

ENTOMOLOGICAL INDEX OF DENGUE HEMORRHAGIC FEVER (DHF) VECTOR IN THE WORKING AREA OF THE TEMINDUNG HEALTH CENTER (STUDY ON THE GUERILLA STREET)

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ABSTRACT

The Vector Entomology Index of Dengue Hemorrhagic Fever (DHF) was conducted in the Working Area of the Temindung Health Center (Study on the Guerilla Street). Dengue hemorrhagic fever (DHF) is an infectious disease caused by the Dengue virus. The virus can be transmitted through *Aedes* sp. The *Aedes* mosquito's life cycle undergoes a complete metamorphosis, starting with the egg-larva-pupa-adult mosquito. Larval density can be a contributing factor to a high risk of dengue transmission in the community. This study aimed to determine the entomological index of dengue hemorrhagic fever vectors on Gerilya Street, Sungai Pinang Dalam Village, Samarinda City. The research design used an observational method with a cross-sectional approach. The number of samples is 100. The data were analyzed using the DHF larva population indicator approach, namely the House Index (HI), Container Index (CI), Breteau Index (BI), and Density Figure (DF). The result was found that the entomological index on Jalan Gerilya in Kelurahan Pinang Dalam Kota Samarinda had HI values of 50% (DF 7), CI values of 23.3% (DF 6), and BI values of 164% (DF 7). HI, CI, and BI values are included in the high-risk transmission category. Immediate control efforts are needed to prevent an increase in dengue transmission.

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INTRODUCTION

The number of dengue fever cases in the world has increased quite drastically, from 2.4 million cases in 2010 to 5.2 million cases in 2019 ⁽¹⁾. In Indonesia itself, dengue fever cases have fluctuated over the last 3 years. In 2018, there were 65,602 cases; in 2019, there were 138,127 cases; and in 2020, there were 103,150 cases ⁽²⁾. DHF cases in Indonesia are spread throughout the region, including in Samarinda City. Based on data from the Samarinda City Health Service, in 2019, dengue fever cases reached 1,843 cases, but in 2020 they decreased to 594 cases, and in 2021 they again experienced a quite drastic increase, reaching 1,366 cases. In 2021, the highest number of dengue fever cases were found in the Temindung health center working area in Samarinda City, with 121 cases. The Temindung Community Health Center work area that has the highest number of dengue fever cases is Sungai Pinang Village with 28 cases, where the largest number of cases is on Jalan Guerilla ⁽³⁾.

The dengue virus causes DHF, an infectious disease. This virus can be transmitted through the *Aedes sp. mosquito*, one of the world's fastest-growing mosquitoes ⁽⁴⁾. The life cycle of the *Aedes mosquito* undergoes complete metamorphosis, starting from egg to larva or larva to pupa to adult mosquito ⁽⁵⁾. Larval density has the potential to significantly increase the risk of dengue transmission within a community ⁽⁶⁾. Containers serve as a breeding place or habitat for mosquito larvae, determining their presence and influencing the population density of *Aedes mosquitoes*. The preferred breeding locations for *Aedes mosquitoes* are standing water in containers, such as drums, bathtubs, barrels, buckets, tree holes, flowerpots, used tires, used bottles, bird drinkers, and so on ^(7, 8).

The method that can be used to determine the level of larval density in a place is by conducting an entomological survey of mosquito larvae. The larva survey will provide an idea of the density level of *Aedes sp. larvae*. The indicators used in the survey are the House Index (HI), Container Index (CI), Breteau Index (BI), and Larval Free Rate (ABJ). Next, the density figure (DF) calculation is carried out, which is a combination of the HI, CI, and BI configurations. A high entomological index value indicates a fairly high risk of dengue transmission in the community ⁽⁹⁾. Based on this, a study is needed to determine the entomological index of the dengue vector in the Temindung Community Health Center Working Area. Information from this study can later be used to control dengue vectors.

MATERIALS AND RESEARCH METHODS

This research uses an analytical survey method with a cross-sectional approach. The population under study consisted of residents living in the Temindung Health Center Working Area in Samarinda City, specifically on Jalan Guerilla in Sungai Pinang Dalam Village, comprising 10 RTs and a total of 943 houses. The sampling technique uses cluster random sampling. According to the sample calculation, 100 samples were obtained. The number of samples for each RT and the formula used are listed below:

$$\text{Sample size calculation} = \frac{\text{Number of house Neighborhood}}{\text{Number of house}} \times \text{A lot of sample}$$

