

## ORIGINAL ARTICLE

# Description of Hematocrit in Malaria Tropica (*Plasmodium falciparum*) Patients at Jayapura Regional General Hospital

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## ABSTRACT

**Introduction:** Indonesia is one of the countries with the highest malaria cases spread across the entire island including Papua. Based on 2015 Annual Parasite Incidence (API) data, the number of positive malaria cases in Papua are 54.24 per 1,000 inhabitants. *Plasmodium falciparum* parasites that cause malaria tropica most cause death. *P. falciparum* transmitted through the bite of a female Anopheles mosquito attacks immature and mature erythrocytes. It caused erythrocyte hemolysis which decreased hematocrit. The importance of hematocrit testing as a simple screening test for anemia. The general objective of this research is to know the description of hematocrit in malaria tropica patients at Jayapura Regional General Hospital of, while the specific purpose is to find out the description of hematocrit based on the average level of *P. falciparum* infection. **Methods:** This study was done during May - June 2015. The research method is descriptive. The inspection method is done manually with microhematocrit. **Results:** The results showed from 44 samples obtained 32 patients (73%) who had low hematocrit and 12 patients (27%) who had normal hematocrit. The mean of hematocrit in patients with malaria tropica based on the level of infection were positive 1 of 8 patients (18%), positive 2 of 7 patients (16%), positive 3 of 14 patients (32%), and positive 4 of 15 patients (34%). **Conclusions:** The conclusion of the study is shown that more malaria tropica (*P. falciparum*) patients low hematocrit based on gender and level of parasite.

**Keywords:** Malaria tropica, *Plasmodium falciparum*, Hematocrit

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## INTRODUCTION

Malaria is found in almost all parts of the world, especially in countries with tropical and subtropical climates. Malaria remains a disease of global health importance with 3.3 billion people in 97 countries at risk, leading to an estimated 200 million cases and around 600,000 deaths (1). Every year this disease attacks nearly 300-500 million people in the world. Malaria causes estimated 212 million cases and 429 thousand deaths annually. *Plasmodium falciparum* is responsible for the vast majority of deaths (99%). The virulence of *P. falciparum* is mostly associated with immune response-evading ability (2).

Indonesia is one of the countries in the world that still faces the highest risk of malaria cases. About 80%

of regencies or cities in Indonesia are categorized as malaria endemic. Papua was one of the malaria-endemic areas, based on data from the 2015 Annual Parasite Incidence (API), the number of a positive case of malaria in Papua was 54.24 per 1,000 population (3).

Malaria is an infectious disease that is caused by intracellular obligate protozoa of the genus *Plasmodium* which is transmitted through the bite of a female Anopheles mosquito infected with a parasite. *P. falciparum* that causes malaria tropica is the most severe type of malaria disease and the only malaria parasite that causes microvascular disease because it can cause severe complications such as cerebral malaria, severe anemia, shock, acute kidney failure, bleeding, shortness of breath (4). *Plasmodium* infects the red blood cells are immature and mature erythrocytes in humans through mosquito saliva. *Plasmodium* in erythrocytes stage, merozoites will develop form trophozoites to form schizonts which can cause erythrocyte rupture (hemolysis) that cause

a decrease of the volume of erythrocytes in the blood. Erythrocyte volume or commonly known as hematocrit will experience a decrease due to hemolysis of erythrocytes which is characterized by a lack of blood or anemia (5).

## MATERIALS AND METHODS

### Setting and time of research

The type of this research is descriptive with the cross-sectional approach. The research was conducted at the Clinical Laboratory of the Regional General Hospital (RSUD) in Jayapura Papua. The research was conducted for one month starting from May 26 to June 26, 2015. The population was all patients with requests for malaria diagnosis who visited RSUD Jayapura. The sample in this research were 44 patients suffering from tropical malaria who visited RSUD Jayapura during the study.

