
Larval Density of *Aedes spp.* in Residential Areas of Singkil District, Manado City, Indonesia

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ABSTRACT

Introduction: Dengue hemorrhagic fever (DHF) is one of the infectious diseases transmitted by *Aedes sp.* mosquitoes, and it remains a serious problem these days. Report from the Health Department of Manado city revealed that the Singkil District is an endemic area of DHF. Singkil District is one of the Districts of Manado City, which has nine sub-districts. According to the data from Manado City's Health Department, in Singkil District, there were 43 cases of DHF in 2013, 57 cases in 2014, and 13 cases in 2015. The data of the vector's larval density is needed for the prevention and control of DHF.

Objectives: This study's aim is to investigate the larval density of *Aedes sp.* in Singkil District, Manado City, North Sulawesi.

Methods: This is a descriptive survey study. Study samples were *Aedes sp.* mosquito larvae in the residential areas in Singkil District. Secondary data of DHF cases in Singkil District and then a survey of larval density was conducted (HI, CI, BI, LFI).

Results: Based on the survey of 100 houses, the House Index (HI) was 43%, the Container index (CI) was 20%, the Breteau index was 50, and the Larva Free Index was 57 %.

Conclusion: According to these findings, the Density Figure (DF) from table 1 is 6, which shows that the density of larva in Singkil District was high.

Keywords: DHF, larval density, *Aedes sp.*

INTISARI

Pendahuluan: Penyakit Demam Berdarah Dengue (DBD) merupakan salah satu penyakit menular yang ditularkan vektor nyamuk *Aedes sp.* yang sampai saat ini masih merupakan masalah kesehatan yang serius. Laporan Dinas Kesehatan Kota Manado, kecamatan Singkil termasuk daerah endemis DBD. Kecamatan Singkil adalah salah satu kecamatan di Kota Manado yang terdiri dari 9 kelurahan. Menurut data Dinas Kesehatan kota Manado, pada tahun 2013 ditemukan 43 kasus DBD, tahun 2014 ditemukan 57 kasus DBD, dan tahun 2015 ditemukan 13 kasus DBD. Pengetahuan tentang kepadatan vektor nyamuk *Aedes sp.* diperlukan sebagai upaya pencegahan dan penanggulangan DBD.

Tujuan: Untuk mengetahui kepadatan jentik nyamuk *Aedes spp.* di Kecamatan Singkil Kota Manado, Sulawesi Utara.

Metode: Jenis penelitian survey deskriptif. Sampel penelitian adalah jentik nyamuk *Aedes sp.* yang ada di lingkungan pemukiman di Kecamatan Singkil. Data sekunder penderita DBD Kecamatan Singkil setempat Tahun 2016 dan selanjutnya dilakukan survey kepadatan jentik nyamuk(HI, CI, BI, ABJ).

Hasil: Dari hasil survey terhadap 100 rumah, di dapat nilai *House Index* (HI) sebesar 43%, *Container index* (CI) 20%, *Breteau index* 50, Angka bebas jentik (ABJ) 57 %.

Simpulan: Sehingga dari nilai-nilai tersebut didapatkan nilai Kepadatan populasi jentik nyamuk atau *Density Figure* (DF) dari tabel 1 adalah 6 yang menunjukkan bahwa kepadatan jentik nyamuk di kecamatan Singkil termasuk kepadatan tinggi.

Kata kunci : DBD, kepadatan jentik *Aedes sp.*

INTRODUCTION

Dengue hemorrhagic fever (DHF) is an infectious disease transmitted by the bite of female *Aedes sp.* that carries the dengue virus in its body. Dengue hemorrhagic fever remains a serious health problem in Indonesia, and it often causes an outbreak with a big mortality rate. This disease remains a public health concern due to its high prevalence and transmission.

Dengue epidemics in the last three centuries are known to occur in areas with tropical, subtropical, and temperate climate across the globe¹. In Indonesia, DHF was first reported in 1968 in Surabaya; 58 children were infected, in which 24 of them died. The case fatality rate (CFR) was 41.3%. Since then, the case number and the affected area have been growing². All of the Indonesian regions are at risk to be affected by DHF, except in areas that lie 1,000 meters above the sea level³.

Manado City is one of the endemic areas in Indonesia. In 2015, there were 446 DHF cases reported with an incidence rate of 104.8%⁴. Singkil District is one of the districts in Manado City, which has nine sub-districts. According to the Manado City's Health Department, there were 57 DHF cases reported in 2013, 57 cases in 2014, and 13 cases in 2015.

The etiology of dengue fever (DF) and dengue hemorrhagic fever (DHF) is the dengue virus (virDen). This virus belongs to the family

of Flaviviridae which transmitted by insects (arthropod borne virus = arbovirus). This virus has four serotypes; DEN-1, DEN-2, DEN-3, and DEN-4. A person who had been infected by one serotype usually shows immunity toward the same serotype in a period, but the person has no immunity towards the other serotypes, even that person becomes more prone to DHF. Insects that are known to be the vector of this disease are *Aedes aegypti* (Linn.) and *Aedes albopictus* (Skuse) (Diptera: Culicidae). Both species are found in all Indonesian region, except in areas that lie 1,000 meters above the sea level⁵.

