

Discovery of Malaria Cases on Forest Workers In Public Health Center, Teluk Kepayang, Tanah Bumbu, South Kalimantan

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Abstract. Regency of Tanah Bumbu has an annual parasitic incidence rate (API) 0.82 and in 2016 the number of API decreased to 0.48. However, there are malaria cases that still occur in the 5 (five) locations of the workplace of the public health center with the category High Case Incidence (HCI). Determining factors in the case of malaria in Tanah Bumbu district are malaria parasites (*Plasmodium falciparum*, *P. vivax*, and mixed), and forest workers. The more dominant malaria attacked the population in the working area of the public health center is the malaria vivax and the mix (*P. falciparum* and *P. vivax*). The purpose of the study was to determine the dominant Plasmodium species that attacked the population. The type of descriptive research with cross-sectional design in the village endemic malaria of the HCI category in the working area of the public health center in the district of Tanah Bumbu. The results show that a total of 773 respondents was examined to detect cases of malaria, mixed malaria results (*P. falciparum* and *P. vivax*), and *P. vivax* were dominantly found in adult men who worked as a forest protector and miners in 73% of cases. While in adult women are gardening in the find 27% of cases of malaria species (*P. falciparum* and *P. vivax*) and *P. vivax*. Conclusion: The rides of malaria sufferers in the working area of the public health center with a total value of SPR 1%. Thus, for people in the working area of the public health center to use a mosquito net with insecticide during the special night, and use mosquito repellent to avoid mosquito bites and use prophylactic drugs when going to the fields/ Forests for work.

1 Introduction

Malaria is a vector caused by a protozoan of the Plasmodium genus that is transmitted via a mosquito broker *Anopheles* spp. The Plasmodium genus, which infected humans, can cause malaria to be a *Plasmodium falciparum*, *P. vivax*, *P. ovale*, and *P. malariae* [1].

Of these four species can be found despite their distribution and infection numbers are not the same. Certain parasites of ape malaria have been reported to infect humans both naturally and experimentally. Among the 20 Plasmodium species known to infect apes, five potential species infect humans are *P. brasilianum*, *P. cynomolgi*, *P. inui*, *P. knowlesi*, and *P. simium* [2].

Among these species, *P. falciparum* is a parasitic that has the highest mortality rate and *P. vivax* is a parasite that has the highest degree of virulence [3].

Malaria to date is still one of the major health problems in the world and reportedly 3.2 billion of the world's population have areas where the risk of malaria transmission originated from 108 countries, and estimated about 300-500 million cases. Clinical malaria worldwide with a mortality rate of more than 1 million people annually [4,5].

Some provinces in Indonesia are still a high endemicity area for malaria, one of which is South Kalimantan. The acceleration of achieving malaria-free needs to be done by South Kalimantan province with hard work, smart work, and cooperation of all Government ranks supported by all layers of society is expected to be free Malaria materialized before 2030 [6].

Tanah Bumbu Regency is one of the regencies in South Kalimantan. In 2015, the land of Bumbu district had an Annual Parasite Incidence (API) Number of 0.82 and in 2016 the decline of API figures to be at 0.48 [1,6]. Some efforts that have been done by the Office of the Health District of Tanah Bumbu and Puskesmas to reduce the number of the API such as mass Blood survey, epidemiological investigation, division of mosquito nets, spraying house, counseling, treatment, posmaldes, and health workers and malaria cadres. However, malaria cases still occur in 5 (five) location points with the High Case Incidence (HCI) category [1].

This research was conducted in the village of the malaria-endemic HCI category which has a mine area in Tanah Bumbu district. In the implementation of data collection activities that include the identification of Mass Blood Survey on mine workers in Tanah Bumbu district.

The activities are expected to be the basis of the malaria surveillance program to strategy Improvement Program awareness to the onset of malaria, especially in the mining area towards the acceleration of malaria elimination in Tanah Bumbu district.

2 Method

The research in this article is a descriptive study using the cross-sectional design approach. This research is done by active case detection (ACT), the officer came directly to the community by taking the blood of the subject, then examined and identified Plasmodium species. When founding a positive subject of malaria given treatment, but not in a follow-up. The target

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population is the whole community in the area of endemic malaria in the working area of Teluk Kepayang Regency of Tanah Bumbu. A sample of research is a community in the Teluk Kepayang village who is willing to retrieve blood to examine malaria parasites. Inclusion criteria are a society with the diagnosis of malaria without complications, aged 0-60 years, willing to participate.

