**Jurnal Info Kesehatan**
Vol. 20, No. 2, December 2022, pp. 286-295
P-ISSN 0216-504X, E-ISSN 2620-536X
DOI: *10.31965/infokes.Vol20Iss2.964*
Journal homepage:*http://jurnal.poltekeskupang.ac.id/index.php/infokes*

**RESEARCH** **Open Access**

# Dengue Control Model, Abate Sowing and Larvitrap Installation in Dengue Endemic Areas of Kupang City

**R. H. Kristina[1a*], Ragu Theodolfi[1b], Oktofianus Sila[1c]**

[1] Department of Enviromental Health, Poltekkes Kemenkes Kupang, Kupang, East Nusa Tenggara, Indonesia

[a] Email address: kristinaharming@gmail.com
[b] Email address: theodolfi@gmail.com
[c] Email address: fianussila@gmail.com

Received: 2 November 2022 Revised: 31 December 2022 Accepted: 31 December 2022

## Abstract

The bite of the *Aedes sp* mosquito causes nearly 0 million people to be infected with the dengue virus annually, one of areas declared as an endemic area is East Nusa Tenggara Province. 5669 cases and 58 deaths due to dengue hemorrhagic fever (DHF) were found in East Nusa Tenggara Province in 2020 (CFR 1.02%). Highly influential external factors include the availability of clean water, the crisis of drinking water and clean water, and poor condition of water container that do not meet the requirements. This study aims to manage Larvitrap installation movement and abatezation of the water containers in the community/households in Kupang City. This was a observational study with survey design regarding the installation of Larvitrap tool. The density of mosquito larvae was measured based on the House Index (HI), Container Index (CI), and Breteau index (BI). 383 families were involved as the study samples who were selected using the accidental sampling technique. The results showed that there were 866 units of water resevoir (47.8%). Fatululi Village had the highest percentage of indoor water container by 15.7% (140 units), and Oesapa Village had the highest percentage of outdoor water container by 15.5% (143 units). The highest percentage of positive indoor water container was found in TDM and Kelapa Lima by 30.4%, while the highest percentage of positive outdoor water container was found in TDM village by 48.4%. *Aedes aegypti* larvae and Aedes albopictus larvae were identified in the indoor and outdoor water containers in TDM Village, while that were only aedes *aegypti* larvae found in six other villages. The positive larvitrap larvae found in Oebufu Village was 15%, 10% was found in Oesapa Village, while there were no larvae found in 5 other villages. The flick density index obtained the highest House Index (HI) in Kelapa Lima village by 58.33%, the highest Container Index (CI) was found in TDM village by 44.03% and the highest Breteau Index (BI) was found in TDM village by 218.75%. It can be concluded that it is necessary to conduct education on mosquito larvae control that involves active community participation and supervision towards weekly draining of community water containers. In addition, abate sprinkling and dengue vector control activities should be carried out simultaneously throughout Kupang City at the beginning of the rainy season, at the peak of case incidence and at the end of the rainy season.

**Keywords:** Larvitrap, Indeks Larva, DHF, Water Reservoir.

***Corresponding Author:***

Ragu Harming Kristina
Department of Enviromental Health, Poltekkes Kemenkes Kupang, Kupang, East Nusa Tenggara, Indonesia.
Email: kristinaharming@gmail.com

## 1. INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is a disease caused by the dengue virus transmitted through the bite of the *Aedes aegypti* and Aedes albopictus mosquitos which has caused nearly 390 million people to be infected annually (Kementerian Kesehatan Republik Indonesia, 2018), (Nuryati, & Thamrin, 2012). DHF disease causes disorders in the capillary blood vessels and blood coagulation system, resulting in bleeding and death (Tairas, 2015), (Karyanti, & Hadinegoro, 2016). Such disease is usually found in tropical regions such as Southeast Asia, India, Brazil, America including in all corners of Indonesia except at an altitude of more than 1000 meters above sea level (Iriani, 2016), (Candra, 2010).

East Nusa Tenggara (ENT) Province is declared an endemic area of dengue fever. Epidemiological data derived from 22 regencies/cities showed an increase in cases and deaths due to dengue fever in 2018 to 2020 (Hartoyo, 2016) (Hadi, Soviana, & Gunandini, 2012). 5669 cases and 58 deaths due to dengue hemorrhagic fever (DHF) were found in East Nusa Tenggara Province in 2020 (CFR = 1.02%). Kupang city is categorized as an endemic area of dengue fever because the highest number of dengue cases exceeds the national figure. In 2017, there were 43 cases and 1 death due to DHF, in 2018 there were 228 cases and deaths due to DHF, in 2019 there were 629 cases and 3 deaths due to DHF, and in 2020 there were 750 cases and 8 deaths due to DHF (Kelen, Salmun, & Setyobudi, 2022), (Prasetyowati & Ginanjar, 2017). In 2020, Kupang City was designated as experiencing dengue hemorrhagic fever (DHF) outbreak.

