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Kepadatan Larva Aedes aegypti Berdasarkan Indeks Entomologi di Desa Huidu, Kabupaten Limboto Barat

Density of Aedes aegypti Larvae Based on the Entomological Index in Huidu Village, West Limboto District

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Abstrak

Demam Berdarah Dengue (DBD) masih menjadi masalah kesehatan masyarakat yang signifikan karena sering menimbulkan wabah dan menimbulkan risiko kematian. Menurut laporan Organisasi Kesehatan Dunia (WHO) per 30 April 2024, lebih dari 7,6 juta kasus dengue telah tercatat di seluruh dunia, termasuk 3,4 juta kasus terkonfirmasi, lebih dari 16.000 kasus berat, dan lebih dari 3.000 kematian. Penelitian ini merupakan penelitian observasional dengan desain deskriptif yang bertujuan untuk menilai tingkat kepadatan vektor Aedes aegypti melalui perhitungan Indeks Rumah (IH), Indeks Wadah (IK), Indeks Breteau (IB), Angka Kepadatan (AK), dan Indeks Bebas Jentik (IKJ). Pemeriksaan dilakukan dengan mengidentifikasi keberadaan jentik pada wadah penampung air tanpa mengambil sampel jentik. Hasil penelitian menunjukkan bahwa HI sebesar 23% dari 100 rumah yang diperiksa, CI sebesar 2,9% dari 800 kontainer yang diperiksa, dan BI sebesar 23% dari 100 rumah. Berdasarkan temuan ini, Angka Kepadatan di Desa Huidu, Kecamatan Limboto Barat, adalah 3,3, yang dikategorikan sebagai Zona Kuning, yang menunjukkan tingkat penularan vektor sedang dan memerlukan kewaspadaan. Upaya pemberantasan sarang nyamuk (PSN) perlu diperkuat melalui kegiatan 3M Plus yang berkelanjutan, pemberdayaan masyarakat dalam menjaga kebersihan lingkungan, dan penguatan peran kader pemantau jentik (Jumantik) untuk secara rutin memeriksa keberadaan jentik guna mengurangi risiko penularan DBD.

Kata Kunci: *Demam Berdarah Dengue, Indeks Wadah, Indeks Breteau, Angka Kepadatan*

Abstract

Dengue Hemorrhagic Fever (DHF) remains a significant public health problem as it frequently causes outbreaks and poses a risk of death. According to the World Health Organization (WHO) report as of April 30, 2024, more than 7.6 million dengue cases have been recorded worldwide, including 3.4 million confirmed cases, over 16,000 severe cases, and more than 3,000 deaths. This study is an observational research with a descriptive design aimed at assessing the density level of Aedes aegypti vectors through the calculation of the House Index (HI), Container Index (CI), Breteau Index (BI), Density Figure (DF), and Larvae-Free Index (ABJ). The examination was carried out by identifying the presence of larvae in water-holding containers without collecting larval samples. The results showed that the HI was 23% from 100 inspected houses, the CI was 2.9% from 800 containers examined, and the BI was 23% from 100 houses. Based on these findings, the Density Figure in Huidu Village, Limboto Barat Subdistrict, was 3.3, categorized as a Yellow Zone, which indicates a moderate level of vector transmission and requires vigilance. Mosquito breeding site eradication (PSN) efforts need to be strengthened through continuous 3M Plus activities, community empowerment in maintaining environmental cleanliness, and strengthening the role of larva monitoring cadres (Jumantik) to routinely inspect larvae presence in order to reduce the risk of dengue transmission..

Keywords: *Dengue Hemorrhagic Fever, Container Indeks, Breteau Index, Density Figu*

BACKGROUND

Dengue Hemorrhagic Fever (DHF) was first identified in Southeast Asia in the 1950s but, since 1975, has become a leading cause of death among children in Asian countries. The global prevalence of this disease has increased drastically in recent decades. DHF is now endemic in more than 100 countries across Africa, the Americas, the Eastern Mediterranean, Southeast Asia, and the Western Pacific. Southeast Asia and the Western Pacific bear the highest burden of the disease. Prior to the 1970s, only nine countries had experienced dengue epidemics, but this number quadrupled by 1995. Since 1997, dengue has been recognized as the most important viral disease of concern, with fatal consequences for humans. Its global spread is comparable to malaria, and it is estimated that each year as many as 2.5 billion people—or two-thirds of the world's population—are at risk of contracting DHF. Annually, there are about 10 million dengue infections worldwide, with a mortality rate of around 5%, particularly among children (Hadi, 2005).