### Treatment of experimental

The tools used in the hematocrit measurement include non-heparin microcapillary tube, microhematocrit centrifuge, hematocrit value reading scales (graph), methylated spirit lamp, and tissue. The material used in the hematocrit measurement is EDTA blood. Hematocrit measurement used the microhematocrit method with the principle of EDTA blood that was centrifuged at a speed of 16,000 rpm, within 5 minutes, the erythrocyte cells would be compressed. The height in the erythrocyte column was measured which was the hematocrit, namely the volume of all erythrocytes in 100 ml of blood and expressed in %.

Malaria diagnosis can be carried out microscopically and non-microscopically. The microscopic test can be seen directly under a microscope, to diagnose malaria disease which has a high level of accuracy and cheap, such as peripheral blood with a 100x magnification of the objective lens. Plasmodium parasite can be observed and differentiated by type under a microscope so that it will be more accurate and easier to determine the treatment procedure in malaria patients (6). Parasite density can be calculated by a semi-quantitative - negative type of assessment. No parasites were found in 100 large field of view (LPB); +1(1–10) parasites per 100 oil-immersion thick film fields, +2 (11–100) parasites per 100 oil-immersion thick film fields, +3 (1–10) parasites per single oil-immersion thick film field, +4 (more than 10) parasites per single oil-immersion thick film field (7)(8). The Normal Limit of Hematocrit value in males; 40%-54% and female; 37-47% (9).

### Data Collection

The data collection used is secondary and primary data that were obtained from the research results from May 26 to June 26, 2015, at the Jayapura Regional General Hospital.

## Analytical Data

The secondary data were obtained in the form of data on the results of malaria tropica measurement and the primary data in the form of hematocrit in malaria tropica patients who came to visit during the research at the Jayapura Regional General Hospital. Data were analysed using SPSS 18.0.

## RESULTS

Table I shows that the distribution of research subject in malaria tropica patients based on gender, hematocrit and level of parasite at Jayapura Regional General Hospital. It was known that out of 44 patients were more males 25 patients (57%) than females 19 patients (43%) suffered from malaria tropica. The mean of hematocrit in patients malaria tropica were  $32,80 \pm 7,401$ , the low result is 32 patients (73%) and normal is 12 patients (27%). The mean of hematocrit in patients with malaria tropica based on the levels of parasite were  $2,82 \pm 1,105$ , positive 1 of 18 patients (18%), positive 2 of 7 patients (16%), positive 3 of 14 patients (32%), and positive 4 of 15 patients (34%). While female patients at positive 1 of 35%, positive 2 of 34%, positive 3 of 30% and positive 4 of 26%.

**Table I : Distribution of Research Subject in Malaria Tropica Patients Based on Gender, Hematocrit and Level of parasite at Jayapura Regional General Hospital.**

	Mean $\pm$ SD	Min	Maks	F	%
<b>Gender :</b>					
Male				25	57
Female				19	43
<b>Hematocrit :</b>					
Low	$32,80 \pm 7,401$			32	73
Normal				12	27
<b>Level of Parasite :</b>					
+1	$2,82 \pm 1,105$	1	4		
+2				8	18
+3				7	16
+4				14	32
				15	34

Source: secondary data and primary data in 2015

## DISCUSSION

The results of the research, that has been carried out on blood samples of malaria tropica patients at the Jayapura Regional General Hospital, show that more patients had low hematocrit, both male and female. The low hematocrit result indicates that the number of erythrocytes in the malaria tropica patients has

decreased. According to Pearce, in malaria infection, the decrease of the hematocrit is caused by the destruction of excessive red blood cells by the malaria parasite. This is caused by *P. falciparum* which infects immature and mature erythrocytes, resulting in excessive and intense destruction of red blood cells. The decrease also occurs due to disruption in the formation of red blood cells in the bone marrow (10). However, this is different from Marjono's study, which stated that more malaria patients had normal hematocrit. This is possibly because in the study conducted by Marjono, the sample used was malaria patients in general without distinguishing the parasite species (11).

