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FACTORS ASSOCIATED WITH THE PRESENCE OF AEDES AEGYPTI LARVAE

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Abstract

Samarinda City ranked third in Indonesia for dengue cases in 2023 with 867 confirmed cases and 3 deaths. The first rank is Balikpapan City (1019 cases) and Kutai Kartanegara Regency (1555 cases and 4 deaths). Bengkuring Health Center is the health center that has the most DHF patients in Samarinda City. The main objective of this study was to identify the presence of *Aedes aegypti* mosquito larvae in Samarinda City, especially in Sempaja Utara Urban Village. This study was conducted using *cross sectional* technique. A total of 98 respondents from 43 RTs in Sempaja Utara Urban Village using *stratified random sampling*. The dependent variable of the study is the presence of *Aedes aegypti* larvae, and the independent variable is draining water reservoirs as well as the location of water reservoirs. Based on the results of the above research, it can be concluded that there is no relationship between draining water reservoirs and the presence of *Aedes aegypti* larvae in Sempaja Utara Village (p-value> 0.05). While the location of water reservoirs has a relationship with the presence of *Aedes aegypti* larvae in Sempaja Utara Village (p-value < 0.05).

Keywords: Aedes Aegypti Larvae, Draining, Color, Water Sheds

Introduction

Dengue fever is an infectious disease caused by dengue virus and transmitted to humans from the bite of *Aedes* genus mosquitoes, mainly *Aedes aegypti* and *Aedes albopictus*. *Aedes aegypti* is the main vector, and its spread is influenced by factors such as lifestyle and high population density, making it easier for mosquitoes to breed and increase their numbers [(1)]. Over the past twenty years, the prevalence of dengue fever has increased significantly worldwide. According to the World Health Organization (WHO), the number of reported cases has increased from 505,430 cases in 2000 to 5.2 million cases in 2019. However, these figures do not reflect the whole picture, as not all cases are officially registered. Many infected people carry the disease in a mild or asymptomatic form, and it is not uncommon for dengue fever to be misdiagnosed as another viral infection. WHO estimates that around 2.5 billion people worldwide are at risk of contracting dengue. Most of them live in urban areas in tropical and subtropical countries, where warm and humid conditions favor the proliferation of vector mosquitoes such as *Aedes aegypti* and *Aedes albopictus*. The rapid increase in the number of cases is not only due to natural factors, but also due to increased urbanization, climate change and lack of mosquito population control efforts. [(2)]

The first time the incidence of dengue fever in Indonesia was reported was in Surabaya in 1968, which from the first time the disease was reported until now has increased [(3)]. The incidence of dengue fever in Indonesia increases every year, which occurs in the middle of the rainy season around January,

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but in February it decreases until the end of the year [4]. Indonesia has a large endemic area for this disease. In 2020, 65,602 cases of dengue fever were reported in Indonesia, of which 467 were fatal. These figures show a slight decrease in the incidence of the disease compared to 2019, when 68,407 cases and 493 deaths were recorded. However, in 2021, there was a sharp increase in the number of infections, with the number of cases more than doubling to 138,127 cases. This surge can be attributed to various factors, including changing climatic conditions, increasing vector mosquito populations, weakening preventive measures and changes in people's lifestyles. [5]

Based on the health profile of East Kalimantan Province, it shows that the number of DHF cases in East Kalimantan in 2021 was 2,898 cases with 22 cases of death, where the area with the highest number of DHF cases was Samarinda City with 1,366 positive cases with 8 cases who died [6] and experienced an increase in 2022 there were 5,887 positive cases with 39 cases who died [7] and in 2023 DHF in East Kalimantan decreased, namely 5,584 positive cases with 25 cases who died [8]. In Samarinda City, the number of DHF cases in 2023 is 867 positive cases with 3 deaths, where Samarinda City is the third highest DHF case after Kutai Kartanegara Regency with 1555 positive cases and 4 deaths and Balikpapan City with 1019 positive cases and 4 deaths [9]. The highest DHF cases in Samarinda City are found in Bengkuring Community Health Center, while the Bengkuring Community Health Center's working areas are East Sempaja and North Sempaja Villages. [10]

