Asian Journal of Healthy and Science
p-ISSN: 2980-4302
e-ISSN: 2980-4310
Vol. 3 No. 12 December, 2024

Relationship of Leukocyte Count, Platelet Count and Hematocrit Value to Length of Hospitalization of Adult Dengue Fever Patients

Asrina Rery Kahowi[1*], Rahel Rara Woda[2], Veny Vicy Vidy Mandang[3]
[1,3] Rumah Sakit Kristen Lendemoripa, Indonesia
[2]Universitas Nusa Cendana, Indonesia
Emails: asrinarerykahowi@gmail.com[1], soladeogloria@gmai.com[2]

Abstract

Dengue fever is a global health challenge especially in high endemic areas such as East Nusa Tenggara, where urbanization, climate change contribute to increased incidence. This study aimed to evaluate the association between hematological parameters platelet count, leukocyte count, and hematocrit value and length of hospitalization in adult dengue patients. This cross-sectional observational study included 69 adult dengue patients admitted to Lendemoripan Christian Hospital from January to March 2024. Participants were selected by consecutive sampling. Patients with ICD-10 codes A90-A91 were included, while patients with blood disorders or chronic liver disease were excluded. Hematological parameters were categorized as follows: platelet count (<100,000/µl, ≥100,000/µl), leukocyte count (<5,000/µl, ≥5,000/µl), and hematocrit value (<45%, ≥45%). Length of hospitalization was classified as <5 days or ≥5 days, and data were analyzed using the Chi-square test or Fisher's exact test with a significance level of $p < 0.05$. The results showed that 56.52% of patients were hospitalized for less than 5 days, while 43.47% were hospitalized for 5 days or more. A significant association was found between hematocrit value and duration of hospitalization ($p = 0.017$), indicating its predictive potential. However, there was no significant association between platelet count ($p = 0.162$) or leukocyte count ($p = 0.799$) and length of hospitalization. These findings have implications suggesting that hematocrit value is a key indicator for predicting length of hospital stay in DHF patients, emphasizing the importance of early hematological evaluation.

Keywords: Dengue Hemorrhagic Fever, Length of Hospitalization, Leukocyte Count, Platelet Count, Hematocrit Value, Adult Patients.

INTRODUCTION

Dengue infection is a group of diseases caused by the dengue virus in humans. There are 4 serotypes of the virus namely DEN-1, DEN -2, DEN-3 and DEN-4 which all cause dengue fever or dengue hemorrhagic fever (Suhendro et al., 2009). The disease is divided into Dengue Fever (DD), Dengue Hemorrhagic Fever (DHF), and Expanded Dengue Syndrome (EDS) (Agustin et al., 2023). Since 2005 until now, the incidence of dengue has continued to increase until it reached its peak in 2016. With the growing population, it means that the number of dengue cases is increasing. Urbanization, climate change, higher population mobilization are factors that contribute to this situation (Ministry of Health, 2022).

Dengue infection has become a major public health concern worldwide and according to the World Health Organization (WHO) more than 2.5 billion humans are at risk of dengue virus infection. Based on Riskesdas data 0.38% of Indonesia's population of 252,124,458

people there are 713,783 people suffering from dengue hemorrhagic fever (Mareta, 2024). In Indonesia, where more than 35% of the population lives in urban areas, 150,000 cases were reported in 2007 (the highest number ever recorded) with more than 25,000 cases reported from Jakarta and West Java. The case fatality rate is about 1% (Sukmawati, 2022). Until the 17th week of 2024, there were 88,593 cases of dengue fever with 621 deaths in Indonesia. Based on reports, out of 456 districts/cities in 34 provinces, deaths due to DHF occurred in 174 districts/cities in 28 provinces. East Nusa Tenggara province ranks 12th with the number of dengue cases in Indonesia (Antok, 2024). According to data from the Central Bureau of Statistics (BPS, *Badan Pusat Statistik*) in 2023. West Sumba district is in the 5th position with the highest cases after Kupang city, Sikka district, West Manggarai district, and Southwest Sumba district (Timur, 2023).

