

## Asymptomatic Malaria Caused By *P. falciparum*, *P. vivax* And *P. malariae* Against Demographic Factors Of Elementary School In Berab Villages, Jayapura District, Papua, Indonesia.

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### Abstract

**Background** Asymptomatic malaria is caused through *Plasmodium* parasites without symptom. It spreads to human by bitten of infected female of mosquitos. **Methods** Among the 78 children's, and positive of asymptomatic malaria was found of 26 (33.3). Type of the research is a descriptive study with using a cross-sectional design. **Result.** Total of 26, children's were infected by *P.falciparum* of 14 (53.8), *P. vivax* 10(38.5) and *P.malariae* 2(7.7), respectively. Based on ages group 10-14 years were infected by *P.falciparum* of 8(30.8) than *P.vivax* 5(19.2). Group of ages at 6 - 9 years of 5(19.2) were infected by *P.falciparum* and *P.vivax* 5(19.2), respectively. Gender was infected by *P.falciparum* all same of 7(26.9) and *P.malariae* of 2(7.7) only male. Children's are not using mosquitoes net was infected by *P.falciparum* of 10(38.5) and *P.vivax* 7(26.9) higher than group are using mosquitoes net 4(15.4) were infected by *P.falciparum* and *P.vivax* of 3(11.5) and *P.malariae* 1(3.85), respectively. Based on residence, all students were living in Berab was infected by *P.falciparum* of 6(23.1) than *P. vivax* 4(15.4). **Conclusion** The result shown that children's were infected by *P.falciparum* with asymptomatic at the age of 10 -14 years the same for female and male, while children who due to being infected with *P. vivax* are slightly higher in female than male who is not using mosquitoes net in Berab villages.

Keywords: Asymptomatic malaria, *P. falciparum*, *P. vivax*, *P. malariae*

### Introduction

Malaria has attack 106 countries in the world including Indonesia. Malaria poses a major public health problem in Indonesia, including Papua Province. In 2018, there were an estimated 228 million cases of malaria occurred world wild, 206-258 million, compared with 251 million cases in 2010 and 231 million cases in 2017. Children aged less than 5 years are the most vulnerable group affected by malaria. In 2018, they accounted for 67% of all malaria deaths worldwild <sup>[1]</sup>

The World Malaria report, 2019 shown that estimates 228 million cases of malaria in the worldwild, causing 405.000 people deaths in the year 2018, many under the age of 5. Malaria is endemic in more than 90 countries, affecting an estimated 40% of the world's population <sup>[1]</sup>. Malaria is associated with travelers to the endemic area, and increasing numbers of imported malaria an understanding of frequency non- specific symptoms, difficulties related to the malaria diagnosis and treatment possibilities <sup>[2,3,4]</sup>

Malaria is an infectious disease caused by four protozoan parasites for the majority of cases of malaria in Papuan and west Papuan; *P. falciparum*, *P. vivax*, *P. oval* and *P. malariae*, respectively, which can be transmitted by the bite of female *Anopheles* mosquitoes species however *P.ovale* is rarely founded <sup>[5,6]</sup>. Manifestations of the malaria range from microscopic asymptomatic infection to symptomatic <sup>[7,8]</sup>. These asymptomatic infections are loosely defined as personals which present with Plasmodium parasites high a period of time but without clinical symptom of malaria and have not recently been treated with anti-malarial drugs <sup>[9]</sup>

The symptoms of malaria is re-include cycles of chills, fever, sweats, muscle aches and headache that recur every few days, with other symptoms such as vomiting, diarrhea, coughing and jaundice of the skin and eyes. Persons with severe falciparum malaria can develop bleeding problem, shock, kidney and liver failure, central nervous system problems, coma and die <sup>[2,3]</sup> *P.falciparum* and *P. vivax* are two main causes of human malaria infections. Falciparum malaria poses can be caused of severe complicated and majority patients OD deaths <sup>[10]</sup>

Naturally acquired antibody responses to parasites antigens have been noted to play significant roles in the acquisition of anti-malarial immunity despite being shows to be short to be lived <sup>[11,12]</sup>. The celulaire responses to

malaria that may involve various lymphocyte subsets and cytokines are secreted, to mediate protection the acquisition of immunity by means of down regulating protective immune responses <sup>[13,14,15,16]</sup>

