ANALYSIS OF ENVIRONMENTAL FACTORS WITH DENGUE HEMORRHAGIC FEVER IN GUNTUR, DEMAK, INDONESIA

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ABSTRACT

Guntur district is one of the districts that is classified as endemic for dengue fever in Demak, Indonesia. In the last three years, there have been consecutive cases or deaths due to Dengue Hemorrhagic Fever (DHF). Based on the epidemiological triangle concept, the emergence of dengue fever can be caused by an imbalance between host (human) factors, the agent as the cause, and the supporting environment. Environmental factors facilitate contact with agents consisting of the physical, social and biological environment. The physical environment that influences the occurrence of dengue fever cases includes house layout, type of container, frequency of draining the container, availability of lids on containers, altitude and climate. DHF cases in Guntur District in 2022 were 67 cases (IR 0.8 per 1,000 population). The case sample in this study was 86 respondents consisting of 43 case groups and 43 as controls. Sampling was taken in Guntur, Demak, Indonesia. The results showed that the factors having influence on the DHF were landfill materials, landfill volume, landfill availability, frequency of landfill draining, and the presence of larvae. The risk factors for dengue fever are the material of the water reservoir, the frequency of draining the water reservoir, the volume of the landfill, and the presence of larvae. People who used cement/soil landfill materials had a 3.529 greater chance of contracting dengue fever. People with less reliable behavior in draining landfills had a 5.569 times greater chance of contracting dengue fever, and people whose water reservoirs containing larvae had a 17.939 times greater chance of contracting dengue fever.

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INTRODUCTION

The distribution of dengue fever cases in Indonesia in 2021 is in 34 provinces in Indonesia, with a total of 73,518 cases, with an incidence rate of 27 per 100,000 population, 747 deaths and a case fatality rate of 0.96%[1]. Dengue Hemorrhagic Fever (DHF) cases in Central Java Province are spread across 35 districts/cities with a total of 4,470 cases with an incidence rate of 12.2 per 100,000 population, the IR of DHF in Central Java is lower than the national target (<51/100,000 population), while the death

rate occurred in 25 districts/cities with a total of 141 deaths with a case fatality rate of 2.7%, this figure is still higher than the national target (<1%)[2].

Based on data from the Demak District Health Service in 2022, dengue fever cases amounted to 305 cases (IR 22.5 per 100,000 population) with 3 deaths (CFR: 1.1), this case is the highest case in the last 5 years, namely in 2021 cases DHF was 67 cases (IR 5.77 per 100,000 population) with 0 deaths (CFR: 0), in 2020 there were 107 cases (IR 9.35 per 100,000 population) with 0 deaths (CFR: 0), in In 2019 there were 168 (IR 14.94 per 100,000 population) with a death toll of 2 cases (CFR: 1.19) and in 2018 there were 42 cases (IR 3.61 per 100,000 population) with a death toll of 1 case (CFR: 2, 38)[3].

Based on the epidemiological triangle concept, the emergence of dengue fever can be caused by an imbalance between host (human) factors, the agent as the cause, and the supporting environment. Environmental factors facilitate contact with agents consisting of the physical, social, and biological environment[4]. The physical environment that influences the occurrence of dengue fever cases includes house layout, type of container, frequency of draining the container, availability of lids on containers, altitude, and climate. The social environmental factor that influences the occurrence of dengue fever cases is population density. Increasing population density will increase contact between vectors and humans, thereby increasing the risk of dengue fever transmission[5]. Biological factors, namely the presence of mosquito larvae and breeding places[6].