The geographical and environmental conditions of Kupang City support the breeding of *Aedes aegypti* mosquitoes so that dengue outbreaks occur every year. Highly influential external factors include the availability of clean water, the crisis of drinking water and clean water, and poor condition of water containers that do not meet the requirements. Based on the study data above, the approach to prevention and control of dengue fever should be carried out across sectors and involve all stakeholders (Kementerian Kesehatan Republik Indonesia, 2017). The expected collaboration strategy is through harmonization of various aspects which include understanding the respective role, sharing knowledge, methods, technologies and resources with each other; having the same goal, certain governance system (effective and efficient management), and community-oriented approach (Palgunadi, & Rahayu, 2011), (Kusuma, & Sukendra, 2016). It is necessary to make a breakthrough and innovation effort by applying a model of eradication of dengue using larvitrap technology as a trap for larvae and mosquitoes, along with abatezation using the sowing method and empowerment of larvae exterminator (Wirayoga, 2014), (Sari, 2013).

This study requires a time series for the sustainability of the study and requires several stages of activities so as to achieve certain goal regarding the decrease in dengue hemorrhagic fever cases or zero growth of dengue fever in East Nusa Tenggara Province. This study aims to implement a simple technology for the eradication of mosquito larvae by installing larvae and mosquito traps in the form of Larvitrap in households and sowing abate, and empowering larvae exterminator from the community as family companions.

## 2. RESEARCH METHOD

This was a observational study with survey design regarding the installation of Larvitrap tool. The density of mosquito larvae was measured based on the House Index (HI), Container index (CI), and Breteau index (BI). The population of this study was all households (RT) in the endemic area of DHF in Kupang City as many as 95,000 households. 383 families were involved as the study samples who were selected using the accidental sampling technique with a total sample method.

The equipment used here were the Aedes sp flick survey form, drip pipette, flashlight, flick container, microscope, slide, and larvitrap. Abate was not provided since it had been distributed to the community by the health center officers. This study was conducted at the Sanitation Study Program Laboratory, Health Polytechnic of Kupang. The data obtained were recapitulated by name,

location and day in the exel program, which were further tabulated and calculated using standard formulas used in the density survey of aedes larvae species.

## 3. RESULTS AND DISCUSSION

**Table 1.** Percentage of Types of Dengue Vector Breeding Ground by Village.

| No | Village | Type of Water container | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Drum | % | Bathtub | % | Crock | % | Non Water container | % |
| 1 | Fatululi | 47 | | 73 | | 134 | | 35 | |
| | Indoor | 10 | 13.9 | 48 | 13.8 | 82 | 17.4 | 7 | 12.3 |
| | Outdoor | 37 | 10.5 | 25 | 14.3 | 52 | 13.1 | 28 | 21.5 |
| 2 | Kayu Putih | 44 | | 61 | | 115 | | 40 | |
| | Indoor | 7 | 9.7 | 52 | 14.9 | 67 | 14.3 | 9 | 15.8 |
| | Outdoor | 37 | 10.5 | 9 | 5.1 | 48 | 12.1 | 31 | 23.8 |
| 3 | Oebufu | 37 | | 63 | | 140 | | 20 | |
| | Indoor | 8 | 11.1 | 42 | 12.0 | 73 | 15.5 | 2 | 3.5 |
| | Outdoor | 29 | 8.3 | 21 | 12.0 | 67 | 16.9 | 18 | 13.8 |
| 4 | TDM | 117 | | 114 | | 106 | | 58 | |
| | Indoor | 19 | 26.4 | 50 | 14.3 | 64 | 13.6 | 32 | 56.1 |
| | Outdoor | 98 | 27.9 | 64 | 36.6 | 42 | 10.6 | 26 | 20.0 |
| 5 | Liliba | 88 | | 99 | | 72 | | 13 | |
| | Indoor | 20 | 27.8 | 72 | 20.6 | 40 | 8.5 | 2 | 3.5 |
| | Outdoor | 68 | 19.4 | 27 | 15.4 | 32 | 8.1 | 11 | 8.5 |
| 6 | Oesapa | 54 | | 57 | | 157 | | 7 | |
| | Indoor | 5 | 6.9 | 42 | 12.0 | 78 | 16.6 | 4 | 7.0 |
| | Outdoor | 49 | 14.0 | 15 | 8.6 | 79 | 19.9 | 3 | 2.3 |
| 7 | Kelapa Lima | 36 | | 57 | | 142 | | 14 | |
| | Indoor | 3 | 4.2 | 43 | 12.3 | 66 | 14.0 | 1 | 1.8 |
| | Outdoor | 33 | 9.4 | 14 | 8.0 | 76 | 19.2 | 13 | 10.0 |
| | Total | 423 | 23.3 | 524 | 28.9 | 866 | 47.8 | 187 | |
| | Indoor | 72 | 100.0 | 349 | 100.0 | 470 | 100.0 | 57 | 100 |
| | Outdoor | 351 | 100.0 | 175 | 100.0 | 396 | 100.0 | 130 | 100 |