The complete blood count (CBC) is one of the regular procedures performed in hospitals to confirm the diagnosis of DHF (Bates-Fraser et al., 2024). From this CBC examination, hematocrit and platelets are important indicators to note. Platelets can describe the presence or absence of blood clotting dysfunction while the hematocrit count can describe vascular permeability, (Widyanti, 2016). Indications for hospitalization of DHF patients are if there are danger signs, complaints and signs of hypotension, bleeding, organ disorders, increased hematocrit in the second examination, and have comorbid factors (pregnancy, diabetes3 mellitus, hypertension). According to protocol 1 which has been made by the Indonesian Association of Internal Medicine Experts (PAPDI, *Perhimpunan Dokter Spesialis Penyakit Dalam Indonesia*) DHF patients should be hospitalized, first if Hb, Ht is normal, with platelet levels <100,000, and second if Hb, Ht increases, with normal or decreased platelets (Suhendro et al., 2014).

DHF patients spend an average of 4.2 ± 1.5 days of hospital stay under standard management (Tai et al., 2014). According to research conducted at RSUD Tarakan in 2004, patients were hospitalized for an average of 4 days, with variations between 1 to 10 days. (Manurung, 2020). Based on research conducted by Mayetti which states that platelet count, hematocrit, and leukocytes are risk factors for shock in DHF (Mayetti, 2016). Hasri Nopianto's research states that there is a significant influence between platelet count (p=0.036) and leukocyte count (p=0.003) on length of hospitalization and hematocrit value (p=0.697) on length of hospitalization (Nopianto, 2014). Nikodemus Siregar's research states that there is a very weak relationship (not meaningful) between platelet count and length of hospitalization (r=0.262) (Nikodemus, 2014). In research conducted by (Perwira, 2014) stated that platelet count (p=0.013, OR=2.585, 95% CI 1.220-5.478) and leukocyte count (p=0.024, OR=1.624, 95% CI 1.065-2.475) had a significant relationship with the length of hospitalization of patients infected with dengue virus (Perwira, 2014).

In this context, it is important to conduct more in-depth research in high endemicity areas such as East Nusa Tenggara, especially to understand how dengue infection affects the adult population. Clinical and hematologic profiles in pediatric patients with dengue in West Sumba, for example, may differ from the results of studies in other regions due to differences in geographical factors, climate, and population characteristics. Several previous studies in this region have shown variations in the distribution of clinical manifestations and hematologic outcomes of dengue patients, which are most likely influenced by local environmental and socio-economic factors.

Therefore, it is necessary to know the factors that can predict the length of hospitalization of DHF patients at Lendemoripa Christian Hospital. The purpose of this research was to analyze the effect of platelet count, leukocyte count, and hematocrit value on the length of hospitalization of dengue hemorrhagic fever (DHF) patients at Lendemoripa Christian Hospital. This research aims to provide a deeper understanding of hematological factors that can be predictors of the length of hospitalization of patients, especially in areas with high endemicity rates such as East Nusa Tenggara. The benefit of this research is to provide important information related to the relationship between platelet counts, leukocytes, and hematocrit values with the length of hospitalization of DHF patients at Lendemoripa Christian Hospital. The results of this research are expected to help the medical team in predicting the length of hospitalization of patients more accurately, improve the efficiency of hospital resource management, and become a reference in clinical decision making. In addition, this research also provides a theoretical contribution to the development of medical science and can be used as a basis for formulating health policies in DHF endemic areas.

RESEARCH METHOD

This research is an observational research with a cross-sectional design. The population consisted of all patients diagnosed and treated at Lendemoripa Christian Hospital, East Nusa Tenggara, between January and March 2024. Samples were selected using a consecutive sampling method. Patients were included if their medical records contained diagnoses coded under the International Classification of Diseases (ICD)-10 A90-A91, representing dengue fever (classical dengue) and dengue hemorrhagic fever during hospitalization. Patients were excluded if they had documented blood disorders or chronic liver disease.

