



**Research Article**

**People behavior and *anopheles* mosquitoes bionomic and its correlation with malaria parasite prevalence and case fatality rate (CFR) in West Seram Regency**

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**ABSTRACT**

WHO mentions that 300-500 million of people in the world are infected with malaria every year, 110 million of people perform the symptoms, and 2.7 million are even died. In 2005, malaria patients in West Seram Regency were 7.760 people. The research design was Survey and Case control in order to investigate the behavior of local society, *Anopheles* mosquito bionomic, malaria prevalence and case fatality rate (CFR). Purposive sampling was taken from the people of 2 villages in 3 districts with the highest numbers of patients. 30 people were taken from each village so total sample was 180 respondents. *Anopheles* bionomics involved habitat and breeding. Malaria cases in 2012-2016 obtained from public health center, health department office and public hospitals. Data analysis was done by using Pearson correlation test. The results showed that people behavior strongly agreed in overcoming the spread of *Anopheles* mosquitoes and malaria. Natural breeding habitat in swamps area where mangrove trees grow and sago trees at trenches, rice fields, ponds and water on the boat. *Anopheles* larvae species encountered was *Anopheles sundaicus* that actively bite all night inside and outside the house with peak activity at 02.00-03.00 a.m. Average larval density was 5.00, 9.00 and Average density of *Anopheles* mosquitoes was 5.09 - 9.85. The Prevalence Rate of Malaria is still high and Case Fatality Rate (CFR) is low. There is a significant correlation between people behavior and prevalence rate and no correlation with Case Fatality Rate (CFR).

**Keywords:** People behavior, bionomic anopheles, prevalence rate, CFR

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**INTRODUCTION**

Malaria is still a public health problem, especially in the tropical areas because its prevalence is sufficiently high. Malaria generally attacks developing countries including Indonesia, especially in socio-economic communities in rural area (Hafriani, 2012). The limitations of multifactorial information on epidemiological and bionomic determinants of malaria vectors have resulted in no effective and efficient specific ways of preventing malaria transmission applied with satisfactory outcomes in rural areas. Until today, many mosquito vector control efforts are done by spraying with several types of insecticides. This effort has been done for decades with high

cost, but the results are not maximized, it is proven that mosquitoes are still one of the main problems of human health (Sumantri & Rosidati, 2015).

Malaria is currently a public health problem in 90 countries, populated by 2.4 billion of people or 40% of the world's population. WHO mentions that 300-500 million of people in the world are infected with malaria every year, 110 million of people perform the symptoms, and 2.7 million are died. In Southeast Asia, 10-11 countries are infected with malaria and *the population at risk* in this region are 1.35 billion. This shows that most of the world's malaria sufferers are in Southeast Asia (Padley et al., 2008; Bjorge, 2004 in Hidajati, 2006). Indonesia is a malaria endemic area, about 60% of Indonesia's population live in malaria endemic areas and according to Household Health Survey (SKRT) data in 2001 there were 15 million malaria patients every year and caused 1.2% or 23.483 mortality (Fahmi, 2004).

Based on the data, in Maluku Province. Malaria morbidity rate in Maluku every year is caused by geographical condition of Maluku which is coastal area and swamp area. According to the information from the Sub-directorate of Communicable Disease Eradication and Environmental Sanitation of Maluku Province, most of the areas in Maluku are included as high malaria endemic areas, with case finding rates between 57 cases per 1000 inhabitants annually. In 2004, the numbers of malaria patients in Ambon city were 7.285, Central Maluku Regency were 16.611, Southwest Maluku Regency were 4,402, Southeast Maluku Regency were 8.782, and Buru Island Regency were 4.663, so malaria morbidity rate in Maluku province was 41.743 people (Health Dept. of Maluku Province, 2005). In 2005, malaria patients in West Seram regency were 7.760 people (Health Dept. of West Seram regency, 2006). Efforts to overcome malaria have been widely practiced, but the morbidity and mortality rates of malaria in some countries remain high.

Soedarto (1995) states that gametocytes, microgamete, and macrogamete found in the human body take place in the life cycle stage of plasmodium, which is through the stage of schizogoni living in red blood cells and will form stages into trophozoite, schizont, and merozoite. This stage takes place with different time according to plasmodium species. The plasmodium cycle takes place inside the human body and the body of the mosquito, in a mosquito's body lasting a sexual life cycle (sporogami), so *Anopheles* mosquito acts as a definitive host. Rampengan (1997) says that a malaria patient can be infested more than one type of plasmodium, such infection is a mixed infection between *Plasmodium falciparum* and *Plasmodium vivax* or with *Plasmodium malariae*. This mixed infection is usually encountered in areas with high rates of transmission. *Anopheles* mosquitoes are a major vector of malaria and its transmission through female *Anopheles* bites containing infective sporozoites. *Anopheles* mosquitoes are dependent on their species, such as *Anopheles sundanicus* which are in brackish water, shallow creeks, fish ponds, and trenches.