The decrease in erythrocytes in malaria tropica patients is caused by long-term infection of *Plasmodium falciparum* against erythrocytes, which causes erythrocyte life to not last long and eventually destroyed. This can be seen in malaria positive 4 patients (Table I), where the hematocrit decreased far below the normal limit. The decrease of erythrocytes is due to parasite infection in malaria tropica patients that cause anemia and even very risky severe anemia that can cause death. Anemia occurs due to the process of red blood cell destruction. Anemia is also caused by the destruction of erythrocytes that are faster than their production (hemolysis) by parasite infection of *P. falciparum* on red blood cells, which are both parasitic and non-parasitic. In addition, it is thought to be due to the decreased immunity in uninfected erythrocytes. Anemia in malaria patients has a hemolytic type caused by the number of erythrocytes that are destroyed and the erythrocyte lifespan that becomes shorter (12).

Based on the results in Table I, it is shown that the mean of hematocrit was lower for both males and females along with the high levels of parasite. The low hematocrit value was due to long erythrocyte infection (severe infection) and also the high number of the malaria parasite, namely *P. falciparum* in the blood. It resulted in the number of erythrocytes being destroyed (lysis) with the number of the parasite in the blood, so the erythrocytes decreased rapidly. Low hematocrit value for both males and female was obtained at a level of positive 4. This is not too different from Susilawati's research, with the lowest mean of hematocrit value in *P. falciparum* infection being 30%. However, this study is different from Marjono at the Kwaingga Regional General Hospital, Keerom Regency with the mean of hematocrit value of malaria patients was still within normal limits. This occurred because it was not based on the degree of infection, and it did not differentiate between species from parasites and the possibility of patients experiencing milder degrees of infection (13).

The increase in the degree of *P. falciparum* infection in erythrocytes is indicated by an increase in the number of malaria parasites in the blood. Usually, the more erythrocytes infected, the more parasites are in the blood. This has the risk of decreasing the number of erythrocyte, hemoglobin level, and hematocrit. According to Loeki, the number of erythrocytes infected by *P. falciparum* affects the high and low degree of parasite infection (parasitemia). The high levels of parasitemia can increase the risk of anemia in malaria (13).

Table I, It shows that the mean of hematocrit for both male and female patients is lower in positive 4 than positive 1, 2, and 3. The mean of hematocrit in malaria tropica patients was based on the level of infection, where the hematocrit for male and female were equally low. If the number of red blood cells increases significantly, the number of hematocrits will also increase, in which activity and pathological conditions, as well as altitude, will also affect the hematocrit. According to Wirawan, the number of erythrocytes varies depending on gender, the number of red blood cells, in which the number of red blood cells in males is more than in females (14).

Table I, shows that the hematocrit in malaria tropica patients was less normal, the low result were 32 patients (73%) and normal were 12 patients (27%). This occurred because of recent infection and the possibility that the patient has a strong immunity to fight infection caused by *P. falciparum*. In addition, it was also because of the patient's duration of infection with *P. falciparum* which was still around 2 or 3 days, and also the level of parasite that was still low. In this situation, the patient still had an appetite, did activities as usual, and looked physically mediocre with no symptoms of paleness or weakness, even though the patient was unconsciously infected by *P. falciparum*. According to the Ministry of Health, the immune system plays an important role in the body's response and increases the body's ability to fight malaria infection, so that symptoms would not have been seen (15). The variable declines in hematocrit which may fall below 30%, the lower threshold of normal in acute *P. falciparum* infections in the non- and relatively non-immune (16).

From the research that has been done on the description of the hematocrit in tropical malaria patients with *P. falciparum* infection against erythrocytes, this infection causes erythrocytes to be destroyed so that most of the hematocrit in malaria tropica patients has decreased in which the patients can be at risk for anemia. Thus it is important to

do a hematocrit measurement to find out the state of erythrocytes in the blood and as a supporting diagnosis of anemia in malaria tropica patients. The results of these examinations are very important to determine the clinical condition that leads to action or treatment of the patient.

## CONCLUSION

The results of the research on the description of the hematocrit in malaria tropica patients at the Jayapura Regional General Hospital, it shown that more malaria tropica (*P. falciparum*) patients have low hematocrit based on gender and level of parasite. It is advisable to carry out further research on the differences in hematocrit and parasite density in malaria tropica.

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