RELATIONSHIP BETWEEN INCREASED HEMATOCRIT LEVELS AND LOWEST PLATELET COUNTS WITH OUTCOMES OF DENGUE FEVER PATIENTS IN CHILDREN

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ABSTRACT

Aedes aegypti mosquitoes carry a virus that causes Dengue Hemorrhagic Fever (DHF), a disease that continues to be a major health concern in Indonesia, particularly for children. Because variations in hematocrit and platelet counts might reveal the severity of the illness, these tests are crucial for both diagnosing and tracking the progression of DHF. The purpose of this study is to create a picture of the patient demographics and to comprehend the association between hematocrit and platelet parameters and the clinical outcomes of juvenile DHF patients. Objective to determine whether there is a relationship between increased hematocrit levels and the lowest platelet count with the outcome of dengue fever patients in children at Ciracas Regional Hospital. This research was conducted through a quantitative descriptive model with a retrospective approach. Data collection was carried out through medical records of pediatric patients with DHF at Ciracas Regional Hospital in 2022-2024, including demographic data, hematocrit, platelet examination results, and patient outcomes. Data analysis through Univariate and Bivariate analysis with the C-Square test. From this research, it can be seen that the majority of patients experienced a decrease in platelets <50,000 and an increase in hematocrit values ≤20%. A significant correlation was found between low platelet levels and an increase of ≤20% in hematocrit levels with patient clinical outcomes with a p value = 0.000. An decreased in plateleft levels and an increased in hematocrited ≤20% are important indicators in determining the clinical outcomes of DHF in children. Patients can recover even with a decrease in platelet levels <50,000, allegedly due to good and appropriate medical intervention, and the low level of increase in hematocrit levels contributes to the patient's clinical outcomes.

Keywords: clinical outcome; dengue hemorrhagic fever (DHF); hematocrit; pediatrics; platelets

INTRODUCTION

Tropical and subtropical areas are often the location of Dengue Hemorrhagic Fever (DHF). According to global data, Asia has the highest number of annual DHF patients. Indonesia has the highest number of DHF patients in Southeast Asia, according to the World Health Organization (WHO). By the end of 2022, there were 143,000 cases of DHF in Indonesia, with the provinces of West Java, East Java, and Central Java having the highest number of DHF cases. Because many people die due to late treatment, the disease progresses very quickly and often results in death (Dianisya et al., 2020; Kemenkes, 2017; Reis et al., 2019). Dengue virus is the cause of an acute infectious disease known as dengue hemorrhagic fever. Female mosquitoes Aedes aegypti, the primary vector, and Aedes albopictus, a co-vector, bite people to spread the virus. It is often characterized by fever lasting two to seven days, accompanied by thrombocytopenia, bleeding, and hemoconcentration with plasma leakage (elevated hematocrit, ascites, pleural effusion, and hypoalbuminemia). It may be accompanied

by vague symptoms including rash, headache, retrobulbar pain, or muscle and bone pain (Octaviani & Kusuma, 2022; Wahyuni & Rubaya, 2024).

The main pathophysiology of dengue fever is abnormal hemostasis and increased permeability of blood vessels. Increased blood vessel permeability can cause plasma leakage, hypovolemia, and shock. It takes 4-6 days for the incubation period (intrinsic incubation period) for the virus before disease occurs in the human body. Transmission can occur if a human is bitten by a mosquito that is experiencing viremia, namely 2 days before fever to 5 days after fever occurs. Then the virus in the salivary glands multiplies for 8-10 days (extrinsic incubation period) before being transmitted back to humans during the next bite. The dengue virus can enter the mosquito's body, grow there, and spread throughout its life (infective). Dengue Hemorrhagic Fever (DHF) develops in three stages: the febrile phase, which lasts for two to seven days;critical phase, which lasts for twenty-four to forty-eight hours; and the healing phase, which lasts for two to seven days (Kristina & Wulandari, 2004; Rasyada et al., 2014). Economic growth is one of the factors that influences the spread of dengue fever. Family income to meet basic needs is the economy as a whole (Dr. Subhan Purwadinata, SE, 2020). The spread of dengue fever is still a public health problem because it is influenced by several factors, one of which is socio-economic status. A person with a low income tends to have inadequate sanitation facilities and has an impact on increasing the risk of spreading disease, especially dengue fever. Conversely, a person with a high income tends to have adequate sanitation facilities, thereby reducing the risk of contracting environmentally-based infectious diseases, especially dengue fever (Sunarya, 2019; TIRTADEVI et al., 2021). The incidence of DHF in children also has a relationship between hematocrit levels and platelet counts. In DHF patients, children can experience a risk of decreasing platelet levels to severe thrombocytopenia which is 3 times greater than in non-DHF patients. Meanwhile, the hematocrit levels of DHF patients in children are at risk of increasing by > 20%, reaching 4 times greater than non-DHF patients in children (Zulaikha et al., 2020).