Table 1. Number of samples Neighborhood

Neighborhood Association	Neighborhood population	Sample
RT 1	65/943 x 100	7
RT 2	120/943 x 100	13
RT 3	84/943 x 100	9
RT 4	66/943 x 100	7
RT 5	85/943 x 100	9
RT 6	121/943 x 100	13
RT 7	72/943 x 100	8
RT 8	172/943 x 100	18
RT 9	95/943 x 100	10
RT 10	63/943 x 100	6
Total	943	100

Larval surveys are carried out using tools such as flashlights, observation sheets, and writing instruments to record observation results. The survey focuses on areas with stagnant water, as these are the typical breeding grounds for *Aedes sp. mosquitoes*. *Aedes sp. mosquitoes*. Females always lay eggs on the walls of water reservoirs or other objects that allow water to stagnate. The data were described using a population indicator approach, and the entomological index method was used to check for dengue fever larvae. The entomological index is calculated using the results of the House Index (HI), Container Index (CI), and Breteau Index (BI). After obtaining the HI, CI, and BI data, the density figure (DF) can then be determined. DF represents the density of *Aedes sp. la*This is a configuration of the calculation results of the House Index (HI), Container Index (CI), and Breteau Index (BI) on a scale of 1 -

9. 1–9. If the DF number is less than 1, it indicates a low risk of transmission; 1–5 is a moderate risk of transmission; and above 5, there is a high risk of transmission. The table below provides an index of larvae.

Table 2. Index Larvae

Density Figure	House Indeks	Container Indeks	Breteau Indeks
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

Sumber: Kemenkes, 2011

RESULTS OF RESEARCH AND DISCUSSION

This research was conducted in the Temindung Health Center Work Area, specifically on Jalan Guerilla, Sungai Pinang Village, and Samarinda City. The research location can be seen on the following map:

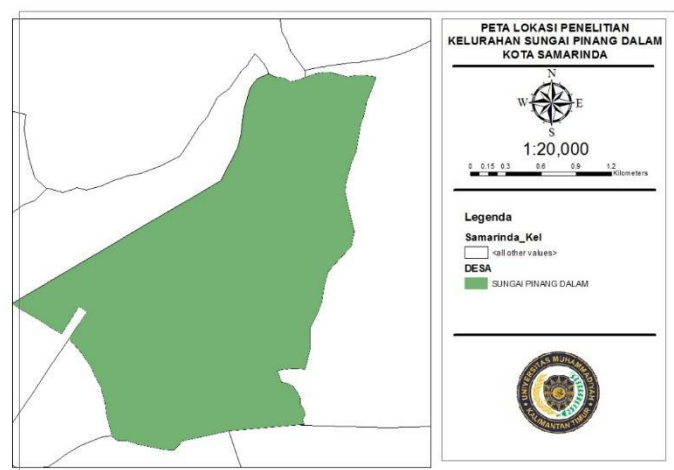


Figure 1. Research Location

The existence of larvae

The presence or absence of larvae in the house under inspection provides an overview of their presence. The frequency distribution of larval presence can be seen in Table 2 below:

Table 3. Frequency Distribution of Larvae Presence on Guerrilla Street
 Sungai Pinang Village in Samarinda City

The existence of larvae	House		Container	
	n	%	n	%
There is	50	50	167	23.3
There isn't any	50	50	538	76.7
Total	100	100	705	100

Source: Primary Data, 2022

Table 2 shows that out of 100 houses there are 50 (50%) houses that are positive for larvae and out of 705 containers there are 164 (23.3) that are positive for larvae. Table 4 below shows the types of containers based on observation results:

Table 4. Types of Containers and Presence of Larvae

No	Container Type	The existence of larvae					
		(+)	%	(-)	%	Number of Containers	Container (%)
1	Drum	67	9.5	88	12.5	155	22
2	Bathtub	5	0.7	64	9.1	69	9.8
3	Crock	2	0.3	3	0.4	5	0.7
4	Bucket	32	4.5	151	21.4	183	25.9
5	Drinking Water Storage	0	0	94	13.3	94	13.3
6	Bird Drinking Place	0	0	17	2.4	17	2.4
7	Flower vase	3	0.4	17	2.4	20	2.8
8	Used tires	3	0.4	16	2.3	19	2.7
9	Used Cans	12	1.7	18	2.6	30	4.3
10	Used Bottles	29	4.1	63	8.9	92	13
11	Used Plastic	10	1.4	1	0.1	11	1.5
12	Jerry cans	0	0	3	0.4	3	0.4
13	Aquarium	1	0.1	6	0.9	7	1
	Total	164	23.3	541	76.7	705	100

