



**Analysis Of Environmental And Behavioral Factors Associated With Dengue Hemorrhagic
Fever In Gading Campaka District Bengkulu City**

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Article details:

Published: 30th November 2022



Abstract

Dengue Hemorrhagic Fever is an environmental-based disease, an infectious disease caused by the dengue virus and transmitted by the *Aedes Aegypti* mosquito. This study aims to determine the relationship between environmental and behavioral factors with the incidence of dengue fever in Gading Cempaka sub-district, Bengkulu City. This study uses a case control method with an observation approach. The number of samples in this study were 114 samples and the

research instrument used observation sheets and environmental parameter measurement tools. Data analysis is univariate and bivariate. The results showed that the average environmental parameters were temperature of 28°C, wind speed of 6.5 km/hour and humidity of 78%. And behavioral factors associated with dengue fever, namely hanging clothes ($p = 0.002$), using lotion ($p = 0.095$), draining water reservoirs ($p = 0.004$), closing water reservoirs ($p = 0.020$), and burying used goods ($p = 0.672$). There is the influence of environmental and behavioral factors, especially the habit of hanging clothes, using lotion, draining water reservoirs, closing water reservoirs. It is hoped that the health center sanitation workers will carry out more frequent inspections and prevention visits to the community's home environment in order to pay attention to environmental health and prevent the occurrence of dengue fever.

Keywords : dengue fever, environment, behavior

To cite this article :

Jaka Fathary, Nurjazuli, S. (2022). *Analysis Of Environmental And Behavioral Factors Associated With Dengue Hemorrhagic Fever In Gading Campaka District Bengkulu City* (pp. 1–16).



Introduction

Dengue Hemorrhagic Fever (DHF) is an environmental-based disease, an infectious disease caused by the dengue virus and transmitted by the *Aedes aegypti* mosquito and can also be transmitted by *Aedes albopictus*, which is characterized by sudden high fever, for no apparent reason, lasting continuously. continuous for 2-7 days, bleeding manifestations, including positive Tourniquet test, thrombocytopenia (platelet count $100,000/\mu\text{l}$), hemoconcentration (elevated hematocrit $\geq 20\%$), with or without enlargement of the liver (Kemenkes RI, 2010)

Bengkulu Province is one of the endemic areas for dengue vectors with carrying capacities ranging from environmental factors, community habits, etc., so that dengue fever vectors will easily breed. Bengkulu Province was previously ranked 26th with a morbidity rate of 17.53 in 2017, rising to rank 3 with a morbidity rate of 72.28 per 100,000 population in 2018 per 100,000 population along with Kalimantan (87.81) and Central Kalimantan (84.39) (Kemenkes RI, 2017).

The city is one of the cities with a high population, there is no urban village in Bengkulu City that is free from dengue fever, all villages, including endemic. One of the diseases in urban society is dengue fever. The areas that are most wary of are densely populated areas, and areas that are inhabited by boarding children and rented houses. In addition, this disease can also be transmitted by people with high mobility⁸. There were 205 cases of dengue fever in Bengkulu City in 2021 and a death rate of 0 people. Despite the decline in the number of cases last year, the still high morbidity and mortality rate for Dengue Fever shows that there is still a need to improve early diagnosis and management of Dengue Fever cases in health facilities and PHBS needs to be improved. Bengkulu City Health Service officers, Bengkulu Province, calculated that



in the last 9 years, as many as 3,152 residents in 9 districts of Bengkulu City, were positively infected with the dengue virus through the bite of the *Aedes Aegypti* mosquito or dengue hemorrhagic fever (DHF) (Dinkes Kota Bengkulu, 2021).