The blood is taken from the middle finger, with the way the middle finger is wiped with alcoholic cotton, then the fingertip part is stabbed using a hand needle, the blood that comes out is capillary blood. This blood is taken as much as 3 drops, 2 drops at the center of the glass object, and 1 drop on the glass end of the upper object. After finishing the blood, the fingertip is cleaned with alcoholic cotton and pressed, so that the blood does not drip again. The blood that has been taken is used to make a thick and apus thin. Thin Blood Apus is made by pasting the tip of another glass object in the blood with an angle of 45 °, then shifted rapidly, so that the thin preparations are obtained. For thick blood is made by turning the glass end of another object clockwise to the blood in the middle of the glass object, forming a circle with a diameter of 1 cm. glass objects are then labeled in the form of the sufferer's name, number, and date of manufacture.

The blood dosage staining is done using the Giemsa method, which is thin blood dosage of methanol fixation, and then with a thick blood preparation in the GIEMSA's Tetesi 10% for 20-25 minutes. In the phase of microscopic examination, the preparation of staining is tested with immersion oil, the objective lens is placed on the preparation of 1 cm from the tip of the tongue, the examination is done right, moving like a spiral. In The thick blood Apus, the examination is done up to 100 fields of view to determine whether the preparation is positive or negative. Examination in thin blood, performed to determine the species and stage of malaria parasites [7].

3 Results

3.1 Demographic state

The Teluk Kepayang village is endemic to malaria in the form of mines, forests, and plantations. This is evident from the spread of the kind of work the sufferer

gets known that the majority of cases occur in mine laborers, forest links, and gardening, and farmers.

3.2 Prevalence of malaria and sample research characteristics.

A Malariometric survey in an endemic village in the working area of the Teluk Kepayang village of the Kazan Hulu Sub-district of Tanah Bumbu succeeded in MBS (mass blood Survey) of 773 respondents acquired SPR (Slide Positive Rate) of 11 respondents positive malaria consists of 1 subject suffered from falciparum malaria, 5 subjects suffered from the malaria vivax and 5 subjects suffered a mixture (falciparum and vivax). Mixed Malaria (*P. falciparum* and *P. vivax*) and *P. vivax* are more dominant found in adult men who work as forest protectors and miners in 73% of cases. While in mature woman gardening is found 27% cases of malaria species (*P. falciparum* and *P. vivax*) and *P. vivax*. Discovery of malaria sufferers in the working area of Teluk Kepayang with a total value of SPR 1%.

The discovery of cases that were mostly experienced by mine workers, forests and gardens, was also strengthened with the case data in 2016 where most of the malaria case sufferers were men of 75% and most in productive people who were 15-54 years as much as 95.20%. Malaria parasites found in cases of malaria occurring in Tanah Bumbu District are Plasmodium Falciparum, Plasmodium vivax, and mix. The case of malaria occurring in 2015 in Tanah Bumbu district is mostly a case of utilization (41.7%), imports (24.6), relapsed (8%), and is not known (25.7%) [6].

In addition to these issues known geographical factors, worker's mobility logging system, worker behavior, and support from neighboring districts also affected in the case of a malaria incident in Tanah Bumbu District given the majority of citizens who is a citizen originating from another district working to the focus area of transmission.

Based on the issue, research is done for malaria case identification activities, taking SDJ on mineworkers, in improving the malaria surveillance program by the District Health Office of Tanah Bumbu and district involvement. Neighbors whose citizens work in the mining area in Tanah Bumbu District, and there are also non-indigenous people/migrants from outside the regency of Tanah Bumbu Province of South Kalimantan.

Table 1. Malaria case identification in the working area of Teluk Kepayang Village of Kusan Hulu Tanah Bumbu District

<i>Mass Blood Survey</i>	Total Slide	Positive Slide	SPR	Description
Teluk Kepayang Clinic (January -August 2018)	773	11	1%	5 mix positive slide 1 positive slide of <i>P. falciparum</i> 5 positive slide of <i>Plasmodium vivax</i>

Table 2. Malaria case identification based on age and gender in the working area of the Teluk Kepayang village of Kusan Hulu Regency

Age	Gender		Total %
	Male (%)	Female (%)	
	N=8	N=3	
0-10 year	0	0	0
11-20 year	3 (27,5)	2 (18)	5 (45,5)
21-30 year	5 (45,5)	0	5 (45,5)
31-40 year	0	1(9)	1(9)
41-50 year	0	0	0

Based on the table above, the case of malaria, based on age and sex in the working area of Teluk Kepayang health centers dominated by males as much as 8 respondents, with an average age between (11-20 and 21-30 years) as much (73%). As for female gender 3 respondents at age (11-20 and 31-40 years) (27%).

