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Density And Species Of Anopheles Sp. In Kota Baru Village, Abepura District, Jayapura City In 2025

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Abstract
Malaria is a disease caused by microorganisms in the form of Plasmodium parasites. This disease is transmitted through the bite of an infected female Anopheles sp. mosquito. The mosquito bite allows the parasite to enter the liver and infect red blood cells in the human body. Research Problem Formulation: "What are the MHD and MBR values of Anopheles mosquitoes and what species were found. General objectives; Knowing the density and species of Anopheles mosquitoes and Calculating the MHD of Anopheles mosquitoes, Calculating the MBR of Anopheles mosquitoes and Identifying the species of Anopheles mosquitoes caught This research is descriptive using a survey approach to capture Anopheles sp mosquitoes directly. The research location is in the Abepura Health Center Working Area, Jayapura City. The research time is June 2025. Subjects and. The research population are all Anopheles sp mosquitoes. Samples. The research of Anopheles sp caught with body bait was carried out at three capture points (locations), namely in RT 02 / RW 1, RT.6 / RW.5 and RT. 8 / RW 10.which was carried out from 18.00 – 06.00 WIT. The average density of Anopheles sp based on the calculation of MHD is 3 tails/person/hour. This means that every hour there are 3 Anopheles sp that suck the blood of 1 person in the Kota Baru sub-district. This shows that the risk of malaria transmission is very high, the highest peak of Anopheles sp activity in searching for blood is from 21.00-22.00 WIT, namely 8 tails with the Anopheles sp species caught entirely (22) tails are Farauti species. Conclusion:MBR of Anopheles sp in the Kota Baru sub-district is 11 tails/person/night. MH) of Anopheles sp in the Kota Baru sub-district is 3 tails/person/hour. Anopheles sp caught in Kota Baru sub-district is Anopheles sp farauti with a total of 22 individuals. Suggestion; To reduce the density of Anopheles sp vectors, it is recommended to provide counseling about malaria and its transmission, carry out physical environmental control by spreading predatory fish larvae in stagnant water, reduce the habit of being outside the house at night.

Keywords: *Density; Species Anopheles sp;Man Biting Rate;Man Hour Density .*

INTRODUCTION

Malaria is caused by a parasitic microorganism called Plasmodium. This disease is transmitted through the bite of an infected female *Anopheles sp* mosquito. The mosquito bite allows the parasite to enter the human body, travel to the liver, and infect red blood cells.

According to the World Health Organization (WHO), the highest number of positive malaria cases occurred worldwide in 2021, reaching 811,636. The trend of new malaria cases globally in 2022 reached 3.1 million cases, an increase of approximately 56% compared to the previous year (WHO, 2023).

Currently, there are 228 million cases of malaria worldwide, 94% of which are in Africa. P. falciparum and P. vivax are the most common parasite species that cause malaria. According to the World Health Organization, up to 50% of cases in Southeast Asia are caused by Plasmodium falciparum and 53% by Plasmodium vivax. Globally, the number of Malaria deaths decreased from 736,000 in 2000 to 409,000 in 2019 during the period 2000-2019, a figure that shows progress in Global Malaria Elimination, but Malaria remains a dangerous epidemic, because many people still suffer. (WHO, 2020).

In Indonesia, malaria cases continue to increase year after year, particularly in eastern Indonesia, namely Papua, West Papua, Maluku, and East Nusa Tenggara (NTT). Nearly 89% of malaria cases occur in these regions. Other regions, such as Java and Sumatra, have eliminated malaria, with an Annual Parasite Incidence (API) of less than 1 per 1,000 population, making these regions relatively safe from the threat of malaria (Maxi Rein Rondonuwu, 2023).

The positive larva of *Aedes aegypti* in water reservoirs were found in the basin with House Index (87.10%), drum with Container Index (16.13%) basins with Brateau Index (72.97%), number density figures (6.3) at the level of high density and with Larva-free Number (62.16%) below the National value of 95% could

categorized the area as safe. However, vigilance is advised because the Larva-free number sometimes changes as influenced by the climate and weather (Aji,2016)

Calculating indicators such as Man-Hour Density (MHD) and Man-Biting Rate (MBR) is an important method for assessing the risk of malaria transmission in an area. MHD is calculated by dividing the number of *Anopheles sp* mosquitoes caught by the number of trappers, multiplied by the time of capture (in hours). The MHD value indicates the average mosquito density per person per hour; therefore, the higher the value, the greater the likelihood of contact between humans and vector mosquitoes (Mudrikah, 2021).

