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RELATIONSHIP BETWEEN THE FREQUENCY OF DRAINING WATER RESERVOIRS AND THE INCIDENCE OF DENGUE FEVER (DHF) IN THE WORKING AREA OF TEMINDUNG HEALTH CENTER, SAMARINDA CITY

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Abstract

This study evaluated the relationship between the frequency of draining water reservoirs and the incidence of Dengue Fever (DHF) in the Temindung Health Center Working Area, Samarinda City. By adopting a quantitative approach and cross-sectional research design, 67 samples were selected using stratified random sampling technique. Data were collected through observation, interviews, and questionnaires, and analyzed using the Chi-square test and Fisher's Exact Test. The results showed that the group that drained water reservoirs more than or equal to once a week had a lower number of DHF cases compared to the group that drained less than once a week. The result using the 0.1 confidence level was 0.060 ($p<0.1$), so the analysis showed an indication of an association between the frequency of draining water reservoirs and the risk of DHF. In conclusion, the practice of regularly draining water reservoirs can potentially be an effective strategy in dengue prevention, and active community participation in this activity plays a crucial role in achieving the goal of dengue prevention and control in the area.

Keywords: Dengue Hemorrhagic Fever, Draining, Water Reservoirs

Introduction

Dengue fever is a disease that occurs due to dengue virus infection that attacks the human body through the bite of mosquitoes of the genus Aedes, especially Aedes aegypti and Aedes albopictus [1]. The disease is characterized by acute febrile symptoms and can lead to serious complications if not treated promptly. The dengue virus enters the human bloodstream through the saliva of infected mosquitoes when they bite. Aedes aegypti, as the main vector of the disease, is often found living in urban and fertile areas [2]. These mosquitoes have a habit of biting during the day, thus increasing the risk of transmitting the dengue virus to humans. Apart from fever, other symptoms of dengue fever include muscle and joint pain, headache, skin rash, and decreased platelet count in the blood. Complications that can arise involve organ damage and can even lead to life-threatening conditions [3]. Prevention of dengue fever involves efforts to control vector mosquito populations and individual protection, such as using mosquito nets, wearing protective clothing, and using mosquito repellants. In addition, it is important to educate the public about preventive measures and early recognition of the symptoms of the disease [4].

The female Aedes aegypti mosquito plays a critical role in the dengue virus transmission cycle. The transmission process begins when this mosquito sucks blood from an individual who is experiencing the acute febrile phase or viraemia, which occurs about 2 days before the onset of fever until 5 days afterwards [5]. During this period, mosquitoes can be infected by the dengue virus present in the blood of the patient. After experiencing the viraemia phase, the mosquito becomes infective within 8-12 days

after sucking the blood of the patient, a period known as extristic incubation. The mosquito retains its infectious ability throughout its life after passing through the extristic incubation phase. While biting and secreting its saliva into the bite wound on another person's body, the Aedes aegypti mosquito can transfer the dengue virus. After transmitting the virus, the mosquito's salivary glands become infected, triggering further transmission capabilities in the next cycle.

When the dengue virus enters the human body through the bite of an infected mosquito, the intristic incubation process begins. Within 3-4 days (4-6 days on average), the initial symptoms of dengue begin to appear suddenly. They involve fever, dizziness, myalgia (muscle pain), loss of appetite, and various other signs or symptoms [6]. Dengue virus transmission is widespread in subtropical regions north and south of the equator, especially in areas with heavy rainfall. The favorable environment for the development of the Aedes aegypti mosquito, the main vector of dengue fever, involves humid conditions, high rainfall, and the presence of stagnant water around residential areas. These mosquito breeding sites include both indoor and outdoor areas, such as unmaintained bathtubs, old tires that can collect rainwater, or irregular cisterns. In addition to climatic and environmental factors, the causes of DHF can also involve poor environmental sanitation, such as poorly managed garbage disposal, and community behavior that does not support prevention practices, such as neglect of vector control efforts or personal hygiene.