A deep understanding of the epidemiological aspects of DHF, especially those that are related to the agent of disease (virDen) and the host (human and the vector), and also the environmental factors that affect it, is an important issue. The causes behind the increased number of cases and affected area are complex and multifactorial, due to a high population density, easier access between one area and another, new residential being built, weather and seasonal factor, anomaly of rain pattern, traditional water storage, widely spread vectors across the country (especially in urban areas), lack of community's participation in controlling the nesting area of mosquitoes, and the four different virus serotype circulated every year⁶. *Ae aegypti* is the main vector species of DHF, due to it being anthropophilic and lives closer to human, often inside the house. Besides *Ae*

agepty, *Ae. albopictus* is one of the potential disease vectors⁷.

To support the succeed of vector surveillance, an entomology survey of DHF to observe the expansion and habitat, also the population and the density of larvae and adult mosquitoes. In entomology survey of DHF consists of five main activities: collecting related data, egg survey, larval survey, adult mosquito's survey, and other surveys². From that explanation, it can be concluded how important a larval survey is in endemic areas of DHF.

Based on the description above, the researchers are interested in doing a study about "Larval Density of *Aedes spp.* in Residential Areas of Singkil District, Manado City, Indonesia."

The aim of this study is to investigate the larval density of *Aedes sp.*, and also to investigate the species of *Aedes sp.* larvae that can be found in Singkil District, Manado City, North Sulawesi.

MATERIALS AND METHODS

The method used in this study is descriptive survey method. To investigate the larval density and the species of *Aedes spp.* mosquitoes can be found at the study site. The samples for this study are the larvae of *Aedes spp.* mosquito collected from 100 houses around the location of DHF cases in Singkil District, Manado.

The larval observation was done inside and outside the house. Any containers or any water contained storage were checked, whether it contained mosquito larvae or not. The container was then recorded. In every container with larvae, the larvae were collected by using a plastic dipper or a long pipette. The larvae samples were then analysed in Parasitology Laboratory, Medical Faculty of Sam Ratulangi University to identify the species. If the larva was identified as *Ae. aegypti*, then all the larvae in

that container were assumed to be *Ae. aegypti* larvae. The larvae were collected in small plastic containers and labelled according to the house number and container number, inside or outside the house (e.g. 1/a/a2 means that the larva was found in house number 1, container type a (tub), and container number a2 (tub number 2)).

Larval density was determined by using the larval indexes:

1. House index (HI) is the percentage of houses infested with larvae of *Aedes spp.*
2. Container index (CI) is the percentage of water-holding containers infested with larvae of *Aedes spp.*
3. Breteau index (BI) is the number of positive containers with *Aedes spp.* larvae per 100 houses inspected.
4. Larva Free Index is the percentage of houses not infested with larvae of *Aedes spp.*

Density figure (DF) was obtained from combining the HI, CI, and BI, and it consists of a 1-9 scale as showed in Table 1. The DF is categorized into three categories; DF = 1, low density; DF = 2-5, moderate density; DF = 6-9, high density.

Table 1. Density figure of mosquito population

Density	House Index	Container Index	Breteau Index
Level	(HI)	(CI)	(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+

*Source: Queensland Government, 2011⁸

RESULTS AND DISCUSSION

Larvae survey in this study was done with a single larva method. In this study, there were 100 houses and 250 water-holding containers inspected. There were 43 houses that were positive for *Aedes sp.* larvae (Table 2). Out of 250 water-holding containers inspected, 50 containers were positive for *Aedes sp.* larvae.

Table 2. A numbers of inspected houses and water-holding containers.

	Total n	(+) larvae	(-) larvae
Houses	100	43	57
Water-holding container	250	50	200

The result of microscopic identification of mosquito species found in the endemic areas of

the study site, which was done in Parasitology Laboratory, Medical Faculty of Sam Ratulangi University is shown in Table 3.

Table 3. Species of larvae found in water-holding container

Species	n	%
<i>Ae. Aegypti</i>	48	96
<i>Ae. Albopictus</i>	2	4
Total	50	100

Based on Table 3, identification result showed that the study area is dominated by *Ae. aegypti* (96%), so it is clear that the main vector of DHF is *Ae. aegypti* mosquitoes while the other species, *Ae. albopictus*, is a secondary vector.

Table 4. Distribution of water-holding container that contained *Aedes sp.* larvae

Types of containers	n	Larvae (+)	Larvae (-)	Percentage of larvae (+)	Percentage of total container
Buckets	100	16	84	16%	6.4%
Tubs	48	8	40	16.6%	3.2%
Pans	40	4	36	10%	1.6%
Barrels	24	6	18	25%	2.4%
Water dispensers	28	10	18	35.7%	4%
Tanks	2	0	2	0%	0%
Used tires	3	3	0	100%	1.2%
Used container	3	3	0	100%	1.2%
Drain pipes	2	0	2	0%	0%
Total	250	50	200		20%

The table above shows that bucket is the most common type of water-holding container that contains *Aedes sp.* larvae. This is because most of the population use bucket to store water (100 out of 250 water holding containers inspected). A study in Buenos Aires, Argentina, and found that black plastic container had more *Ae. aegypti* larvae (82.1%), when compared to

glass (8.5%), metal (6%), and ceramic (3.4%) container⁹.

By using the larvae indexes, these following numbers were obtained: 43% for HI, 20% for CI, 50 for BI, and 57% for larva free index. Thus, the DF (according to Table 1) is 6, which means that the larval density in Singkil District is high.

CONCLUSION

The survey of 100 houses in Singkil District found that the HI is 43%, the CI is 20%, the BI is 50, and the LFI is 57%. Thus, the DF (according to Table 1) is 6, which means that the larval density in Singkil District is high. Prevention and vector control are needed to decrease the risk of DHF infection in the population, especially population in Singkil district.

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