Guntur District is one of the districts classified as endemic for dengue fever in Demak Regency, namely a district where in the last 3 years there have been consecutive cases or deaths due to Dengue Hemorrhagic Fever. DHF cases in Guntur District in 2022 were 67 cases (IR 0.8 per 1,000 population)[2]. With a larvae free rate of 64%, this figure is still far from the national target of ≥95%. Behavior that does not pay attention to environmental cleanliness, such as a lack of awareness of draining the bathtub at least once a week, the behavior of hanging clothes, lots of unused trash/containers around the house that can hold water, and dark conditions in the house due to people's habits of not even opening windows. having no windows in the house is one of the factors behind the low larvae-free rate in Guntur District. The large number of second-hand goods collection businesses and the large number of empty houses have also played a role in increasing dengue cases in Guntur sub-district. Based on the description above, the problem in this research can be formulated, namely identifying environmental factors related to the incidence of Dengue Fever, as well as spatially assessing rainfall factors with the incidence of Dengue Fever in Demak Regency.

This research aims to analyze environmental factors (container material, frequency of draining containers, availability of container lids, container volume, and presence of larvae) with the incidence of dengue fever in Guntur, Demak, Indonesia.

MATERIALS AND METHODS

This type of research was observational with a case control design which aimed to determine the relationship between environmental factors (container naterial, frequency of container draining, availability of container lids, container volume, and presence of larvae) with the

incidence of dengue fever in Guntur District. In this study, an analysis of the relationship between the independent variables (the environmental factors) and the dependent variable (DHF incidence) was carried out using the chi-square correlation test and spatial-temporal analysis using Geographic Information Systems (GIS).

The samples in this study were calculated using the Lemeshow formula which resulted in 86 samples consisting of 43 as case groups and 43 as control groups. Statistical tests of the relationships used the chi-square test and the spatial tests used the overlay mapping model.

RESULTS

This research was located in Guntur, Demak, Indonesia. This research was carried out on 14-19 August 2023.

Table 1. Univariate Analysis of The Environmental Factors Affecting The DHF Incidence

Characteristics	Case		Control	
	N	%	N	%
Landfill materials				
Cement and soil	30	69.17	17	39.53
Ceramics and plastic	13	30.23	26	60.47
Landfill Volume				
> 50 liters	30	69.77	17	39.53
≤ 50 liters	13	30.23	26	60.47
Availability of landfill cover				
Available	38	88.37	40	93.02
Not Available	5	11.63	3	6.98
Landfill Draining Frequency				
>1 week	33	76.74	16	37.21
<1 week	10	23.26	27	62.79
The existence of larvae				
Positive	37	86.05	11	25.58
Negative	6	13.95	32	74.42

Table 2. Bivariate Analysis of The Environmental Factors Affecting The DHI Incidence

Characteristics	p	OR (95%Cl)
1. Landfill materials	0.004	13.529 (1.445-8.619)
2. Landfill Volume	0.004	0.283 (0.116-0.692)
3. Availability of landfill cover	0.356	0.570 (0.127-2.551)
4. Landfill Draining Frequency	0.000	5.569 (2.176-14.251)
5. The presence of larvae	0.000	17.939 (5.962-53.975)

Table 2 shows that environmental factors that influence dengue fever in Guntur District are landfill materials (P=0.004), landfill volume (p=0.004), frequency of landfill draining (p=0.000), and the presence of larvae (p=0.000), while those that do not have the influence is the availability of landfill (p=0.356).

DISCUSSION

The result of this study showed there was a significant relationship between water reservoir materials and the incidence of dengue fever (p=0.004). From the results of the analysis, an OR value of 13.529 was also obtained, which means that water reservoir materials made from cement and soil had a 13.529 times greater chance of contracting dengue fever than water reservoir materials made from ceramic and plastic. The results of this research were in line with research conducted by Rahmawati et. al. (2022) which stated that the basic materials for water reservoirs that are at risk of dengue fever are cement walls and floors[7]

Container materials made from cement/earth are materials that are at risk of dengue fever because they have rough surface characteristics that are difficult to clean, easily become mossy and have low light reflection[8]

Statistical tests of the research revealed p=0.004, OR = 0.283, 95% CI = 0.116 - 0.692, meaning that there was a

significant relationship between the volume of water reservoirs and the incidence of dengue fever. The OR value of 0.283 indicated that water reservoir with a volume of > 50 liters had a 0.2 times greater chance of contracting dengue fever than a water reservoir with a volume of < 50 liters. The results of this research were in line with the result of a previous research[8] which found relationship between the volume of water reservoirs and the incidence of dengue fever (p=0.031).