Understanding the complex relationship between these factors is key to designing effective prevention strategies and raising public awareness to reduce the risk of dengue transmission. Dengue fever transmission has experienced a rapid increase globally in recent years. Based on information published by the World Health Organization (WHO) in 2020, approximately 390 million individuals were infected with the dengue virus each year. The Asian region ranks the highest risk, with about 3.9 billion people in 128 countries at risk of contracting dengue virus, and about 70% of the risk is concentrated in the region. The Philippines showed the highest rate of dengue cases at 52%, followed by Thailand at 30%, and Indonesia ranked third at around 29%. This data reflects a significant escalation in the spread of dengue worldwide and underscores the urgency to implement measures to prevent and control the disease [7].

In 2019, Indonesia recorded 138,127 cases of dengue fever (DHF), with an incidence rate (IR) of 51.53 per 100,000 population, and a Case Fatality Rate (CFR) of 0.67, resulting in 919 deaths. This figure shows a significant increase compared to the previous year, 2018, which recorded 65,602 dengue cases, an IR of 27.73 per 100,000 population, and a CFR of 0.70, with 462 deaths [8]. In general, the prevalence of DHF cases is high in most districts/cities in East Kalimantan Province, Indonesia. The East Kalimantan Provincial Health Office report shows that the DHF Incidence Rate (IR) in 2012 reached 84.32, and four years later, in 2016, the IR increased dramatically to 305.95. This increase was triggered by an increase in the number of DHF cases in various districts/cities, including Samarinda City. Therefore, measures to prevent and control DHF at the local level have become increasingly crucial to address the public health problems associated with the surge in DHF cases in Indonesia.

The Head of the Samarinda City Health Office informed that since the beginning of January 2022, 75 cases of Dengue Fever (DHF) have been identified among the city's residents, including both children and adults. The public is urged to take dengue prevention measures by implementing the 3M Plus Movement, as well as avoiding the risk of mosquito bites by using mosquito nets and mosquito repellent when sleeping. Samarinda, which consists of 10 sub-districts, 59 villages, and 26 community health centers, on average has working areas that are endemic to DHF. Of the 26 Puskesmas, some of them have recorded an increase in DHF cases over the past three years, including Temindung Puskesmas. Some diseases that are still a serious concern in the working area of Puskesmas Temindung, one of which is DHF [9].

In 2017, it was documented that there were 36 cases of Dengue Fever (DHF) in Temindung Health Center. The number of cases increased significantly in 2018, reaching 99 cases, and continued

to increase in 2019 by recording 143 cases. In 2020, there was a decrease to 46 cases, but in 2021 there was another increase to 121 cases. The causes of the emergence of DHF disease in Temindung Health Center can be attributed to various factors, including social environmental factors. Some habits that are potentially detrimental to health and lack of attention to the environment, such as hanging clothes, napping, draining water reservoirs, and using mosquito repellent, are the main contributors to the increase in DHF cases in the area.

The factor that correlates with the incidence of dengue fever is the frequency of draining water reservoirs. The most effective measure in preventing mosquito larvae breeding is through Mosquito Nest Eradication (PSN), known as 3M Plus [3]. 3M Plus activities involve draining bathtubs or water reservoirs, tightly closing water reservoirs, and managing used goods that have the potential to become breeding grounds for Aedes aegypti mosquito larvae. The importance of draining water reservoirs lies in the need to carry it out regularly, at least once a week, to prevent mosquito breeding. If the entire community is involved in PSN DHF activities, the potential population of Aedes aegypti mosquitoes can be minimized, avoiding the occurrence of DHF transmission [10]. Therefore, based on this context, researchers are interested in exploring the relationship between the frequency of draining water reservoirs and the incidence of DHF in the Temindung Health Center working area.

