

CORRELATION BETWEEN MALARIA INFECTION AND HEMOGLOBIN LEVELS AND PLATELET COUNTS AT THE INDONESIAN NAVY HOSPITAL DR. SOEDIBJO SARDADI JAYAPURA

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Abstract: Malaria is an infection caused by Plasmodium through female Anopheles bites. Malaria affects almost all components of the blood cells. Decreased of hemoglobin levels in malaria infection caused by hemolysis of red blood cells and lack of ferrin due to the entry of Plasmodium sp. into the erythrocytes while the decrease in the number of platelets is due to the destruction of platelets by macrophages in the spleen. The aim of the study was to determine the correlation between malaria infection and hemoglobin levels and platelet counts at the dr. Soedibjo Sardadi Jayapura hospital. This type of research used analytic observational techniques by cross sectional design. The study sample were malaria sufferers who met the inclusion and exclusion criteria was then examined for hemoglobin levels and platelet counts of 48 respondents. Study result showed that the average hemoglobin level in malaria sufferers is 10.5 gdl⁻¹ with the Spearman correlation test result 0.171 (>0.05). The average number of platelets in malaria sufferers is 127,000/mm³ with Spearman correlation test result 0.003 (<0.05). The conclusion of the study was that there was no relationship between malaria infection and hemoglobin levels and there was a relationship between malaria infection and platelet counts.

Keywords: malaria, *Plasmodium Sp.*, hemoglobin levels, platelet counts

Introduction

Malaria is an infection caused by Plasmodium through female Anopheles bites. Plasmodium will multiply in the liver and then infect red blood cells in the human body. Malaria infection caused by *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale*, and *Plasmodium malariae* (Milner, 2018).

The spread of malaria infection has several variables related to disease transmission including environmental factors, mosquito breeding sites and population behavior related to malaria prevention programs. The programs to accelerate the reduction of malaria cases require cross-sector involvement so that the target of reducing malaria infection can be achieved (Ministry of Health, 2019).

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WHO states that there are 228 million cases of malaria in the world in 2019. Malaria cases in Indonesia is 0,93 per 1000 population based on annual parasites incidence (API) 2019. Malaria infection cases at the Indonesian Navy Hospital dr. Soedibjo Sardadi in 2021 was the highest prevalence with a total of 1,614 patients (Navy Hospital, 2021).

Malaria parasite infection can affect the decrease in hemoglobin levels and platelet counts which are haematological disorders and have received much attention in the scientific literature. A decrease in hemoglobin levels can occur in malaria infection, causing anemia, especially in *Plasmodium falciparum* infection. Anemia is the most common clinical manifestation and plays an important role in the morbidity and mortality of malaria. The decrease in hemoglobin levels in malaria is due to the destruction of red blood cells and a lack of ferrin due to the entry of *Plasmodium* into the erythrocytes (Sakwe et al., 2019; White, 2018). The decrease in the number of platelets in malaria infection can be caused by the destruction of platelets by macrophages in the spleen due to *Plasmodium* which causes many platelets to be destroyed so that thrombocytopenia occurs (Zulfian, 2018). Based on the background above, a study was conducted to see the correlation between malaria infection and hemoglobin levels and platelet counts at the Indonesian Navy Hospital, dr. Soedibjo Sardadi Jayapura.

Materials and Methods

Materials that needed in this study were blood lancet, object glass, hematology analyzer (Mindray BC-3000), microscope, needle and vacuum tube with EDTA (BD 3mL). The instruments used were capillary and venous blood, Giemsa 3%, and methanol.

Study design was observative cross sectional study. The number of research samples was 48 samples with consecutive sampling method. The study was conducted in Indonesian Navy hospital dr. Soedibjo Sardadi Jayapura from May to June 2022.

Procedure for taking capillary blood

Clean the tip of the patient's middle finger or ring finger with alcohol cotton and allow it to dry, then the fingertip was pricked quickly using a sterile lancet for approximately 3 mm, let the blood come out by itself, clean the first drop of blood with dry cotton or tissue and wait for the blood to come out again, the second blood drop can be used as a specimen (Health, 2020b).

Venous blood sampling procedure

The skin surface is cleaned with 70% alcohol cotton, a bandage is attached and asked the patient to clench and open his hand so that the vein is clearly visible, the visible vein was pierced using a 3 cc syringe with the needle facing upwards, if venous blood was visible at the tip of the syringe, released the dam slowly then withdraw the syringe from the patient's vein and apply plaster to the stab wound then enter the blood that has been obtained into the EDTA K3 vacuum tube (World Health Organization, 2016).

Procedure for making blood smears, Giemsa staining, and Plasmodium counts

Drop 2 drops of blood on a dry and fat-free object glass and then make a thick blood smear by rotating the tip of the object glass clockwise so that a circle with a diameter of approximately 1 cm is formed. -60 minutes later rinsed with running water and dried, identified under a microscope, carried out in a zig-zag manner, namely from one side to the other then to the original side and so on every time the direction is shifted one micrometer field of view is always arranged so that a wide field of view is obtained. obviously, use oil immersion with an objective lens magnification of 100 times, parasite calculation Plasmodium quantitatively based on the number of leukocytes in the thick blood smear, if the parasite count is carried out on 200 leukocytes, the number of parasites is multiplied by 40; if the parasite count is carried out on 500 leukocytes, the number of parasites is multiplied by 16 (Health, 2020a).