According to WHO (2024), as of April 30, 2024, more than 7.6 million dengue cases have been reported globally, including 3.4 million confirmed cases, more than 16,000 severe cases, and over 3,000 deaths. While a substantial increase in dengue cases has been reported worldwide over the past five years, this surge has been particularly significant in the Americas, where the number of cases exceeded seven million by the end of April 2024—surpassing the previous annual record of 4.6 million cases in 2023.

Dengue Hemorrhagic Fever (DHF) remains a priority public health problem as it frequently causes outbreaks and fatalities. The disease is caused by the dengue virus, transmitted primarily by the Aedes aegypti mosquito as the main vector. Dengue continues to be a major public health issue worldwide, especially in tropical and subtropical regions, including Indonesia, which is an endemic country (Nurmalasari et al., 2021). Four main components influence the transmission of DHF: the agent, vector, host, and environment. However, in the absence of specific vaccines or treatments, vector control and environmental management remain the most important strategies for preventing and controlling dengue (Yushananta Prayudhy & Agus Setiawan, 2020).

With its increasing global spread, Asia remains the region with the highest number of dengue cases each year. Between 1968 and 2009, the World Health Organization (WHO) recorded Indonesia as the country with the highest number of dengue cases in Southeast Asia (Heryanto & Meliyanti, 2021). As a tropical country with high humidity, Indonesia provides favorable conditions for the breeding of mosquitoes such as Aedes aegypti, the primary vector of DHF. Consequently, DHF can easily be transmitted through the bites of infected mosquitoes. This creates major public health problems, as many areas are endemic and the number of cases continues to rise, with transmission expanding into new areas due to increasing mobility and population density. The growing burden of dengue has significant economic impacts, including loss of work time, disruptions to education, and medical expenses, in addition to increased morbidity and the risk of mortality among DHF patients (Lesmana & Halim, 2020).

Based on internal data from the Directorate of Disease Prevention and Control (P2P), in 2015 there were 201,885 reported cases of dengue across 34 provinces in Indonesia, with 1,071 deaths. The incidence rate (IR) of DHF in 2015 was 50.75 per 100,000 population, and the case fatality rate (CFR) was 0.83%. In 2016, there were 129,650 cases, with an IR of 77.96 per 100,000 population and a CFR of 0.79%. These data show an increase in cases from 2015 to 2016 of 27.25 per 100,000 population (Amalia, 2019). According to WHO (2024), Indonesia experienced a surge in dengue cases in 2024, with 88,593 confirmed cases and 621 deaths as of April 30, 2024—nearly three times higher compared to the same period in 2023.

The occurrence of DHF across Indonesia is associated with several risk factors, including environments conducive to Aedes breeding, limited public understanding of mosquito control, the expansion of endemic areas due to environmental changes caused by urbanization and new residential developments, as well as increasing population mobility. Efforts to control dengue vectors in Indonesia generally include fogging, abate larvicide application, environmental quality monitoring, and mosquito breeding site elimination (PSN) (Melangi et al., 2018).

The main breeding sites of Aedes aegypti are clean water containers located near human dwellings, usually within 500 meters of homes. These include man-made containers such as jars, water storage tanks, bathtubs, flower vases, cans, bottles, drums, and discarded tires that collect rainwater, as well as natural breeding sites such as plant axils (e.g., taro, banana), coconut shells, bamboo stumps, and tree holes filled with rainwater (Suharno Zen, 2015). Heavy rainfall in Gorontalo Province over several days has caused flooding in some areas, and even landslides in certain locations. Such weather increases the risk of disease outbreaks, including Dengue Hemorrhagic Fever (DHF). Stagnant water provides breeding grounds for Aedes aegypti, increasing the risk of transmission if not addressed promptly (Sanga, 2024).