Data on leukocyte count, hematocrit value, platelet count, and length of hospitalization were obtained from medical records. Platelet counts were categorized as <100,000/µl and ≥100,000/µl, hematocrit values as <45% and ≥45%, and leukocyte counts as <5,000/µl and ≥5,000/µl. The dependent variable, length of hospitalization, was classified as <5 days or ≥5 days.

The Chi-square test or Fisher's exact test was employed to assess the association between hematological parameters and the length of hospitalization. Statistical significance was set at $p < 0.05$. Data analysis was conducted using IBM SPSS Statistics software, version 26.0 (IBM Corp., Armonk, NY, USA).

RESULT AND DISCUSSION

Characteristics of Research Subjects

A total of 223 patients were admitted to Lende Moripa Hospital, West Sumba, East Nusa Tenggara during the period January-March 2024 and only 69 patients met the inclusion criteria, the patients consisted of 45 males (65.22%) and 24 females (34.78%). The entire sample has been proven to have dengue hemorrhagic fever with dengue IgM and IgG serology tests.

Groups in this research based on WHO division, young adults (18 years-44 years) as many as 52 people (75.36%). Middle adults (45 years-65 years) as many as 12 people (17.39%) and Elderly > 65 years. A total of 5 people (7.3%). Where the number of those treated < 5 days was 39 people (56.52%) and ≥ 5 days was 30 people (43.47%).

Table 1. Characteristics of Research Subjects

Characteristics		
Age		
18- 44 yrs	52	(75,36 %)
45-65 yrs	12	(17.39 %)
>65 yrs	5	(7,3%)
Gender		
Male	45	(57.69%)
Female	24	(34.78%)
Length of stay		
< 5 days	39	(56.52 %)
≥ 5 days	30	(43.47%)

Relationship between platelet count and length of stay

Table 2. Relationship between platelet count and length of stay.

		Length of Hospitalization		Total	P.Value
		< 5 days	≥ 5 days		
Platelets	<100000	13	15	28	0,162
	≥ 100000	26	15	41	
Total		39	30	69	

From the table above, it can be seen that in this research, the number of patients with platelets < 100,000 who were treated < 5 days was 13 people and the remaining 15 people were treated ≥ 5 days from a total of 28 patients. In patients treated with platelets ≥ 100,000, the length of stay < 5 days was 26 patients and the length of stay ≥ 5 days was 27 patients out of a total of 41 patients. In table 2. it can be seen that the P. Value value is 0.162 so that > 0.05, it can be concluded that there is no relationship between platelet values and the length of hospitalization of DHF patients at Lendemoripa Hospital.

Relationship between leukocyte count and length of hospitalization.

Table 3. Relationship between leukocyte count and length of hospitalization.

		Length of Hospitalization		Total	P. Value
		< 5 days	≥ 5 days		
Leukocytes	< 5000	17	14	31	0.799
	≥ 5000	22	16	38	
Total		39	30	69	

From the data in Table 3 above, it can be seen that the number of patients treated < 5 days who have leukocytes < 5000 is 17 people while those treated ≥ 5 days are 114 people out of a total of 31 patients. In patients with leukocytes ≥ 5000 who were treated < 5 days as many as 22 patients and 16 patients were treated ≥ 5 days from a total of 38 patients. Table 3 also shows the p value of 0.799 so that > 0.005, it can be concluded that the number of leukocytes has no relationship with the length of hospitalization of DHF patients at Lendemoripa Hospital.

Relationship between Hematocrit count and length of hospitalization

Table 4. Relationship between Hematocrit count and length of hospitalization.

		Length of Hospitalization		Total	P. Value
		< 5 days	≥ 5 days		
Hematocrit	< 45 %	38	24	62	0.017
	≥ 45 %	1	6	7	

	Length of Hospitalization		Total	P. Value
	< 5 days	≥ 5 days		
Total	39	30	69	

From table 4 above, it can be seen that patients who have hematocrit < 55% total 62 people, including those treated < 5 days totaling 38 people and those treated ≥ 5 days totaling 24 people. It can also be seen that patients who have hematocrit ≥ 45% total 7 people where those treated < 5 days are 1 person, those treated ≥ 5 days are 6 patients. From the table it can also be seen that the P. Value is 0.017, this value is smaller than 0.05, so it can be concluded that there is a significant relationship between hematocrit and the length of hospitalization of patients at Lendemoripa Hospital.