Methode

This study adopted a quantitative approach with a cross-sectional research design to describe and analyze the relationship between the variables under study at one specific point in time. A total of 67 samples were selected using stratified random sampling techniques to ensure adequate representation of the population. Data collection methods involved observations, interviews, and questionnaires to gain a comprehensive understanding of the variables involved. Data analysis was conducted using the Chi-square test and Fisher's Exact Test to identify relationships and statistical significance among the variables. This approach was designed to provide deep insights into the phenomenon under study and significantly contribute to our understanding of the relationships between variables in the context of this study.

Results

The results of the questionnaire analysis highlighted an interesting pattern regarding the practice of draining water reservoirs and the incidence of Dengue Fever (DHF) among the respondents. Out of a total of 5 respondents who had been affected by DHF, interestingly all of them did not engage in the activity of draining water reservoirs. On the other hand, of the 62 respondents who were not affected by DHF, 30 respondents actively practiced water reservoir draining, while the remaining 32 respondents did not engage in the practice. Most respondents reported that they drain their water reservoirs at least once a week, indicating a high level of care and awareness towards dengue prevention. However, there were also respondents who only drained water containers when they were very dirty, with a lower frequency of once every two weeks or even more. This shows variations in the community's understanding and engagement with DHF prevention measures, which may reflect different levels of knowledge or understanding of the risks of DHF.

Table 1. Relationship between frequency of draining water reservoirs and dengue fever

Frequency of Draining Water Reservoirs	Dengue Fever		Total	P-value
	Never had Dengue Fever	Had Dengue Fever	N	
Draining ≥ 1 time a week	30	0	30	0,060
Draining < 1 time a week	32	5	37	
Total	**62**	**5**	**67**	

The table illustrates the relationship between the frequency of draining water reservoirs and DHF cases in the study sample of 67 people. The table shows that there was a difference in the number of DHF cases between the group that drained water containers more than or equal to once a week (30 people never had DHF) and the group that drained less than once a week (32 people never had DHF). Although the difference was not significant at the 0.1 confidence level (p-value = 0.060), there is a tendency that the frequency of draining water reservoirs may affect the risk of DHF. However, note that the results of the analysis suggest that at the 0.1 level of freedom there is an association between frequency of draining water reservoirs and DHF because the p-value (0.06) is smaller than 0.1. This indicates that there is a possible relationship between the frequency of draining water reservoirs and the risk of DHF.

Discussion

Climate plays an important role in the presence and spread of mosquitoes that vector dengue fever, such as Aedes aegypti. Climate change can impact mosquito ecology and behavior, affecting geographic distribution as well as population intensity. Rising temperatures can accelerate the life cycle of mosquitoes, shortening the time for eggs to develop into larvae, pupae and adults. Increased rainfall also creates ideal conditions for mosquitoes to breed, as rainwater fills water reservoirs that serve as breeding grounds for larvae [11]. A warmer and wetter climate can expand dengue endemic areas, increasing the risk of disease transmission. An increase in extreme weather events, such as flooding, can also create conditions that favor an increase in mosquito populations. Therefore, understanding the impact of climate change on the presence of dengue mosquitoes is important in designing prevention and control strategies, especially in the context of adapting to ongoing global climate change.

Unorganized or poorly maintained water reservoirs can be ideal breeding grounds for mosquitoes, particularly Aedes aegypti, which vector serious diseases such as dengue fever. This poses a significant potential hazard to public health. Water storage areas, such as bathtubs, buckets, or stagnant rainwater reservoirs, provide a highly favorable environment for mosquito breeding [12]. These mosquito larvae can easily develop in stagnant water, and if not addressed, can become a source of infectious disease spread. Aedes aegypti mosquitoes are the main vector of dengue, and unattended water reservoirs can be optimal reproduction sites for these mosquitoes [13]. Therefore, the lack of management and cleanliness of water reservoirs can pose a serious health threat, with an increased risk of transmission of infectious diseases such as dengue. Prevention efforts, including regular draining and maintenance of water containers, are crucial in protecting communities from potential hazards associated with mosquito breeding and disease transmission.