Malaria is still a public health problem in Indonesia and the populations were living in endemic regions of malaria, local transmission is still at risk of malaria. By 2014 there are 74% of the population living in malaria without risk regions and 3% living in high risk regions. In the last 4 years most of the population is showing increased. Whereas people in high endemic regions have the lowest presentage and level to fall of 4.7% in 2012 to 2.2% in 2015 <sup>[17]</sup> and in 2020 positive malaria cases decreased to 235.7 thousand with Annual Parasite Incidence (API) reaching 0.87 <sup>[18]</sup>

In 2016, Papua Province ranks highest in malaria morbidity in Indonesia with Annual Parasite Incidence (API) reaching 28.4% of the population. The highest number of malaria cases at 5 districts; in Mimika district of 49.519 cases, Keerom district of 25.915 cases, Jayapura district of 24.442 cases, Jayapura municipal of 19.06 cases and sarmi district of 15.549 in Papua Province, respectively <sup>[10]</sup>.

In 2017, malaria was second out of 10 diseases in the health service of Jayapura district with a total of 22.140 cases with API 203 per 1000 populations. From 19 districts in Jayapura District, Nimbokrang District has the highest Annual Parasite Incidence (API) of malaria with 258 per 1000 populations out of a total of 7159 people <sup>[19]</sup>

In hyper and holoendemic regions, malaria control is not effective so that acute malaria attack often occur in this region. Host factors (human and *Anopheles mosquitoes* sp), agent (*Plasmodium*) and the environment are strongly related to cause malaria spread <sup>[5,17,19]</sup>.

Human population at high risk of contracting malaria include children are living in endemic regions who are not yet immune to the form of *Plasmodium* and malignant types of malaria. The Berab is one of the villages in Nimbokrang with a population of 499 subjects who have a high number of malaria cases with annual parasite incidence of 294.5 per 1000 population in 2018 <sup>[19]</sup>

## Material and Methods.

**Description of Study Site.** This study was conducted at Christian elementary school children in Berab, Jayapura District. Total sample of 78, the positive sample of malaria as much 26. The result was conducted in Nimbokrang Laboratory of Community Health Center. The land area of the Community Health Center was established on 5000 m<sup>2</sup> of land with a building area of 396 m<sup>2</sup>, the status of output patient services with basic health services. Total populations were 7.159. The Papuan was living in Berab villages of 529 <sup>[19]</sup>.

The climate is typically tropical with average temperature between 25-35°C. The difference between rainy season of September to December and dry season as because of wind effect May to August, the wind is blowing from South east with less amount of water vapor whereas in December to April the westerly wind is blowing sea and causes rainfall. The range of rainfall is between 1,500-6000 mm per year <sup>[19]</sup>

**Sample Collection.** The research was conducted on May 2019 in Brab Villages in each of the fourth sub villages. The selected sub-villages represented the rivers, rice fields and forest environmental setting of malaria. The target population was the students were living and life in the Berab villages. In the blood will be taken by finger prick and prepared for thin and thick blood smears, which were then used for Giemsa microscopy to detect malaria parasites and species of malaria. This study was carried out with the approach by Ethics Committees at the Ministry of Health, Polytechnic of Health Jayapura Indonesia.

**Parasite detection.** We were using thin and thick blood smears taken during malariometric survey were stained with Giemsa and subsequently examined through light binocular microscopy. Parasite density was determined by accounting the number of parasites per leucocytes in 100-high-film, assuming an average of 200 leucocytes per microscopic field and 8000 leucocytes/ $\mu$ l of blood. Slides were declared negative if parasite could not be detected in 100 microscopic field. The parasite count was classifield as: ( + ) if 1-10 parasites were found per 100 thick film fields, (++) if 11-100 parasites per 100 microscopic thick film fields, (+++) if 1- 10 parasite per one thick film fields and (+++++) if more than 10 parasites per one thick film fields <sup>[20,21]</sup>.

## Result

### Frequency distribution of malaria by Microscopy and parasites Rate

The children in this study of asymptomatic malaria through active case detection we have been taken blood samples were collection from children of elementary school at Berab villages in Nimbokrang Community Health Center's, total of 78. Based on the microscopic examination, there is of 26 (33.3) positive children's were infected by *Plasmodium* sp as follow:

Table 1  
Data of Asymptomatic Malaria of Children's Elementary School  
in Berab, Jayapura District

Malaria parasites	Frequency	Presentage (%)
Negative	52	66.67
<i>Plasmodium falciparum</i>	14	17.95
<i>Plasmodium vivax</i>	10	12.82
<i>Plasmodium malariae</i>	2	2.56
Total	78	100.0

