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Analysis of the Presence of Anopheles Larvae in the City Areas in DKI Jakarta on the Risk of Indigenous Malaria Cases in 2022

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ABSTRACT

Malaria is one of the diseases that until now is still a special concern for tropical countries such as Indonesia. Prevention of non-indigenous malaria transmission has recently become a priority for the Indonesian government's program to minimize the incidence. This study aims to analyze the presence of anopheles larvae in city areas in DKI Jakarta province which have the potential to be at risk of causing the emergence of indigenous malaria cases in 2022 by observational survey methods and strengthened by literature studies. The results were obtained by discovering anopheles in such "empang" in Marunda Village, Cilincing, North Jakarta, which is adjacent to the Navy Special Forces Command Headquarters dormitory. This is very potential for malaria to spread considering the mobility of troops who often go in and out of endemic areas both at home and abroad. Thus, it is necessary to improve coordination and cooperation between various stakeholders, especially the Province Health Department, the Navy Health Service, or other related agencies.

INTRODUCTION

Malaria is an infectious disease that is still a public health problem worldwide, especially in tropical developing countries including Indonesia. This disease affects the high mortality rate of infants, toddlers and pregnant women. Every year more than 500 million people are infected with malaria and more than one million die (Ariati, 2014).

Until now, malaria is a re-emerging disease that is still a global problem (Chala & Hamde, 2021). Malaria cases are estimated to reach 241 million with 627,000 deaths worldwide by 2020 (PMI, USAID & CDC, 2022). Based on the confirmation method, the trend of malaria cases over the past ten years in the regions of Africa, the Americas, the Eastern Mediterranean, Europe, Southeast Asia, and the Western Pacific showed an increase in the number of cases year by year from 2011 to 2017. In 2011 the global number of cases was below 120 million and in 2017 the number of cases was above 170 million. In 2018 the number of cases fell to between 160-170 million, but rose again above 170 million in 2019 and 2020 (Kemenkes RI., 2021).

Malaria occurs because of the interaction between the patient (host) as a source of infection, Plasmodium spp. (agent) as a disease pathogen, Anopheles spp. as an intermediary (vector) and environmental factors that support transmission. Malaria is a disease that is local specific area because the incidence of disease and its spread is strongly influenced by the environment, season, local community behavior, and the behavior of the infectious vector (Ipa et. al., 2013). Five (5) species are known: Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malaria and Plasmodium knowlesi. The last mentioned parasite has not been widely reported in Indonesia (Kemenkes RI., 2017).

In 2017, 52% of Indonesia's 514 districts/cities were classified as malaria-free. The burden of malaria is highest in five provinces in Eastern Indonesia (Papua, West Papua, East Nusa Tenggara, Maluku and North Maluku). These provinces have only 5% of the Indonesian population, yet account for 70% of malaria cases in Indonesia. The obstacles to malaria elimination are low socioeconomic status, geographical characteristics (hard-to-reach areas, forests, mining and logging areas), poorly trained human resources, and shortage of rapid test kits (RDTs). To increase the acceleration of

malaria elimination, it is necessary to improve the EDAT (Early Diagnosis and Treatment) approach by increasing human resources capacity, forming village malaria cadres for case detection, providing RDTs and drugs, and improving surveillance (Kemenkes RI., 2020).

Based on the data that 514 districts/cities in Indonesia have been classified as malaria-free areas, it should not make these areas complacent and relax prevention and control efforts. As is known, the cause of the spread of this disease is not only indigenous but also due to congenital or imported from endemic areas to non-endemic areas. This often happens to many officers or government officials, both the State Civil Apparatus, the Indonesian National Army, the Indonesian National Police and business people who often go in and out of the area.

Such is the case in Gunungkidul District, Yogyakarta Special Region. Gunung Kidul District received a certificate of elimination in April 2014, but in 2019 there was one imported case and there may be potential for indigenous transmission. Gunungkidul is also a tourist area visited by many domestic tourists who can come from malaria endemic areas (Atikah Mulyawati et. al., 2022). Thus, the potential for outbreaks of cases is very possible considering that the activities of the tourism sector in this area are growing rapidly and have become a mainstay of local revenue.