Table 1 revealed the number of mosquito shelters in the form of drums by 423 units (23.3%), bathtubs by 524 units (28.9%) and crocks by 866 units (47.8%).

**Table 2.** Percentage of Types of Inside & Outside Dengue Vector Breeding Ground by Village.

| No | Village | Indoor | | | | Outdoor | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Water container | % | Non Water container | % | Water container | % | Non Water container | % |
| 1 | Fatululi | 140 | 15.7 | 7 | 12.3 | 114 | 12.4 | 28 | 21.5 |
| 2 | Kayu Putih | 126 | 14.1 | 9 | 15.8 | 94 | 10.2 | 31 | 23.8 |
| 3 | Oebufu | 123 | 13.8 | 2 | 3.5 | 117 | 12.7 | 18 | 13.8 |
| 4 | Tuak Daun | 133 | 14.9 | 32 | 56.1 | 204 | 22.1 | 26 | 20.0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Merah | | | | | | | | |
| 5 | Liliba | 132 | 14.8 | 2 | 3.5 | 127 | 13.8 | 11 | 8.5 |
| 6 | Oesapa | 125 | 14.0 | 4 | 7.0 | 143 | 15.5 | 3 | 2.3 |
| 7 | Kelapa Lima | 112 | 12.6 | 1 | 1.8 | 123 | 13.3 | 13 | 10.0 |
| | Total | 891 | 100.0 | 57 | 100.0 | 922 | 100.0 | 130 | 100.0 |

Table 2 revealed that Fatululi Village had the highest percentage of indoor water container by 15.7% (140 pieces), and Oesapa Village had the highest percentage of outdoor water container by 15.5% (143 pieces).

**Table 3.** Percentage of Positive & Negative Dengue Vector Breeding Ground by Village.

| **No** | **Village** | **Indoor** | | | | **Outdoor** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **Positive** | **%** | **Negative** | **%** | **Positive** | **%** | **Negative** | **%** |
| 1 | Fatululi | 1 | 1.0 | 139 | 17.6 | 2 | 0.9 | 112 | 16.1 |
| 2 | Kayu Putih | 8 | 7.8 | 118 | 15.0 | 14 | 6.2 | 80 | 11.5 |
| 3 | Oebufu | 2 | 2.0 | 121 | 15.3 | 1 | 0.4 | 116 | 16.6 |
| 4 | Tuak Daun Merah | 31 | 30.4 | 102 | 12.9 | 109 | 48.4 | 95 | 13.6 |
| 5 | Liliba | 6 | 5.9 | 126 | 16.0 | 22 | 9.8 | 105 | 15.1 |
| 6 | Oesapa | 23 | 22.5 | 102 | 12.9 | 38 | 16.9 | 105 | 15.1 |
| 7 | Kelapa Lima | 31 | 30.4 | 81 | 10.3 | 39 | 17.3 | 84 | 12.1 |
| | Total | 102 | | 789 | | 225 | | 697 | |

Table 3 revealed that TDM and Kelapa Lima villages had the highest percentage of positive indoor water container by 30.4% and TDM village had the highest percentage of positive outdoor water container by 48.4%.