The number of dengue cases in Gorontalo Regency has recently increased sharply. From January to August alone, the District Health Office recorded 465 cases spread across various regions. In detail, there were 84 cases in January, 85 in February, 50 in March, 38 in April, 70 in May, 56 in June, 66 in July, and 16 cases as of August 20. Of the total cases, seven resulted in death. Two deaths were reported in Limboto Barat Subdistrict, one in Telaga Biru, one in Telaga Jaya, one in Biluhu, one in Pulubala, and one in Tilango. The subdistricts contributing the highest number of cases in 2024 were Limboto (124 cases), Limboto Barat (91 cases), Telaga Biru (39 cases), Tilango (24 cases), and Tabongo (24 cases). According to the Head of the Communicable Disease Program at the Gorontalo District Health Office, Yulianti Saleh, the total number of dengue cases this year has already surpassed the 2023 total of 351 cases.

The government has launched several dengue prevention programs under the framework of the National Dengue Control Program (P2DBD). One of the key strategies is the Mosquito Breeding Site Eradication Program (PSN). To support this effort, the government has introduced a communication approach emphasizing behavioral change based on local socio-cultural values, known as Communication for Behavioral Impact (COMBI). This method was introduced by

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WHO in 2004 and has since been implemented in several Indonesian cities such as Jakarta, Padang, Yogyakarta, Bandung, Semarang, and Surabaya. COMBI remains one of the priority strategies within Indonesia's national dengue control program (Cakranegara, 2021).

METHODS

In this study, the authors employed an observational research design with a descriptive approach. The descriptive study aimed to assess and describe the density level of Aedes aegypti mosquitoes by calculating the House Index (HI), Container Index (CI), Breteau Index (BI), Density Figure (DF), and Larvae-Free Index (ABJ), based on the presence or absence of larvae in each water container without larval collection. The larval survey was conducted in Huidu Village, Limboto Barat Subdistrict, Gorontalo Regency. The research sample consisted of 100 households. The sampling technique used was proportional random sampling. The research instruments included observation sheets and equipment for larval inspection.

RESULTS AND DISCUSSION

A. Presence Of Larvae Based on Hamlet in Huidu Village, West Limboto District.

The analysis results show the frequency distribution of Aedes aegypti mosquito larvae based on hamlet in Huidu Village, West Limboto District.

Table 1. Frequency Distribution of Larvae Presence Based on Hamlet in Huidu Village, West Limboto District

Dusun	Keberadaan Jentik				Jumlah	%
	+	%	-	%		
Hamlet 1	2	10	18	90	20	14,2%
Hamlet 2	9	45	11	55	20	14,2%
Hamlet 3	2	10	18	90	20	14,2%
Hamlet 4	0	0	20	100	20	14,2%
Hamlet 5	10	50	10	50	20	14,2%
Jumlah	**23**	**23**	**77**	**77**	**100**	**100%**

B. Presence of Larvae Based on Container Type

The analysis results show the frequency distribution of Aedes aegypti mosquito larvae based on container type in Huidu Village, West Limboto District.

Table 2. Frequency Distribution of Larvae Presence Based on Container Type in Huidu Village, West Limboto District

Type of Container	The presence of larvae										Amount	%
	Dusun 1		Dusun 2		Dusun 3		Dusun 4		Dusun 5			
	n	%	n	%	n	%	n	%	n	%		
Flower Pots	0	0	0	0	0	0	0	0	0	0	0	0
Dispensers	0	0	0	0	0	0	0	0	0	0	0	0
Drinking Water Buckets	0	0	1	1	0	0	0	0	0	0	1	1
Bathtubs	0	0	4	4	1	1	0	0	0	0	5	5
Used Tires	0	0	2	2	0	0	0	0	2	2	4	4
Outdoor Water Buckets	1	1	2	2	1	1	0	0	7	7	11	11
Used Cans	1	1	0	0	0	0	0	0	0	0	1	1
Used Bottles	0	0	0	0	0	0	0	0	1	1	1	1
Jumlah	**2**	**2**	**9**	**9**	**2**	**2**	**0**	**0**	**1**	**1**	**23**	**23**

Source: Primary Data on Larvae Inspection in Huidu Village 2024

Based on Table 2, the results of larval inspection in various types of containers across five hamlets in Huidu Village, Limboto Barat Subdistrict, showed that not all types of containers served as breeding sites for *Aedes aegypti* mosquitoes. Observations revealed that out of a total of 100 houses inspected, 23 containers (23%) were found positive for larvae.