Discussion

Dengue fever can turn into a life-threatening condition if it turns into dengue hemorrhagic fever. Dengue fever causes bleeding, leakage of blood vessels (channels that drain blood) and low levels of blood platelets that cause blood to clot easily (Karyanti & Hadinegoro, 2016).

Thrombocytopenia is one of the criteria in diagnosing DHF (Clémente-Bartoli et al., 2014). Platelet count is usually normal in the first 3 days. Thrombocytopenia starts to appear a few days after fever and reaches its lowest condition in the shock phase of the patient. Thrombocytopenia (100,000 or less) is found on day 2/ 3 and reaches its lowest on day 4-6 and day 7-10 of illness. The cause of thrombocytopenia in DHF is still controversial until now and there is no mechanism that explains it for sure, but many believe it is due to bone marrow suppression and due to platelet destruction and shortening of platelet life span (Hidayat et al., 2017).

The platelet count drops drastically between the third and tenth day of the onset of fever. The peak is on the fifth day of fever, where a very drastic decrease in platelets is related to the severity of dengue virus infection where at this time complications can occur that exacerbate dengue infection, resulting in an increase in hospitalization time (Pranata & Artini, 2017).

In this research, the total number of patients with platelets < 100,000 was 28 people where those treated < 5 days were 13 people and the remaining 15 people were treated ≥ 5 days. The total number of patients treated with platelets ≥ 100,000 was 41 patients, of which the length of stay < 5 days was 26 patients and the length of stay ≥ 5 days was 27 patients. from the results of the analysis it can be seen that the value of P. Value 0.162 which means greater than 0.05 so it can be concluded that the number of platelets has no relationship with the length of hospitalization of patients at Lendemoripa Hospital. This is in line with research conducted by Nur Halimah at ulin hospital banjarmasin which found no relationship between platelet count and length of hospitalization in pediatric patients at that time (Amini et al., 2020). However, research from Agustin 2023 states otherwise in this research a significant relationship was found between platelet count and length of hospitalization of DHF patients (Agustin et al., 2023).

Leukopenia is a leukocyte disorder caused by dengue virus infection that attacks the site of leukocyte cell production, the spinal cord. If the spinal cord is disrupted and inflammation occurs, both of these can cause a decrease in the number of leukocytes.

The normal leukocyte count in dengue infection can be caused by the condition of the patient when brought to the hospital already had a fever on the fifth day so that the leukocyte count has returned to normal. Dengue infection can also occur due to secondary infection

caused by bacteria which can be the cause of death in dengue hemorrhagic fever cases. Leukocytosis can be a sign of severe dengue fever infection (Daakeek et al., 2017). From the data obtained 38 patients with leukocyte counts ≥ 5000 where some patients had leukocytes ≥ 10,000. this can occur due to other infections that can occur simultaneously with dengue infection. Comorbidities are a cause of mortality in DHF and a contributing factor to prolonged DHF treatment.

In the research, from the results of the analysis obtained a p value of 0.799 so that> 0.005, it can be concluded that the number of leukocytes has no relationship with the length of hospitalization of DHF patients at Lendemoripa Hospital. In line with research conducted by Tuzzahra where there is no relationship between leukocyte count and length of hospitalization in south Tangerang rsud (p = 0.393) (Cahyani et al., 2020). However, previous research showed the opposite results where in this research a correlation was found between the number of leukocytes and the length of hospitalization of DHF patients. (p=0.001) (Agustin et al., 2023).