Jakarta is one of the areas declared malaria-free. Some cases that occur are generally due to congenital cases from malaria endemic areas such as Papua and other areas that have not been declared malaria-free. However, it does not rule out the possibility that several locations in Jakarta have the potential to become malaria breeding grounds. This is because Jakarta is the center of dynamic economic, socio-cultural and high activity activities with its metropolis.

Learning also from the incidents in Kulon Progo District in the Special Region of Yogyakarta, Magelang and Purworejo Districts in Central Java, the three districts bordering the Menoreh Mountains area since 2011 are still declared not fully free and always alert to malaria. This means that the few or zero malaria cases in an area cannot be considered as a guarantee that the area will always be malaria-free.

Especially in Jakarta where the population is very diverse in terms of educational background, occupation, economic status, social status, diversity and high levels of population mobility, there is great potential to threaten the position and status of malaria elimination in the DKI Jakarta areas. Several local government measures have been taken to minimize casualties due to malaria and one of them is receptive mapping of anopheles mosquito breeding grounds.

Based on this background, it is very interesting to conduct research with the aim of analyzing the potential for malaria transmission related to the presence of Anopheles larvae in the City areas in DKI Jakarta Province which is at risk of causing indigenous malaria. This research is expected to provide readers an overview of the position and potential spread of dengue fever with a case study in the DKI Jakarta Province areas.

METHOD

This study used a survey method and was reinforced by a literature review study and field observations. Larval capture surveys were conducted in potential vector puddle types around settlements and outside settlements. The survey was conducted in all 14 Anopheles breeding place populations in the city area in DKI Jakarta. Parameters measured were larvae. Species identification method using microscopy. After the larvae were found, they were taken as samples. Several mosquitoes for identification material to determine the type of species. In addition, in each type of potential vector puddle, the type of puddle, volume/area of water, salinity, pH level of water, status of breeding sites, type of larval species found and mosquito density in 1x puddle were measured. As for the identification of larval samples, larval samples found in each type of habitat were separated and stored in larval bottles and labeled and then identified to determine the type of species in each type of habitat.

RESULTS AND DISCUSSION

Based on the larval survey in the working area of the DKI Jakarta Provincial Health Office, the following conclusions were obtained:

1. Anopheles spp larvae were found in the type of habitat in the form of ponds around residential areas of the Marunda Village community health center service area, with an average density of 3 larvae.
2. It was found that when vector surveillance was conducted during the dry season, there were still potential habitats, namely mossy ponds with permanent habitat status.

It was found that the location of the pond, which is the habitat of the malaria vector, is close to residential areas and there is a dormitory / special forces base of the Indonesian Navy, which is a high risk group for malaria due to the high level of mobilization to malaria endemic areas, which has the potential for local transmission of malaria.

Malaria is known to be caused by protozoa of the genus Plasmodium, phylum Apicomplexa which belongs to the Alveolate group (Cavalier-Smith, 1993; Hikosaka et. al., 2013; Sato, 2021). Five naturally recognized Plasmodium species can infect humans and cause malaria: P. falciparum, P. vivax, P. malariae, P. ovale and P. knowlesi (Sato, 2021).

Malaria is a zoonotic disease spread by the bite of female Anopheles sp. mosquitoes (Mota & Mello-Vieira, 2019; Curr Biol, 2020), so the presence of this mosquito is important to note. Anopheles mosquitoes can be monitored by Anopheles entomological surveys as well as environmental mapping and breeding places (Widoyono, 2011). This monitoring is mainly focused in endemic areas, but also needs to be done in malaria-receptive areas for maintenance of elimination (Kemenkes RI.., 2017). Daerah reseptif malaria adalah daerah yang ditemukan adanya nyamuk Anopheles vektor malaria, yang memiliki lingkungan dan iklim yang menunjang terjadinya penularan malaria, dan populasi yang rentan terhadap penularan malaria (WHO, 2021; WHO, 2018).