Table 3. Identification of falciparum Malaria cases based on age and gender in the working area of Teluk Kepayang district of Kusan Hulu Regency of Tanah Bumbu.

Age	Gender		Total (%)
	Male (%)	Female (%)	
	N=1	N=0	
0-10 year	0	0	0
11-20 year	0	0	0
21-30 year	1(100)	0	1
31-40 year	0	0	0
41-50 year	0	0	0

According to the table above, the case of falciparum malaria based on age and sex in Teluk Kepayang village is only one case dominated by male gender 1 respondent, with an average age above (21-30 years) as much (100%).

Table 4. Identification of the vivax malaria case based on age and sex in the working area of the Teluk Kepayang village of Kusan Hulu Regency.

Age	Gender		Total %
	Male (%)	Female (%)	
	N=4	N=1	
0-10 year	0	0	0
11-20 year	0	1 (20)	1(20)
21-30 year	4 (80)	0	4 (80)
31-40 year	0	0	0
41-50 tahun	0	0	0

Based on the table above, the case of a vivax malaria based on age and gender in the village of bankruptcy is dominated by male gender as much as 4 respondents, with an average age above (21-30 years) as much (80%), while the female as much as 1 Respondent, with an average age above (11-20 years) as much (20%).

Table 5. Identification of mixed Malaria cases (falciparum and vivax) based on age and gender in the working area of Teluk Kepayang in Kusan Hulu Sub District Regency of Tanah Bumbu

Age	Kind of Sex		
	Male (%)	Female (%)	Total %
	N=3	N=2	N=5
0-10 year	0	0	0
11-20 year	3 (60)	1 (20)	4 (80)
21-30 year	0	0	0
31-40 year	0	1(20)	1(20)
41-50 year	0	0	0

Based on the table above, mixed malaria cases (falciparum and vivax) based on age and sex in the working area of the Teluk Kepayang clinics, dominated by male sex of 3 respondents, with an average age between (11-20 years) as much as (60%). The WHO standards in malaria determination are the microscopic observation of parasites. Observations were made in the preparation of the thick blood to determine malaria positive and thin blood preparations to determine the Plasmodium species [7].

4 Discussion

4.1 Prevalence of malaria and sample research characteristics.

The prevalence of the asymptomatic malaria case based on the highest positive rate slides found in the Teluk Kepayang village is the Plasmodium vivax and mix/malaria mix (falciparum and vivax). The case condition is caused by environmental, human, vector (mosquitoes Anopheles) and parasitic in the Teluk Kepayang village.

4.2 The environmental factors of the Teluk Kepayang Village

4.2.1 Physical environmental aspects

The village of Teluk Kepayang is located in the highlands of the mountainous region. The temperature of this area ranges from 25-27 ° C. Temperature affects the development of parasites in mosquitoes. The optimum temperature ranges from 20-30 ° C. The higher the temperature (to a certain extent) the shorter the period of extrinsic incubation (Sporogoni) and conversely the lower the temperature the longer the incubation period [2]. Air conditioning in this windy area, and high humidity rate, so that mosquitoes become more active and more often bite, thus the transmission of malaria will be higher. Low humidity shortens the life of the mosquito, although it does not affect the highest rainfall parasites ranging from 1500-6000 mm/year in December to April, resulting in many puddles of rainwater in the lemurs, sewers and Former traditional gold and coal mines, and interspersed with

the summer turnover in May to November is an important condition for the transmission of malaria disease. In general, the rain will facilitate the development of mosquitoes and the occurrence of malaria pandemic. Its small influence depends on the type and the rain, type of vector, and the type of place of the missed. Hot-interspersed rain enlarges the likelihood of breeding mosquitoes *Anopheles* [2].

4.2.2 Biological environment aspects

Teluk Kepayang Village is a tropical forest, forest and palm oil plantations, paddy fields, and other plants that can affect the development of a life of larvae because the above plants can block the sunlight or protect from Other life attacks [2]. Paddy fields are also a place of longing for the mosquito species *An. balabacensis* and *An. Nigerrimus* as the main vector in Tanah Bumbu district. The communities in this area are often infected by asymptomatic falciparum malaria based on microscopic examination.

