematocrit as key diagnostic parameters for DHF. *Objectives:* This study aimed to assess the correlation between hematocrit levels and platelet counts in patients with Dengue Hemorrhagic Fever at Emanuel Hospital, Banjarnegara. *Materials and Methods:* This cross-sectional study used secondary data from the hospital's Electronic Medical Records (EMR) and Laboratory Information System (LIS). Statistical analysis was performed using Pearson's correlation test. *Results:* The analysis showed a significant negative correlation between hematocrit and platelet counts in DHF patients ($r = -0.760$, $p < 0.001$). *Conclusions:* The findings indicate that an increase in hematocrit is associated with a decrease in platelet counts, emphasizing the importance of simultaneous monitoring of both parameters in the clinical management of DHF. This study contributes to local epidemiological data and underscores the potential of these laboratory indicators as practical tools for assessing disease severity.

Keywords: *Banjarnegara, Correlation, Dengue Hemorrhagic Fever, Hematocrit, Platelet Count*

1. Introduction

Dengue Hemorrhagic Fever (DHF) is an infectious disease caused by the dengue virus and transmitted by *Aedes aegypti* mosquitoes. Clinical manifestations include high fever lasting 2–7 days, bleeding tendencies, thrombocytopenia, increased hematocrit, hepatomegaly, and in severe cases, shock (Noor et al., 2021). According to the World Health Organization (WHO), the main diagnostic criteria for DHF are thrombocytopenia (≤100,000/μL) and plasma leakage indicated by a ≥20% increase in hematocrit compared with convalescent levels (Lailla & Fitri, 2021; Maulin & Irma, 2023) Hematocrit levels reflect plasma leakage and hemoconcentration, which indicate disease severity and the risk of shock (Fachraeni & Dwi, 2025).

However, a decrease in hematocrit of more than 20% after fluid therapy can also serve as a marker

of clinical improvement (Mariana, 2022). In contrast, platelet counts play a critical role in assessing bleeding risk and monitoring disease progression. Previous studies have shown that platelet counts in DHF patients often fall below 50,000/µL, particularly during the critical phase (6,7). Severe thrombocytopenia is associated with an increased risk of bleeding and progression to Dengue Shock Syndrome (DSS)(Rianti & Metasari, 2023), which reported that in shock cases, platelet counts declined to ≤50,000/µL. It is important to note that bleeding tends to occur more frequently in individuals with severe thrombocytopenia, where platelet levels are critically low. In DHF patients, platelet transfusion is required when bleeding occurs or in situations where prophylactic transfusion is indicated, particularly if platelet counts fall below 20,000/µL. A decrease in platelet count is considered one of the major risk factors contributing to the development of Dengue Shock Syndrome (DSS) (Lestari et al., 2018). espite numerous studies examining hematocrit and platelet parameters separately, limited research has analyzed their correlation in local settings such as Banjarnegara, an endemic area for DHF. Understanding the relationship between these parameters may enhance diagnostic accuracy and support timely clinical intervention. Therefore, this study aimed to analyze the correlation between hematocrit levels and platelet counts in patients with Dengue Hemorrhagic Fever at Emanuel Hospital, Banjarnegara.

2. Materials and Methods

2.1. Study Design

This study used an observational analytic design with a cross-sectional approach to examine the correlation between hematocrit levels and platelet counts in patients diagnosed with Dengue Hemorrhagic Fever (DHF) at Emanuel Hospital, Banjarnegara. Secondary data were obtained from the hospital's Electronic Medical Records (EMR) and Laboratory Information System (LIS).

The study population consisted of all patients diagnosed with DHF during the period from January to December 2024. A total of 128 patients were initially identified. After excluding cases with incomplete medical records and patients with comorbidities that could affect hematological parameters (e.g., leukemia, aplastic anemia, or other hematologic disorders verified through medical records review by the clinical team), 111 patients met the inclusion criteria and were included in the final analysis.

The inclusion criteria were patients diagnosed with DHF confirmed by a positive dengue IgG/IgM test and who underwent hematocrit and platelet count examinations. The total

sampling technique was used because the number of eligible cases within the study period was relatively limited, and all available data met the inclusion criteria.

Data analysis was conducted using SPSS version 25 (IBM Corp., Armonk, NY, USA). Normality was assessed using the Shapiro–Wilk test. Pearson's correlation test was applied to normally distributed data, while Spearman's rank correlation test was used for non-normally distributed data. A p-value of < 0.05 was considered statistically significant.

3. Results and Discussion

3.1. Characteristics of Respondents

Table 1. Respondents' Characteristics by Age

Age	Frequency (n)	Percentatage (%)
26-35 (Adult)	60	54.1
36-45 (Late Adult)	51	45.9
Amount	111	100.0

Table 1 shows that most DHF patients were in the early adulthood age group (26–35 years), comprising 60 patients (54.1%). This finding aligns with previous studies reporting that dengue cases are more common among individuals of productive age (Asmarani, 2021), people in this age group tend to have higher mobility and greater exposure to mosquito vectors due to outdoor activities, which increases their risk of dengue transmission (Charisma et al., 2020).

Table 2. Respondents' Characteristics by Gender

Gender	Frequency (n)	Percentage (%)
Male	52	46.8
Female	59	53.2
Total	111	100.0

Table 2 indicates that the majority of patients were female (59 patients, 53.2%), while male patients accounted for 52 (46.8%). This finding is consistent with a previous study showing that the risk of DHF infection is relatively similar across genders, though slightly higher among females. Differences in exposure behavior and hormonal or immunological factors may influence this pattern.