Increased hematocrit in DHF patients is caused by decreased plasma volume due to increased vascular permeability. The diagnosis of DHF can be made if the hematocrit level increases by ≥ 20% or decreases by 20% after receiving fluid therapy. Hematocrit value ≥ 20% causes plasma leakage. The highest increase in hematocrit levels on day 3 indicates the beginning of the critical phase. The highest hematocrit on day 4 and hematocrit levels can be used in determining the number of patients admitted which can then determine how long the patient is treated. In the research it can be proven that hematocrit levels are associated with the length of hospitalization of patients where the P. Value = 0.017 this value is smaller than 0.05. The research of Banggai et all obtained the same thing, namely hematocrit levels affect the length of hospitalization (Banggai et al., 2017). In line with the research of Milenia Y et all stated that there was a relationship between hematocrit levels and the length of patient care (Milenia & Sirait, 2022).

CONCLUSION

This research examined the relationship between leukocyte count, platelet count, and hematocrit values with the length of hospitalization for adult patients with Dengue Hemorrhagic Fever (DHF) at Lendemoripa Christian Hospital from January to March 2024. The results showed a significant relationship between hematocrit values and the length of hospitalization (p = 0.017), indicating that hematocrit is a key parameter influencing patient outcomes. However, no significant relationship was found between leukocyte count (p = 0.799) or platelet count (p = 0.162) and the length of hospitalization.

This research successfully achieved its objective by identifying hematocrit value as an important predictor of hospitalization duration in DHF patients. The findings highlight the need for close monitoring of hematocrit levels in clinical settings to anticipate the need for prolonged care and improve patient management. Furthermore, this research contributes valuable insights into the hematological factors affecting DHF outcomes, particularly in high-endemic regions like East Nusa Tenggara. By emphasizing the role of hematocrit, this research provides a foundation for optimizing resource allocation, guiding clinical protocols, and supporting future research aimed at improving the management of DHF in adult patients within similar regional healthcare settings.

BIBLIOGRAPHY

Agustin, A. C., Nugroho, Y. E., & Pangesti, I. (2023). Hubungan Jumlah Trombosit dan Leukosit pada Pasien Dewasa Dengan Demam Berdarah Dengue (DBD) Terhadap Lama Rawat Inap di RSI Fatimah Cilacap Bulan Februari-Maret 2022. *Pharmaqueous: Jurnal Ilmiah Kefarmasian*, *5*(2), 32–36.

Amini, N. H., Hartoyo, E., & Rahmiati, R. (2020). Hubungan Hematokrit dan Jumlah Trombosit terhadap Lama Rawat Inap Pasien DBD Anak di RSUD Ulin Banjarmasin. *Homeostasis*, *2*(3), 407–416.

Antok, N. A. (2024). *Laporan Penelitian 2024*.

Banggai, C. E., Lisdawati, V., Suliati, S., Kusumowardhani, D., Firmansyah, I., & Montain, M. M. (2017). Association between hemoconcentration and longer hospitalization day of dengue patients. *Health Science Jurnal of Indonesia*, *8*(1), 19–24.

Bates-Fraser, L. C., Moertl, K. M., Stopforth, C. K., Bartlett, D. B., Ondrak, K. S., Jensen, B. C., & Hanson, E. D. (2024). A practical approach for complete blood count analysis following acute exercise: Capillary vs. venous blood sampling. *Advanced Exercise and Health Science*, *1*(1), 43–50. https://doi.org/https://doi.org/10.1016/j.aehs.2024.01.002

Cahyani, S., Rizkianti, T., & Susantiningsih, T. (2020). Hubungan jumlah trombosit, nilai hematokrit dan rasio neutrofil-limfosit terhadap lama rawat inap pasien DBD anak di RSUD Budhi Asih bulan januari–september tahun 2019. *Seminar Nasional Riset Kedokteran*, *1*(1).

Clémente-Bartoli, A., Epelboin, L., Daval, S., Fabre, I., Lamaury, I., & Beaucaire, G. (2014). Deep thrombocytopenia due to dengue fever in a patient splenectomized for immune thrombocytopenia. *La Presse Médicale*, *41*(11), 1151–1153. https://doi.org/https://doi.org/10.1016/j.lpm.2012.01.014

Daakeek, A. M., Alghasali, H. S., & Bahashwan, A. A. (2017). Dengue Related at Ibnu-Sina Hospital-Al-Mukalla: Causes and Alarming Signals. *Journal of Infection Diseases and Treatment*, *3*(2), 1–7.