The containers with the highest number of larvae were outdoor water buckets, with 11 containers (11%) distributed across all hamlets, the highest concentration being in Hamlet 5 with 7 containers. Furthermore, larvae were also found in bathtubs, with 5 containers (5%), primarily in Hamlet 2 (4%) and Hamlet 3 (1%). In addition, 4 containers (4%) of used tires were positive for larvae, found in Hamlet 2 (2%) and Hamlet 5 (2%). Other containers with larvae included drinking water buckets with 1 container (1%) in Hamlet 2, used cans with 1 container (1%) in Hamlet 1, and used bottles with 1 container (1%) in Hamlet 5.

Meanwhile, no larvae were found in flower pots or dispensers in any of the hamlets. This indicates that the risk of dengue transmission in Huidu Village is largely associated with containers that frequently store large amounts of water and are located outdoors, such as outdoor water buckets and bathtubs.

These findings emphasize the importance of dengue vector control (PSN) by focusing on the management and regular cleaning of water storage containers, particularly those placed outside the house, as well as the reuse or disposal of discarded items that could serve as breeding sites for *Aedes aegypti* mosquitoes.

1. **House Index (HI)**

The House Index (HI) indicates the percentage of houses where mosquito larvae are found (Kurnia & Edwar, 2022). The HI value provides a clearer description of the extent of mosquito distribution in a particular area (Leri et al., 2021). The House Index is one of the indicators used to describe environmental quality, categorized as low (<5%) and high (>5%) (Kusumawati & Sukendra, 2020). The House Index (HI) is one of the most widely used indicators to monitor the level of mosquito infestation. The HI value also reflects the risk of Dengue virus transmission in an area (Tomia et al., 2022). Based on **Table 1** above, it can be stated that out of 100 house samples examined for larvae, 23 houses (+) were found with larvae and 77 houses (–) were not found with larvae. According to the HI formula below:

$$\text{HI}=\frac{jumlah\ rumah\ yang\ ditemukan\ jentik}{jumlah\ rumah\ yang\ diperiksa}\text{x}100\%$$

Sehingga hasil yang didapatkan:

$$\text{HI: } \frac{23}{100}\ x\ 100\% = 23\%$$

An area is considered at high risk of Dengue Hemorrhagic Fever (DHF) transmission if the House Index is ≥ 10% (Nurhidayah et al., 2022). This indicates that the HI value in Huidu Village, West Limboto District, has already exceeded the established standard, meaning that the houses in the village have a high potential to become breeding sites for *Aedes aegypti* larvae.

2. **Container Index (CI)**

The Container Index (CI) is the proportion of containers found to contain larvae out of the total containers inspected (Mulyani et al., 2022). The Container Index (CI) can serve as an important comparative tool in evaluating vector control programs. Based on Table 6 above, it can be stated that out of 800 inspected containers, 23 containers (+) were found to contain larvae, while 777 containers (–) were free of larvae

$$CI = \frac{jumlah\ kontainer\ yang\ ditemukan\ jentik}{jumlah\ kontainer\ yang\ diperiksa}x100\%$$

Sehingga hasil yang didapatkan:

$$\text{CI: } \frac{23}{800}\ x\ 100\% = 2{,}9\%$$

An area is considered at high risk of dengue transmission if the Container Index is ≥ 5%. Meanwhile, the CI value in Huidu Village is only 2.9%, which means that Huidu Village is not at risk of dengue transmission.

