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Thrombocytopenia as a Hematologic Marker in Malaria Patients at Bitung City, North Sulawesi

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Abstract **Original Research Article**

The malaria parasite *Plasmodium sp* is in the blood for most of its life cycle, inducing changes in almost all blood components. Malaria is transmitted to humans through the bite of the female anopheles mosquito vector. Malaria is still a disease that affects tropical and subtropical countries worldwide. In Indonesia, malaria is still one of the health problems, especially in some endemic areas; the number of malaria cases is still relatively high. This study aims to determine the hematological profile of malaria patients at Budi Mulia Bitung Hospital in North Sulawesi from May 2022 to May 2023. This study was descriptive with a cross-sectional research design conducted at Budi Mulia Bitung Hospital, North Sulawesi. Data came from laboratory data of positive malaria patients with malaria Rapid Diagnostic Test examination and thin/thick smears and the results of routine hematological examinations with a purposive sampling technique. The data were interpreted according to the results obtained. The results showed that of the 56 patients who suffered from malaria, it was found that males were more infected with malaria, namely 33 people (58.9%), while women were 23 people (41.1%). Most malaria sufferers are from the adult age group (18-45 years), as many as 25 people (44.6%). It was also found that of the 56 malaria patients, 52 people (92.8%) had leukocyte counts within normal limits, two people (3.6%) had leukocytosis, and two people (3.6%) had leukopenia. Erythrocytes with average numbers in malaria patients were found to be 35 (62.5%), and 21 (37.5%) had low erythrocyte counts. Normal hemoglobin levels in malaria patients were found in 40 people (71.4), and 16 (28.6%) had anemia. Malaria patients with thrombocytopenia were 46 people (82.1%), and normal platelets were ten people (17.9%). ***Conclusion:*** The incidence of malaria is dominated by male patients, and mostly in adulthood (18-45 years), infected with *Plasmodium vivax* with a decrease in the number of platelets in the blood or thrombocytopenia.

Keywords: Hematology profile, Thrombocytopenia, Plasmodium sp, Malaria.

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INTRODUCTION

Malaria is a disease caused by intracellular obligate protozoa of the genus *Plasmodium*. Five species can infect humans: *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium malaria*, *Plasmodium ovale*, and *Plasmodium knowlesi*. Female mosquitoes of the genus Anopheles transmit malaria. Of the approximately 400 species of *Anopheles* mosquitoes, 67 have been found to transmit malaria, and 24 are in Indonesia. In addition to mosquito bites, malaria can be sent directly through blood transfusions or from pregnant women to their babies (Kemenkes RI, 2022; Sutanto I & Pribadi W, 2008; CDC, 2020; Gunawan, 1999).

Malaria is still the most significant health problem in the world, especially in developing countries located in tropical and subtropical regions. An estimated 2.37 billion people live in *Plasmodium falciparum* transmission areas, such as Africa, and 2.6 billion people live in *Plasmodium vivax* transmission areas, such as southern and western Asia. In 2021, globally, it is estimated that the number of malaria cases in the world will reach 247 million cases in 84 malaria endemic countries, which is an increase of 2 million cases compared to 2020 (WHO, 2022; Feachem *et al.*, 2009).

Plasmodium infection gives fluctuating fever symptoms with a typical picture of high fever accompanied by chills and ends with a decreased body temperature and profuse sweating. Depending on the infecting species, these symptoms occur every 36, 48, or 72 hours (Natadisastra & Ages R, 2009).

Malaria affects almost all blood components. The most influential pathogenesis of malaria is

erythrocytes and platelets. Platelets (also called platelets) are small discs with a diameter of 1 to 4 micrometers. Platelets are formed in the bone marrow from megakaryocytes, which are considerable cells in the hematopoietic array in the marrow; megakaryocytes break up into small platelets, either in the bone marrow or soon after entering the blood, particularly when entering capillaries. The average concentration of platelets in the blood is between 150,000 and 300,000 per microliter (Guyton & Hall, 2008).

Several districts in North Sulawesi Province are malaria-endemic areas due to the natural conditions in the form of forests, shrubs, and swamps, as well as the existence of prominent people's rice fields, which cause the formation of mosquito breeding places. The more accessible transportation between regions can allow malaria transmission from endemic to non-endemic areas. Malaria case data for 2022 in North Sulawesi are Bitung City 228 cases, Sangihe 141 cases, North Minahasa 117 cases, Manado 97 cases, Minahasa 96 cases, Southeast Minahasa 93 cases (Dinas Kesehatan Sulawesi Utara, 2023).