Meanwhile, the MBR measures the average number of mosquito bites per person per night. This indicator reflects the intensity of mosquito-human contact, which is directly related to the chance of malaria transmission. By regularly monitoring MHD and MBR values, vector control programs can respond quickly and effectively to increased transmission risks (Ministry of Health, 2022).

Kota Baru is a sub-district in the Abepura district. Kota Baru sub-district is at potential risk of mosquito development due to its location as a breeding ground for *Anopheles sp* mosquitoes. However, the level of mosquito density is not yet known, so it is necessary to conduct a survey of the density level of *Anopheles sp* mosquitoes as a vector for transmitting malaria.

This research is important to conduct in Kota Baru Village because the area has the potential to become a malaria transmission location due to the presence of habitats that support the development of *Anopheles sp* mosquitoes. By calculating mosquito density, we can obtain an indication of the risk of community exposure to vector mosquito bites.

The general objective of this research is to determine the density and species of *Anopheles sp* mosquitoes in Kampung Baru Village, Abepura District, Jayapura City, in 2025.

Specific Objectives

a) Calculate the Man-Hour Density (MHD) of *Anopheles sp* mosquitoes in the Yoka Community Health Center work area

b) Calculate the Man-Biting Rate (MBR) of *Anopheles sp* mosquitoes in the Yoka Community Health Center work area

c) Identify the species of *Anopheles sp* mosquitoes captured

METHODOLOGY

The descriptive research design used a survey approach, involving direct capture of *Anopheles sp*. mosquitoes in the Abepura Community Health Center work area.

Research Location and Time

1. Research Location: This research was conducted in the Abepura Community Health Center work area in Jayapura City.
2. Research Time: This research was conducted in June 2025.

Research Subjects

Population: The population in this study was all *Anopheles sp*. mosquitoes in Kotabaru Village, Abepura District, Jayapura City.

Sample: The samples in this study were *Anopheles sp*. caught using body bait at three capture points: RT 02/RW 1, RT 6/RW 5, and RT 8/RW 10, from 6:00 PM to 6:00 AM WIT.

Research Instruments

The tools and materials used for the study consisted of:

a) Aspirator
b) Tweezers
c) Plastic cups
d) Flashlight
e) Label paper
f) Cotton
g) Gauze
h) Microscope
i) Chloroform

Materials, consisting of:
j) Stationery
k) Recording Form

Research Procedure

According to Sarwoko (2010), mosquito trapping is as follows:
Mosquito trapping:
a. Mosquito trapping is carried out at a predetermined location.
b. Mosquito trapping is carried out from 6:00 PM to 6:00 AM WIT.
c. Mosquito trapping is carried out using the HLC (human landing collection) method in people's homes. Two people catch mosquitoes at each house, one inside and one outside, using a flashlight, an aspirator, and paper cups.
d. Mosquito trapping is carried out for 50 minutes per hour, divided into 40-minute intervals.
Catching with bait inside and outside the house, and for 10 minutes on the inside and outside walls of the house (the walls of the pen), followed by a 10-minute rest or collection of the catch.
e. Each catch was placed in a paper cup and the time and location of the catch, as well as inside and outside the house, were recorded.
f. The same procedure was then carried out for the following periods or hours, until 6:00 a.m. WIT.
Identification of *Anopheles sp* species
Identification of *Anopheles sp*. was performed using the identification key for Indo-Australian Anopheles species (Eastern Indonesia) by Wepster, J. B., Swellengrebel, N. H., (1945), a dissecting microscope, chloroform, petri dishes, and insect tweezers.
Data sources were obtained directly at the research site regarding the density and species of *Anopheles sp*.
Data Analysis: Analysis was conducted descriptively to describe the density of *Anopheles sp*. in Kotabaru Village, Abepura District.
1. Species Identification:
Using the morphological identification key for *Anopheles sp* mosquitoes based on the characteristics of the palps, wings, antennae, and thorax

General Description

Kota Baru is one of eight urban villages in the Abepura District of Jayapura City. The urban village has an area code of 91.71.03.1012 from the Ministry of Home Affairs. Kota Baru is located in a lowland area, approximately 20 meters above sea level, with an area of approximately 12.7 km2. Its boundaries are as follows: (Kota Baru Urban Village Profile, 2024).
a) North with Waymhorock Urban Village
b) East with Awiyo Urban Village
c) West with Abepura Urban Village
d) South with Asano Urban Village
1. Demographics
The population of Kota Baru Urban Village, Abepura District, in 2024 was 1,215, consisting of 627 males and 588 females.