Larval surveys and adult mosquito capture can do measurements of Anopheles mosquito presence. Larval surveys are conducted by observing breeding places, while adult mosquito capture is conducted by Human Landing Collection (HLC) and Resting Collection (RC) methods (Widoyono, 2011). HLC was conducted inside and outside the house, while RC was conducted on the walls of the house and in cages in the neighborhood. In HLC mosquito capture, biting and non-biting mosquitoes were separated. The results of mosquito capture will be identified, Anopheles mosquitoes that bite in the HLC method are used to calculate the Man Biting Rate (MBR), which is the number of Anopheles mosquito bites per person per night (Kemenkes RI., 2017). Environmental health quality standards for malaria vectors are measured from the capture of Anopheles sp mosquitoes that bite human bait by calculating the Man Biting Rate (MBR)

and the presence of Anopheles sp larvae by calculating the habitat index. MBR is the number of mosquito bites per person per night with a quality standard limit. This study was conducted by surveying the presence of Anopheles sp larvae by calculating the habitat index.

Table 1.
Collection results in the working areas of the City of Jakarta on September 29, 2022

Location	Habitat Type	Coordinate Point	Volume Water (Liter)	Salt content o/oo	pH	breeding site status	Species Type	Density of larvae
Cijantung Subdistrict	Dam	-6.3422451524819055, 106.91756391580579	400.000	0	7	permanent	-	-
Ciracas Sub-district	Dam	0708989, 9297052	500.000	0	7	permanent	-	-

Table 2.
Collection results in the West Jakarta City work area on October 4, 2022

Location	Habitat Type	Coordinate Point	Volume Water (Liter)	Salt content o/oo	pH	breeding site status	Species Type	Density of larvae
Kalideres Sub-district	Swamp 1	0687015, 9324844	500	0	7	permanent	-	-
	fishpond 1	0686991, 9324777	1000	0	7	permanent	-	-
	fishpond 2	0686931, 9325029	1000	0	7	permanent	Culex sp	-
	Swamp 2	0687349, 9324911	800	0	7	permanent	-	-
	Ricefield	0687517, 9324750	500	0	7	permanent	-	-
	fishpond 3	0687110, 9325058	1000	0	7	permanent	Culex sp	-

Table 3.
Collection results in the North Jakarta City working area on October 13 and 14, 2022

Location	Habitat Type	Coordinate Point	Volume Water (Liter)	Salt content o/oo	pH	breeding site status	Species Type	Density of larvae
Cilincing Subdistrict	Ricefield	0716267, 9323361	1000	0	6	permanent	-	-
	fishpond 1	0716213, 9323460	1500	1	6	permanent	-	-
	fishpond 2	0716215, 9323499	2000	3	6	permanent	Anopheles sp	3
Penjaringan Sub-district	Swamp	0689807,	1000	1	6	permanent	Culex sp, Aedes sp.	-
	Used tires	9325699	< 1 liter	0	7	Not permanent	Culex sp, Aedes sp.	-
	fishpond	0689730, 9325698	700	0	6	permanent	Culex sp,	-

Referring to the results of surveys in three municipalities in DKI Jakarta province, Anopheles spp larvae were found in the type of habitat in the form of ponds around residential areas of the Marunda Village public health center service area, with an average density of 3 larvae per trap. This needs to be a special concern of the DKI Jakarta government in this case the Provincial Health Office to carry out monitoring and preventive actions appropriately and quickly and measurably so as to avoid malaria transmission both indigenous and congenital residents around the sampling location.

