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RESEARCH ARTICLE

Correlation Between Platelet Count and Hematocrit Value in Hospitalized Patients with Dengue Hemorrhagic Fever at RSUD Dokter Pirngadi Medan, 2022-2023

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ABSTRACT

Background : *Dengue Hemorrhagic Fever (DHF) is an infectious disease caused by the dengue virus transmitted through the bite of the Aedes aegypti mosquito. This disease remains a global health issue, including in Indonesia. One of the main complications of DHF is thrombocytopenia and hemoconcentration, which can lead to serious conditions such as hypovolemic shock.* ***Objective:*** *The objective of this study is to determine the correlation between platelet count and hematocrit levels in DHF patients at Dr. Pirngadi General Hospital, Medan City, in 2022-2023.* ***Research Method:*** *This research is observational with a cross-sectional design. The sampling technique used is purposive sampling. The data used in this study are secondary data obtained from medical records, involving the collection of information from existing patient medical records at Dr. Pirngadi General Hospital, Medan. Data presentation includes univariate and bivariate analysis using the Spearman correlation test.* ***Results:*** *The results of this study, with a total of 280 samples, show a significant negative correlation between platelet count and hematocrit levels in DHF patients, both in males (rs calculated (0.619) > rs table (0.350); 0.05) and females (rs calculated (0.296) > rs table (0.169); 0.05).* ***Conclusion****: There is a significant negative correlation between platelet count and hematocrit levels in DHF patients hospitalized at Dr. Pirngadi General Hospital, Medan City.*

Keywords: DHF, Platelet, Hematocrit.

INTRODUCTION

Dengue fever is caused by the dengue virus (DENV), transmitted to humans by the *Aedes aegypti* mosquito. This viral disease has spread extensively worldwide, particularly in tropical and subtropical regions, imposing a significant public health burden.1 Dengue Hemorrhagic Fever (DHF) remains a major global infectious disease challenge. The World Health Organization (WHO) estimated that over 2.8 million DHF cases occurred globally in 2022. Of the total cases reported through July 1, 2023 (2,997,097 cases), 45% were laboratory-confirmed, and 0.13% were classified as severe dengue. As of 2023, the highest case counts have been reported in Brazil, Peru, and Bolivia, with 1,302 deaths recorded in these regions and a Case Fatality Rate (CFR) of 0.04% attributed to Dengue Shock Syndrome (DSS).2

In Asia, the highest DHF cases were reported in Bangladesh (101,000 cases), Malaysia (131,000 cases), the Philippines (420,000 cases), and Vietnam (320,000 cases).3 By the end of 2022, DHF cases in Indonesia reached 143,000, with the highest incidence occurring in the provinces of West Java, East Java, and Central Java.4

Under the Indonesian Strategic Plan 2015–2019, the target Incidence Rate (IR) of DHF (< 49 per 100,000 population) was not met by 23 out of 38 provinces, including North Sumatra. In 2019, the IR for North Sumatra was 60.6 per 100,000 population, with 7,731 cases and 38 deaths (CFR = 0.49%). According to data from the Ministry of Health of the Republic of Indonesia, the five provinces with the highest DHF incidence in 2017 were East Java, West Java, Central Java, North Sumatra (5,058 cases, IR 51.17 per 100,000 population), and Bali.4 Medan is a DHF-endemic area in North Sumatra, reporting 1,068 cases recently. The IR in Medan fluctuated between 2015 and 2018: 61 per 100,000 in 2015, increasing to 80 in 2016, dropping to 56 in 2017, and rising again to 66 in 2018.5 Data from the Medan City Health Office showed 441 cases and 3 deaths in 2020, which increased to 648 cases and 2 deaths in 2021.6

In the nearly century-long history of DHF pathogenesis research, two primary theories have emerged. First, the viral virulence theory posits that DENV infection leads to disease if the viral load and virulence are sufficient to overcome the host's defenses. Second, the immunopathology theory suggests that immunological processes in the infected individual lead to plasma leakage, hemorrhage, and other clinical manifestations. Both theories explain how high mortality rates in DHF are closely linked to hemorrhagic manifestations triggered by thrombocytopenia and hemoconcentration. In DHF patients, thrombocytopenia occurs due to antibodies reacting against platelets via antigen-antibody complexes, disrupting blood coagulation. Hemoconcentration is caused by increased vascular permeability, which can lead to hypovolemic shock. Ultimately, thrombocytopenia and hemoconcentration may culminate in Disseminated Intravascular Coagulation (DIC).7