The asexual cycle is when a sporozoite infection of the female anopheles liver gland is inserted into the human blood through the mosquito's puncture, and within just thirty minutes it enters the liver parenchymal cells and begins the erythrocytic stage of the life cycle. The sexual cycle occurs in the body of a mosquito, where the gametocytes with the blood are not digested by other cells. In macrogamete (female) chromatin divides into 6-8 nuclei that move parasitic to the edge (Zein, 2005).

Based on the results of the bionomic survey, *Anopheles sp* mosquitoes in Kairatu District and Taniwel District of West Seram Regency, the species found were *Anopheles aconitus*, *Anopheles balanbacensis* and *Anopheles subpictus* as malaria vectors (Rehena, 2005). The density of *Anopheles sp* mosquitoes from the results of a survey in 2006 at Kairatu District, mosquito density with man biting rate (MBR) was 0.9 in coastal areas and mountain areas was 0.8 (Rehena, 2006). The results of survey in June-August 2007 found that *anopheles* larvae density was 7.3, while the adult mosquito with man biting rate (MBR) was 5.

Mosquito behavior always requires 3 places for its survival: (a) Blood Seeking Behavior: mosquitoes in different blood-seeking behaviors are *Culex* mosquitos which are active in the morning, at noon, and in the evening or at night. *Aedes* mosquitoes look for active blood during the day, and *Anopheles* is actively looking for blood in the evening and at night. (b) Resting Behavior: a process of waiting for egg maturation and when mosquitoes are still actively looking for blood, in the process mosquitoes usually break on the walls of the house. (c) Breeding Behavior: Mosquitoes have the ability to choose spurs or places to breed with their needs, some prefer brackish water, in clear water and some others prefer dirty water. Non-sanitary waste water can be a breeding medium for pathogenic microorganisms (Pulungan et al., 2012).

Health behaviors or behaviors to nurture and promote this conducive health contain multiple dimensions. Changes of people behavior that are not in accordance with the values of health or negative behavior then need to be altered. While the change of healthy society to be maintained. The development of healthy behavior is primarily intended to familiarize healthy life for children should start as early as possible. The concept of health education is an effort to influence and invite other people, groups and individuals and communities to implement healthy life behavior (Notoatmodjo, 2003). The objective of the study is to investigate the condition of people behavior, anopheles mosquito bionomic, prevalence and CFR of malaria in West Seram Regency.

## METHODS

This research employed Survey and Case Control design, it is intended to investigate the behavior of society, *Anopheles* mosquito bionomic and view disease progression (prevalence) and case fatality rate (CFR). The population in this research was the people of West Seram Regency. *Anopheles* mosquitoes Bionomic as well as cases of malaria. The sample in this research is the people of Taniwel, Piru and Kairatu District. Purposive sampling procedures and technique with consideration of the object under research are widely expected that this technique can be used to investigate the behavior of people at homes, *Anopheles* mosquitoes bionomics at each location in in swamp areas, ponds, rice fields, mangroves area in Taniwel, Piru and Kairatu District. Data collection of malaria was in Puskesmas (Public Health Center) in Taniwel, Piru, and Kairatu, also at Health Department Office of West Seram Regency and Piru Public Hospital.

Determining the number of the sample was based on the consideration; the need of analysis so that the sample taken is the people of 2 villages in 3 districts that have sufficiently high number of patients, then 30 people of each village so total sample are 180 respondents. *Anopheles* mosquitoes Bionomic in swamp areas, ponds, rice fields, mangrove areas; *Anopheles* larvae was found. Malaria cases from 2012 - 2016 are collected from Public Health Center, Health Department and Public Hospital. The instrument used in this research is questionnaire of behavior of society and observation sheet. The equipment used includes: Small bottle / film roll for mosquito larva, pipette, aspirator / mosquito catcher, petri, microscope, loop, preparation / cover. Composition of Ingredients: 70% alcohol, 5% formalin, egg white.

The independent variable consists of People behavior, *Anopheles* mosquito Bionomic, the density of larvae and *Anopheles* mosquitoes. The dependent variable consists of number of people with malaria (Prevalence), Case fatality rate (CFR) of malaria.