4.2.3 Socio-cultural environment aspects

Aspects of socio-cultural environment in the form of lack of public awareness about the dangers of malaria and living habits outside the home, cottage/camp until late night, which causes the vector is exophilic and exofagic will facilitate mosquito bites. This aspect also plays a role in influencing the development of the mosquito. *Balabacensis* and *An. Nigerrimus* as the main vector [7]. Based on a positive rate slide, this area can be categorized as a High Prevalence Area (HPA) region due to $SR > 3\%$. 4 Teluk Kepayang Village has a very suitable environment for the growth of falciparum malaria parasites because only parasites can Adapt to the Anthropofilik *Anopheles* mosquito repellent, it will form sporogonic and produce effective sporozoid, which can be transmitted into the human body. The prevalence of malaria cases in one area endemic malaria and other malaria-endemic areas is not the same, depending on the behavior of the mosquito species being vector [7].

Prevalence of asymptomatic malaria cases based on relatively high positive rate slides found in Teluk Kepayang village is the malaria vivax and mixture (falciparum and vivax) is 90% while the rest is falciparum malaria of 10%. This is due to the physical condition of Teluk Kepayang Village with a temperature of 22 -24,5 ° C will affect the development of parasites in mosquitoes. Moisture and high humidity, as well as rainfall ranging from 1500-6000 mm/year, are important factors for the transmission of malaria disease [7]. From the socio-cultural aspect, the level of community density can be divided into less dense and the livelihoods of gold miners, traditional coal, lumberjack, farmers, and gardening. It is in line with the research results [8]. The majority of infections occur in males and aged > 15 years. SPR miners and not miners in central Kalimantan and South Kalimantan, there is a meaningful difference between SPR on wood loggers and not wood loggers. It was

concluded that forests are one of the environments that support the transmission of malaria in central Kalimantan and South Kalimantan, with the highest transmission in the adult. Miners in the central Kalimantan Forest are at risk 5 times to be attacked by malaria compared to non-miners. While in South Kalimantan, wood loggers in forests are at risk of malaria 7 times compared to non-lumberjack.

4.3 Vector Factors

The mosquito species *Anopheles* which plays an important role in the transmission of malaria in Tanah Bumbu District is *An. Balabacensis* and *An. Nigerrimus*. Both species are the main vector of malaria transmission. 7 Places of the vector larvae of *An. Balabacensis* and *An. Nigerrimus* are in gardens, forests, pools of former coal mines, a former pool of gold mines left open/abandoned so It is suitable for a place to miss the larvae in the water open and exposed to sunlight, and by the river. The mosquito life is determined by the circumstances of the environment such as temperature, humidity, rainfall, and so on. The height of transmission depends on the density of vector, bite frequency, the length of the Sporogoni cycle, sporozoid figures (parasites found in the mosquito-salivary gland), and the presence of parasitic reservoirs (humans with parasites in the blood) [2].

4.4 Human Factors

Everyone can be infected by the cause of the disease and is the place of the breeding agent (*Plasmodium* parasites). For your work, several intrinsic factors can affect the vulnerability of the agent. These factors include age that children are more susceptible to malaria parasitic infections because the child's body immunity has not been perfect against *P. falciparum* and *P. vivax* infections, compared to adults as more and more often adults are exposed to By the parasitic *P. falciparum* and *Vivax*, the body will form antibodies against the parasites *P. falciparum* and *P. vivax* [9].

Based on gender, girls have stronger body resistance compared to boys.⁽²⁾ But the subject at Teluk Kepayang village is different because women aged over 11-30 years are more dominant infected by mixed malaria (falciparum and vivax) so that their immune power is not perfect against falciparum malaria and vivax. Indigenous groups of malaria-endemic areas have a natural immunity to malaria.

History of previous diseases, people living in this area have not been exposed by infection *P. falciparum* and vivax so that their bodies have not been immune to infection. Way of life, people in this area are using mosquito nets there are also who do not and often stay outside the house until the afternoon in the forest, life behavior like this is also very influential to the transmission of malaria. Nutritional Status, the community in this area is quite good and the immunity of people in this area is being because it is still often

infected by parasites *falciparum* and *vivax*, thereby their body has not had a natural immune system [8].

4.5 Parasites Factors

Malaria is a vector-borne disease caused by a protozoan of the *Plasmodium* genus that is transmitted via an intermediary of mosquitoes *Anopheles* spp. The *Plasmodium* Genus that infects humans can lead to malaria disease is *Plasmodium Falciparum*, *Plasmodium vivax*, *Plasmodium ovale*, and *Plasmodium malariae*. Of these four species, the bias was found despite its distribution and the infection numbers were not the same. Some malarial parasites have been in the report that can infect humans both in the natural and experimental. Among the 20 *Plasmodium* species known to infect apes, five potential species infect humans are *P. brasilianum*, *P. cynomolgi*, *P. inui*, *P. knowlesi*, and *P. simium*. (11) Among those species, *P. falciparum* is a parasitic that has the highest mortality rate and *P. vivax* is a parasite that has the highest degree of virulence [3].

