

# The Relationship between Environmental Factors and Nutritional Status on Malaria Incidence in Woyla District, West Aceh Regency

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## ABSTRACT

Malaria is one of the main causes of death in many developing countries, still spread in the tropics and subtropics. This study aims to determine the relationship between environmental factors and nutritional status with malaria incidence in the Kuala Bhee Health Center Work Area, West Aceh Regency.

This study uses a case-control or retrospective study design. The case group was recorded as malaria patients based on registration data at the Kuala Bhee Health Center, Woyla District, Aceh Regency and resided in the working area of the Kuala Bhee Health Center Woyla District, West Aceh Regency. At the same time, the controls were all people who were declared free of malaria.

The results showed that the presence of livestock cages and standing water had a significant relationship with malaria incidence.

It is recommended that the public avoid activities outside the home at night by reducing the frequency of going out or not leaving the house during active hours of biting malaria vector mosquitoes, cleaning livestock cages and eliminating puddles around their homes.

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## Introduction

Malaria is one of the main causes of death in many developing countries, especially children and pregnant women, as the main easily infected group (Sembel, D, 2009). Malaria is a tropical disease which until now is widespread in the tropics and subtropics, a disease caused by parasites of the genus *Plasmodium* which is transmitted through the bite of the *Anopheles* mosquito is still found in almost all parts of the world, at least around 2.3 billion or 41% of the world's population. At the risk of contracting malaria (Prabowo, A, 2008).

The incidence of malaria is supported by environmental conditions such as poor housing and poor sanitation, which then becomes a factor related to malaria transmission. It provides a suitable environment as a resting place and breeding place for malaria-carrying mosquitoes (Saikhu, 2007). Malaria vectors' place and time distribution are influenced by topography, temperature, rainfall, land use, migration, and forest destruction (Bretas, 1996). The failure of the eradication program also causes the increasing malaria epidemic. (Mouchet, 1998).

Malnutrition is responsible for more than 50% of deaths each year in developing countries. In varying

degrees, malnutrition increases the risk of infectious diseases and mortality from these infectious diseases (Harohalli, 2006).

The incidence of clinical malaria in Aceh Barat district in 2010 the annual parasite incidence (API) reached 2.6 per 1000 population then API in 2011 decreased by 1.05 per 1000 population. In 2012 the API decreased by 0.9 per 1000 population. The API increased again in 2013 by 0.93 per 1000 population (West Aceh Health Office, 2013).

This research aims to find out the relationship of environmental risk factors inside the house, outside the home, and nutritional status to the occurrence of malaria.

## Method

This study used a case-control or retrospective study design to determine the relationship between risk factors in the home environment, outside environment and nutritional status on the occurrence of malaria. The case group was recorded as malaria patients based on registration data at the Kuala Bhee Health Center, Woyla District, Aceh Regency and resided in the working area of the Kuala Bhee Health Center Woyla District, West Aceh Regency. At the same time, the controls were all people who were declared free of malaria. The number of samples in this study was 92 respondents, 46 case samples were taken, and 46 controls were also taken.

## Results

### Relationship of Risk Factor Variables with Malaria Incidence

Bivariate analysis was carried out on malaria risk factors to assess the relationship between each independent variable in the study of environmental risk factors in the house (the presence of a ceiling, the presence of ventilation screens, the density of the walls of the house), the risk factors of the outdoor environment (the presence of cattle pens, the presence of puddles). water) with the dependent variable, the incidence of malaria. The results of the bivariate test of the independent variable with the dependent used the Chi-Square test ( $X^2$ ) with the statistical significance of the relationship between the independent variable and the dependent variable determined by p-value  $<0.05$  and the strength of the relationship by looking at the OR value.

**Table 1.** Variable risk factors with the incidence of malaria

| No | Risk factors                    | OR    | 95%CI       | p-value | description  |
|----|---------------------------------|-------|-------------|---------|--------------|
| 1  | Presence of Ceilings            | 1,488 | 0,619-3,579 | 0,505   | Insignifcant |
| 2  | Presence of ventilation screens | 1,230 | 0,347-4,355 | 1,000   | Insignifcant |
| 3  | Wall Density                    | 1,692 | 0,741-3,861 | 0,297   | Insignifcant |
| 4  | Presence of Cattle Cages        | 2,673 | 1,095-6,521 | 0,049   | Significant  |
| 5  | Presence of puddles             | 4,026 | 1,667-9,724 | 0,003   | Significant  |
| 6  | Nutritional status              | 1,135 | 0,561-4,351 | 1,000   | Insignifcant |

## Discussion

### Presence of Ceilings with Malaria Incidence

Based on the study results, it was found that there was no significant relationship between the presence of the palate and the incidence of malaria (p-value: 0.505; OR: 1.488). Where respondents whose houses do not have ceilings in the working area of the Kuala Bhee Health Center Woyla District are not at risk of contracting malaria, this could be because respondents who live in houses with no ceilings often sleep using mosquito nets or mosquito repellent. The results of this study are in line with the research conducted by Devinta (2012), which stated that there was no significant relationship between the presence of a house ceiling and the incidence of malaria (p-value: 0.206; OR: 5,400; 95%CI: 0.610-47.828).