3.2. Univariate Analysis

Table 3. Distribution of Hematocrit Values

Hematocrit Values	Frequency (n)	Percentagege (%)
Low	12	10,8
Normal	73	65,8
High	26	23,4
Amount	111	100,0

Table 3 shows that the majority of samples in this study had normal hematocrit levels, totaling 73 samples (65.8%). In addition, increased hematocrit levels were found in 26 samples (23.4%), while 12 samples (10.8%) had low hematocrit levels. Hematocrit levels in patients with Dengue Hemorrhagic Fever (DHF) may vary depending on the clinical phase of the disease. During the febrile phase, hematocrit levels are generally within the normal range or may show a slight increase due to high fever, vomiting, and loss of appetite. Plasma leakage typically occurs during the critical phase, which is characterized by a decrease in body temperature accompanied by an increase in hematocrit levels. This plasma leakage most commonly develops between the third and seventh day of illness, corresponding to the critical phase of DHF (Rasyada et al., 2015).

The increase in hematocrit values among DHF patients is primarily caused by hemoconcentration, which occurs as a result of plasma leakage. When plasma leakage is significant, the volume of plasma decreases while the number of red blood cells remains relatively constant, leading to an increase in the proportion of red blood cells (hematocrit) in circulation (Tansil et al., 2021) . Conversely, hematocrit values may decrease (hemodilution) due to a reduction in blood cellular components or an increase in plasma volume. According to WHO criteria, a decline in hematocrit following fluid replacement is also considered a diagnostic indicator. Therefore, the majority of patients in this study presented with normal or even reduced hematocrit levels, which is consistent with a confirmed diagnosis of DHF.

Several studies have shown that not all dengue patients experience hemoconcentration or an increase in hematocrit values during the initial examination. Most patients actually present with hematocrit levels that remain within the normal range at the first check-up. A rise in hematocrit ≥20% from the baseline is generally observed starting on the third day of fever, which coincides with the critical phase characterized by plasma leakage (Supenah et al., 2021). This explains why the

majority of samples in this study had normal hematocrit levels, while only a portion demonstrated an increase.

Table 4. Platelet Count Distribution

Platelet Count	Frequency (n)	Percentatage (%)
Low	96	86,5
Normal	15	13,5
Total	111	100,0

Table 4 shows that most patients had platelet counts below the normal range (96; 86.5%). Thrombocytopenia is a hallmark feature of DHF, resulting from increased platelet destruction, decreased production, and immune-mediated aggregation (Mayasari et al., 2019). In this study, several patients still had normal platelet counts. This condition may be due to platelet changes that usually appear a few days after the fever subsides, which is known as the shock phase. These changes may also be influenced by an increase in young megakaryocytes between days 5 and 8 of the disease course, when platelet counts begin to return to normal levels (Az-zahra et al., 2022).

Thrombocytopenia in dengue cases occurs as a result of platelet aggregation. This aggregation is triggered by the attachment of antigen–antibody complexes to the platelet membrane, which subsequently induces the release of adenosine diphosphate (ADP). The release of ADP causes platelets to adhere to one another, leading to their destruction by the reticuloendothelial system (RES), ultimately resulting in thrombocytopenia (Yusa, 2023).

Several studies have stated that there are other factors contributing to the decrease in platelet count in dengue cases, namely improper blood sampling procedures (Amala, 2019). Collecting blood from a site of a previous puncture wound may cause platelet aggregation, resulting in a reduced platelet count or pseudothrombocytopenia. Furthermore, delays in mixing blood with anticoagulants, inadequate mixing, or inappropriate ratios between blood volume and anticoagulant may affect platelet examination results, leading to variations in platelet counts across samples. However, due to the lack of data regarding patients' medication history as well as details on blood collection and anticoagulant mixing procedures in this study, these factors cannot be confirmed as the cause of thrombocytopenia.

3.3. Bivariate Analysis

Table 5. *Correlation Analysis between Hematocrit Levels and Platelet Counts*

Variable	n	*Kolmogorov - smirnof*	*Pearson*	*Correlation*
Hematocrit Value	111	0.200	0,00	-0,760

Table 5 presents the results of Pearson's correlation analysis between hematocrit levels and platelet counts. The analysis revealed a strong, negative, and statistically significant correlation ($r = -0.760$; $p < 0.001$). This indicates that higher hematocrit levels are associated with lower platelet counts, and vice versa, suggesting that both parameters change inversely during the course of DHF. This finding supports the concept that hemoconcentration and thrombocytopenia occur concurrently as part of the pathophysiological response to dengue virus infection (Bahar et al., 2023), Thrombocytopenia arises from platelet destruction and aggregation triggered by antigen–antibody complex formation and complement activation, while increased hematocrit levels reflect plasma leakage due to endothelial dysfunction (Sutriyawan & Kencana, 2021). Together, these alterations contribute to intravascular volume loss and circulatory failure, emphasizing the importance of simultaneous hematological monitoring for early detection of severe DHF.

4. Conclusions

This study identified a strong negative correlation between hematocrit and platelet counts in patients with Dengue Hemorrhagic Fever, suggesting that concurrent changes in these parameters may serve as reliable indicators of disease severity. The findings emphasize the clinical relevance of simultaneous hematocrit and platelet monitoring in supporting timely diagnosis and management of DHF. However, this study was limited by its cross-sectional design and reliance on secondary data, which may not capture dynamic clinical variations. Future studies involving longitudinal designs and larger sample sizes are recommended to further validate these findings and explore their prognostic implications.

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Author Contributions: YP : Conceptualize and implement research and data analysis. IP and YEN: Evaluate and review research until it becomes a draft manuscript.

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