In Indonesia, until 2012 was found four cases of *P. knowlesi* malaria and all its transmission occurred locally in the forest or around the forest in South Kalimantan. The discovery of four cases of *P. knowlesi* Malaria in South Kalimantan is preliminary evidence of the transmission of this type of malaria in Indonesia [3].

The specific properties of the parasite differ for each species of malaria and this affects the occurrence of clinical manifestations and the transmission of *P. falciparum* and *Vivax* has a different period of infection. *P. Falciparum* has the most short period of infection but produces high parasitemia, the most severe symptoms, and the shorter incubation period. Whereas *P. vivax* generally produces low-light parasitemia and has a longer incubation period [9].

In the working area of Teluk Kepayang Village, Kusan Hulu District, Land of Bumbu, during 2014 there was a tendency to increase cases of malaria. Most malaria sufferers are found to be indigenous and migrants from outside South Kalimantan, so that suspected incidence of malaria in the working area of Teluk Kepayang district of Kusan Hulu District Land of Bumbu is a case of transmission Local/Local.

The results of microscopic observation of mixed patients with positive malaria (*P. falciparum* and *P. vivax*) at the age of 11 months and 18 months and are found in the case of pregnant mothers of 1 positive malaria *falciparum*, it is indicative that in the area Transmission utilization. The prevalence of *falciparum* malaria cases in females aged 21-30 years is 60% more dominant than in adult males and children, this may be due to women (children and adults) having the immune resistance more vulnerable than Male (child and adult) plus their residence is not permanent, only a small cottage/camp, so it is very prone to get mosquito bites in the evening and at night, added again they are new to use mosquito nets if you want Sleep.

Some studies have shown that women have a stronger immune response than men, but pregnancy

increases the risk of malaria. Malaria in pregnant women has a poor impact on maternal and child health. Genetic factors in humans can affect malaria, with the prevention of parasite invasion of cells, altering immunologic responses, or reducing exposure to vectors [9].

Pregnant women have a risk of being infected with *falciparum* malaria more often and heavier than women not pregnant. The concentration of erythrocytes infected with parasites is found in the placenta so that the immune response to parasites in the field has been suppression. It relates to the suppression of the immune system both humoral and mobile during pregnancy concerning the existence of a fetus as foreign objects in the mother's body [1].

Suppression of the immune system during pregnancy is associated with hormonal conditions. Concentrations of progesterone hormones that increase during pregnancy effect inhibit the activation of T lymphocytes against antigen stimulation. Additionally, cortisol immunosuppression effects also play a role in inhibiting the immune response [6].

Pregnant women are more easily infected with malaria compared to the general population, besides being easily infected with pregnant women also suffer, recurrent infections, and severe complications resulting in death. This may be due to the weakness of the immunity of the body and decreased immunity gained in the area of *Histrio malaria* [10].

According to Molineaux and Gramiccia (1980) Inside (9), women have a stronger immune response compared to men. However, in Temunih village, this may be due to different ethnic and geographic influences. Distribution differences according to age and gender are related to the difference in immune degrees due to variations of exposure to mosquito bites.

The results interviewed the mother of the baby and the toddler, they never go anywhere or get into the woods for wood, and they just stay in the camp to keep her child.

The source of malaria transmission in Temunih village is a former gold mine that was left abandoned, clearing new land to serve as the location of their/camp for wood loggers in the forest. Therefore, people around the house there is a mosquito resting place may have a risk of malaria mosquitoes bitten higher than those around the house there is no mosquito resting place. People, nearby there is a mosquito resting place risk to suffer malaria 4.8 times higher than those around the house there is no mosquito resting place by controlling the social-economic factors [6].

5 Conclusion

The discovery of malaria sufferers in the working area of Teluk Kepayang with a total MBS of 773 respondents found a positive case of 11 respondents with a value of SPR of 1%. The occurrence of malaria cases based on gender, occupation, and more dominant age is found in adult men who work as forest protectors

and miners in 73% of cases. While in mature women gardening is found only 27% of cases of malaria, with species (*P. falciparum* and *P. vivax*) and *P. vivax*. The age that is vulnerable to the vivax malaria infection and the mixture (falciparum and vivax) is the age between 11-20 and 21-30 years with the male gender. While in women who are susceptible to the vivax malaria infection and mixture (falciparum and vivax) are ages between 11-20 and 31-40 years.

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