**Table 4.** Aedes Larvae (single larvae) species in Positive Water container by Village.

| **No** | **Village** | **Location of Water Container** | **Species of Larvae** |
|---|---|---|---|
| 1 | Fatululi | Indoor & outdoor | *Ae. aegipty* |
| 2 | Kayu Putih | Indoor & outdoor | *Ae. aegipty* |
| 3 | Oebufu | Indoor & outdoor | *Ae. aegipty* |
| 4 | Tuak Daun Merah | Indoor & outdoor | *Ae. aegipty & Ae. albopictus* |
| 5 | Liliba | Indoor & outdoor | *Ae. aegipty* |
| 6 | Oesapa | Indoor & outdoor | *Ae. aegipty* |
| 7 | Kelapa Lima | Indoor & outdoor | *Ae. aegipty* |

Table 4 revealed the results of the identification of single larvae survey at positive indoor and outdoor water containers. It was found that there were Aedes aegipty and *Aedes albopictus larvae* in TDM Village, while that were only *aedes aegipty larvae* found in six other villages.

**Table 5.** Percentage of Positive & Negative Larvitrap by Village.

| No | Village | Total Larvitrap | Indoor | | | | Outdoor | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Positive | % | Negative | % | Positive | % | Negative | % |
| 1 | Fatululi | 80 | 0 | 0 | 40 | 100 | 0 | 0 | 40 | 100 |
| 2 | Kayu Putih | 80 | 0 | 0 | 40 | 100 | 0 | 0 | 40 | 100 |
| 3 | Oebufu | 80 | 0 | 0 | 40 | 100 | 6 | 15 | 34 | 85 |
| 4 | Tuak Daun Merah | 80 | 0 | 0 | 40 | 100 | 0 | 0 | 40 | 100 |
| 5 | Liliba | 80 | 0 | 0 | 40 | 100 | 0 | 0 | 40 | 100 |
| 6 | Oesapa | 80 | 0 | 0 | 40 | 100 | 4 | 10 | 36 | 90 |
| 7 | Kelapa Lima | 80 | 0 | 0 | 40 | 100 | 0 | 0 | 40 | 100 |
| | Total | 280 | 0 | 100 | 280 | 0 | 10 | 3.6 | 270 | 96.3 |

Table 5 revealed that the percentage of positive larvitrap was found in Oebufu Village by 15% and Oesapa Village by 10%.

**Table 6.** Flick Density Index by Village

| No | Village | Total House | Positive House | HI (%) | Total Count | Positive Count | CI (%) | BI (%) |
|---|---|---|---|---|---|---|---|---|
| 1 | Fatululi | 58 | 14 | 23.73 | 254 | 22 | 8.66 | 37.93 |
| 2 | Kayu Putih | 59 | 5 | 8.47 | 220 | 3 | 1.36 | 5.08 |
| 3 | Oebufu | 60 | 4 | 6.67 | 240 | 3 | 1.25 | 5.00 |
| 4 | Tuak Daun Merah | 64 | 48 | 75.0 | 318 | 140 | 44.03 | 218.75 |
| 5 | Liliba | 66 | 21 | 31.82 | 259 | 28 | 10.81 | 42.42 |
| 6 | Oesapa | 60 | 33 | 55.0 | 268 | 61 | 22.76 | 101.67 |
| 7 | Kelapa Lima | 60 | 35 | 58.33 | 245 | 70 | 28.57 | 116.67 |
| | Total | 420 | 160 | 38.9 | 1804 | 327 | 18.13 | 18.13 |

Table 6 revealed that regarding the flick density index, the highest House Index (HI) was found in Lima coconut Village by 58.33%, the highest Container index (CI) was found in TDM Village by 44.03% and the highest Breteau Index (BI) was found in TDM Village by 218.75%.

The type and number of water containers as breeding ground for *Aedes aegypti* larvae variedin some areas. The results of the study in Kupang City found that there were 423 units of drums (23.3%), 524 units of bathtubs (28.9%) and 866 units of crocks (47.8%). These results are not in line with a study conducted by Henry, et al (2010) which found the types of water containers in the Pangandaran Tourism Market in the form of buckets by 57.24%, crocks by 13.54%, bathups by10.93%, dispensers by 4.51%, basins by 3.80%, refrigerator water containers by 2.38%, jerry cans 1.43% barrels by 1.19%, pots by 0.48% and bird drinking cups made of drums, wooden boxes, stereofoam boxes, tires, drinking toll bo, cans and pots by 0.24% (Hendri, RES & Prsetyowati, 2010). Another study conducted by Widyastuti & Rahayu (2018) found that cement bath containers were most widely used as water containers and had the potential to be a suitable breeding ground for *Aedes* sp (Widyastuti, & Rahayu, 2018).