The incidence of dengue fever is closely related to environmental factors that cause the availability of breeding places for the *Aedes aegypti* mosquito vector, where the *Aedes aegypti* mosquito breeds in stagnant and open water, for example, suitable places for breeding are barrels, drums, pots, buckets, flower vases, stems or leaves of plants, tanks, discarded bottles, cans, old tires and others. This mosquito breeding place is in the form of puddles that are accommodated in a place or containers that have never been cleaned (Astuti, 2010)

Theoretically, there are several risk factors that are closely related to the incidence of Dengue Hemorrhagic Fever. These factors include physical environmental factors, community habits or behavior, the level of public knowledge, population mobility from one area to another, and areas with tropical climates. Of the several risk factors that cause Dengue Hemorrhagic Fever above, physical environmental factors play an important role in the development of the spread of Dengue vectors. Categories in the physical environment such as climate (temperature, humidity, light, rainfall, wind), ventilation, type and condition of water reservoirs (TPA) and the presence of larvae in water reservoirs (Alim dkk, 2017)

Eradication of mosquito nests or PSN is an activity to eradicate eggs, larvae and cocoons of mosquitoes that transmit dengue hemorrhagic fever in their breeding places. How to eradicate mosquito nests can be done by draining, closing, burying (3M) plus such as raising larvae-eating fish. The success of PSN activities includes controlling the *Aedes aegypti* mosquito population so that the transmission of Dengue Fever can be prevented or reduced (Ishak, 2016).



Results

1. Environment Parameter

Sampling the air temperature of respondents in Gading Campaka District obtained an average temperature of 29°C with the lowest temperature obtained at 28,8°C and the highest reaching 31,3 °C. The temperature range of 20°C-30°C is the ideal temperature for the survival of mosquitoes at all stages of their cycle. %. From the results of measurements that have been carried out using a thermohygrometer, the results obtained at the respondent's house in Gading Cempaka District, Bengkulu City, it is known that the average humidity is 78.8%, with the lowest humidity being 72% and the highest humidity being blood at 83%. While the results of direct measurements using an anemometer. From the table above, it can be concluded that the average wind speed parameter in the Gading Cempaka sub-district is 6.5 km/hour. (Table 1)

Table 1. Distribution of Environmental Parameters in Gading Cempaka District, Bengkulu City in 2021

Number	Category	Mean	Median	Min	Max
1	Air Temp	29,7	29	28,8	31,3
2	Humidity	78,8%	75%	72%	83%
3	Wind Speed	6,5km/jam	6,5km/jam	6,1km/jam	6,8km/jam

2. Behavior Factor

In the variable habit of holding clothes, it was found that 83 respondents still had the habit of hanging clothes and 31 respondents who did not have the habit of hanging clothes, while the results of the statistical test showed a p value of 0.002 meaning that there was a



relationship between the behavior of hanging clothes and the incidence of dengue fever in Gading Cempaka District Bengkulu City. (Table 2).

In the variable habit of using anti-mosquito lotion there were 52 respondents and those who did not use anti-mosquito lotion were found as many as 62 respondents, while the statistical test obtained a p value of 0.095 meaning that there was a relationship between the behavior of using anti-mosquito lotion and the incidence of dengue fever. (Table 2)

In the behavior of draining water reservoirs in the respondent's homes, the results of a direct survey were that respondents had good behavior of draining water reservoirs, there were 36 and 38 respondents who did not experience dengue fever. There is also the behavior of draining the water reservoir which is not good, it is found that 19 respondents have dengue fever and 19 respondents do not have dengue fever. While the statistical test showed a p value of 0.004 which means there is a relationship between the behavior of draining water reservoirs and the incidence of dengue fever. (Table 2)

Respondents' behavior regarding the habit of closing water reservoirs which can be a source of breeding of mosquito vectors is known that some respondents have good habits in closing water reservoirs with details of 82 respondents having good behavior and 32 respondents having bad behavior. In the statistical test using chi square, it is known that the p value is 0.020. It can be concluded that the behavior of closing water reservoirs is related to the incidence of dengue fever. (Table 2)

It can be seen that in the table most respondents have bad behavior regarding the habit of burying used goods. Respondents' behavior regarding the habit of burying used goods which can be a source of breeding mosquito vectors. From the results of the questionnaire survey that was distributed to each respondent, it was found that only 30 respondents had



good behavior and 84 other respondents had bad behavior regarding the habit of burying used goods. Meanwhile, for statistical tests, a p-value of 0.672 was obtained, which means that there is no relationship between the behavior of burying used goods and the incidence of dengue fever in Gading Cempaka District, Bengkulu City. (Table 2)