The result shown that children with asymptomatic malaria was infected by *P. falciparum* of 14(17.95) higher than *P.vivax* 10(12.82) and *P. malariae* 2(2,56), respectively

Table 2  
Data of Malaria Parasites Based on Ages Group of Children's at Elementary School  
in Berab, Jayapura District

Ages ( years)	Negative (%)	Malaria parasites (%)			Frequency (%)	P.value
		<i>P. falciparum</i>	<i>P. vivax</i>	<i>P. malariae</i>		
6 to 9	29(37.2)	6 (7.7)	5 (6.4)	1(1.3)	41(52.6)	0.855
10 to14	23(29.5)	8(10.3)	5 (6.4)	1(1.3)	37(47.4)	
Total	52( 66.7)	14(17.4)	10(12.8)	2 (2.6)	78(100)	

Based on ages, the result shown that children's were infected *P. falciparum* of ages group 10 -14 years of 8 (10.3) slightly more than ages 6 - 9 years 6 (7.7). The ages group 6 - 9 years and 10-14 years were infected *P. vivax* with the same number of 5(6.4) and *P. malariae* 1(1.3) for two age groups, respectively.

The Chi-square statistical test shown that there is not significant correlation between malaria parasites with ages groups were found of children at elementary school (P value = 0.855> 0.05 ( CI=95%,  $\alpha$  = 5%)

Table 3  
Data of Malaria Parasites Based on Gender of Children's at Elementary School  
in Berab, Jayapura District

Gender	Negative (%)	Parasites of malaria (%)			Frequency (%)	P.value
		<i>P. falciparum</i>	<i>P. vivax</i>	<i>P. malariae</i>		
Male	27(34.6)	7(9.0)	4(5.1)	2(2.6)	40(51.3)	0.489
Female	25(32.1)	7(9.0)	6(7.7)	0(0)	38(48.7)	
Total	52(66.7)	14(18.0)	10(12.8)	2(2.6)	78(100)	

Based on gender, the result shown that children's were infected by *P. falciparum* for male and female the same number of 7(9.0) whereas by *P. vivax* for female slightly more of 6 (7.7) than male 4(5.1) and *P.malariae* 2(2.6), respectively.

The Chi-square statistical test shown that there is not significant correlation between malaria parasites with gender was found of children's in elementary school. (P.value 0.489> 0.05 (CI=95%,  $\alpha$  = 5%),

Table 4  
Data of Malaria Parasites Based on Residence of Children's at Elementary School  
in Berab, Jayapura District

Berab villages	Negative (%)	Parasites of malaria (%)			Frequency (%)	P.value
		<i>P.falciparum</i>	<i>P. vivax</i>	<i>P.malariae</i>		

village I	7( 9.0)	0	3 (3.8)	0	10(12.8)	0.275
village II	12( 15.4)	3 (3.8)	0	1 (1.3)	16(20.5)	
village III	11(14.1)	6 (7.7)	4(5.1)	0	21(27.0)	
village IV	22(28.2)	5 (6.4)	3(3.9)	1(1.3)	31(39.3)	
Total	52 (66.7)	14 (17.5)	10(12.8)	2(2.6)	78(100)	

Based on residence shown that children's were living at village III in Berab was infected by *P. falciparum* of 6(7.7) more than *P. vivax* 4(5.1), respectively. The Chi-square statistical test shown that there is not significant correlation between malaria parasites with residence was found of children's in elementary school. (P. value = 0.275 > 0.05 (CI=95%,  $\alpha$  = 5%),

Table 5  
Data of Malaria Parasites Based on Mosquito Net of Children's Elementary School in Berab, Jayapura District.

Habit of sleeping	Negative (%)	Parasites of malaria (%)			Frequency (%)	P.value
		<i>P.falciparum</i>	<i>P. vivax</i>	<i>P.malariae</i>		
Without Mosquito Net	49( 62.8)	10(12.8)	7 (9.0)	1(1.3)	67(85.9)	0.022
With Mosquito net	3( 3.8)	4 (5.1)	3(3.8)	1(1.3)	11(14.1)	
Total	52(65.6)	14(17.9)	10(12.8)	2(2.6)	78(100)	

The result shown that children's were sleeping without mosquitoes net was infected by *P. falciparum* of 10(12.8) than *P. vivax* 7(9.0) and *P.malariae* 1(1.3), respectively. Children's were sleeping with mosquitoes net was infected by *P. falciparum* of 4(5.1) than *P.vivax* 3(3.8) and *P. malariae* 1(1.3), respectively.