A study conducted by Agustina & Kartini (2018) in Gampong Supervised by Aceh Environmental Health Academy found 20 types water containers and non-water rervoirs as breeding grounds of *Aedes aegypti* mosquitoes where they laid eggs, developed into larvae, pupae and became adult mosquitoes (Agustina & Kartini, 2018). Zubaidah et al, (2014) explained that the most type of containers inside the house that was positive for Aedes sp larvae was bathtub (60.63%), while the most type of containers outside the house that was positive for Aedes sp larvae was drum (54.55%). There were 49 positive containers acted as mosquito shelters (17.44%) out of 281 units examined (Zubaidah, Setiadi & Akbari, 2014). Furthermore,

a study conducted by Wanti & Darman (2014), found that the most larvae-positive containers were containers for daily needs, the containers were not covered, the location of the containers was outside thehouse, made of ceramic material, and white in color (Wanti & Darman, 2014). The results of a study conducted by Zen and Rahmawati (2015) showed that of the 250 containers examined, there were 33 types of containers that became breeding grounds for Aedes spp mosquitoes. The types of containers in the Central Metro District were Basins, Bathtubs, Shards Bottles, Flower Pots, Used Car Toys, Used Tires, Buckets, Plastic Drink Containers, Used Ceramic Drinking Places, Used Ablution Place. Buckets were the most widely used type of containerfor Aedes spp mosquitoes to breed with a total of 9 (27.27%), while plastic containers were the least used containers for Aedes spp mosquitoes to breed (3.030%) (Zen, & Rahmawati, 2015).

The people of Kupang City have many water containers at home, due to the limited water flowof PDAM every day, so the community choise to prepare many water containers to meet water needs for 3-7 days. With open storage conditions, it provides an opportunity for mosquitoes to lay eggs and breed within the period of storage of the water. Table 2 revealed that Fatululi Village had the highest percentage of indoor water container by 15.7% (140 pieces), and Oesapa Village had the highest percentage of outdoor water container by 15.5% (143 pieces). Such findings indicated that community water containers in Kupang City were evenly distributed inside and outside the house. Thus the breeding potential of Aedes sp mosquitoes was even greater which lead the potential to transmit dengue fever.

Table 3 revealed that TDM and Kelapa Lima village had the highest percentage of positive indoor water container by 30,4% and TDM village had the highest percentage of positive outdoor water container by 48,4%. Such findings are supported by the results of a study conducted by Sari (2021) among 99 bathtubs which found 71 (71.71%) larvae-positive bathtubs in the house and 22 (22.22%) larvae-negative bathtubs inside the house. Meanwhile there were 4 (4%) larvae-positive bathtubs outside the house and 2 (2%) larvae-negative bathups outside the house (Sari, 2021). Furthermore, a study conducted by Zubaidah, et al (2014) found 38 (38.00%) indoor containers and 11 (11.00%) outdoor containers (Zubaidah, Setiadi, & Akbari, 2014). Sari (2021) who conducted a study among 99 bathtubs further found 75 (75.75%) larvae-positive bathtubs and 24 (24.24%) larvae-negative bathtubs (Sari, 2021). It can be concluded that there were only a few indoor conteiners, but had a greater chance of becoming a breeding ground for mosquitoes. This result is also due to many hiding sites in the house where mosquitoes can lay eggs.

Table 4 revealed the results of the identification of single larvae survey at positive indoor and outdoor water containers. It was found that there were *Aedes aegipty* and *Aedes albopictus larvae* in TDM Village, while that were only *aedes aegipty larvae* found in six other villages. The study findings indicated that indoor water container was a suitable site for *Aedes aegypti* mosquitoes to live and the outdoor water container was a suitable site for *Aedes aegypti* and *Aedes albopictus* mosquitoes to live. Such findings are supportedby a study conducted by Purnamasari, et al (2016) which found that the Aedes sp species obtained during the study were Aedes aegypti and Aedes albopictus. The Aedes albopictus species was only found in one place, namely the bath (Purnamasari & Kadir, 2016).

Table 5 revealed that the percentage of positive larvitrap was found in Oebufu Village by 15% and Oesapa Village by 10%. Aedes *aegypti* population in ovitraps inside the house was 94.3%, while *Aedes albopictus* population in ovitrap outside the house was 53.4%. The results of this study are in line and clarified with the results presented in tables 3 and 4. The percentage of larvae-positive larvitrap was due to there were still many water containers in Kupang City that had no tight lid, with a larger open space than the open spaceon the larvitrap, and

mosquitoes prefer an open container to lay their eggs. The distributed larvitrap was observed after 7 days of installation. If no water is added for 7 days, the surface where mosquitoes place eggs will be dry so that the eggs cannot hatch. Therefore, it is necessary to add water to the larvitrap to inundate mosquito eggs until they hatch. Arfan and Rizky (2021) found that the use of larvitrap through manual and animated media could increase knowledge. The results of the Wilcoxon alternative test obtained p-value = (0.004) <0.05 which can be concluded that there was a significant increase in knowledge score (Arfan & Rizky, 2021).