Table 2 Cross Tabulation of Respondents Based on Behavioral Factors in Gading Cempaka District, Bengkulu City in 2022

Number	Behavior Factor	Case		Control		Amount	P value
		N	%	N	%	N	
1	Hanging of clothes						
	a. Yes	47	17,5	36	63,2	83	0,002
	b. No	10	17,5	21	36,8	31	
2	Use mosquito repellent lotion						0,095
	a. Yes	30	52,7	22	38,6	52	
	b. No	27	47,3	35	61,4	62	
3	Drain The Water Reservoir						0,004
	a. Well	36	63,1	19	33,4	55	
	b. Bad	21	36,9	38	66,6	59	
4	Close he Water Reservoir						0,020
	a. Well	46	80,7	36	63,1	82	
	b. Bad	11	19,3	21	36,9	32	
5	Bury Waste						0,672
	a. Well	14	24,5	16	28,0	30	
	b. Bad	43	75,5	41	72,0	84	

Discussion

1. Air Temperature to the Incidence of Dengue Hemorrhagic Fever

Based on the results of direct measurements using a thermometer, it was found that the average temperature in Gading Cempaka District was 29.7 °C, 95% of each respondent's house met the optimum temperature criteria for mosquito breeding. The average temperature in the Gading Cempaka District is 29 °C with a temperature range of 28.8 °C-31.9 °C. This



temperature is the optimum temperature for mosquito breeding. The optimum temperature for mosquitoes is in the range of 25°C-27°C. In addition, the temperature range of 20°C-30°C is the ideal temperature for the survival of mosquitoes at all stages of their cycle. The extrinsic incubation period of the virus in the mosquito's body was reduced from 9 days at 26°C and 28°C to 5 days at 30°C.

The reproductive cycle of female mosquitoes is also affected by environmental temperature where at temperatures of less than 20°C the fertility of female mosquitoes decreases⁴¹. The above research is supported by other studies which show a relationship between temperature and DHF cases which can increase the risk of DHF cases. Other research shows that the results of the correlation between temperature and DHF cases have a moderate strength and direction of positive relationship ($r = 0.301$) so that an increase in temperature will be followed by an increase in DHF⁴² cases (Kurniawati, 2016).

2. Air Humidity to the Incidence of Dengue Hemorrhagic Fever

The results of the study using a hygrometer showed that the average humidity in the Working Area of Gading Cempaka District was 78.8% with the highest humidity being 83% and the lowest being 72%. The results of this analysis are in line with research conducted with the results of Wirayoga's research in the city of Semarang which states that air temperature, rainfall, and relative humidity have a significant relationship with the incidence of dengue fever (Gama Dkk, 2010).

Air humidity is very influential on the breeding of *Ae. aegypti* mosquitoes, especially in the egg cycle. If the humidity is not enough, the eggs can hatch in a long time. Air humidity affects the lifespan of mosquitoes. At a temperature of 20°C, relative humidity of 27%, the age of female mosquitoes can reach 101 days and the age of male mosquitoes



reaches 35 days, relative humidity is 55%, the age of female mosquitoes is 88 days and male mosquitoes are 50 days. At a relative humidity of less than 60% the lifespan of a mosquito will be short, it cannot become a vector, because there is not enough time for virus transfer from the stomach to the salivary glands (Widoyono, 2008).

Air humidity affects the age of the *Aedes aegypti* mosquito which is the vector of dengue transmission. Mosquito breathing using a tracheal tube with an air opening is called a spiracle. An open spiracle without a regulating mechanism at a time of low humidity will cause the evaporation of water from the mosquito's body so that the mosquito's body fluids will come out⁴⁴. In addition, the need for high humidity causes mosquitoes to look for damp and wet places outside the house as a place to rest during the day. Air humidity of more than 60% makes the lifespan of *Ae. aegypti* is long and has the potential to breed *Ae. Aegypti* (Anggraini, 2016)