This is in line with research conducted in Gunung Kidul Regency Yogyakarta where the Anopheles sp species found in Ngawis Village are Anopheles vagus and Anopheles aconitus with breeding places in the form of ponds, irrigation channels, rice fields, rivers, river basins, and cow footprints. Likewise, the Anopheles species found in Pacarejo Village are An. vagus and An. maculatus with lake and river habitats. This means that the discovery of Anopheles in ponds as a breeding place is similar in character to Anopheles found in Gunung Kidul Regency, namely in ponds, irrigation channels and others (Atikah Mulyawati et. al., 2022). Similar studies elsewhere reported that Anopheles barbinotres, Anopheles vagus and Anophlese aconitus mosquitoes forage for blood during the night (Mursid Rahardjo, 2019).

Another interesting point is the timing of the research survey. It was found that when vector surveillance was conducted during the dry season, there was still potential habitat in the form of mossy ponds with permanent habitat status. During the rainy season, where there is more standing water in the capital city, even in areas prone to flooding, it is necessary to consider the local government so that the potential spread of malaria does not occur in the capital city

of Jakarta in the future. Changes in weather and the influence of landforms have a dominant role in the dynamics of the spread of the Anopheles aconitus mosquito, which is the vector of malaria (Mursid Raharjo, 2003). In another study it was reported that in controlling the risk of global climate change impacts on malaria outbreaks in Indonesia can use the Malaria Vulnerability Index (MLI) (Mursid raharjo, 2011).

Until now, malaria cases that occur in Jakarta are mostly due to congenital or non-indigenous cases. Due to the very high mobility of the city of Jakarta and the largest business center in Indonesia, it is possible that from various regions both endemic and endemic malaria will gather and interact in Jakarta. Thus, if someone who is already infected is bitten by anopheles and then bites another person, there will be a chain transmission.

Based on a survey in North Jakarta City where anopheles were found, it was obtained that the location of the ponds that became the habitat of the malaria vector was close to residential areas and there was a dormitory / military base for the Indonesian National Navy special forces in the Marunda Cilincing Village area. The Indonesian National Army special forces are very likely to be carriers due to assignments in malaria-endemic areas such as Papua Maluku and others so that they are at risk of carrying the agent/cause of the disease (Plasmodium) malaria, so that the area can be categorized as a vulnerable area. Thus, it becomes a high-risk group for malaria so that more intensive coordination and cooperation between the Health Office both at the Tribal and Provincial levels with the Health Office of the Indonesian National Army Navy or other related ranks is needed.

LIMITATIONS OF THE STUDY

Limitations this research did not take the entire DKI Jakarta area as a whole but focused on the locations of East Jakarta, West Jakarta, and North Jakarta. Furthermore, the potential inundation is only focused on dams, swamps, fishponds, and used tires.

CONCLUSIONS AND RECOMMENDATION

Based on the results of analysis and field surveys, it was found that areas where malaria vectors were found, especially in East Jakarta and West Jakarta in 2018. However, no Anopheles larvae were found in this study, still need to be vigilant and monitored again at different times and in different physical habitat conditions to rule out the possibility of the re-emergence of dangerous larvae. Because if the vulnerable and receptive areas are in the same area, this is a strong risk at any time for the emergence of indigenous malaria cases in DKI Jakarta. Thus, if due to environmental changes, certain border locations need to be aware that they will impact the types of vector-borne diseases. Based on the results of the analysis, it is recommended that the government tighten and increase the frequency of Local Area Monitoring on Entomological Aspects, or conduct periodic vector surveillance in each community's residential environment in order to know the peak population of species that act as vectors and as basic data to carry out appropriate control. In order to protect themselves from vector-borne diseases, local communities should use mosquito nets at night to avoid contact with vectors, and maintain the cleanliness of potential vector environments. In addition to these two things, it is necessary to maintain environmental cleanliness, especially places that have the potential to become a habitat for malaria vectors such as mossy ponds or mossy dams or swamps or rice fields, it is necessary to collaborate across sectors to take immediate action. Finally, it is recommended that health officials conduct regular migration surveillance of malaria-risk groups, especially those in malaria-receptive areas, to prevent local transmission.

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The authors declare that they have no involvement with any external parties and this paper is purely from the sources listed in the bibliography and does not contain plagarism from any journal article. All sources of writing have been listed in the bibliography

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