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Vector Density Analysis of Dengue Hemorrhagic Fever in Tumpok Teungoh Village, Lhokseumawe City

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A B S T R A C T

Dengue hemorrhagic fever (DHF) is an infectious disease of the dengue virus, which is transmitted by the *Aedes aegypti mosquito* as the main vector and *Aedes albopictus* as a potential vector. Monitoring the population density of *Aedes aegypti* is very important to assist in evaluating the presence of threats in each city, and so that mosquito eradication measures can be improved. The purpose of this study was to determine the density of the DHF vector in the village of Tumpok Teungoh, Lhokseumawe City. The population in this study were all houses in the village of Tumpok Teungoh, Lhokseumawe City, which amounted to 2,531 houses. The number of samples used is 100 houses which will be carried out by random sampling. Data was collected through direct observation by observing the type and number of containers as well as the presence of *Aedes aegypti* in water containers/holds in each house. Data analysis was carried out descriptively on the type of container, the number of larva-positive containers, the number of larva-positive houses, and the larval density, which was calculated based on the house index, container index, and Breteau index numbers. The results showed that the House Index (HI) was 29%, the container index (CI) was 20.5%, and the Breteau index (BI) was 41%. In conclusion, the density of DHF larvae in Tumpok Teungoh Village, Lhokseumawe City, is at level 5, which is the category of moderate risk of DHF transmission.

1. Introduction

Dengue hemorrhagic fever (DHF) is a dengue virus infection disease that is transmitted by the *Aedes aegypti mosquito* as the main vector and *Aedes albopictus* as a potential vector.[1,2] This disease is very dangerous because it can cause death.[3] The high incidence of DHF is closely related to the presence of the vector. One of the risk factors for transmission of DHF and the increase in cases of DHF is the growing spread and density of vectors. Therefore, it is necessary to make efforts to reduce the density of DHF vectors by minimizing vector breeding sites, reducing vector age, and reducing vector contact with humans so that the risk of DHF transmission decreases.[4] DHF vector is the *Aedes aegypti mosquito*.[5,6]

The incidence rate of DHF in Aceh Province in 2012-2014 was 51%, decreased by 29%, and increased again to 45%. Surveillance data from the Aceh Provincial Health Office shows that DHF cases fluctuate in various regions every year. The distribution of DHF cases in Lhokseumawe City, Banda Aceh and Aceh Besar Regency in 2012-2014 was as follows: Lhokseumawe City 300, 258, 128; Banda Aceh City 506, 258, 128 and Aceh Besar Regency 376, 156, 261. The larva-free rate (ABJ) in 2012-2014 in Banda Aceh City was 75.9%, 74.5%, and 70.8%; Lhokseumawe City was 74.1%, 84.4%, and 82.6%; Aceh Besar Regency 73.3%, 70.6% and 85%.[7]

Patients with DHF were reported as 1,510 cases in Aceh Province in 2015 and increased in 2016 to 2,651 cases.[8]

The breeding ground for *Aedes aegypti* is in a humid environment with high rainfall, and there are puddles of water inside and outside the house. Other factors that cause DHF are poor environmental sanitation, unhealthy community behavior, and behavior in the house during the day, which play the biggest role in the transmission of the dengue virus.[9] DHF is caused by the dengue virus, which is transmitted through the bite of an *Aedes aegypti mosquito* that already contains the virus from other dengue fever sufferers. *Aedes aegypti mosquito* is crepuscular and actively sucks human blood in the morning (after sunrise) and evening (until before sunset). But the pattern of sucking the blood of this mosquito shows various variations. In some areas, it is reported to be active until early at night (nocturnal). The group at risk for dengue fever in children under 15 years old, and most of them live in humid environments.[10] This study aims to analyze the vector density of dengue hemorrhagic fever in Tumpok Teungoh Village, Lhokseumawe City, Aceh, Indonesia.

2. Methods

This research is a descriptive observational study. This research was conducted in Tumpok Teungoh Village, Lhokseumawe City, in July - August 2019. A total of 100 houses in Tumpok Teungoh Village were used as research subjects, where sampling was done by simple random sampling. Data was collected through direct observation by observing the type and number of containers as well as the presence of *Aedes aegypti* in water containers/holds in each house. The number of water reservoirs observed in each house is one water reservoir inside the house and one water reservoir outside the house. Observations were made by using an observation sheet to record data on the number, type of container, and the presence of larvae, as well as recording the number of houses observed, both positive and negative larvae.

Data analysis was carried out descriptively on the type of container, the number of larva positive containers, the number of larva positive houses, and the larval density calculated based on the house index (HI), container index (CI), and Breteau index (BI) numbers with the following formula:

House index (HI)

$$HI = \frac{Number\ of\ positive\ \ larvae\ houses}{Number\ of\ houses\ inspected} x100\%$$

Container index (CI)

$$CI = \frac{Number\ of\ positive\ larvae\ containers}{Number\ of\ inspected\ containers} x100\%$$

Breteau index (BI)

$$BI = \frac{Number\ of\ positive\ larvae\ containers}{Number\ of\ houses\ inspected} x100\%$$

Data analysis was carried out with the help of Microsoft Excel software. The data is presented univariately in the form of an average and or percentage of the value of the house index, container index, and bretau index.