Based on Bengkuring Health Center data, every year there is an increase, where in 2021 there were 48 cases of DHF, and in 2022 there were 67 cases where East Sempaja Village had 47 cases and North Sempaja had 20 cases, in 2023 there were 94 cases of DHF where East Sempaja Village had 56 cases and North Sempaja had 38 cases, DHF is a serious problem at the Bengkuring Health Center where from January to August 2024 there were 106 cases of DHF divided into East Sempaja Village 52 cases and North Sempaja Village 54 cases. [10]

Sempaja Utara Urban Village, is a village located in Bengkuring Health Center, Samarinda City there are 43 Rt in Sempaja Utara Urban Village, where the highest DHF cases are in Bengkuring Health Center, especially Sempaja Utara Urban Village, with 54 cases from January to August 2024 [10]. *Dengue* fever (DHF) is an endemic disease that is a serious health problem in Indonesia, including in Samarinda City. One of the effective ways to prevent dengue fever is by using the 3M Plus method (Draining, Covering, Recycling, and Installing wire mesh on vents) as well as other pluses. This figure shows that DHF cases in Sempaja Utara urban village are increasing, which means that the efforts made have not been fully effective in reducing the incidence of DHF.

This study has a high urgency to determine the factors associated with the presence of *Aedes aegypti* mosquito larvae, especially in Sempaja Utara Village. Given the high number of DHF cases, this study is expected to provide knowledge to the community about locations that are potential breeding grounds for *Aedes aegypti* mosquitoes so that they can play a role in reducing or preventing dengue transmission. This study aims to analyze the relationship between the habit of draining water reservoirs and the location of water reservoirs with the presence of *Aedes aegypti* mosquito larvae in Sempaja Utara Village, Samarinda City.

Methods

This study uses a quantitative method using observation techniques and a cross-sectional approach. This method makes it possible to study the relationship between risk factors and their consequences by collecting data at a specific point in time. This study was conducted in Kelurahan Sempadja Utara, located in Samarinda City, during the period January to February 2025. The general population of this study was all houses in Kelurahan Sempaja Utara, which consists of 43 RTs and 6282 housing units. To determine the sample population, the Slovin formula was used to calculate the number of respondents needed, which was 98 respondents. Data sources in this study consisted of primary and

secondary data. Secondary data included DHF (dengue hemorrhagic fever) case data from the East Kalimantan Provincial Health Office, Samarinda City Health Office, and Bengkuring Community Health Center, as well as the number of households in North Sempadja Sub-district. Primary data were collected directly from the research. A stratified random sampling technique was used to select participants and questionnaires and observation sheets were used to collect information. Data were analyzed using chi-square criteria at 95% significance level. This means that if the *p* value is greater than 0.05, the null hypothesis (*Ho*) is accepted, whereas if *p is* less than 0.05, the null hypothesis is rejected, indicating that there is a statistically significant relationship between the variables under study.

Results

Table 1 Univariate Distribution of Research Results

Variables	Tota	(%)
Presence of larvae		
Available	1	1,0
	97	99
Water Reservoir Drain		
Drainwater reservoir< once week	9	9,2
the water reservoir≥ 1 times a.	89	90,8
Latak Water Reservoir		
In the house	82	83,7
Outdoors	14	14,3
No water storage	2	2,0

1, it can be that out of 98 the the dengue fever in Sempaja Utara of Samarinda1 or (1.0%) in the water reservoir and 97 or (99%) who did not the water . Of the 98 of the on the DHF in Sempaja Utara , Samarinda, respondents who drainedwater < once week9 or (9.2%) and those who did not the water ≥ 1 once week 89 or (90.8%). Table 1, it can also be that out of 98 of the on the dengue fever in Sempaja Utara , Samarindathe existence of water reservoirs Respondents in the house had water reservoirs as many as 82 (83.7%), outside the house 14 (14.3%) and those without water reservoirs were 2 respondents (2%).

