DIFFERENCES IN HEMATOCRIT LEVELS AND PLATELET COUNTS ON THE 4th To 6th DAY OF FEVER IN DENGUE HEMORRHAGIC FEVER PATIENTS

PERBEDAAN KADAR HEMATOKRIT DAN JUMLAH TROMBOSIT PADA FEBRIS HARI KE-4 SAMPAI KE-6 PASIEN DEMAM BERDARAH DENGUE

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Abstract

Dengue Hemorrhagic Fever (DHF) is an endemic disease in Indonesia caused by the dengue virus and transmitted through the bites of Aedes aegypti and Aedes albopictus mosquitoes. The risk of serious complications primarily arises during the critical phase, typically between the 4th and 6th days of fever, during which plasma leakage may occur, leading to shock and severe bleeding. Hematocrit levels and platelet counts are important parameters in the diagnosis and monitoring of DHF patients. This study aimed to determine the differences in hematocrit levels and platelet counts during days 4 to 6 of fever in DHF patients at Prima Medika Hospital Denpasar, in February 2025. This research employed a descriptive quantitative design with purposive sampling, involving 35 patients who met the inclusion criteria. The results showed a decrease in hematocrit levels with averages of 42.8%, 42%, and 41.2%, and platelet counts with averages of $87 \times 10^3/\mu L$, $59 \times 10^3/\mu L$, and $47 \times 10^3/\mu L$ from day 4 to day 6 of fever. Data were analyzed using the Shapiro-Wilk normality test, the Friedman non-parametric test for hematocrit levels, and the Repeated Measures ANOVA parametric test for platelet counts. Statistical analysis showed a p-value of 0.002 for hematocrit levels and 0.000 for platelet counts. The conclusion of this study is that there are significant differences in hematocrit levels and platelet counts between days 4 to 6 of fever in DHF patients.

Keywords: DHF, Critical Phase, Hematocrit, Platelets

Abstrak

Demam Berdarah Dengue (DBD) merupakan penyakit endemik di Indonesia yang disebabkan oleh virus dengue dan ditularkan melalui nyamuk *Aedes aegypti* dan *Aedes albopictus*. Risiko komplikasi serius terutama muncul pada fase kritis antara hari ke-4 sampai ke-6 demam, dimana dapat terjadi kebocoran plasma yang menyebabkan syok dan perdarahan hebat. Pemeriksaan kadar hematokrit dan jumlah trombosit menjadi parameter penting dalam diagnosis dan pemantauan pasien DBD. Penelitian ini bertujuan untuk mengetahui perbedaan kadar hematokrit dan jumlah trombosit pada febris hari ke-4 sampai ke-6 pasien DBD di RSU Prima Medika Denpasar pada bulan Februari 2025. Penelitian ini menggunakan desain deskriptif kuantitatif dengan teknik *purposive sampling*, melibatkan 35 pasien yang memenuhi kriteria inklusi. Hasil menunjukkan penurunan kadar hematokrit dengan rata-rata 42,8%, 42%, 41,2% dan jumlah trombosit dengan rata-rata 87 x 10^3/µL, 59 x 10^3/µL, 47 x 10^3/µL dari hari ke-4 sampai ke-6 febris. Data dianalisis menggunakan uji normalitas *Shapiro-Wilk*, uji non parametrik (uji *Friedman*) untuk kadar hematokrit dan uji parametrik (uji *Repeated Measures ANOVA*) untuk jumlah trombosit. Hasil uji statistik diperoleh *p-value* 0,002 untuk kadar hematokrit dan *p-value* 0,000 untuk jumlah trombosit. Simpulan penelitian ini adalah ada perbedaan signifikan antara kadar hematokrit dan jumlah trombosit pada febris hari ke-4 sampai ke-6 pasien DBD.

Kata Kunci: DBD, Fase Kritis, Hematokrit, Trombosit

1. INTRODUCTION

Indonesia, as a tropical country, has a high potential for the proliferation of various disease vectors, particularly those responsible for transmitting endemic diseases such as Dengue Hemorrhagic Fever (DHF). In early 2020, the World Health Organization (WHO) designated dengue as one of the top ten global health threats. By 2023, the highest surge of dengue cases had spread across more than 80 countries, marking a historical record of over 6.5 million cases and 7,300 reported deaths since the beginning of the year (WHO, 2024).