In principle, until now there has been no cure found to treat dengue fever. Patients are only given intensive care to control their symptoms so that the patient's condition can recover. Treatment for DHF patients is usually done by hospitalization in the hospital, because during the critical period the patient needs a lot of fluid supply. Dengue fever patients are allowed to go home from the hospital if they meet the discharge criteria, namely the patient has no fever for 24 hours without giving antipyretics, clinical progress (appetite improves), hematocrit has not increased, platelets> 50,000 / μL, and respiratory distress is no longer found. After the patient is allowed to go home, the patient is required to return to the hospital for a re-check based on the schedule recommended by the doctor (Rohmah, 2018).Although very low platelet counts (<50,000/μL) are often a concern in dengue hemorrhagic fever (DF) in children, many patients recover with appropriate management. Significant platelet decline occurs because dengue virus infection affects platelet production and destruction, but not all patients with low platelets experience severe complications. Important factors that affect recovery are the body's ability to overcome the infection, careful medical supervision, and appropriate care, such as optimal rehydration and close monitoring for signs of bleeding. Good medical support and early intervention allow many patients to recover fully even with very low platelet counts (Cakranegara, 2021)Based on the paragraph above, the author conducted research with the intention of seeing whether there is a relationship between increased hematocrit levels and the lowest platelet count with the outcome of dengue fever sufferers in children at the Ciracas Regional General Hospital, East Jakarta.

METHOD
Research Design
Using medical record data from January 2022 to March 2024, this study used a cross-sectional approach and a retrospective correlational design to examine the association between outcomes of children with Dengue Hemorrhagic Fever and the lowest platelet count and high hematocrit levels

Research Location and Time
This research was conducted in June 2024 – August 2024, at the Ciracas Regional General Hospital, East Jakarta. The population of this research was pediatric patients with dengue fever at Ciracas Regional Hospital which occurred from January 2022 to March 2024. Meanwhile, the sample in this study was taken using a total sampling technique of 150 patient data that met the inclusion and exclusion criteria.Inclusion Criteria are: 1) Complete medical records with complete hematology examination, 2) Pediatric patients up to 18 years of age diagnosed with dengue fever and 3) Pediatric patients diagnosed with dengue fever who were hospitalized in the regular ward at Ciracas Regional Hospital from January 2022 to March 2024. Exclusion Criteria are Children with DHF who have other diseases that cause thrombocytopenia and increased hematocrit levels. There are two research variables: 1) Hematocrit and Platelets, as Independent variables; and 2) Dengue Fever Patient Outcomes, as Dependent variables. Data Analysis Method with the univariate analysis (describes each variable by describing the frequency distribution of samples based on age and gender of patients, clinical outcomes of DHF patients, platelet counts, and hematocrit levels, taken from the medical records of Ciracas Hospital and provided in the form of tables and narratives; and then the bivariate analysis (to determine how close the relationship is between variables, a comparative analysis using the Chi-square test is conducted to analyze data on platelet counts and hematocrit levels with clinical outcomes of DHF patients in children at Ciracas Hospital)

RESULT
Distribution of Respondents' Demographic Characteristics

Table 1.
Demographic data of pediatric dengue fever patients

Categories	f	%
Gender		
Male	79	53
Female	71	47
Age		
<5 year	27	18
5-9 year	41	27
10-18 year	82	55
Income of Family		
< RMW	103	69

There were 150 pediatric DHF patients at Ciracas Regional Hospital in 2022-2023 with more than half of them being male patients (53%) while 71 people (47%) were female patients. Of all pediatric DHF patients at Ciracas Regional Hospital in 2022-2023, the majority (55%) were aged 10-18 years, 41 people (27%) were aged 5-9 years, and 27 patients (18%) were under five years old. In terms of family income, more than half had incomes below the minimum wage, namely 103 patients (69%), while above the minimum wage were 47 patients (31%).

Table 2.
The relationship between the lowest platelet count and the outcome of pediatric DHF patients

| Platelets | Output | | % | P Value |
	Healed	Not Healed		
< 50.000	78	0	52	0.000
≥ 50.000	72	0	48	
Total	150	0	100	

Based on Table 2. All pediatric DHF patients in 2022-2023 were found to have recovered, with 72 patients with the lowest platelet count during treatment being more than 50,000/dL and 78 patients with the lowest platelet count being less than 50,000/dL.

Table 3.
The relationship between increasing hematocrit levels and outcomes of pediatric DHF patients

| Hematocrit | Output | | % | P Value |
	Healed	Not Healed		
≤ 20 %	116	0	77.3	0.000
> 20 %	34	0	22.7	
Total	150	0	100	

Based on table 3. pediatric DHF patients at Ciracas Regional Hospital and it was found that all patients recovered with 34 patients having an increase in hematocrit levels of more than 20% and 116 patients with an increase in hematocrit levels of less than 20%.