Almost every patient with fever symptoms in hospitals is often recommended for a complete blood test, including platelet, leukocyte, and hemoglobin levels in the blood. Moreover, a decrease in blood platelet levels or thrombocytopenia is often found, but malaria is not suspected. Based on this, researchers want to know the role of blood profiles in diagnosing malaria.

MATERIAL AND METHODS

This study is a descriptive study using a cross sectional design with purposive sampling technique on positive malaria patients with malaria Rapid Diagnostic Test examination and microscopic examination of thin / thick smears and the results of routine hematological examinations. The location of the research was conducted at Budi Mulia Bitung Hospital, North Sulawesi Province. Samples in this study were patients with positive malaria test results with routine hematology examination.

RESULTS OF THE STUDY

This study at Budi Mulia Bitung Hospital aims to determine the hematologic picture of malaria, especially the number of leukocytes, erythrocytes, and hemoglobin in malaria patients, distribution based on demographic data (gender and age) and the type of plasmodium identified. Samples were obtained from confirmed malaria patients with routine hematology examination at Budi Mulia Bitung Hospital in May 2022 - May 2023. The number of samples that met the criteria amounted to 56 patients.

Characteristic data analyzed in patients include gender, age, and plasmodium type. The following are the results of the subject characteristic data:

a. Gender

Table 1: Malaria patients at Budi Mulia Bitung Hospital by Gender

Gender	N	Persentage (%)
Male	33	58,9
Female	23	41,1
Total	56	100

From Table 1 namely the distribution of malaria sufferers based on gender, it was found that men were more infected with malaria, namely 33 people (58.9%), while women were 23 people (41.1%).

b. Age

Table 2: Malaria patients at Budi Mulia Bitung Hospital by Age

Age category	N	Persentage (%)
Baby (0-1 year)	0	0
Toddler and preschool (1-6 year)	2	3,6
school age children & teenage (6-18 year)	13	23,2
Adults (18-45 year)	25	44,6
Pre elderly (45-59 year)	14	25
Elderly (>/ 60 year)	2	3,6
Total	56	100

Table 2 on the distribution of malaria patients by age shows that most malaria patients are from the adult age group (18-45 years), as many as 25 people (44.6%). Plasmodium infection was also found in the pre-elderly age group (45-59 years), as many as 14 people (25%), and in school-age children and adolescents (6-8 years), as many as 13 people (23.2%). Meanwhile, although rare, malaria was also found in the age group of children under five and preschool (3.6%) and in the elderly (3.6%).

c. Types of Plasmodium

Plasmodium is known to have 4 (four) species, namely *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale*, *Plasmodium malariae*, and one additional species, *Plasmodium knowlesi* (not yet discovered). The distribution of samples based on the

type of Plasmodium found can be seen in the following table:

Table 3: Patients with malaria at Budi Mulia Bitung Hospital based on Plasmodium sp

Plasmodium sp	N	Persentage (%)
Plasmodium falciparum	5	8,9
Plasmodium vivax	51	91,1
Plasmodium ovale	0	0
Plasmodium malariae	0	0
Plasmodium knowlesi	0	0
Total	56	100

Table 3 is The distribution based on the type of Plasmodium shows that the most common cause is *Plasmodium vivax* at 91% while Plasmodium falciparum at 8.9%. Other types of Plasmodium were not found in patients.

Data on Hematology Profile Characteristics in Malaria patients at Budi Mulia Bitung Hospital can be seen in the following table.

Table 4: Hematology Profile of Malaria Patients at Budi Mulia Bitung Hospital

Hematology Profile	N	Persentage (%)
Leukosit		
Normal	52	92,8
Leukositosis	2	3,6
Leukopenia	2	3,6
Eritrosit		
Normal	35	62,5
High		
Low	21	37,5
Hemoglobin		
Normal	40	71,4
Anemia	16	28,6
Trombosit		
Normal	10	17,9
Trombositopenia	46	82,1

In table 4 Describes that of the 56 patients suffering from malaria, there are 52 people (92.8%) have leukocyte counts within normal limits, two people (3.6%) have leukocytosis, and two people (3.6%) have leukopenia. Erythrocytes with average numbers in malaria patients were found in 35 people (62.5%), and 21 (37.5%) had low erythrocyte counts. Normal hemoglobin levels in malaria patients were found in 40 (71.4%), and 16 (28.6%) had anemia. Malaria patients with thrombocytopenia were 46 people (82.1%), and normal platelets were ten people (17.9%).