In Indonesia, dengue cases fluctuate annually and tend to show an increasing trend in both incidence and geographical distribution. The rise in the number of cases and the extent of affected areas is attributed to high population mobility, urban expansion, climate change, and shifts in population distribution. Currently, there is no specific treatment for dengue infection. The Province of Bali is categorized as an endemic area for dengue in Indonesia. Based on the Health Profile data from 2016 to 2021, dengue has consistently ranked among the top ten most common diseases among hospitalized patients in general hospitals across all districts and municipalities in Bali. In 2021, there were 2,673 reported cases of dengue with an incidence rate of 61.3 per 100,000 population (Murti & Yudhastuti, 2023). Dengue hemorrhagic fever is caused by the dengue virus, which is transmitted by mosquito vectors of the *Aedes aegypti* or *Aedes albopictus* species. Dengue virus infection can be asymptomatic or symptomatic, ranging from mild fever to classic dengue fever, dengue hemorrhagic fever, and Dengue Shock Syndrome. Early detection of dengue virus infection is crucial for nurses and physicians to ensure timely management and reduce fatality rates (Putri et al., 2023).

One of the key diagnostic methods for dengue patients is routine hematological examination. This includes assessment of leukocytes, erythrocytes, hematocrit, platelets, and

differential leukocyte counts, with a particular focus on platelet and hematocrit values. Thrombocytopenia and hemoconcentration are hallmark features of dengue infection. Platelets are anucleate blood cell fragments that play a vital role in blood clotting. Thrombocytopenia typically appears 2–4 days after the onset of fever, with platelet counts dropping below 100,000/μl. Hematocrit measurement serves as an indicator of hemoconcentration, reflecting the percentage of red blood cell volume relative to total blood volume. A decrease in plasma volume and an increase in hematocrit levels suggest plasma leakage and hemoconcentration (Putri et al., 2022).

According to WHO, the clinical course of dengue infection comprises three phases known as the "saddleback" pattern: febrile phase, critical phase, and recovery phase. The febrile phase occurs during days 1 to 3, characterized by high fever and bleeding symptoms. The critical phase typically occurs between days 4 to 6 and is marked by a drop in body temperature and the risk of shock due to plasma leakage, which may lead to fatal outcomes. If patients survive the critical phase, they enter the recovery phase, during which clinical symptoms improve, including a return of appetite, reduced abdominal pain, and normalization of urinary output (Soentpiet et al., 2024).

Previous studies, such as the one conducted at Anwar Medika General Hospital in Sidoarjo, reported a decrease in platelet counts (thrombocytopenia) and an increase in hematocrit levels (hemoconcentration) in dengue patients (Charisma, 2017). In contrast, a study at Siti Rahmah Islamic Hospital in Padang by Kafrawi (2019) found that although patients experienced thrombocytopenia, their hematocrit levels remained within normal limits. Monitoring hematocrit and platelet levels is critically important, especially during the febrile days 4 to 6, which correspond to the critical phase of the disease. Through close monitoring, medical personnel can initiate timely interventions such as fluid therapy to prevent complications. A solid understanding of the changes in hematocrit and platelet levels is essential for effective and efficient dengue patient management and can significantly reduce mortality rates.

This study aims to determine the differences in hematocrit levels and platelet counts during the febrile days 4 to 6 in patients with Dengue Hemorrhagic Fever (DHF). By understanding whether significant differences exist in these parameters during the critical febrile phase, this research is expected to contribute to the existing body of knowledge regarding hematological changes in dengue patients. Furthermore, it may serve as a reference for healthcare practitioners in monitoring hematocrit and platelet levels during the critical phase of dengue infection.

2. METHODS

This research employed a quantitative descriptive approach and was conducted at the Clinical Pathology Laboratory of Prima Medika General Hospital in February 2025. The sampling technique used was purposive sampling, involving 35 samples that met the inclusion criteria: patients diagnosed with Dengue Hemorrhagic Fever (DHF) by the attending physician (DPJP), who provided informed consent, and had complete hematocrit and platelet examination results recorded in the Laboratory Information System (LIS) from the 4th to the 6th day of fever. The exclusion criteria included DHF patients with a history of hematological disorders such as Autoimmune Hemolytic Anemia (AIHA) and Idiopathic Thrombocytopenic Purpura (ITP). All examinations and data collection were conducted in accordance with standard

laboratory procedures. Data analysis was performed using both univariate and bivariate methods with the aid of SPSS (Statistical Package for the Social Sciences) version 30. The bivariate analysis was carried out in two stages: first, the normality test using the Shapiro-Wilk method (Ghozali, 2018). If the data were normally distributed, the parametric test Repeated Measures ANOVA was used. If the data were not normally distributed, the non-parametric Friedman test was applied instead (Sarwono, 2014). This study was approved by the Health Research Ethics Committee of STIKES Wira Medika Bali, as evidenced by an ethical clearance letter with reference number 413/E1.STIKESWIKA/EC/III/2025. All respondents provided written informed consent, and data confidentiality was strictly maintained for academic purposes.