Previous research by Syuhada (2021) concluded that as platelet counts decrease, hematocrit levels tend to rise, indicating a negative correlation between these two variables.8 Conversely, a study by Andrew et al. (2012) showed no significant relationship between platelet count and hematocrit levels in DHF patients.9 Meanwhile, established pathophysiology suggests that hemoconcentration occurs as a consequence of the processes surrounding thrombocytopenia.10 Due to these conflicting findings, this study aims to investigate the correlation between platelet count and hematocrit values in DHF patients at RSUD Dr. Pirngadi Medan.

MATERIALS AND METHODS

Study Design This study is an observational analytical research utilizing a cross-sectional design. In this approach, observations and measurements of variables were conducted at a single point in time. The objective of this study is to analyze the correlation between platelet counts and hematocrit values among

hospitalized DHF patients at RSUD Dr. Pirngadi Medan from 2022 to 2023.

Sampling Technique The samples were selected using a purposive sampling technique, which involves selecting subjects based on predefined characteristics. The use of purposive sampling was determined by specific considerations established by the researcher, aligned with the known traits or properties of the population. This technique is highly suitable for case studies where numerous aspects of representative cases are observed and analyzed.

Participants and Criteria The study population included all patients diagnosed with DHF who possessed complete medical record data. The inclusion criteria were focused on patients with a confirmed DHF diagnosis and accessible laboratory results. Conversely, the exclusion criteria for this research involved DHF patients with comorbidities, such as diabetes, hypertension, or heart disease.

Data Analysis A total of 280 samples were successfully collected and processed. Data analysis was performed using SPSS (Statistical Product and Service Solution) software. The data were evaluated through univariate analysis to describe respondent characteristics and bivariate analysis to determine the correlation between the primary variables.

RESULTS

Table 1. Frequency Distribution Based on Gender

Gender	Frequency (n)	Percentage (%)
Female	98	35%
Male	182	65%
Total	280	100%

Description for Table 1 (Narasi Tabel 1)

Table 1 shows that the frequency distribution of patients based on gender is predominantly male, with 182 patients (65%), while female patients account for 98 individuals (35%).

Table 2. Frequency Distribution of Platelet Counts

Platelet Count (×103/µL)	Frequency (n)	Percentage (%)
≤ 100	267	95%
> 100	13	5%
Total	280	100%

Table 2 shows that the frequency distribution of patients based on platelet count is predominantly those with a platelet count ≤100×103/µL, totaling 267 patients (95%), while those with a platelet count >100×103/µL account for 13 patients (5%).

Table 3. Frequency Distribution of Hematocrit Values

Hematocrit Value	**Frequency (n)**	**Percentage (%)**
≥ 20%	269	96%
< 20%	11	4%
Total	280	**100%**

Table 3 shows that the frequency distribution of patients based on the increase in hematocrit values is predominantly those with a hematocrit increase of ≥20%, totaling 269 patients (96%), while those with a hematocrit increase of <20% account for 11 patients (4%).

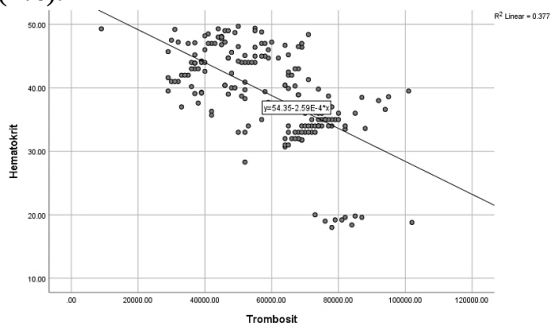

Figure 1. Scatter Plot of Platelet Counts and Hematocrit Values among Male DHF Inpatients at RSUD Dr. Pirngadi Medan