Research data on people behavior was tested with Likhert scale. *Anopheles* mosquitoes Bionomic were analyzed descriptively. The prevalence of malaria disease was analyzed using the formula of [Idram et al. \(2002\)](#) and [Chandra \(1995\)](#) as follows:

$$\text{Prevalence Rate (PR)} = \frac{\text{number of old/newpatients in certain period}}{\text{population at risk of malaria}} \times 100\%$$

$$\text{(CFR)} = \frac{\text{number of deaths of a disease}}{\text{total number of malaria case}} \times 100\%$$

*Anopheles* Mosquito Bionomic is determined by the formula Chandra (1995), as follows:

$$\text{Mosquito Density Formula: MBR} = \frac{\text{number of mosquito biting man}}{\text{number of catching time} \left( \frac{\text{hour}}{\text{person}} \right)}$$

$$\text{Larvae Density Formula :} = \frac{\text{number of larvae obtained}}{\text{number of cuts performed}}$$

The correlation between people behavior with Prevalence Rate and Case Fatality Rate (CFR) of malaria was done by Pearson correlation test. The analysis was performed with SPSS version 20.0.

## RESULTS AND DISCUSSION

### Description of research setting

West Seram Regency as research setting is geographically located at 1°19' - 1°16' Lat. S and 129° 1' - 127° 20' Lon. E with total area of 85,953.40 km<sup>2</sup> which consists of 6,948,40 km<sup>2</sup> (8.08) wide plains and an area of 79,005 km<sup>2</sup> (91.92%) with the boundaries of West Seram District are as follows:

- North Seram is bordered by Seram sea
- The south by the Banda Sea
- The east is bordered by Central Maluku Regency
- The west is bordered by the Buru Sea

West Seram Regency consisting of 11 districts, 92 villages and 112 orchards with population in 2013 recorded as 178,781 people with annual population growth rate of 1% and population density (soul / km<sup>2</sup>) is around 42.

## People behavior

Behavior is influenced by attitudes but also by subjective norms that is our beliefs about what others remind us to do, attitude toward behavior along with subjective norms form an intention to behave. Behavior broadly, certainly can not only be reviewed in relation to human attitudes. Human behavior is not simple to understand and to predict because so many internal and external factors of the past, present and future dimensions affect humans (Azwar, 1995). The behavior of the people towards the use of malaria drugs (Klorokuin, promakuin and traditional medicine), the use of mosquito repellent (*Bakar and baigon*), the habit of hanging clothes and traveling outside the house with a test using a Likhert scale to 180 respondents in 6 villages of West Seram Regency who strongly agreed. There is a significant correlation between the behavior of society with Prevalence Rate of malaria disease after correlation analysis was carried out.

## Anopheles mosquito bionomic

**Tabel 1.** Correlation is behavior prevalence malaria

Correlations			
		Behavior people	Prevalence malaria
Behavior people	Pearson Correlation	1	-0.948**
	Sig. (2-tailed)		0.004
	N	6	6
Prevalence malaria	Pearson Correlation	-0.948**	
	Sig. (2-tailed)	0.004	1
	N	6	6

**Table 2.** Mosquito bionomic in West Seram Regency

Bionomics	Taniwel	Piru	Kairatu
Eating Behavior	-Biting man, evening and night 16.00-24.00 Peak: 02.00-03.00.	-Biting man, evening and night 16.00-06.00 Peak: 02.00-03.00.	-Biting man, night 16.00-05.00 Peak: 02.00-03.00.
Breeding Behavior	-Lay eggs in the pool, boats, tub of water, coconut	-Lay eggs in the pool, well, water barrel, boats, swamp	-Lay eggs in the rice field, pool, bathtubs
Resting/ Sleeping Behavior	-Outdoor -Indoor -Hanger	-Indoor -Outdoor -Hanger	-Indoor -Outdoor -Hanger
Species	-Sundaicus	-Sundaicus	-Sundaicus

Qomariah (2004) states that spawning places, mosquito habitats can be divided into *container habitats* and *ground water habitats*. Container habitats consist of natural containers and artificial containers. Groundwater puddle is a puddle of water with the ground at the bottom. Rehena (2005) also asserts that the species that have groundwater inundation habitat is *Anopheles sp*, Anopheles mosquito breeding behavior carried out after absorbing the blood of prey or host until the egg maturity in the stomach and ready to reproduce i.e., lay eggs in the water. Health Department (1987) states that breeding behavior is also very definite according to species and where the breed is where anopheles mosquito species placed the eggs well in the place of direct sunlight as well as the shade.