3. RESULTS AND DISCUSSION

The results of this study are divided into two main sections: (1) the overview of hematocrit levels and platelet counts on febris days 4 to 6 in patients with Dengue Hemorrhagic Fever (DHF), and (2) the analysis of differences in hematocrit levels and platelet counts during the same febrile period. However, prior to presenting these results, the researcher also describes the characteristics of the respondents, as follows:

Table 1. Characteristics of Respondents

No	Characteristics	Number (People)	Percentage
	Gender		
a	Male	20	57%
b	Female	15	43%
	Total	35	100%
	Age		
a	0 - 11	2	6%
b	12 - 25	20	57%
c	26 - 45	11	31%
d	46 - 65	2	6%
	Total	35	100%

Based on the gender characteristics of DHF patients at Prima Medika General Hospital, male patients were more prevalent (20 patients, 57%) compared to female patients (15 patients, 43%). Hermawan (2017) stated that males are more susceptible to dengue virus due to less efficient production of immunoglobulins and antibodies compared to females. Estrogen in females promotes the synthesis of IgG and IgA, enhancing their resistance to infection. Novrita (2017) further explained that males produce fewer cytokines, resulting in a weaker immune response. Similarly, studies by Djuma (2020) and Monica (2023) found a higher incidence of DHF among males. However, contrasting findings were reported by Kafrawi (2019) and Hukom (2013), who observed that the majority of patients were female. These varying results suggest that the relationship between gender and dengue infection is inconsistent, and the risk

of contracting DHF is generally balanced between males and females, as both are equally exposed to bites from *Aedes aegypti* mosquitoes (Rizza, 2013).

Regarding age distribution, DHF affects all age groups, but the majority of cases were found among adolescents and children: 20 cases were aged 12–25 years, 2 cases were aged 1–11 years, 11 cases were aged 26–45 years, and 2 cases were aged 46–65 years. The high incidence in younger age groups is associated with more frequent outdoor activities and lower awareness of personal protection (Lisa, 2016). According to Hakim & Kusnandar (2012), the immune system of children and adolescents is not yet fully developed. Permatasari (2013) added that the lack of specific antibodies leads to weak immunity, limited cytokine production, and reduced interferon secretion, allowing uncontrolled viral replication. The younger the age, the higher the risk of DHF. In addition, high transmission rates of the dengue virus further elevate the risk, indicating that vigilance is necessary across all age groups (Apriliani, 2015). These findings are consistent with reports from the Caribbean Epidemiology Center (2000) and a 1981 study in Cuba, both of which highlighted age as a significant factor influencing the severity of clinical manifestations such as plasma leakage in DHF patients (Marlini, 2019).

Table 2. Results of the Friedman Test

Variable	Mean	Std. Deviation	Sig
HCT_4	427.971	417.454	0,002
HCT_5	420.029	520.076	
HCT_6	412.057	694.512	

The decreasing trend in hematocrit levels from 42.8% on day 4 to 41.2% on day 6 indicates a positive response to fluid therapy and prevention of hypovolemic shock. Intravenous fluids help replace lost plasma volume due to vascular leakage, resulting in hemodilution, which reflects physiological stabilization and the effectiveness of the treatment (Rahmawati et al., 2019).

The Friedman test yielded a p-value of 0.002 ($p < 0.05$), indicating that the null hypothesis (H0) is rejected and the alternative hypothesis (Ha) is accepted. This means there is a statistically significant difference in hematocrit levels from day 4 to day 6 of the febrile phase. This finding demonstrates that hematocrit is a dynamic and essential parameter in the clinical monitoring of DHF patients. Changes in hematocrit levels are closely associated with hemoconcentration due to plasma leakage, a hallmark of the critical phase of DHF. According to WHO, the diagnosis of DHF should not be based solely on an increase in hematocrit levels, but also on a reduction of more than 20%, which may occur due to fluid therapy or bleeding. Therefore, continuous and simultaneous monitoring of hematocrit is crucial for optimal patient management (Ulfah et al., 2022).

Table 3. Results of Repeated Measures ANOVA

Variable	Mean	Std. Deviation	Sig.
PLT_4	874.000	3.895.035	0

PLT_5	591.143	2.686.871
PLT_6	471.429	2.579.118

Thrombocytopenia commonly occurs during the critical phase (days 4 to 6) of dengue infection and, if not managed properly, can increase the risk of bleeding and shock (Sugiono, 2013). Thrombocytopenia is triggered by platelet aggregation as a result of interactions between the dengue virus, antibodies, and platelets. Antigen-antibody complexes activate the complement and coagulation systems, leading to endothelial cell damage and bleeding. Platelet aggregation induces the release of ADP, forming platelet clusters that are then destroyed by the reticuloendothelial system (Heatubun, 2013).