But this research is not in line with the research conducted by Fitriana which states that there is no relationship between the two variables. There is no relationship between humidity and cases of DHF. This shows that the increase in humidity will not be followed by an increase in the incidence of dengue fever in the work area of the Putat Jaya Health Center (Fitriana, 2017)

3. Wind Speed to the Incidence of Dengue Hemorrhagic Fever

Direct measurements that have been obtained are the average wind speed in Gading Cempaka District, which is 6.5 km/hour while the results of the research that have been carried out show that there is no significant relationship between wind speed and the incidence of dengue fever in Gading Cempaka District, Bengkulu City. This is in line with Wirayoga's research that the statistical results between wind speed and the incidence of DHF



show the value of $r = 0.057$ and $p = 0.632$, which means that wind speed has a very weak relationship strength and there is no significant relationship between wind speed and the incidence of DHF (Wirayoga, 2013). conducted by Ririn Wind speed was statistically significant ($P=0.000$) (Winarsih, 2013)

Wind affects water evaporation and air temperature. Mosquitoes start to enter the trap at a speed of less than 5.4 m/s. Wind can affect the process of flying and the spread of mosquitoes. If the wind speed is 11-14 km/hour, the flying activity of mosquitoes will be hampered. Wind speed at sunrise and sunset, when mosquitoes fly into or out of the house, is one of the factors that determines the amount of contact between humans and mosquitoes. The flying distance of mosquitoes can be shortened or extended according to the direction of the wind⁴⁹ (Fathi, 2010).

When the air is calm, the mosquito's temperature may be several fractions or degrees higher than the ambient temperature. If there is good evaporating wind and good convection, the mosquito's temperature will drop several fractions or degrees lower than the ambient temperature (Ditjen P2PL, 2013).

4. The Relationship of Hanging Clothes Behavior to the Incidence of Dengue Hemorrhagic Fever

As from the statistical test results, the p value was 0.002, meaning that there was a relationship between the behavior of hanging clothes and the incidence of dengue fever in Gading Cempaka sub-district, Bengkulu city. According to the results of the information obtained during direct observation, most of the respondents still had the habit of hanging clothes in the house which could be a resting or hiding place for mosquitoes which could be a potential contact between mosquitoes and humans.



This is because both the case group and the control group have more. the habit of hanging clothes in the house so that the difference in proportion is not significant between the two groups of respondents, meaning that dengue fever events are not always caused by the habit of hanging clothes at home, there are other factors that can cause mosquito viruses, namely unhealthy body conditions or fatigue factors so immunity reduced in humans. This condition is prone to dengue fever in humans. Used clothes hanging in houses is one of the media favored by mosquitoes that transmit dengue fever and is a risk factor that increases the occurrence of dengue fever transmission in an area. The habit of hanging hanging clothes in the house for mosquitoes to rest⁵³ (Ariati, 2012).

This is because the habits of the respondents are community habits that have been going on and have been going on for a long time so that it has become a habit in everyday life to find clothes that are hung intentionally behind doors, on walls, and there are some clothes that are left just like that whether it's dirty clothes or dirty clothes. clean for a long enough period of time so that it can be said to be bad behavior. Besides that, with the bad habit of hanging clothes, the respondents balanced this with the behavior of draining the bath, keeping larvae-eating fish.

5. The Relationship Between Using Lotion/Anti-Mosquito to the Incidence of Dengue Hemorrhagic Fever

Based on bivariate analysis using chi square to determine the relationship between the behavior of using anti-mosquito lotion and the incidence of dengue fever, the p value was obtained, namely 0.095. This research is in line with research conducted by I Gusti (2012) regarding the factors associated with the incidence of dengue fever, stating that there is a



significant relationship between the behavior of using mosquito coils and the incidence of dengue fever, with a p value of 0.001.