Determination of hemoglobin levels and platelet counts used Hematology analyzer (Mindray BC-3000). After obtaining the research data, the results were analyzed with the normality test of Shapiro Wilk. Since the data was not normal, so the Rank Spearman's test was used to analyse the correlation.

Results and Discussion

Samples in the study were obtained from 48 venous blood samples taken from Plasmodium infected patients. The research respondents came from Plasmodium infected patients then an examination of hemoglobin levels and platelet counts was carried out in patients in the laboratory of the Indonesian Navy Hospital, dr. Soedibjo Sardadi Jayapura.

Table 1. Respondents Characteristics

Category	amount	percentage
	N	%
Number of patients	48	100
Gender		
Man	29	60
Woman	19	40
Age (years)		
15-24	15	7,2
25-34	23	11,4
35-44	8	3,84
>44	2	0,96

According to Table 1, it can be seen that malaria sufferers at the Indonesian Navy Hospital dr. Soedibjo Sardadi Jayapura are dominated by male and range in age from 25-34 years.

Table 2. Descriptive analysis of study variable

Variable	Mean ± SD	Minimum	Maximum
Malaria infection (Parasites/ μ l blood)	9.310 ± 3,48	2.680	16.000
Hemoglobin levels (g/dL)	10,5 ± 2,31	6,0	17,0
Platelet counts (/mm ³)	127.000 ± 55,68	56.000	345.000

The results showed that the average number of malaria infection was 9.310 parasites/ μ L blood. The average hemoglobin level in malaria patients was 10.5 g/dl and the average platelet count in malaria patients was 127.000/mm³. The correlation study was analyzed by Rank Spearman's test and that showed in table 3.

Table 3. Correlation between malaria infection and hemoglobin levels

Hemoglobin levels		
Malaria infection	Correlation Coefficient	-0,201
	Sig (2-tailed)	0,171
	N	48

Table 4. Correlation between malaria infection and platelet counts.

Platelet counts		
Malaria infection	Correlation Coefficient	-0,426
	Sig (2-tailed)	0,003
	N	48

Table 3 showed that there was no correlation between malaria infection and hemoglobin levels. Whereas table 4 showed that there was correlation between malaria infection and platelet counts. The correlation coefficient was -0,426, it described the negative and moderate correlation. The negative correlation meant that the higher number of malaria infections caused the lower platelet counts.

The results of the study descriptively showed that the average hemoglobin level in malaria sufferers was 10.5g/dL and the platelet count in malaria sufferers was 127,000/mm³. Correlation Test Spearman malaria infection on hemoglobin levels obtained values significance value was 0.171 (<0.05) indicating that there was no correlation between malaria infection and hemoglobin levels with a correlation coefficient of -0.201 this indicates that the tested variable has a negative correlation direction with weak correlation strength, where if the value of the malaria infection variable is higher than the hemoglobin will decrease.

Rank Spearman's test on malaria infection on the number of platelets obtained significance value was 0.003 (<0.05) indicating that there is was correlation between malaria infection and platelet count with a correlation coefficient of -0.426. This indicates that the tested variable has a negative correlation direction with moderate correlation strength, where if the value of the malaria infection variable was higher, the platelet count will decrease.

Malaria infection causes a decrease in hemoglobin levels depending on the type of *Plasmodium Sp.* that infects. The results of this study dominant malaria infection occurs caused by *Plasmodium falciparum* and *Plasmodium vivax* with the highest number of trophozoites found in blood smears. Abnormal conditions that often occur in malaria infection caused by *Plasmodium falciparum* with an average hemoglobin level lower than *Plasmodium vivax* because *Plasmodium falciparum* can infect all types of red blood cells.

A decrease in the number of platelets can occur in patients infected with malaria. When parasitic erythrocytes penetration, healthy erythrocytes and platelets will be destroyed by macrophages in the spleen so that many parasitic erythrocytes and healthy erythrocytes and platelets are destroyed which causes a decrease in platelet levels and cannot be excreted due to loss of elasticity due to the parasite infection, thus clogging and resulting in enlargement of the spleen (Milner, 2018). According to (Ratcliff et al., 2007), states that malaria infection causes abnormalities in the structure and function of platelets and there are several mechanisms postulated as the cause of thrombocytopenia including immune-mediated destruction, abnormalities in the platelet structure which are invaded by parasites and sequestration in the spleen (splenomegaly). This is in line with previous studies which also showed a correlation between the density of malaria parasites and the number of platelets (Asmerom et al., 2023; Margono et al., 2016).

Conclusion

The conclusion of this study was there was no correlation between malaria infection and haemoglobin levels. Whereas there was correlation between malaria infection and platelet counts. The higher number of malaria infections cause the lower platelet counts.

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Declaration of Interest Statement

The authors declare that there is no conflict of interests.

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