Source: Primary Data, 2022

Table 4 shows that of the 705 containers, there were 164 positive for larvae. The highest type of larva-positive container was drums with 67 (9.5%), followed by buckets with 32 (4.5%), and used bottles with 29 (4.1%). There are three types of containers that are negative for larvae: drinking water containers, bird drinking containers, and jerry cans. The following picture graphically illustrates the distribution of larval presence by container type on Jl. The guerrillas of Sungai Pinang Village in Samarinda City:

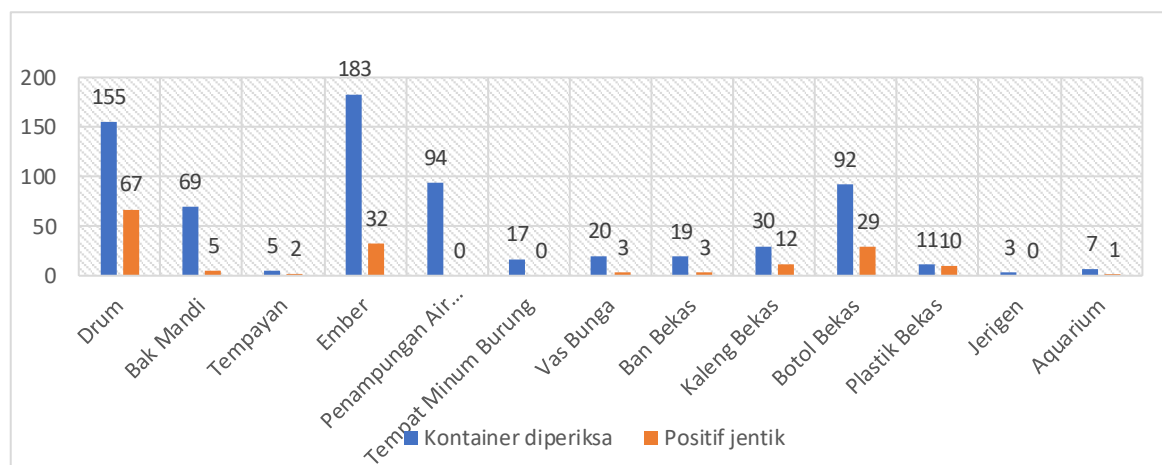


Figure 2. Distribution of larval presence according to container type on Jl. Guerrilla of Sungai Pinang Village in Samarinda City

Entomology Index

The method that can be used to determine the level of larval density in a place is by conducting an entomological survey of mosquito larvae. The larva survey provides an overview of the density level of *Aedes* sp. larvae. The House Index (HI), Container Index (CI), and Breteau Index (BI) indicators provide an overview of the density level of *Aedes* sp. larvae.

a. *House Index*(HI)

House index is the percentage of houses/buildings found to have larvae divided by the houses/buildings inspected. The HI calculation is as follows:

$$HI = \frac{\text{Number of positive buildings}}{\text{Number of buildings in check}} \times 100$$

$$HI = \frac{50}{100} \times 100$$

$$HI = 50\%$$

b. *Container Index*(CI)

Container Index is the percentage of containers found for larvae divided by all containers inspected. CI calculation as follows:

$$CI = \frac{\text{Jumlah Kontainer Positif}}{\text{Jumlah Kontainer di Periksa}} \times 100$$

$$CI = \frac{164}{705} \times 100$$

$$CI = 23,3\%$$

c. *Breteau Index*(BI)

Breteau Index is the percentage of containers found with larvae divided by houses inspected. BI calculations are as follows:

$$BI = \frac{\text{Number of positive containers}}{\text{Number of house in check}} \times 100$$

$$BI = \frac{164}{100} \times 100$$

$$BI = 164\%$$

d. *Density Figures*(DF)

Based on the HI, CI and BI data, the Density Figure (DF) can then be determined. DF values HI (7), CI (6) and BI (8). The DF HI, CI and BI values are all above 5, which means they are in the high transmission risk category,

The existence of larvae

The presence of larvae can be influenced by the containers in which adult mosquitoes breed can influence the presence of larvae. Based on observations in 100 houses, 705 containers were found, consisting of 13 types, but larvae were found in only 10 types of containers. The most common type of container was a bucket at 183 (25.9%), and the least common was a jerry can at 3 (0.4%). The type of container that tested positive for larvae the most was drums with 67 (9.5%), followed by buckets with 32 (4.5%), and used bottles with 29 (4.1%). There are three types of containers that are negative for larvae: drinking water containers, bird drinking containers, and jerry cans.