A study by Charisma (2016) at Anwar Medika General Hospital found that 98.7% of DHF patients had platelet counts below $100 \times 10^3/\mu L$. Similarly, Sebayang (2018) reported that 88.6% of patients at Curup Regional Hospital experienced thrombocytopenia. The trend data from this study also showed a significant decline in platelet counts, from $87 \times 10^3/\mu L$ on day 4 to $47 \times 10^3/\mu L$ on day 6. Dengue virus suppresses bone marrow function and infects both platelets and megakaryocytes, leading to decreased production and increased platelet destruction. Moreover, the host immune system may attack platelets due to structural similarities between the virus and host cells (Siahaan, 2023).

The results of the Repeated Measures ANOVA showed a p-value of 0.000 ($p < 0.05$), indicating a statistically significant difference in platelet counts across days 4, 5, and 6. The mean platelet count declined from $87 \times 10^3/\mu L$ on day 4 to $47 \times 10^3/\mu L$ on day 6, with a minimum recorded value of $6 \times 10^3/\mu L$ on day 6, indicating severe thrombocytopenia. This decline reflects bone marrow suppression, increased platelet destruction, and consumption during inflammation and plasma leakage. The significant decrease highlights the importance of close monitoring of platelet levels during the critical phase of DHF to prevent bleeding complications and to guide timely and appropriate medical interventions (Nugraheni, 2023).

4. CONCLUSION

The findings of this study indicate that hematocrit levels during the febrile phase (days 4 to 6) in DHF patients showed a gradual decrease, with mean values of 42.8% on day 4, 42.0% on day 5, and 41.2% on day 6. This decline reflects a positive response to fluid therapy. In contrast, platelet counts demonstrated a consistent decrease from day 4 to day 6, with mean values of $87 \times 10^3/\mu L$ on day 4, $59 \times 10^3/\mu L$ on day 5, and $47 \times 10^3/\mu L$ on day 6, which is indicative of the impact of dengue virus infection. Statistical analysis revealed a significant difference in hematocrit levels across days 4 to 6, with a p-value of 0.002 ($p < 0.05$), and a significant difference in platelet counts with a p-value of 0.000 ($p < 0.05$).

5. REFERENCES

Apriliani, D. (2015). Management of Dengue Fever. *Angewandte Chemie International Edition*, 6(11), 15–38.

Charisma, A. M. (2017). Description of platelet count and hematocrit values in dengue hemorrhagic fever patients at Anwar Medika Hospital during February-December 2016. *Journal of Pharmacy and Science*, 2(2), 15–19.

Kafrawi, V. U., Dewi, N. P., & Adelin, P. (2019). Description of platelet count and hematocrit levels in dengue hemorrhagic fever patients at Siti Rahmah Islamic Hospital, Padang. *Health and Medical Journal*, 1(1), 38–44.

Nugraha, G. (2022). Techniques for collection and handling of human venous blood specimens for research. *LIPI Press*. https://doi.org/10.14203/press.345

Nugraheni, E., Rizqoh, D., & Sundari, M. (2023). Clinical manifestations of dengue hemorrhagic fever (DHF). *Journal of Medicine and Health: Scientific Publication of the Faculty of Medicine, Sriwijaya University*, 10(3), 267–274.

Putri, H. G. A., Mahtuti, E. Y., & Faisal, F. (2022). Platelet count and hematocrit levels in dengue hemorrhagic fever patients based on sex and age. *Journal of Health*, 13(2), 123–130. https://doi.org/10.38165/jk.v13i2.312

Putri, N. A. D., Shinta, H. E., & Patricia, T. (2023). Relationship between hematocrit and platelet levels and severity in dengue hemorrhagic fever patients at RSUD dr. Doris Sylvanus in 2020-2021. *Barigas: Student Research Journal*, 1(2), 46–52. https://doi.org/10.37304/barigas.v1i2.8029

Rahmawati, A., Perwitasari, D. A., & Kurniawan, N. U. (2019). Effectiveness of initial fluid therapy compared to WHO standard fluid therapy on length of hospital stay in dengue hemorrhagic fever patients in pediatric ward at PKU Muhammadiyah Bantul Hospital. *Indonesian Journal of Clinical Pharmacy*, 8(2), 91.

Rizqa, A. A. (2020). Description of hematocrit and hemoglobin levels in dengue patients at Lubuk Basung Regional Hospital. (Undergraduate thesis, Perintis Indonesia University).

Sarwono, J. (2014). *Linear and nonlinear models in IBM SPSS 21*. Elex Media Komputindo.

Siahaan, A. H. L. I. P. (2023). Description of platelet count decline and bleeding signs in dengue hemorrhagic fever patients at RSUP H Adam Malik and RS Prof Dr Chairuddin P Lubis in 2022-2023. (Undergraduate thesis, University of North Sumatra).

Soentpiet, M. G. O., Umboh, J. M. L., & Tatura, S. N. N. (2024). Factors related to dengue hemorrhagic fever incidence in children in South Minahasa Regency. *Prepotif: Journal of Public Health*, 8(1), 1198–1206. https://doi.org/10.31004/prepotif.v8i1.27295