DISCUSSION

Research conducted in Bitung, North Sulawesi, found that malaria patients with male gender were more infected with malaria, namely 33 people (58.9%) than women as many as 23 people (41.1%). The results of this study are similar to research by Ernawati *et al.*, (2011) in Lampung, where the incidence of malaria was higher in men at 54.6%. Also, the research results on inpatient malaria patients at Panglima Sebaya Hospital, Paser Regency, in 2015-2018 were 87.5% (Salsabila A *et al*., 2021). In contrast to the results of research in several Padang city hospitals, it was found that female patients were 51.5% more than men (48.5%) (Kustiah SU *et al*., 2020). In general, everyone can get malaria. Men are more likely to be at risk of malaria due to their activities outside the home due to work such as farming, raising livestock, managing ponds, and leaving the house at night (Mayasari R *et al.*, 2016).

The age of most malaria sufferers in this study was from the adult age group (18-45 years), as many as 25 people (44.6%). This study's results align with the analysis of Indonesian Riskes das data in 2013, which shows that ages 25-34 years are the most at risk of malaria infection (Mayasari R *et al*., 2016). This age is included in the productive age, an active age to move around in activities, both in work and traveling outside malaria-endemic areas (Solikhah, 2012).

Based on the type of Plasmodium shows that the most common cause of malaria is Plasmodium vivax by 91%. The results of this study are the same as research on hematologic profiles based on the type of plasmodium in malaria patients at the Padang City Hospital, where 97% of malaria patients were infected by *Plasmodium vivax*. (Kustiah SU *et al.*, 2020) Another study conducted

by Murwati *et al*., in 2017 at Bengkulu found that the dominant type of Plasmodium infecting was *Plasmodium vivax* as many as 35 cases (100%). This research is in line with research conducted by Lukman Hakim with the title Malaria: Epidemiology and Diagnostic in 2011, namely Plasmodium species that live in humans that are dominant in all regions in Indonesia are *Plasmodium falciparum* and *Plasmodium vivax*. While Plasmodium *ovale* and *Plasmodium malariae* are usually found in the eastern part of Indonesia although with a small amount.

The hematological profile in this study illustrates that of the total patients suffering from malaria had several leukocytes within normal limits (92.8%), an average erythrocyte count (62.5%), normal hemoglobin levels (71.4%) and a low platelet count or thrombocytopenia (82.1%). This study's results align with the results of research conducted in Paser Regency, where patients with normal leukocyte counts (67.5%), normal hemoglobin levels (52.5%), and 87.5% experienced thrombocytopenia (Salsabila *et al*., 2021).

Thrombocytopenia is a common hematologic finding in malaria and is often used as an indicator of malaria in endemic areas. In Indonesia, hemoglobin levels are still assessed as an indicator of severe malaria, even though Plasmodium infection also affects platelet levels in the peripheral blood, and is associated with the pathogenesis of severe malaria (Natalia D, 2014).

Platelets (also called platelets) are small discs with a diameter of 1 to 4 micrometers. The normal concentration of platelets in the blood is between 150,000 and 300,000 per microliter (Guyton & Hall, 2008). Thrombocytopenia is a decrease in platelet count below normal <150,000 cells/ul in the blood. Thrombocytopenia is one of the hematological abnormalities often used as a suspicion to diagnose malaria and as a predictor of poor prognosis by *Plasmodium vivax* and *Plasmodium falciparum* infections. The mechanism of thrombocytopenia is not clearly known, the possibility of a decrease in platelets is said to be due to immune-mediated lysis, sequestration in the spleen, and dyspoitenic processes in the marrow. Mechanism of immune play a role in the lysis of platelets, involving specific platelet associated IgG antibodies that bind directly to malarial antigen in the platelets (Makkar R P, 2002). The damage to platelets due to oxidative stress is an Another ethiopathogenesis of thrombocytopenia. This is based on the findings of high lipid peroxidase and low platelet gluthathione peroxidase superoxide dismutase activity in malaria patients compared with healthy subjects (Metanat M & Sharifi-Mood B, 2010).

CONCLUSIONS

The incidence of malaria is dominated by male patients, and mostly in adulthood (18-45 years). Looking at the average platelet count, shows that *Plasmodium vivax* and *Plasmodium falciparum* malaria patients experience a decrease in platelet count or thrombocytopenia.

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