### Relationship between the presence of ventilation screens and the incidence of malaria

The use of gauze in ventilation can reduce contact between Anopheles mosquitoes and humans. The use of gauze in ventilation is sometimes difficult for the public to accept because it limits air circulation from ventilation. Still, the gauze should be installed in areas where the incidence of disease caused by vector mosquitoes is relatively high.

Based on the study results, it was found that there was no significant relationship between the presence of gauze on ventilation and the incidence of malaria (p-value: 1,000; OR: 1,230). This can be seen from the number of houses that do not have ventilation screens. Both cases and controls are almost the same. So it can be concluded that it may be influenced by the local Anopheles bionomy, which is more exotic, namely biting outside the house, which is strongly supported by the habit of going out at night without using body

armor or repellent. This study is in line with research conducted by Devinta (p-value : 0.206; OR : 5,400; 95%CI : 0,610-47,828).

### **Wall Density Relationship with Malaria Incidence**

The condition of the walls that are not tight will make it easier for mosquitoes to enter the house compared to the condition of the tight walls of the house. This condition causes the house's occupants to be more potentially bitten by *Anopheles* mosquitoes because mosquitoes are freer to enter the house, increasing the risk of malaria transmission. According to Mukono (2009), the construction of houses with walls that are not tightly closed allows malaria transmission in the house.

Based on the study results, it was found that there was no significant relationship between wall density and the incidence of malaria (p-value: 0.297; OR: 1.692). This can be caused by the mosquito's habit of looking for blood outside the house (exophagic) even though it continues to enter the house after it comes out again, or it can also be a mosquito that prefers to suck the blood of livestock (zoophilic). The results of this study are in line with research conducted by Devinta (2012) which states that the density of the house's walls does not affect the occurrence of malaria (p-value: 1,000; OR: 1,000).

### **The Relationship between the Presence of Cattle Cages and the Incidence of Malaria**

Cattle cages are a resting place for malaria mosquito vectors before and after contact with humans because they are protected from sunlight and humidity. In addition, several types of *Anopheles* mosquitoes are zoophilic and anthropophilic or like animal blood and human blood. So the existence of cattle pens is at risk for malaria cases. Barodji (2001) stated that in areas where there were no cows or buffalo, most of the vector mosquitoes (more than 75%) were caught biting people or perched inside the house, only a small proportion (less than 25%) were caught in the cage. Goat and its surroundings.

The results showed that cattle pens around the house were a risk factor for malaria (p-value = 0.049) with an OR value of 2.673. The results of this study are in line with research by Bambang Hadi (2005), which states that the livestock enclosure environment affects the increase in vector density in the house and affects the increase in malaria cases (p = 0.001; OR: 16.98; 95% CI: 5.67-50,89).

The results of this study are also supported by research conducted by (Mayagaya et al., 2015) which states that the presence of cattle pens has a significant impact on malaria vectors and resting behavior. *Anopheles arabiensis* is commonly found resting in cattle pens when cattle are present and indoors with no livestock. Large livestock such as cows, buffaloes and pigs can function as a cattle barrier that will reduce the number of mosquito bites in humans (Gunawan, 2000).

### **Relationship between the presence of puddles and the incidence of malaria**

Based on the study results, it was known that there was a relationship between the presence of puddles and the incidence of malaria (p-value: 0.003), with OR = 4.026. This means that people whose houses have the presence of puddles have a 4,026 times greater risk of contracting malaria than people whose houses do not have puddles of water.

The existence of breeding places around the house is certainly a risk factor for malaria transmission. Based on research from the Ministry of Health, it is known that the main factor of malaria transmission on the Ciamis coast is the *An. sundaicus* mosquito. This type of mosquito can be found in ponds/pools that are not maintained. Larvae will gather in places covered by plants and on moss that gets sunlight.

In their life cycle, mosquitoes need water. Even with very little water, mosquitoes can use it as a breeding ground. So the presence of standing water at that distance will bring humans closer to the malaria mosquito vector. The risk of getting malaria in people who live near puddles is higher than in people who live far from puddles.