Table 6 revealed that regarding the flick density index, the highest House Index (HI) was found in Lima coconut Village by 58.33%, the highest Container index (CI) was found in TDM Village by 44.03% and the highest Breteau Index (BI) was found in TDM Village by 218.75%. The study findings are not in line with the stusy conducted by Widada, et al, (2021) in Bengkulu City, which found that the density of mosquito larvae had an HI value of 90.6%, a CI value of 70.98% and a BI value of 78.23% or cosideres as high density (Widada, Putri, & Sari, 2021). The study findings are similar to a study conducted in several locations such as by Zen & Rahmawati (2015) which found the density of larvae measured through parameters of HI = 27%, CI = 13.2%, BI = 33% (Zen & Rahmawati, 2015). In addition, a study conducted by Khairunisa, et al (2018) in Semarang City and its surroundings obtained a house index (HI) of 44.44% which was categorized in the density figure (DF) category 6 (Khairunnisa, Wahyuningsih, & Hapsari, 2017). The density of Aedes sp larvae inSurgi Mufti Village had an HI of 33%, a CI of 19.93%, a BI of 49%, and DF value of 5, soit was categorized as an area with moderate transmission rate (Zubaidah, et al, 2014). A study conducted by Cahyani, *et al* (2018) which applied the *Chi-square* analysis test showed the density of larvae based on House Index (p value = 0.004, OR = 4.189, CI: 1.660 – 10.568) and Container Index (p-value = 0.002, OR = 4.661 CI: 1.835 – 11.840) (Cahyani, 2018).

The results of a study conducted by Wanti & Darman (2014) showed an HI of 0.887, a CI of 0.146 and a BI of 0.080, which indicated that there was no difference in larvae density between Alak Village (endemic area) and Belo Village (free area) (Wanti & Darman, 2014). In contrast, a study conducted by Inten, et al, (2018) showed a House Index of 16%, a Container Index of *8%*, *a Breteau* Index of *16%*, *ABJ* of *84%* and DF (Density Figure) of 3 which was categorized in the moderate category (Wanti & Darman, 2014). Another study conducted by Sinaga & Simanungkalit (2021) found a house index (HI) of 36.2%, a BI 2.21% and a CI of 19.9% which was included in the Density Figure (DF) of 5 which was categorized in the moderate category. These findings indicated a high transmission of DHF as well as faster and easier spreading of Aedes Aegypti mosquitoes (Sinaga & Simanungkalit, 2021). The high density of larvae was due to most of water containers were not covered, people who had received larvicide (Abate) did not sow it on the container, and household members did not perform weekly draining of water containers.

Ernyasih, et al (2022) explained a process system involving certain activities such as counselling, eradication of mosquito nests, and community involvement, but improvement is still required. The goals of the output system still need to be achieved since the morbidity rate was still high, and the ABJ was 94%. Description of the input system, process system involving specific activities, and output system in implementing dengue prevention and control programs could be better but should consider certain technical obstacles (Ernyasih et al., 2022).

## 4. CONCLUSION

Based on the study findings, it is necessary to conduct education on mosquito larvae control that involves active community participation and supervision towards weekly draining of community water containers. In addition, abate sprinkling and dengue vector control activities should be carried out simultaneously throughout Kupang City at the beginning of the rainy season, at the peak of case incidence and at the end of the rainy season.

## REFERENCES

Agustina, E., & Kartini, K. (2019). Jenis Wadah Tempat Perindukan Larva Nyamuk Aedes Di Gampong Binaan Akademi Kesehatan Lingkungan. *Prosiding Seminar Nasional Biotik*, 6(1), 600-606. Retrieved from https://jurnal.ar-raniry.ac.id/index.php/PBiotik/article/view/4302

Arfan, I., & Rizky, A. (2021). Pemanfaatan Larvitrap sebagai Upaya Pencegahan Demam Berdarah di Daerah Endemis. *E-Dimas: Jurnal Pengabdian kepada Masyarakat*, 12(4), 703-709. https://doi.org/10.26877/e-dimas.v12i4.7035