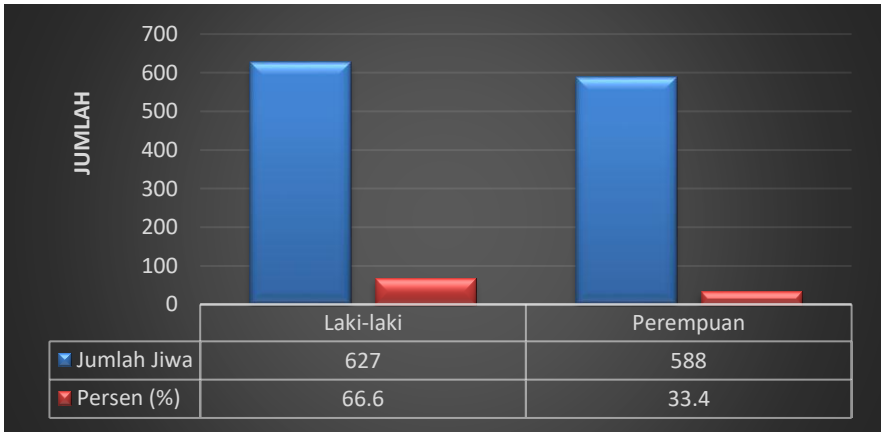

Figure 6: Diagram of Maribu Village Population by Gender, 2024

2. Climatology
The climate in Kota Baru Village is not described in detail, but broadly speaking, Jayapura City's climate is classified as humid with relatively high rainfall.
Jayapura's location between the Asian and Australian continents results in a tropical climate influenced by the Southeast Monsoon, which alternates every six months.
Jayapura is located on the equator, so the average maximum air temperature is 31.80°C and the minimum is 23.50°C (BMKG, 2024).

RESEARCH RESULTS

1. Density of Anopheles sp. based on the Man Biting Rate (MBR).

The Man Biting Rate (MBR) is the density of *Anopheles sp*. biting blood per person per night. Based on mosquito captures conducted in Kota Baru Village, it was found that blood-feeding activity of *Anopheles sp*. mosquitoes (groups) in the Kota Baru area began at 6:00 PM WIT and reached its peak density between 9:00 PM and 10:00 PM WIT, at 8 individuals per person, before decreasing to 2 individuals per person between 11:00 PM and 12:00 PM WIT. The MBR for *Anopheles sp*. in Kota Baru Village is as follows:

$$MHD = 22/2$$
$$= 11 \text{ ekor/orang/jam}$$

The number of *Anopheles sp*. captured was 22, with an average *Anopheles sp*. density based on the Man Biting Rate (MBR) calculation of 11 per person per night. This means that each night, 11 *Anopheles sp*. bites per person in the Kota Baru sub-district, making the risk of malaria transmission very high.

2. Anopheles sp. Density based on Man-Hour Density (MHD)

Man-Hour Density (MHD) is the density of *Anopheles sp* . biting per person per hour. Based on the results of mosquito captures conducted in the Kota Baru sub-district, the following results were obtained:
MHD=22/(2x6(40'))
=22/2x240'
=22/(2x4 hours)
=22/(8 hours)

MHD=3 mosquitoes/person/hour
The average density of *Anopheles sp*. mosquitoes, based on Man-Hour Density (MHD) calculations, is 3 mosquitoes/person/hour. This means that every hour, 3 *Anopheles sp*. mosquitoes feed on the blood of 1 person in the Kota Baru sub-district. This indicates a very high risk of malaria transmission.

The table above illustrates that the peak blood-feeding activity of Anopheles sp. was between 9:00 PM and 10:00 PM WIT, with 8 individuals. All 22 *Anopheles sp* species captured were Farauti.