Larvae are the most important stage in the mosquito breeding life cycle. A high population of larvae in an area tends to have a high risk of dengue transmission. This is in accordance with

Nyarmiati's statement: the increase in potential dengue vector habitat is directly proportional to the growth of the mosquito population, so the risk of dengue transmission will be higher ⁽¹⁰⁾. People on Jalan Guerilla tend to use drums as water reservoirs. Several researchers found that larvae were most commonly found in large containers because they were difficult to clean ⁽¹¹⁾.

Buckets are one of the most common types of containers found at survey locations, used to store water because they tend to be more flexible in use. However, the problem is that people still pay little attention to its condition, such as not being closed, so that when the survey was carried out, many buckets were still found that were positive for larvae. A similar study also found that buckets were the containers where the most larvae were found ⁽¹²⁾. Using a bucket as a water container should make it easier to control the presence of larvae, but in fact, the bucket is actually the dominant container that plays a role in the presence of larvae ⁽¹³⁾.

In this area, there are numerous used items, such as tires, cans, bottles, and plastic, that could serve as potential breeding places for mosquitoes acting as dengue vectors. Used bottles, used cans, used plastic, and used tires are among the types of containers found positive for larvae. Most of these items are found outside the house and are not looked after, making them breeding grounds for mosquitoes. Aedes mosquitoes usually like clean puddles of water that are not in direct contact with the ground. Used goods that are not in use and have the potential to become breeding grounds for mosquito larvae should be recycled ⁽¹⁴⁾.

Entomology Index

Entomological indicators, such as a density index for Aedes aegypti larvae in a particular settlement, are an important consideration in determining effective vector control efforts. The mosquito larvae density in Jalan Guerilla, Sungai Pinang Subdistrict, and Samarinda City falls into the high transmission risk category, with a HI of 50% (DF 7), CI of 23.3% (DF 6), and BI of 164% (DF 8). The average density is $7 + 6 + 8/3 = 7$. Figure 7 shows a high risk of transmission.

House Index (HI) is an indicator used to monitor houses that are positive for larvae based on the number of houses inspected. The research results indicate a HI value of 50%, which, when adjusted to the density figure table, falls into the high category on a scale of 7. Larval density: Jl. guerillas in Sungai Pinang Village, Samarinda City, have a high risk of transmitting dengue fever. Factors that can influence the high HI value are the lack of community behavior and participation in mosquito nest eradication (PSN) activities can influence the high HI value. Research conducted by Tiya Taslisia found an HI value of 57% equivalent to DF 7, and similarly, Risman Kurnia's research found an HI value of 45% equivalent to DF 6 ^(15, 16).

The Container Index (CI) value on Jl. Guerilla Sungai Pinang Village in Samarinda City falls into the high category, with a DF value of 6. The presence of containers in the home environment plays a crucial role in the reproduction of mosquito larvae, because more containers as water reservoirs can increase the mosquito population, resulting in a high risk of dengue fever transmission. The Breteau Index (BI) value on Jl. Guerrilla, Sungai Pinang Village in Samarinda City, is in the high category with a DF value of 8 and has a high risk of transmitting dengue fever.

The entomological index of Jalan Guerilla, Pinang District, and Samarinda City is supported by several factors, namely humans, the environment, and vectors. Dengue fever can appear throughout the year and attack all age groups. Dengue fever is related to environmental conditions and community behavior. During the rainy season, the incidence of dengue fever can increase due to high rainfall, which creates standing water around housing and community settlements. This standing water serves as a breeding place for Aedes sp. mosquitoes, leading to an increase in mosquito population and an increase in dengue fever transmission within the community.

CONCLUSIONS AND RECOMMENDATIONS

The entomological index on Jalan Guerilla, Pinang District, Samarinda City, obtained an HI value of 50% (DF 7), a CI of 23.3% (DF 6), and a BI of 164% (DF 8). The DF values HI, CI, and BI, the configuration of the three entomological indices, produce a DF value of 7, which is included in the high transmission risk category. Immediate control efforts need to be carried out to prevent an increase in dengue fever transmission, immediate control efforts must be made.