Cahyani, I. P. (2019). Hubungan Kepadatan Jentik Aedes sp. Dengan Kejadian Demam Berdarah Dengue (DBD) Di Kecamatan Magetan, Kabupaten Magetan Tahun 2019. *Skripsi Thesis*. Poltekkes Kemenkes Surabaya. Retrieved from http://repo.poltekkesdepkes-sby.ac.id/910/

Candra, A. (2010). Demam Berdarah Dengue: Epidemiologi, Patogenesis, dan Faktor Risiko Penularan. *ASPIRATOR-Journal of Vector-borne Disease Studies*, 2(2), 110-119. Retrieved from http://ejournal2.litbang.kemkes.go.id/index.php/aspirator/article/view/1787

Ernyasih, E., Janati, Y. N., Fauziah, M. & Andriyani. (2022). Overview of Evaluation of The Implementation of Dengue Hemorrhagic Fever Prevention and Control Program In The Work Area Puskesmas Tanah Baru, Depok City, in 2021. *Muhammadiyah International Public Health and Medicine Proceeding*, 2(1), 350-365. Retrieved from https://e-journal.fkmumj.ac.id/index.php/miphmp/article/view/292

Hartoyo, E. (2016). Spektrum klinis demam berdarah dengue pada anak. *Sari Pediatri*, 10(3), 145-150. http://dx.doi.org/10.14238/sp10.3.2008.145-150

Hadi, U. K., Soviana, S., & Gunandini, D. D. (2012). Aktivitas nokturnal vektor demam berdarah dengue di beberapa daerah di Indonesia. *Jurnal Entomologi Indonesia*, 9(1), 1-6. https://doi.org/10.5994/jei.9.1.1

Hendri, J., RES, roy, & Prasetyowati, H. (2010). Tempat Perkembangbiakan Nyamuk Aedes spp. Di Pasar Wisata Pangandaran. *ASPIRATOR - Journal of Vector-Borne Disease Studies*, 2(1), 23-31. Retrieved from http://ejournal2.litbang.kemkes.go.id/index.php/aspirator/article/view/1767

Inten, A. A. I., & Purna, N. (2019). Tingkat Kepadatan Jentik Nyamuk Aedes Aegypti Sebagai Vektor Demam Berdarah Dengue (DBD) Di Wilayah Kerja Unit Pelaksana Teknis Kesmas Blah batuh I Tahun 2018. *Jurnal Kesehatan Lingkungan (JKL)*, 9(1), 63-72. https://doi.org/10.33992/jkl.v9i1.656

Iriani, Y. (2016). Hubungan antara curah hujan dan peningkatan kasus demam berdarah dengue anak di Kota Palembang. *Sari Pediatri*, 13(6), 378-383. http://dx.doi.org/10.14238/sp13.6.2012.378-83

Karyanti, M. R., & Hadinegoro, S. R. (2016). Perubahan epidemiologi demam berdarah dengue di Indonesia. *Sari Pediatri*, 10(6), 424-32. http://dx.doi.org/10.14238/sp10.6.2009.424-32

Kelen, M., Salmun, J., & Setyobudi, A. (2022). Risk Factors of Dengue Hemorrhagic Fever in Oesapa Village, Kelapa Lima Sub-District. *Media Kesehatan Masyarakat*, 4(2), 140-148. https://doi.org/10.35508/mkm.v4i2.3164

Kementerian Kesehatan Republik Indonesia. (2018). Situasi Penyakit Demam Berdarah Di Indonesia 2017. Journal of Vector Ecology, 31(1), 71–78.

Kementerian Kesehatan Republik Indonesia. (2017). 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. Kementerian Kesehatan Republik Indonesia.

Khairunnisa, U., Wahyuningsih, N. E., & Hapsari, H. (2017). Kepadatan Jentik Nyamuk Aedes sp. (House Index) sebagai Indikator Surveilans Vektor Demam Berdarah Dengue di Kota Semarang. *Jurnal Kesehatan Masyarakat*, 5(5), 906 -910. https://doi.org/10.14710/jkm.v5i5.19216

Kusuma, A. P., & Sukendra, D. M. (2016). Analisis spasial kejadian demam berdarah dengue berdasarkan kepadatan penduduk. U*nnes Journal of Public Health*, 5(1), 48-56. https://doi.org/10.15294/ujph.v5i1.9703

Nuryati, E., & Thamrin, T. (2012). Analisis Spasial Kejadian Demam Berdarah Dengue Di Kota Bandar Lampung Tahun 2006-2008. *Jurnal Ilmiah Kesehatan*, 1(2). Retrieved from https://www.ejournal.umpri.ac.id/index.php/JIK/article/view/1004