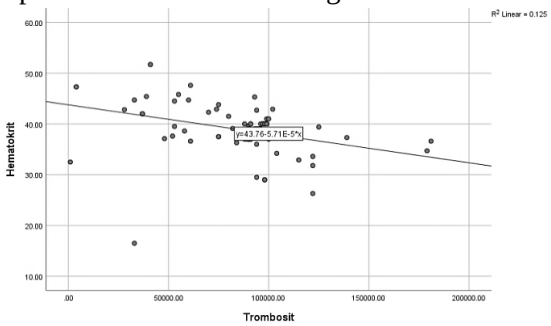

Figure 2. Scatter Plot of Platelet Counts and Hematocrit Values among Female DHF Inpatients at RSUD Dr. Pirngadi Medan

STATISTICAL ANALYSIS RESULTS

Based on the scatter plots, the data exhibited an uneven distribution pattern with significant outliers. Normality testing was conducted using the Kolmogorov-Smirnov and Shapiro-

Wilk tests to determine the distribution of platelet counts and hematocrit values. The results indicated a significance value (p-value) of <0.05 for both male and female groups. Since the data were not normally distributed, a non-parametric correlation test, the Spearman Rank Correlation, was utilized.

The Spearman correlation was performed to evaluate the relationship between the two variables. For male patients, the results showed rs count (−0.619)>rs table (0.350); p<0.05. For female patients, the results showed rs count (−0.296)>rs table (0.169); p<0.05. These findings indicate a strong negative correlation in males and a moderate negative correlation in females, both being statistically significant (p<0.05).

DISCUSSION

From the sample size calculation, 280 DHF patients met the inclusion criteria. The distribution comprised 182 males (65%) and 98 females (35%). This higher frequency in males may be influenced by physiological differences; males generally have higher hematocrit values due to larger erythrocyte volumes. Genetic factors also play a role, specifically polymorphisms in the erythropoietin receptor (EPOR) gene, which are more frequently found in females and affect erythropoiesis levels differently between genders.12

Furthermore, biological factors might influence infection frequency. Research suggests that the female immune system is often more responsive to viral infections, including the dengue virus. Estrogen may exert a protective effect, potentially reducing the likelihood of females developing severe disease or requiring hospitalization despite exposure.13

In this study, nearly all patients experienced thrombocytopenia and hemoconcentration. Platelet counts were predominantly ≤100×103/μL (95%), while 96% of patients showed a hematocrit increase of ≥20%. The negative correlation found (p<0.05) implies that as platelet counts decrease, hematocrit levels significantly increase.

This study aligns with research by Arifa (2014), which found a significant negative correlation (p=0.014), although with weak strength (r=0.222), likely due to a smaller sample size and single-point measurements.14 Conversely, Rasyada (2014) found no significant correlation (p>0.05), possibly because their sample had more patients with normal hematocrit levels or due to timing differences in blood sampling (day 1 or 2 of admission).15

Hematocrit levels typically rise around the third day of fever, signaling plasma leakage into the extravascular space through damaged capillaries. This leads to a decrease in plasma volume, potentially resulting in hypovolemic shock. Meanwhile, the cause of thrombocytopenia in DHF remains debated. Proposed mechanisms include suppressed thrombopoiesis and increased peripheral destruction. Immune complexes on the platelet surface may trigger aggregation, leading to destruction by the reticuloendothelial system in the spleen and liver.11

CONCLUSION

Based on the research findings regarding the correlation between platelet counts and hematocrit values in hospitalized DHF patients at RSUD Dr. Pirngadi Medan (2022-2023), it can be concluded that:

1. Sample Size: A total of 280 DHF patients met the inclusion criteria for this study.
2. Gender Distribution: DHF inpatients were predominantly male (65%) compared to female (35%).
3. Platelet Count: The vast majority of patients (95%) presented with a platelet count ≤100×103/μL, indicating that thrombocytopenia is a common clinical manifestation in DHF.
4. Hematocrit Value: The majority of patients (96%) experienced a hematocrit increase of ≥20%, reflecting significant hemoconcentration.
5. Correlation Analysis: The Spearman correlation test demonstrated a significant negative correlation between platelet counts and hematocrit values in both male and female patients. Since the rs count was greater than the rs table value ($p<0.05$), it is concluded that a lower platelet count is associated with a higher hematocrit value.

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