Hidayat, W. A., Yaswir, R., & Murni, A. W. (2017). Hubungan jumlah trombosit dengan nilai hematokrit pada penderita demam berdarah dengue dengan manifestasi perdarahan spontan di RSUP Dr. M. Djamil Padang. *Jurnal Kesehatan Andalas*, *6*(2), 446–451.

Karyanti, M. R., & Hadinegoro, S. R. (2016). Perubahan epidemiologi demam berdarah dengue di Indonesia. *Sari Pediatri*, *10*(6), 424–432.

Kemenkes, R. I. (2022). Laporan tahunan 2022 demam berdarah dengue. *Laporan Tahunan*, 17–19.

Manurung, T. G. H. (2020). *Hubungan Lama Demam dan Profil Darah dengan Kadar Hematokrit pada Pasien Demam Berdarah Dengue di RSUD DR Moewardi*.

Mareta, O. S. (2024). *Hubungan Antara Spiritual Well Being Dan Motivasi Dengan Perilaku Pencegahan Penyakit Ginjal Kronik Pada Pasien Hipertensi Di RSI Sultan Agung Semarang*. Universitas Islam Sultan Agung Semarang.

Mayetti, M. (2016). Hubungan Gambaran Klinis dan Laboratorium Sebagai Faktor Risiko Syok pada Demam Berdarah Dengue. *Sari Pediatri*, *11*(5), 367–373.

Milenia, Y., & Sirait, R. H. (2022). Hubungan Jumlah Trombosit dan Kadar Hematokrit dengan Lama Rawat Inap Pasien DBD pada Anak di RSUP DR. Sitanala Tahun

2019-2021. *Majalah Kedokteran UKI*, *38*(2), 50–54.
Nikodemus, S. (2014). Hubungan Hasil Pemeriksaan Jumlah Trombosit Dengan Lama Rawat Inap Pada Pasien Demam Berdarah Dengue di Rumah Sakit Umum Pusat Haji Adam Malik (RSUPHAM) Medan. *Medan: Fakultas Kedokteran Universitas Sumatera Utara*.
Nopianto, H. (2014). Faktor-faktor yang berpengaruh terhadap lama rawat inap pada pasien demam berdarah dengue di RSUP Dr. *Kariadi Semarang, Eprints. Semarang: UNDIP*, 20–25.
Perwira, I. (2014). Faktor-faktor yang mempengaruhi lama rawat inap pada pasien yang terinfeksi virus dengue di RSUP Persahabatan Jakarta Timur. *Universitas Indonesia*, 35–46.
Pranata, I. W. A., & Artini, I. G. A. (2017). Gambaran pola penatalaksanaan demam berdarah dengue (DBD) pada anak di instalasi rawat inap rumah sakit umum daerah Kabupaten Buleleng tahun 2013. *E-Jurnal Medika*, *6*(5), 21–27.
Suhendro, N. L., Chen, K., & Pohan, H. T. (2014). Demam berdarah dengue. *Buku Ajar Ilmu Penyakit Dalam Jilid III*, 2773–2779.
Sukmawati, S. (2022). *Pengendalian Populasi Nyamuk Aedes Aegypti*.
Tai, D. Y. H., Chee, Y. C., & Chan, K. W. (2014). The natural history of dengue illness based on a study of hospitalised patients in Singapore. *Singapore Medical Journal*, *40*, 238–242.
Timur, B. P. S. J. (2023). Jumlah Kasus Penyakit Menurut Kabupaten/Kota dan Jenis Penyakit di Provinsi Jawa Timur, 2022. *Surabaya: BPS Jawa Timur*.
Widyanti, N. N. A. (2016). Hubungan jumlah hematokrit dan trombosit dengan tingkat keparahan pasien demam berdarah dengue di rumah sakit Sanglah tahun 2013-2014. *E-Jurnal Medika*, *5*(8), 51–56.