### **Relationship of Nutritional Status with Malaria Incidence**

According to the Ministry of Health (2012), children aged 0-15 years are more susceptible to malaria parasite infections, especially malnourished ones. Infection can be more severe at a young age or very young because the immune system is immature, whereas, in old age, it is more caused by a decrease in the body's immune system.

The results showed that nutritional status was not a risk factor for malaria (p-value = 1,000) with an OR value of 1.135. This result is not in line with several other studies, including those conducted by Rice et al. (2007), which said a significant relationship between malnutrition increases the risk of death from malaria in children in developing countries. Shanker, who examined the relationship between malaria and

nutritional status, showed that protein and energy malnutrition was associated with morbidity and mortality in various malaria. In addition, a study conducted by Suwadera (2010) showed that children under five with poor nutritional status were at risk of suffering from malaria 1.86 times more than those with good nutritional status.

## Conclusion

This study concluded that the presence of livestock cages, standing water and nutritional status were associated with the incidence of malaria. It is expected that the community as much as possible avoids activities outside the home at night by reducing the frequency of going out or not leaving the house during active hours of mosquito-biting malaria vectors. If you have to leave the house for work, you should always wear protective clothing such as long pants and long-sleeved shirts, which can cover the entire body and eat a balanced diet to maintain the body's immune system.

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## Author Contribution and Competing Interest

The author's contribution to this research includes designing a research project, collecting data or analyzing results, and preparing or revising scientific papers.

## References

- Bambang H. (2005) *Kandang Ternak dan Lingkungan Kaitannya dengan Kepadatan Vektor Anopheles Aconitus di Daerah Endemis Malaria* (Tesis).
- Barodji. (2001) Keberadaan ternak sapi atau kerbau di daerah pedesaan dan pengaruhnya terhadap vektor malaria. Pertemuan Sosialisasi Penanggulangan Malaria di Kabupaten Kulonprogo, DIY, di Wates.
- Bretas, G., (1996), Geographic Information Systems for the Study and Control of Malaria [online], available: <http://www.idrc.ca/books/focus/766/bretas.html> accessed 10 October 2021
- Dinas Kesehatan Kabupaten Aceh Barat. (2013). Profil Kesehatan Kabupaten Aceh Barat
- Depkes RI. 2012. Pedoman Penatalaksanaan Kasus Malaria di Indonesia. Direktorat Jenderal P2PL, Depkes RI. Jakarta
- Devinta. (2012) *Hubungan Lingkungan Fisik Rumah dan Perilaku Individu dengan Kejadian Malaria di Kabupaten Purworejo* (Tesis).
- Gunawan S. (2000). Epidemiologi malaria. Dalam: Harjanto PN, penyunting. Malaria: patogenesis, manifestasi klinik dan penanganan. EGC, Jakarta
- Harohalli RS, Donna GG. Malnutrition. (2006). Diunduh dari <http://www.emedicine.medscape.com/article/985140-overview>. accessed 10 September 2021
- Mouchet, J., (1998), Origin of malaria epidemics on the plateaus of Madagascar and the mountains of east and south Africa, Bull Soc Pathol Exot 1998;91(1):64- 6.
- Mukono, H. J. (2009) *Prinsip Dasar Kesehatan Lingkungan*. Surabaya: Airlangga University Press, 2009.
- Prabowo. (2008) *Malaria Mencegah dan Mengatasinya*. Puspa Swara, Jakarta.
- Saikhu Ahmad. (2007). Faktor Risiko Lingkungan Dan Perilaku Yang Mempengaruhi Kejadian Kesakitan Malaria Di Propinsi Sumatera Selatan (Analisis Lanjut Data Riset Kesehatan Dasar 2007). Journal litbang kemkes.
- Sembel, D. (2009) *Entomologi Kedokteran*. Ed I. Andi. Yogyakarta.
- Suwadera. (2010). Analisis Hubungan Antara Kondisi Ventilasi, Kepadatan Hunian, Kelembaban Udara, Suhu, Dan Pencahayaan Alami Rumah Dengan Kejadian Malaria Di Wilayah Kerja Puskesmas Wara Utara Kota Palopo. Jurnal FKM Universitas Samratulangi 2(2): 5-8.
- Rice, Tallud P, Andaman. (2007). Interactive Resource For The Rational Selection And Comparison Of Putative Drug Target Proteins In Malaria. Malaria Journal 8(5): 12-18.
- Valeriana S Mayagaya, Gamba Nkwengulila, Issa N Lyimo, Japheti Kihonda, Hassan Mtambala, Hassan Ngonyani, Tanya L Russell and Heather M Ferguson. (2015). The impact of livestock on the abundance, resting behaviour and sporozoite rate of malaria vectors in southern Tanzania. *Malaria Journal*.

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