**Table 3.** Larva bionomic in West Seram Regency

Bionomic	Taniwel	Piru	Kairatu
Larva location / container	- Pool - Boat - Bathtub - Coconut	-Pool -Well -Barrel -Boat -Swamp	-Rice field -Pool -Barrel -Coconut
Amount of larva	- 200	-150	-120

Larva species	-Sundaicus - Aconitus	- Sundaicus - Letifer	-Sundaicus - Aconitus - Subpictus
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Gandahusada (2000) states that anopheles mosquitoes prefer resting places inside the house or endophilic and outdoors or exophthalic. Rehena (2005) states that the determination of malaria vector in Uraur in Kairatu Village of Kairatu District, 3 species of Anopheles mosquito were found such as; *Anopheles aconitus*, *Anopheles subpictus* and *Anopheles balabacensis*. Natural containers are commonly found in forest areas or plantation areas, but natural containers are also found elsewhere, such as logged-over areas, bamboo segments, beach areas where there are many coconut shells. Species that have a natural container habitat are *Aedes sp*, *Anopheles sp* (Rattanarithkul and Harisson, 2005).

**Table 4.** Anopheles larvae density

Larva density	Sohuwe	Lumalata	Wimital	Kairatu	Piru	Ds Talaga
	8.33-9.00	6.00 - 7.33	6.00-7.00	5.007,33	6.00- 7.50	6.00 - 7.50
Remarks	High	Medium	Medium	Medium	Medium	Medium

**Table 5.** Anopheles mosquito density

Mosquito density	Sohuwe	Lumalata	Wimital	Kairatu	Piru	Ds Talaga
	7.00- 9.85	5.89 - 6.82	5.09- 6.50	6.00-7,00	6.50- 7.00	6.08 - 7.80
Remarks	High	Medium	Medium	Medium	Medium	Medium

#### Number of malaria patients (prevalence)

1. Prevalence Rate (PR)Sohuwe Village =  $\frac{127}{909} \times 100\% = 13,9$
2. Prevalence Rate (PR)Lumalatal Village =  $\frac{68}{570} \times 100\% = 11,92$
3. Prevalence Rate (PR)Wamital Village =  $\frac{170}{1.886} \times 100\% = 9,01$
4. Prevalence Rate (PR)Kairatu Village =  $\frac{130}{1.260} \times 100\% = 10,32$
5. Prevalence Rate (PR)Piru Village =  $\frac{126}{1.996} \times 100\% = 6,32$
6. Prevalence Rate (PR)Talaga Orchard =  $\frac{85}{760} \times 100\% = 11,18$

Different species of *Anopheles sp* often exhibit different behaviors and the ability to transmit different diseases. Therefore, the type of *Anopheles sp* mosquitoes that transmit the disease in one area is often different with *Anopheles sp* that transmit malaria or *chikungunya* disease in other areas (Sembel, 2009).

#### Malaria death rate (CFR)

1. CFR Sohuwe Village =  $\frac{10}{127} \times 100\% = 7,87$
2. CFR Lumalatal Village =  $\frac{5}{68} \times 100\% = 7,35$
3. CFR Wamital Village =  $\frac{8}{170} \times 100\% = 4,70$
4. CFR Kairatu Village =  $\frac{9}{130} \times 100\% = 6,92$
5. CFR Piru Village =  $\frac{6}{126} \times 100\% = 4,76$
6. CFR Talaga Orchard =  $\frac{5}{85} \times 100\% = 5,88$

#### CONCLUSION

The behavior of the people towards the use of malaria medicines (Klorokuin, promakuin and traditional medicine), the use of mosquito repellent (*Bakar and baigon*), the habit of hanging clothes and traveling outdoors by using the Likhert scale to 180 respondents in 6 villages of West Seram Regency strongly agreed. Bionomics related to human biting behavior, at dusk and at night 16.00-24.00 peak: 02.00-03.00. Breeding behavior from anopheles mosquitoes by laying eggs in water ponds, boats. water basins, coconuts, wells, water barrels,

swamps, and bathtubs. While the resting/sleeping behavior either outdoor / indoor and on the clothes hanger. Average of *Anopheles* larvae density was 5.00, 9.00 and Average density of *Anopheles* mosquitoes was 5.09 - 9.85. Prevalence of malaria disease in West Seram Regency was between 6.32-13.9 and CFR value was 4.76-7.87. It is advisable for researchers to conduct follow-up studies related to the spread of *Anopheles* mosquitoes in mountainous areas and other diseases caused by *Anopheles* mosquitoes.

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