3. Results and Discussion

Table 1 shows that of the 100 houses that were inspected, there were 29 houses that were positive for larvae. Overall, the house index in Tumpok Teungoh Village is 29%. The highest HI value was found in hamlet 1 (35%), and the lowest was in hamlet 3 and hamlet 5, with an HI value of 25%. Table 2 above also shows that from the 200 containers inspected, 41 containers were found that were positive for larvae. Analysis of the CI figures for all hamlets in Tumpok Teugih Village shows a value of 20.5%. The area with the highest CI number was hamlet 1, with a CI rate of

25%, and the lowest was in hamlet 3 and hamlet 5 (17.5%). Table 2 above also shows that of the 100 houses inspected in Tumpok Teungoh Village, 41 containers were found to be larva positive. Overall in Tumpok Teungoh Village, Lhokseumawe City, the BI figure shows a value of 41%, with the BI value varying in each hamlet. In this case, the highest BI was found in hamlet 1 (50%), and the lowest was in hamlet 3 and hamlet 5 (35%).

Table 1. Distribution of house index (HI) numbers in Tumpok Teungoh Village

Hamlet	Larvae's house (+)	House inspected	Larvae container (+)	Inspected container	House index (HI)	Container index (CI)	Breteau index (BI)
Hamlet 1	7	20	10	40	35%	25%	50%
Hamlet 2	6	20	8	40	30%	20%	40%
Hamlet 3	5	20	7	40	25%	17.5%	35%
Hamlet 4	6	20	9	40	30%	22.5%	45%
Hamlet 5	5	20	7	40	25%	17.5%	35%
Total	29	100	41	200	29%	20.5%	41%

The density figure (DF) was determined based on the results of the larval survey conducted. The density figure is determined after calculating the results of HI, CI, and BI and then compared with the larva index table. If the DF number is less than 1, the risk of transmission is low, 1-5, the risk of transmission is moderate, and above 5 the risk of transmission is high.

Table 2. Larvae index

Density figure (DF)	House index (HI)	Container index (CI)	Breteau index (BI)
1	1-3	1-2	1-4
2	4-7	3-5	5-9
3	8-17	6 -9	10-19
4	18-28	10-14	20-34
5	29-37	15-20	35-49
6	38-49	21-27	50-74
7	50-59	28-31	75-99
8	60-76	32 -40	100-199
9	>77	>41	>200

Based on table 2 it is known that the house index (HI), container index (CI), and Breteau index (BI) in Tumpok Tengoh Village are 29%, 20.5%, and 41%. When compared with the Larva Index table (table 3) above, the density of DHF larvae in Tumpok Teungoh Village, Lhokseumawe City, is at density figure (DF) 5. Thus, Tumpok Teungoh Village, Lhokseumawe City, is at moderate risk of transmission.

The results of larvae research conducted on several types of containers from a predetermined number of house samples made it easier to determine the frequency of larval presence by using the house index (HI), container index (CI) and to determine the density of larvae through Breteau index (BI) analysis. The three indices are very important as determinants in knowing the level of risk of transmission of DHF disease and can be used as an early warning for the prevention of DHF disease.

The larvae indicate the emergence of a new vector candidate that causes DHF. If somewhere there are larvae, there is an opportunity for the development of vectors that cause DHF. Density is the result of measuring the density of larvae at the intervention site with the presence of larvae in water reservoirs (TPA), productive containers, and used goods inside and outside the room/house or both, calculated using the

House Index (HI). The surrounding community is still unfamiliar with the introduction of the types of mosquito larvae. In this case, the larvae of *Aedes aegypti* are vectors of dengue fever. The high density of larvae in the study area is largely due to the behavior and knowledge community which is still minimal in improving environmental sanitation.[11]

Larvae are usually found in waterlogged areas. Such as bathtubs, used tires, used drink bottles/cans, and barrels, some of which are even in the dispenser. In this process, the larvae will land up to 7 days before becoming adult mosquitoes and will spread the dengue virus. The high density of larvae that occurs in this area is indeed prone to finding larvae that settle in water reservoirs. From the results of the study, it was found that most of the houses did not cover the water reservoirs. It is possible that the water reservoir is not closed due to the absence of a lid on the water reservoir used.[12]

Many houses use a water reservoir in the form of a bucket in the bathroom, and all the buckets used in the bathroom are not covered. Closing the water reservoir is considered impractical because it will make it difficult for residents to use the water in the water reservoir. It will be difficult to get used to being orderly in using the water reservoir by opening and closing it again after use. If the water reservoir is not closed, it will provide an opportunity for mosquitoes to lay eggs, namely on the open surface of clean water.[13]

Most residents have a habit of throwing garbage or used items in open trash cans. Disposing of garbage in an open trash can is included in the category of disposing of garbage that is not good. This is because an open trash can has the potential to become a breeding ground for *Aedes sp.* In addition, residents are more likely to pay attention to the cleanliness of the front yard of the house. The backyard often goes unnoticed, as can be seen from the discovery of several used paint cans, drinks, and unused plant pots in the backyard. Without realizing it, these used goods can potentially become a nest for DHF mosquitoes if they are filled with water during the rainy season.[14]

Based on the research results, many respondents have not implemented PSN DHF chemically and biologically. This method is not yet done by many respondents. Chemically, PSN DHF is usually done by sprinkling abate powder on water reservoirs. However, abate powder cannot be obtained easily, so respondents cannot do PSN DHF chemically. This of course, can also increase the risk for *Aedes aegypti* to live and breed in water reservoirs. The respondent also has not done the PSN DHF biologically by keeping fish in water reservoirs. Actually, this method is a natural and quite effective way to eradicate *Aedes aegypti larvae,* but respondents are reluctant to do it because the fish that are kept will cause a fishy smell in the respondent's water reservoir. Wijaya (2012) found that water tanks are the type of container that has the highest contribution as a breeding medium for Aedes mosquitoes in Minomartani Village, Sleman. This type of container is proven to have a greater potential to be used as an oviposition medium for the *Aedes aegypti mosquito.*[15]

4. Conclusion

The density of DHF larvae in Tumpok Teungoh Village, Lhokseumawe City, is at level 5, in the category of moderate risk of transmission.

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