Larger containers have more capacity to hold water so that the water in the water reservoir lasts quite a long time because it is difficult to drain, making it suitable for mosquito breeding places[9].

This study found no significant relationship between the availability of landfill covers and the incidence of dengue fever (p=0.356). This research was in line with a research by Ketut purnajaya[10] which states that there is no significant relationship between the availability of container lids and the incidence of dengue fever in Way Kandis Village, but this research was not in line with Novita Dian's research which states that there was a significant relationship between the behavior of closing water reservoirs and the incidence of Dengue Fever in the Ngawi Community Health Center working area (p=0.0001)[11].

The availability of water reservoir covers is closely related to the presence of mosquito larvae[12]. Covered water reservoirs do not allow mosquitoes' access when laying eggs, so the use of lids in water reservoirs has a significant impact in reducing the presence of larvae in water reservoirs compared to water reservoirs that are not covered[13].

This research found a significant relationship (p=0.00) between the frequency of draining and the incidence of dengue fever. The obtained OR value of 5.569 indicated that the frequency of poor drainage (>1 week) had a 5.569 times greater chance of contracting dengue fever than those who drain water reservoirs at least once a week. This was in line with Maurien's research (2015)[14] which states that there is a significant relationship between draining water reservoirs and the incidence of Dengue Fever in the Gogagoman Community Health Center area, Kotamobagu City with an OR value of 5.9, which means that respondents who do not frequently drain water reservoirs have a 5.9 times greater risk of suffering from dengue fever compared to respondents who frequently drain water reservoirs.

Implementing the eradication of mosquito nests through 3M approach (drain, bury, and cover), one of which is draining water reservoirs, is an effective way to reduce the number of dengue larvae and cases[15]. Several respondents stated that sometime after draining, larvae were still found in the water reservoir. This was due to the practice of draining the water reservoir incorrectly[16].

This research also found that there was a significant relationship (p=0.00) between the presence of larvae and the incidence of dengue fever. The OR value of 17.939 indicated that houses positive for larvae had a 17.939 times greater chance than those that were negative/no larvae. This finding confirmed the research by Sulina (2012) which states that the presence of larvae has a significant relationship with the occurrence of dengue fever (p= 0.002)[17].

The presence of larvae in the respondents' water reservoirs is closely related to the preventive measures taken[18]. One effective prevention to reduce larvae is by implementing “3M Plus approach”

which consists of draining water reservoirs at least once a week, closing water reservoirs, burying/using used items, especially during the rainy season because they can collect rainwater, plus changing the water in flower vases and drinking places for birds once a week, repairing damaged water gutters, installing wire mesh, covering tree holes with soil, keeping larvae-eating fish in water reservoirs, not hanging clothes, having sufficient lighting[19] and ventilation, and using anti-mosquito lotion especially in the morning and evening when mosquitoes are looking for food[20].

CONCLUSION

There is a significant relationship between the material of the water reservoir, the volume of the water reservoir, the frequency of draining the water reservoir, the presence of larvae and the incidence of dengue fever in Guntur District, Demak Regency. There is no significant relationship between the availability of water reservoir covers and the incidence of dengue fever.

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CONFLICT OF INTEREST

Case reports were obtained from Puskesmas and Hospital data. The research implementation included letters of approval for publication from patients and their guardians totaling 86 respondents.

ETHICS CONSIDERATION

This research had received Ethical Approval no. 429/EA/KEPK-FKM/2023 issued by Health Research Etichs Committee Faculty of Public Health Dipenogoro University on 27 July 2023.

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AUTHOR CONTRIBUTION

All authors have contributed to all processes in this research, including preparation, data gathering and analysis, drafting, and approval for publication of this manuscript.

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