REFERENCES

1. WHO. Dengue and severe dengue [Internet]. 2022 [cited 2022 Mar 24]. Available from: <https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue>
2. Kementerian Kesehatan Republik Indonesia. Data DBD Indonesia [Internet]. 2021 [cited 2022 Mar 24]. Available from: https://ptvz.kemkes.go.id/storage/media-download/file/file_1619447946.pdf
3. Dinas Kesehatan Kota Samarinda. Kasus Demam Berdarah Menurut Jenis Kelamin, Kecamatan dan Puskesmas Kota Samarinda . Samarinda; 2021.
4. Kemeterian Kesehatan Republik Indonesia. Profil Kesehatan Indonesia Tahun 2019 [Internet]. 2020 [cited 2022 Mar 24]. Available from: <https://pusdatin.kemkes.go.id/resources/download/pusdatin/profil-kesehatan-indonesia/Profil-Kesehatan-indonesia-2019.pdf>
5. Kementerian Kesehatan Republik Indonesia. Peraturan Menteri Kesehatan Republik Indonesia Nomor 50 Tahun 2017 Tentang Standar Baku Mutu Kesehatan Lingkungan Dan Persyaratan Kesehatan Untuk Vektor Dan Binatang Pembawa Penyakit Serta Pengendaliannya [Internet]. 2017. Available from: www.peraturan.go.id
6. Carmelia Yunitra Angrida Putri Leri, Agus Setyobudi, Enjelita Mariance Ndoen. View of Density Figure of Aedes Aegypti Larvae and Community Participation in Prevention of Dengue Hemorrhagic Fever (DHF). Lontar: Journal of Community Health [Internet]. 2021 [cited 2022 Mar 24];3(3):123–32. Available from: <https://ejurnal.undana.ac.id/index.php/LJCH/article/view/4329/2932>
7. Irayanti, Martini Martini, Arie Wurjanto, Henry Setyawan Susanto. Survei Jentik Nyamuk Aedes Sp. Di Wilayah Kerja Pelabuhan KKP Kelas II Tarakan. Jurnal Ilmiah Mahasiswa. 2021;11(2):43–6.
8. Budiman, Hamidah. Karakteristik Tipe Kontainer yang Disukai oleh Jentik AAedes Aegypti di Wilayah Kerja Puskesmas Bulili . Promotif: Jurnal Kesehatan Masyarakat [Internet]. 2017 [cited 2022 Mar 24]; Available from: <https://media.neliti.com/media/publications/223807-characteristics-of-continuity-type-suppo.pdf>
9. Fansiri T, Buddhari D, Pathawong N, Pongsiri A, Klungthong C, Iamsirithaworn S, et al. Entomological risk assessment for dengue virus transmission during 2016–2020 in kamphaeng phet, thailand. Pathogens. 2021 Oct 1;10(10).
10. Nyarmiaty. Spasial Faktor Risiko Lingkungan Pada Kejadian Demam Berdarah Dengue [Internet]. 2017. Available from: <http://journal.unnes.ac.id/sju/index.php/higeia>
11. Maksud M, Udin Y, Mustafa H, Risti, Jastal. Survei Jentik DBD di Tempat-tempat Umum (TTU) di Kecamatan Tanantovea, Kabupaten Donggala, Sulawesi Tengah. Vol. 9, Jurnal Vektor Penyakit. 2015.
12. Fuadzy H, Hendri J. Indeks Entomologi Dan Kerentanan Larva Aedes Aegypti Terhadap Temefos Di Kelurahan Karsamenak Kecamatan Kawalu Kota Tasikmalaya Entomology Index And Susceptibility Of Aedes Aegypti Larvae Againts Temephos In Karsamenak District Kawalu Tasikmalaya. Vektora. 2017;7(2):57–64.

13. Heni Prasetyowati, Endang PujiAstuti, Joni Hendri, Hubullah Fuadzy. Risiko PenularanDBDBerdasarkan Maya IndexdanKey ContainerpadaRumah Tangga Kasus dan Kontrol diKota Bandung [Internet]. Balaba: Jurnal Litbang Pengendalian Penyakit Bersumber Binatang Banjarnegara. 2018 [cited 2022 Jul 31]. Available from: <https://ejournal2.litbang.kemkes.go.id/index.php/blb/article/view/399/435>
14. Kementerian Kesehatan Republik Indonesia. Pedoman Pengendalian Demam Berdarah Dengue di Indonesia. Jakarta: Direktorat Jenderal Pengendalian Penyakit Dan Penyehatan Lingkungan Kementerian Kesehatan RI; 2017.
15. Risman Kurnia, Tri Baskoro Tunggul Satoto, M Lutfan Lazuardi. Indeks Entomologi Vektor Nyamuk Aedes spp di Daerah Endemis Demam Berdarah Dengue (DBD) di Kecamatan Tanjungpinang Timur Kota Tanjungpinang Provinsi Kepulauan Riau. Vol. 12, Jurnal Kesehatan Terpadu (Integrated Health Journal. Online; 2021.
16. Taslisia T, Renita Rusjdi S. Survei Entomologi, Maya Indeks, dan Status Kerentanan Larva Nyamuk Aedes aegypti terhadap Temephos. Jurnal Kesehatan Andalas [Internet]. 2018 [cited 2022 Jul 31];7(1). Available from: <http://jurnal.fk.unand.ac.id>