The important role of the frequency of draining water reservoirs in controlling the incidence of DHF can be seen from the finding that the group that drained water reservoirs more than or equal to once a week had a lower number of DHF cases compared to the group that drained less than once a week. Draining water reservoirs is a crucial step in the prevention of dengue fever. The importance of this activity lies in the main role of these places as breeding grounds for the Aedes aegypti mosquito, the main vector of DHF disease [14]. To ensure its effectiveness, draining needs to be done regularly, at least once a week. This action aims to eliminate water pools that serve as breeding grounds for mosquito larvae, thus reducing the possibility of disease transmission.

The importance of active participation of the entire community in DHF Mosquito Nest Eradication (PSN) activities cannot be overlooked. If every individual and household is committed to conducting regular draining of water reservoirs, the impact can be felt on the population level of Aedes aegypti mosquitoes. Thus, the mosquito breeding potential can be suppressed as far as possible, creating a less favorable environment for the spread of DHF [15]. This step is not only individual, but also has a significant collective impact. When the entire community is jointly involved in PSN DHF activities, the potential for disease transmission can be significantly minimized. This collaboration is key in achieving the success of DHF prevention, considering that the Aedes aegypti mosquito does not recognize certain household or neighborhood boundaries. Thus, the active contribution of each individual is the foundation for creating a safe environment from the risk of DHF.

Through the incorporation of community efforts in draining water reservoirs, we can achieve greater prevention goals. A controlled mosquito population will reduce the risk of DHF transmission, and can even create conditions where transmission of the disease no longer occurs. Therefore, it is important to continuously educate the community on the important role of draining water reservoirs, stimulate active participation, and foster collective awareness to achieve the common goal of safeguarding public health from the threat of DHF. Based on the results of research conducted in the Temindung Health Center work area with the Chi-square test results obtained $p = 0.060 < (\alpha = 0.1)$ thus Ha is accepted and Ho is rejected so it can be concluded that there is a relationship between the frequency of draining water reservoirs with the incidence of DHF in the Temindung Health Center work area. This study is in line with research conducted by Apriyani and Yulianus (20202) on factors associated with the incidence of dengue hemorrhagic fever in the working area of the Air Putih Health Center which shows a relationship between the frequency of draining containers with the incidence of dengue hemorrhagic fever and the p value $= 0.003 < (\alpha = 0.1)$ [16].

In addition, the results of this study also indicate the need for community awareness of the importance of their role in avoiding places that can become breeding grounds for Aedes aegypti mosquitoes as the vector of DHF. More intensive health education and campaigns can be an important step to improve the community's understanding of the dangers of DHF and its prevention efforts, especially related to the management of water reservoirs at home.While these findings provide a valuable contribution in the context of public health policy, further research with a larger scale and more sophisticated research design may be needed to confirm these results. Additional variables such as environmental conditions, the presence of Aedes aegypti mosquitoes, and individual behavior could be added to provide a more comprehensive picture of the factors influencing the incidence of DHF in the area. Therefore, the results of this study can serve as a basis for further research that can provide a deeper understanding and more effective solutions regarding dengue control in the Temindung Health Center area, Samarinda City.

Conclusion

The overall study highlighted the crucial role of the frequency of draining water reservoirs in the prevention of dengue fever in the working area of Puskesmas Temindung, Samarinda City. Results show that regular draining, at least once a week, has the potential to reduce the number of Aedes aegypti mosquito larvae and thus, can help control the spread of DHF. In addition, the importance of active participation of the entire community in dengue mosquito nest eradication activities is not only an individual responsibility, but also a collective effort that can result in a significant impact on mosquito population levels. These preventive measures, if widely adopted, have the potential to create a less favorable environment for Aedes aegypti mosquitoes, thereby minimizing the risk of DHF transmission. Therefore, raising public awareness, educating on preventive practices, and encouraging active participation in PSN DHF activities are key to achieving DHF prevention and control goals in the region.

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