DISCUSSION

Based on the demographic characteristics of gender and age of 150 patients with DHF at RSUD Ciracas, it was found that the number of male patients exceeded the number of female patients. This finding is also in line with research conducted by Handayani et al and Sihombing et al which reported that the majority were dominated by the male gender (Made et al., 2022; Sihombing et al., 2023). The prevalence that exceeds the male gender is likely to be associated with the lifestyle of male individuals and their increased exposure to the environment in society (Zohra et al., 2024). In addition, in general, the immune system in women is stronger against infectious agents than men. This is caused by biological and hormonal factors. They show increased activity of immune cells such as macrophages, dendritic cells, and T cells, with higher cytokine production, stronger inflammatory responses, and stronger antibody formation. Hormones such as estrogen play important role by increasing immune cell activity, encouraging pro-inflammatory TH1 responses, and increasing antibody production, while testosterone in men tends to weaken the immune response (Jacobsen & Klein, 2021). Based on age, this research is in line with research conducted by Rahmasari and research by Mayasari which reported that the incidence of DHF was most often found in children and adolescents (Mayasari et al., 2019; Tule et al., 2020). The reason is because during this age period, the activities of children and adolescents are mostly carried out outside the home and this can increase the risk of vector bites and being infected with the dengue virus (Vebriani et al., 2016).

Based on family income data, it was found that the majority had incomes below the minimum wage. Based on research by Cahyo, family income plays a role in being one of the risk factors for dengue fever in children with a 3.93-fold risk for their children to experience dengue fever compared to parents with good incomes. This is because poor income can cause limitations in meeting family health needs. Parents with low incomes tend to only respond to health problems if they have already developed a disease. In addition, the quality of the house as a place to live greatly affects health. Houses that do not meet health standards, such as poor ventilation, inadequate clean water, and lack of environmental cleanliness, can increase the risk of transmitting diseases such as dengue fever (Bestari et al., 2020; Wahyu Nur Cahyo,

2016). In the research results on the relationship between platelet and hematocrit levels with the outcome of patients infected with dengue fever, all patients were declared cured (100%). The majority of the data on pediatric dengue fever patients had the lowest platelet count <50,000/μL but fully recovered with a p-value of 0.000, this shows a statistically strong relationship between the lowest platelet count and patient outcomes. However, because all patients were declared cured, there was no variability in the clinical outcome results.

Low platelet counts (<50,000) in this studyall had a cured outcome. However, it may reflect that Indonesian Christian University patients with lower platelets require more attention to ensure recovery. Previous studies by Mishra et al. showed that low platelets are common in DHF patients, but are not always the sole predictive factor for mortality, provided that appropriate medical intervention is performed (Mishra et al., 2016a) found significant results between platelet levels and clinical outcomes, suggesting that close monitoring of DHF patients during hospitalization can help predict disease progression, guide care management and possible outcomes (Pothapregada et al., 2016). Thrombocytopenia is a common feature in pediatric dengue patients. Studies have shown that the severity of thrombocytopenia does not consistently predict clinical outcomes Studies have shown that platelet counts do not always correlate well with the severity of bleeding or other complications. Although severe thrombocytopenia (<50,000/μL) is generally more common in older children than in infants, this does not necessarily lead to worse outcomes (Bhakri et al., 2023; Day et al., 2024b). In the hematocrit category where the majority of the data, patients had an increase in hematocrit ≤20%, all patients were declared cured if the p-value = 0.000 and this means that in this study, hematocrit levels play a statistically important role in predicting patient outcomes in pediatric dengue fever. However, because all patients were declared cured, there was no variability in clinical outcomes. A study by Day, et al observed that lower hematocrit levels during illness were associated with better clinical outcomes with a reported p value of $p < 0.05$, indicating the significance of the findings. The study observed that in children with dengue fever, hematocrit levels began to decline around day 5 of the illness and remained low throughout the illness. This lower increase in hematocrit levels was associated with better clinical outcomes, suggesting that hematocrit levels may be an indicator of outcome in dengue patients (Day et al., 2024a; De Onis et al., 2013; Mishra et al., 2016b)

CONCLUSION
After conducting research on pediatric DHF patients at Ciracas Regional Hospital in January 2022 - March 2024, the authors concluded, among others: 1) Characteristics of DHF Patients: The majority of patients are male, in line with other studies that link this to environmental exposure and stronger female immunity. Most come from families with incomes below the minimum wage. Lifestyle factors, immunity, and activities outside the home contribute to this finding; 2) Hematocrit with Patient Outcomes: All patients were declared cured, with an increase in hematocrit of ≤20% and statistical test results with a p value of 0.000 indicating a strong association with outcomes based on statistical tests. Pediatric DHF patients with an increase in hematocrit of ≤20% usually indicate that the plasma leakage condition is not severe and can be managed with good fluid therapy and close monitoring. With appropriate medical intervention, the patient's body is still able to recover without experiencing serious complications; 3) Platelets with Patient Outcomes: All patients were declared cured, with platelet counts <50,000/μL and statistical test results with a p value of 0.000 indicating a strong association with outcomes in statistical tests. Most children who experience severe thrombocytopenia due to DHF can recover completely within a few weeks with appropriate treatment. Adequate fluid therapy, close monitoring, and prompt treatment can help patients recover and prevent further complications.

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