DISCUSSION

1. Density of *Anopheles sp*. based on the Man Biting Rate (MBR)

Anopheles sp. were active throughout the night, although most were captured between 6:00 PM and 10:00 PM, with a blood-feeding frequency of 2-4 days. At night, they were known to be more active or feed outdoors (exophagic) (Ministry of Health of the Republic of Indonesia, 2006).
Based on the results of research conducted by measuring the density of *Anopheles sp* based on the Man Biting Rate (MBR), the results showed that the blood sucking activity of Anopheles spp mosquitoes (group) in the Kota Baru sub-district, started at 18.00 WIT and reached peak density at 21.00-22.00 WIT, which was 8 tails/person. At 23.00-24.00 WIT it decreased to 2 tails/person. This shows that as the night goes on, the activity of *Anopheles sp* in sucking blood also decreases or decreases. This possibility is caused by changes in temperature and humidity, but it could also be caused by *Anopheles sp* being full so that it no longer needs blood.
This means that for approximately six hours (from 6:00 PM to 12:00 PM WIT), every resident in the Kota Baru sub-district is at risk of being bitten or having their blood sucked by 11 *Anopheles sp*. individuals per night. Therefore, the risk of malaria transmission in the Kota Baru sub-district is very high. Basically the results of this study are the same as the research of Sandy S., et al (2016) which stated that *Anopheles sp* has the habit of sucking blood all night and the peak density of *Anopheles sp* p blood sucking in Bikar village at 20.00-21.00 WIT outside the house and inside the house at 22.00-23.00 WIT and at 01.00-02.00 WIT in the

morning with an average density of *Anopheles sp* (An. punctulatus, An. koliensis and An. farauti) people per hour (MHD) inside the house 0.39 tails/person/hour, while outside the house 0.33 tails/person/hour. Meanwhile, based on the results of research conducted in Kota Baru sub-district, the results obtained that the peak density of *Anopheles sp* sucking blood was at 21.00-22.00 WIT, which was 8 tails/person/night.

Based on their blood-feeding habits, it can be concluded that *Anopheles spp*. in Bikar village, Tambrauw district, prefers to feed indoors (endophagic) rather than outdoors (exophagic). This contrasts with the blood-feeding habits of *Anopheles spp*. in Kota Baru sub-district, which are more active outdoors (exophagic) than indoors (endophagic).

This is likely due to the physical condition of the houses. Many houses in Bikar village are still constructed of planks, which allow for holes or gaps for mosquitoes to enter. Furthermore, there are no livestock nearby. This contrasts sharply with the physical condition of houses in Kota Baru sub-district, which are all constructed of brick or permanent structures.

Based on research by Noviarti P.I., et al. (2016), a correlation was found between the type of house walls and the incidence of malaria in the Kokap II Community Health Center (Puskesmas Kokap II) working area, with p = 0.000, OR = 8.488, and 95% CI = 2.831-25.448. This means that houses with plank walls are at higher risk of malaria than permanent houses. Furthermore, the presence of livestock around the house can act as a barrier against Anopheles spp. from entering the house.

2. Density of *Anopheles spp.* based on Man-Hour Density (MHD)

Man-Hour Density (MHD) is the number of *Anopheles sp* species that feed per person per hour. Based on mosquito captures conducted in Kota Baru Village, the Man-Hour Density (MHD) calculation was 3

Jam Penangkapan	Jumlah *Anopheles sp*	Spesies *Anopheles*
18.00-19.00 WIT	2	*Farauti*
19.00-20.00 WIT	4	*Farauti*
20.00-21.00 WIT	3	*Farauti*
21.00-22.00 WIT	8	*Farauti*
22.00-23.00 WIT	2	*Farauti*
23.00-24.00 WIT	3	*Farauti*
Jumlah	22 ekor	
Jam Penangkapan	Jumlah *Anopheles sp*	Spesies *Anopheles*
18.00-19.00 WIT	2	*Farauti*
19.00-20.00 WIT	4	*Farauti*
20.00-21.00 WIT	3	*Farauti*
21.00-22.00 WIT	8	*Farauti*
22.00-23.00 WIT	2	*Farauti*
23.00-24.00 WIT	3	*Farauti*
Jumlah	22 ekor	
Jam Penangkapan	Jumlah *Anopheles sp*	Spesies *Anopheles*
18.00-19.00 WIT	2	*Farauti*
19.00-20.00 WIT	4	*Farauti*
20.00-21.00 WIT	3	*Farauti*
21.00-22.00 WIT	8	*Farauti*
22.00-23.00 WIT	2	*Farauti*
23.00-24.00 WIT	3	*Farauti*
Jumlah	22 ekor	

mosquitoes per person per hour. This means that every hour, three *Anopheles sp* species feed on the blood of one person in Kota Baru Village. This indicates a very high risk of malaria transmission.