The Chi-square statistical test shown that there is significant correlation between parasite of malaria with mosquitoes net was found of children's in elementary school. (P. value = 0.022 < 0.05 (CI=95%,  $\alpha$  = 5%),

### Discussion

The frequency of distribution of the asymptomatic malaria was conducted to students in Christian elementary school, Berab villages, shown that of 78 suspect of malaria which is examined microscopically was found *P. Falciparum* is higher than *P. vivax* and *P. malariae*, respectively. This cases can be caused by environmental factors such as; rivers, irrigation, rice fields, swamps, and paddy fields which to become breeding place of *Anopheles* mosquitoes were infected by *Plasmodium* species. Malaria transmission is largely determined by human factors and species of *Anopheles* mosquitoes as malaria vectors, *Plasmodium* parasites and the surrounding environment that influence each other's spread in one particular area. The high transmission depends on the density of *Plasmodium* Parasites, frequency of mosquito bites, the length of life mosquito, the sporogonic cycle, the sporozoid number and the parasitic reservoir [5,7,9,19,20]

Based on ages, the students were infected by *P. falciparum* of age groups 10 to 14 years more than the age groups 6 to 9 years, but the two ages groups were infected through *P. vivax* in the same number. This cases is caused by student with aged 6 to 9 years, they do not have a completed immune system so they can become infected, whereas students with ages group 10 to 14 years, they have been a completed immune system but are still sick, therefore the number of parasites that enter erythrocytes is more than the immune system, and this students perhaps usually do activities in the outside home so that can be bitten by *Anopheles* mosquito or can also occur due to contact with student who suffer of malaria asymptomatic with carrier of gametocyte in the blood that can be transmission [5,7,11]. It could also because the likelihood of contact with mosquitoes is higher and becomes a range of malaria endemic region, the difference in prevalence of malaria by age is related to the degree of immunity, exposure to mosquito bites in children's and density of *Plasmodium parasite* [5,11,22,23]

Based on gender, the children's were infected by *P. falciparum* of male and female the same number, whereas gender was infected by *P. vivax* of female slightly more than male and *P. malariae* only male. This result of the same [13], that the gender there is no relationship with asymptomatic malaria because of malaria can be attack of all gender, and students are sickening more and cause seizures *P falciparum* tends to collect, stick of

blood vessels causing blockages, and it is also influenced by parasites density and the child's immune system. [5,21,23].

Based on residence, the result shown that student was infected by *P. falciparum* of village III slightly more than *P. vivax*. This cases can be caused of the dominance of malaria cases in village III area because the physical environment of this areas is close to the river downstream and is under a hill which is mostly forest which can become a breeding place for mosquitoes and their a place to life from species of mosquito *Anopheles* as a malaria vector [5,19,22]. Human as intermediate host was infected by *Plasmodium* can be a source of malaria transmission in a region and contact behavior between children's of elementary school with mosquito fly distances [5,19].

Based on mosquito net, The students were sleeping without used mosquitoes net was infected by *P.falciparum* higher than *P. vivax* and *P.malariae* therefor they are not sleeping with use mosquito net and still being outside the house all the night and more contact with mosquitoes, and perhaps they were living in mosquito breeding places so that can be infected [5,22]

### Conclusions

The Frequency of distribution of the malaria parasite infecting to children in elementary school was found *P. falciparum* higher than *P. vivax* and *P.malariae* in the ages group 10 to14 years more higher than the ages group 6 to 9 years, because they have infected by *Anopheles* mosquitoes exceeding the level of body immunity and or the difference in prevalence of malaria more than to degree of immunity system and can be also caused exposure to mosquito bites to children's and density of *Plasmodium parasite* is higher<sup>[13,15]</sup> which causes malaria of them and the malaria cases who attacks gender of female slightly more than male who are not using mosquitoes net while sleeping at night in Berab villages.

### Abbreviations

*P.falciparum*: *Plasmodium falciparum*, *P.vivax*: *Plasmodium vivax* and *P.malariae*: *Plasmodium malariae*

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### Availability of data and material

The data sets analyzed in this study are of available from the corresponding author on request.

### Ethics approval and consent to participate

Research approval was taken from Health Research Ethics Committee of Polytechnic of Health, Ministry of Health Jayapura. Discription of ethical approval No. 006/KEPK-J/IV/2020.

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### Completing/ Interest

The Authors have no conflict of interest to declare regarding the publication of this manuscript

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