Table 2: Relationship between draining water reservoirs and the presence of *Aedes aegypti* mosquito larvae in Sempaja Utara Urban Village, Samarinda City

Draining Water Reservoirs	Presence of larvae		Total	P Value	α
	Available	None			
the water reservoir< **1** times a week.	0	9	9	0,749	0,05
the water reservoir≥ **1** times a week.	1	88	89		
Total	1	97	98		

on Table 6 analysis of the of water reservoirs presence of larvae, it can be seen that out of 98 , 1 presence of larvae where drained water reservoirs≥ **1** times a , while 97 water reservoirs were not found to have larvae. The results of the analysis using the *chi-square* test showed a *p* value = 0.749 which exceeds the significance level α (0.05). This means that the null hypothesis (*Ho*) is accepted while the alternative hypothesis (*Ha*) is rejected. Thus, it can be concluded that there is no statistically significant relationship between draining water bodies and the presence of *Aedes aegypti* mosquito larvae in Sempaya Utara Urban Village, Samarinda City.

Table 3 Relationship between the presence of water reservoirs and the presence of *Aedes aegypti* mosquito larvae in Sempaja Utara Urban Village, Samarinda City

Location of Water Reservoir	Presence of larvae		Total	P Value	α
	Available	None			
In the house	0	82	82		
Outdoors	1	13	14	0,048	0,05
No water storage	0	2	2		
Total	1	97	98		

on the analysis of Table 3,location of water presence of mosquito larvae can be seen from 98 samples. One mosquito larva was found in 14 outdoor water reservoirs, while no mosquito larvae were found in 82 indoor water reservoirs. Statistical analysis using the *chi-square* test showed a *p* value = 0.048 which is below the significance level α (0.05). This indicates acceptance of the alternative hypothesis (*Ha*) and rejection of the null hypothesis (*Ho*). Therefore, there is a statistically significant relationship between the location of water reservoirs and the presence of *Aedes aegypti* larvae in Sempaya Utara Urban Village, Samarinda City

Discussion

Dengue fever, a public health problem with significant impact in Indonesia, is transmitted by the *Aedes aegypti* mosquito. Prevention measures often focus on the eradication of mosquito nests, mainly through regular cleaning of water storage containers [(11)]. However, the effectiveness of this practice in reducing the presence of *Aedes aegypti* larvae is debated [(12)]. This study in Sempaja Utara, Samarinda found no significant association between the frequency of cleaning water storage containers and the presence of *Aedes aegypti* larvae (p = 0.749 > α 0.05), suggesting that cleaning water storage containers alone is not sufficient to control mosquito breeding.

Several studies have explored the relationship between water reservoir management and the presence of *Aedes aegypti* larvae. Research in Indonesia shows that larvae are often found in clean water reservoirs, particularly in bathtubs and indoor containers. This study recommends covering water reservoirs, draining them at least once a week, and keeping toilets and closed sewage systems clean to reduce the presence of larvae [(13)]. A study in Makassar, Indonesia, analyzed factors affecting the presence of *Aedes aegypti* larvae in endemic and non-endemic areas. The study used the cross-sectional method and analyzed the data using the chi-square test. The results indicated a significant association between the presence of larvae and the variables of water temperature (p=0.000) and humidity (p=0.000), while knowledge (p=0.025) and container type (p=0.141) were not significantly associated. [(14)]

A study in Gowa District, Indonesia, investigated the relationship between container types and materials and *Aedes aegypti* larval density. Pearson chi-square test results showed a significant association, suggesting that certain container types and materials may be more conducive to larval breeding [(15)]. The relationship between water container management practices and the presence of *Aedes aegypti* larvae is complex and influenced by various factors, including container characteristics, environmental conditions, and human behavior. Some studies have found a significant association between regular cleaning and reduced larval presence, but other studies have found no significant association, indicating that cleaning alone is not sufficient. A comprehensive approach that includes proper container maintenance, environmental management, and community education is essential for effective dengue vector control.