Palgunadi, B. U., & Rahayu, A. (2011). Aedes aegypti sebagai vektor penyakit demam berdarah dengue. Surabaya: Universitas Wijaya Kusuma Surabaya. Retrieved from https://repository.dinus.ac.id/docs/ajar/AEDES_AEGYPTI_SEBAGAI_VEKTOR_PENYAKIT_DEMAM_BERDARAH_DENGUE.pdf

Prasetyowati, H & Ginanjar, A. (2017). Gambaran Maya Indeks dan Kepadatan Larva di Daerah Endemis DBD Jakarta Timur. *Vektora: Jurnal Vektor dan Reservoir Penyakit*, 9(1), 43-49. https://doi.org/**10.22435/vk.v9i1.5263.43-49**

Purnamasari, B., & Kadir, S. Distribusi Keruangan Spesies Larva Aedes sp. dan Karakteristik Tempat Perkembangbiakan di Kelurahan Karunrung Kota Makassar. *Bionature*, 17(1), 7-13. Retrieved from https://ojs.unm.ac.id/bionature/article/view/2588

Sari, I. P. (2021). Gambaran Kepadatan Jentik Nyamuk Aedes Aegypti Ditinjau Dari Tempat Perkembangbiakan (House Index) Di Kelurahan Kebun Bunga Kecamatan Sukarami Kota Palembang Tahun 2021. *Diploma Thesis.* Retrieved from https://repository.poltekkespalembang.ac.id/items/show/3169

Sari, N. A. (2013). Sistem Pakar Mendiagnosa Penyakit Demam Berdarah Menggunakan Metode Certainty Factor. Pelita Inform. Budi Darma, 4, 100-103.

Sinaga, M., & Simanungkalit, C. (2021). Kepadatan Jentik Aedes Aegypti Di Kelurahan Angin Nauli Kecamatan Sibolga Utara. *Jurnal Ilmiah Keperawatan Imelda*, 7(1), 68-72. https://doi.org/10.52943/jikeperawatan.v7i1.511

Tairas, S. (2015). Analisis pelaksanaan pengendalian demam berdarah dengue di Kabupaten Minahasa Utara. *Jikmu*, 5(1), 21-29. Retrieved from https://ejournal.unsrat.ac.id/index.php/jikmu/article/view/7175

Wanti, W., & Darman, M. (2014). Tempat penampungan air dan kepadatan jentik Aedes sp. di daerah endemis dan bebas demam berdarah dengue. *Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)*, 9(2), 171-178. http://dx.doi.org/10.21109/kesmas.v9i2.514

Widada, A., Putri, V. H. E., & Sari, A. K. (2021). Analisis Kepadatan Jentik Nyamuk Aedes sp Di Kelurahan Kandang Kota Bengkulu. *Journal of Nursing and Public Health*, 9(1), 1-9. https://doi.org/10.37676/jnph.v9i1.1426

Wirayoga, M. (2014). Hubungan Kejadian Demam Berdarah Dengue Dengan Iklim Di Kota Semarang Tahun 2006-2011. *Unnes Journal of Public Health*, 2(4), 1-9. https://doi.org/10.15294/ujph.v2i4.3055

Widyastuti, D. A., & Rahayu, P. (2018). Karakteristik Tempat Perindukan Aedes Sp. Dan Potensi Penularan Demam Berdarah Dengue Di Kelurahan Karangtempel Kecamatan Semarang Timur Kota Semarang. *Prosiding Seminar Nasional Pendidikan Biologi dan Saintek Ke-3*, 307-312. Retrieved from https://publikasiilmiah.ums.ac.id/handle/11617/10506

Zen, S., & Rahmawati, D. (2015). Kepadatan Jentik Nyamuk Aedes spp Ditinjau Dari Nilai Breteu Index (BI), Container Index (CI), dan Human Index (HI) Di Kelurahan Metro Kecamatan Metro Pusat Kota Metro Lampung Tahun 2015. *Prosiding Seminar Nasional ISBN Universitas Muhammadiyah Metro*, 294-303. Retrieved from https://repository.ummetro.ac.id/files/artikel/2829d5a121e6f323b419795589583a95.pdf

Zubaidah, T., Setiadi, G., & Akbari, P. (2014). Kepadatan jentik aedes sp pada kontainer di dalam dan di luar rumah di Kelurahan Surgi Mufti Banjarmasin tahun 2014. *Jurnal Buski*, 5(2), 95-100. Retrieved from http://ejournal.litbang.kemkes.go.id/index.php/buski/article/view/3751