Most *Anopheles sp* species prefer to perch or rest outdoors (exophilic), in cool, damp, and shady places, such as at the base of banana trees, with a flight distance of 1.5 km. These mosquitoes have also been reported to feed outdoors in shady areas during the day, such as in forests (Ministry of Health of the Republic of Indonesia, 2015).

Anopheles sp koliensis is anthropophilic and is known to prefer resting indoors in large numbers (90%) compared to An. farauti and An. punctulatus (Ministry of Health of the Republic of Indonesia, 2015).

3. *Anopheles* Species

Most *Anopheles* species prefer to perch or rest outdoors (exophilic), in cool, damp, and shady areas, including at the base of banana trees, with a flight range of up to 1.5 km. These mosquitoes have also been reported to feed outdoors in shady areas during the day, such as in forests (Ministry of Health of the Republic of Indonesia, 2015).

Anopheles koliensis is anthropophilic and is known to prefer resting indoors in large numbers (90%) compared to *Anopheles* farauti and Anopheles punctulatus (Ministry of Health of the Republic of Indonesia, 2015).

Based on a survey conducted in Kota Baru Village, Abepura District, 22 *Anopheles* mosquitoes were found. All 22 of the *Anopheles* species captured were *Anopheles* farauti, with an MBR of 11 individuals per night and an MHD of 3 individuals per person per hour. This indicates a very high risk of malaria transmission in Kota Baru Village.

Several species have been confirmed as malaria vectors in Papua, including *Anopheles punctulatus, Anopheles farauti, Anopheles koliensis, and Anopheles longirostris*. One species commonly found in Papua Province is *Anopheles farauti*. In addition to Papua, *Anopheles farauti* has also been reported in the Solomon Islands, Northern and Southern Australia, the Maluku Islands, and New Guinea. In Papua, the An. farauti mosquito can be found from coastal areas to the mountains (Hanna S.I. Kawulur, et al., 2019).

Based on research by Hanna S.I. Kawulur et al. (2019), two *Anopheles* species, An. farauti and An. koliensis, were found in coastal and swamp ecosystems. The number of An. farauti mosquitoes caught in the coastal ecosystem was 1,700 (702 caught indoors and 998 outdoors). The smallest number was found in January (211) and the largest in December (220). The number of An. farauti mosquitoes caught in the swamp ecosystem was 2,543 (1,075 outdoors and 1,468 indoors). The smallest number was found in August (299) and the largest in September (352).

An. farauti larvae inhabit coastal areas, brackish waters (with salinity tolerance), and artificial or natural irrigation. Adult An. Female An. farauti are nocturnal and diurnal, exophagic, exophilic, and anthropophilic (Semuel Sandy, 2014).

Several studies have shown that An. farauti is a vector with significant potential, both in its reproduction and in the spread of malaria. This is supported by the topography of the Kota Baru sub-district, which is abundant in temporary and natural pools of water, making it suitable for use as a bionomic source for An. faraut. Therefore, it can be concluded that the risk of malaria transmission in the Kota Baru sub-district is very high.

CONCLUSION

A. Conclusion

1. The Man Biting Rate (MBR) for *Anopheles sp.* in the Kota Baru sub-district is 11 individuals/ person/ night.
2. The Man-Hour Density (MHD) for *Anopheles sp.* in the Kota Baru sub-district is 3 Individuals/ person/ hour.
3. The *Anopheles sp.* caught in the Kota Baru sub-district are *Anopheles farauti*, with a total of 22 individuals.

B. **Recommendations**

Based on the conclusions above, the following are recommended to reduce the density of *Anopheles* vectors in the Kota Baru sub-district:

1. Continuously educate parents and schoolchildren about malaria and its transmission to improve community behavior (knowledge, attitudes, and actions) in an effort to reduce contact between humans and mosquito vectors.
2. Physical environmental control is carried out in the form of environmental modification and manipulation to eliminate the habitat of Anopheles sp vectors such as draining gutter water, filling puddles and clearing bushes as well as biological control, namely by spreading predatory fish larvae in puddles and using livestock as cattle barriers which are carried out intensively and in an integrated manner.
3. Reduce the habit of spending time outside at night, wear long pants when outdoors, and use mosquito repellent.

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AUTHOR CONTRIBUTIONS

All authors contributed to the conception and design of the study, data collection, and analysis. They collaboratively prepared, reviewed, and revised the manuscript. All authors approved the final version of this article.

CONFLICT OF INTEREST: The authors declare no conflicts of interest.

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