3. **Breteau Index (BI)**

The Breteau Index (BI) is the number of containers positive for larvae per 100 houses inspected. BI illustrates the density and distribution of vectors in an area (Lesmana & Halim, 2020). The Breteau Index (BI) is considered the most informative larval index used to focus control efforts on the management or elimination of the most common habitats in a given environment. The Breteau Index (BI) is also used as a predictor of dengue fever outbreaks (Extraordinary Events/Outbreaks), where if the BI value is ≥ 50, the area is considered at risk of experiencing an outbreak (Athaillah et al., 2019). Based on Table 6 above, it can be seen that the number of containers (+) with larvae found was 23 containers out of 800 containers inspected.

$$BI = \frac{jumlah\ kontainer\ yang\ positif\ jentik}{100\ rumah\ yang\ diperiksa}x100\%$$

Sehingga hasil yang didapatkan:

$$\text{BI: } \frac{23}{100}\ x\ 100\% = 23\%$$

According to WHO (2005) in the study by Lesmana & Halim (2020), the standard value for the Breteau Index (BI) is <50%. Meanwhile, the BI value in Huidu Village is below 50%. This indicates that the density and distribution of the Aedes aegypti mosquito vector in Huidu Village is low.

4. **Density Figure (DF)**

The Density Figure is the combined result of the House Index, Container Index, and Breteau Index (Nurhidayah et al., 2022). The analysis of mosquito larvae population density in an area (DF) has three criteria:

- If the Density Figure is in the range of 1–3, the area is classified as a *Green Zone*, meaning the transmission level of vector-borne diseases is low or not transmissible.

• If the Density Figure is in the range of 4–5, the area is classified as a *Yellow Zone*, meaning the transmission level of vector-borne diseases is moderate and requires caution.
• If the Density Figure is greater than 5, the area is classified as a *Red Zone*, meaning the transmission level of vector-borne diseases is high and immediate control measures are required.

Tabel 3. Larvae Density Figure of Mosquitoes

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

From the calculation results obtained from the combination of HI, CI, and BI, the mosquito larvae density level based on the Density Figure (Table 7) can be seen below:
• House Index (HI) of 23% at DF position 4
• Container Index (CI) of 2.9% at DF position 2
• Breteau Index (BI) of 23% at DF position 4

Density Figure (DF): (4 + 2 + 4) / 3 = 10 / 3 = 3.3
Based on the DF calculation above, it can be seen that the DF value in Huidu Village, West Limboto District, is greater than 2. This means that Huidu Village, West Limboto District, falls into the *Yellow Zone* category, indicating a moderate transmission level of vector-borne diseases, which requires caution.

Larvae Free Index (ABJ)
The Larvae Free Index (ABJ) is the calculation of the percentage of houses or buildings—including offices, factories, apartments, and public facilities—that are free from mosquito larvae (Rizaldi et al., 2022). It represents the percentage of general households where no larvae were found during larvae inspection. The Larvae Free Index (ABJ) serves as an indicator of the success of the Mosquito Nest Eradication Program (PSN), which is obtained from Routine Larvae Inspections (PJB) (Yusy et al., 2022).

ABJ formula:
(Number of houses without larvae) / (Number of houses inspected) × 100%
Thus, the result is:
ABJ = 77 / 100 × 100% = **77%**
The ABJ can be considered good if the value exceeds the national standard of 95% of the total houses inspected. Based on the above calculation, the ABJ value in Huidu Village is 77%, which indicates that the ABJ is below the national standard. This means mosquito larvae density remains high and poses a risk of accelerating the transmission of Dengue Hemorrhagic Fever (DHF) by the Aedes aegypti mosquito vector in the area.

CONCLUSION

Based on the results and discussion above, it can be concluded that the density of *Aedes aegypti* larvae in Huidu Village, West Limboto District, is as follows: based on the House Index (HI), 23% from 100 houses inspected; based on the Container Index (CI), 2.9% from 800 containers inspected; and based on the Breteau Index (BI), 23% from 100 houses inspected. From these values, the Density Figure in Huidu Village, West Limboto District, was obtained at 3.3, which means it falls into the *Yellow Zone* category, indicating a moderate level of vector-borne disease transmission that requires caution.

RECOMMENDATIONS

The researcher's recommendation for the community is to play an active role in carrying out the **3M Plus** movement in their residential environment. In addition, the **"One House, One Larvae Inspector" (Gerakan Satu Rumah Satu Jumantik)** program established by the village authorities needs to be supported and encouraged by the community so that routine larvae inspections and mosquito nest eradication activities can be implemented effectively and efficiently.

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