Dengue fever remains a significant public health problem in Indonesia, especially in Sempaja Utara, Samarinda. Research conducted in this area showed a statistically significant association between

the location of water reservoirs and the presence of *Aedes aegypti* larvae, with a p-value of 0.048 ($p < 0.05$). This finding suggests that the placement of water reservoirs plays an important role in the breeding of *Aedes aegypti* mosquitoes. A study in 2023 assessed 1,269 water containers in 300 households. The study found that container type, location, and frequency of weekly draining were significantly associated with the presence of Aedes larvae and pupae. In particular, containers located indoors and not drained at least once a week were more likely to harbor Aedes mosquitoes. This underscores the importance of regular maintenance and strategic placement of water storage containers to reduce mosquito breeding. [16]

Research conducted in three Colombian cities with different average temperatures explored the relationship between household water storage behavior and *Aedes aegypti* pupae production. The study revealed that emptying water storage containers more than once every seven days significantly reduced pupal production in all cities. Moreover, the effectiveness of this practice varied depending on the climate of the city, indicating that both behavioral and environmental factors influence mosquito breeding [17]. Meanwhile, a study in 2024 investigated the spatio-temporal occurrence and habitat characteristics of *Aedes aegypti* larvae. This study identified that water catcher tires and water storage drums were the most common breeding sites. Notably, containers located in household habitats showed a significant positive correlation with the presence of Aedes larvae and pupae. These findings emphasize the need for targeted control measures focusing on specific container types and their location within residential areas. [18]

In addition to the habit of draining water reservoirs, there are several other factors that influence the presence of *Aedes aegypti* larvae, such as the level of knowledge and environmental conditions. A study in Mijen Subdistrict, Indonesia, found a significant relationship between the knowledge and attitude of cleaning staff about mosquito nest eradication and the density of Aedes spp. larvae in public places. The chi-square test showed p values of 0.001 and 0.006, respectively. This shows the importance of education and awareness in mosquito control efforts [19]. Research in North Banjarbaru District, Indonesia, explored the correlation between room temperature, humidity, and the presence of *Aedes aegypti* larvae. While no significant correlation was found with room temperature, a significant relationship was found with air humidity, suggesting that environmental factors play a role in larval development. [20]

In addition to the location of the water reservoir, there are several other factors that determine the presence of *Aedes aegypti* larvae such as the type and material of the container and the source and quality of water. Certain container types and materials may be more conducive to mosquito breeding. For example, studies have shown that old tires and drums are often ideal habitats for Aedes larvae due to their ability to retain water and provide shelter. The source and quality of stored water can affect larval development [21]. Research shows that containers filled with tap water are less likely to harbor Aedes larvae compared to containers filled with rainwater or other sources. [22]

The significant association between the location of water storage containers and the presence of *Aedes aegypti* larvae has important implications for dengue prevention strategies, where households should be encouraged to place water storage containers in locations that are less conducive to mosquito breeding, such as areas exposed to sunlight or places that are easily accessible for routine maintenance. In addition, implementing routine maintenance practices such as covering containers, emptying frequently, and cleaning them periodically can significantly reduce mosquito breeding grounds. Furthermore, increasing community awareness and engagement in understanding the impact of water container placement and maintenance on mosquito breeding can empower them to take proactive steps in dengue prevention.

Conclusion

Based on the results of the study, it shows that the frequency of draining water bodies does not significantly affect the presence of *Aedes aegypti* mosquito larvae in Sempaya Utara Urban Village, Samarinda City as evidenced by the p value = 0.749 (> 0.05). However, there was a statistically significant relationship between the location of water reservoirs and the presence of mosquito larvae (p = 0.048 < 0.05). This indicates that water reservoirs outside the house have a higher risk of becoming a breeding ground for mosquito larvae compared to water reservoirs inside the house. This finding indicates that in addition to the habit of draining water, the location factor of container placement also plays an important role in controlling the population of *Aedes aegypti* mosquitoes. Therefore, dengue prevention strategies should consider the placement of water containers, implementation of more effective maintenance habits, as well as increasing public awareness to manage water reservoirs properly to reduce mosquito breeding potential.

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