To eradicate DHF, all people must maintain cleanliness so that their homes and their environment are free from the *Aedes aegypti* mosquito. The *Aedes aegypti* mosquito likes to thrive in water reservoirs such as bathtubs, toilet tubs, jars, drums and items that allow stagnant water such as bird drinkers, water plant pots, flower vases, used tires, used cans, used plastic, coconut shells and others that are thrown away carelessly (Palgunadi, 2013)

Chemical control This method can be done for adult mosquitoes and larvae. Currently, adult mosquitoes are treated by thermal fogging or colg fogging = ultra low volume. The eradication of adult mosquitoes is not by spraying on walls (residual spraying) because *Aedes aegypti* mosquitoes do not like to perch on walls, but on hanging objects such as mosquito nets and hanging clothes. This result was supported by the respondents. This can also be seen from the results of the cross-tabulation analysis where in the case group there were 27 respondents with good habits of using anti-mosquito lotion and in the control group there were 35 respondents with bad habits of using anti-mosquito lotion.

They didn't even do this because they felt that using anti-mosquito lotion could damage their skin because the respondents' skin was sensitive and thought that anti-mosquito lotion had a bad effect if they were exposed to their skin too often. There are also those who don't use mosquito repellent but they don't get dengue fever because they have a healthy lifestyle and eat nutritious food to maintain their body's immunity.



6. The Relationship of the Behavior of Draining Water Reservoirs to the Incidence of Dengue Hemorrhagic Fever

The results showed that the statistical test obtained in the form of p value = 0.004 which means that there is a significant relationship between the behavior of draining water reservoirs with the incidence of dengue fever in Gading Cempaka District, Bengkulu City. This study is in line with Prastiani (2016) which states that based on the results of statistical tests, the relationship between the practice of draining water reservoirs and the incidence of DHF was found to be p -value = 0.036, which means that there is a significant relationship between the practice of draining water reservoirs and the incidence of DHF in the working area of the Sronдол Health Center.

To eradicate DHF, all people must maintain cleanliness so that their homes and their environment are free from the *Aedes aegypti* mosquito. The *Aedes aegypti* mosquito likes to thrive in water reservoirs such as bathtubs, toilet tubs, jars, drums and items that allow stagnant water such as bird drinkers, water plant pots, flower vases, used tires, used cans, used plastic, coconut shells and others that are thrown away carelessly (Rahayu, 2013)

Dengue mosquito prevention practices such as draining water reservoirs such as bathtubs, toilet bowls, flower vases, ant traps, etc. A good way to drain is by brushing or rubbing the walls of the water reservoir flat, horizontally or up and down, meaning that the attached mosquito eggs can be released and do not hatch larvae. The implementation of eradicating mosquito nests can have a significant effect on the presence of larvae. This can be explained because active participation activities in eradicating mosquito nests can reduce the population of mosquito larvae. Efforts to eradicate mosquito nests must also be supported by all family members, as well as in the implementation of eradicating mosquito nests carried



out both in the home environment to the environment outside the home in a balanced way so that the growth of mosquito larvae can be avoided (Ditjen P2PL, 2013).

7. The Relationship Between The Behavior Of Closing Water Reservoirs To The Incidence Of Dengue Hemorrhagic Fever

The results showed that the statistical test was obtained in the form of a p value of 0.020, which means that there is a significant relationship between the behavior of closing water reservoirs and the incidence of dengue fever in Gading Cempaka District, Bengkulu City. This research is in line with research conducted by Novita Dian which states that there is a significant relationship between the behavior of closing water reservoirs and the incidence of dengue fever in the Working Area of the Ngawi Public Health Center with a p value of 0.001 and OR 1.985

Most of the respondents who use the bath in the house do not close the bath and there are mosquito larvae. Bathtubs tend to have clean water because they are not affected by outdoor weather conditions. Respondents who do not take action to close the container can cause mosquitoes to freely enter the water reservoir to breed. *Aedes* sp mosquitoes like to lay their eggs in clear/clean water and do not like to lay their eggs in direct contact with the ground. In addition, there is no cover on the tub because it has a wide enough surface so that people rarely close the tub. Mosquito breeding is supported by the size of the water reservoir which is quite large and the water in it is quite long.

Outside containers that contain a lot of larvae are those that are protected from direct sunlight, in an open state and water changes are rarely carried out, such as in animal feeding places, flower pots. *Aedes* sp mosquitoes are more interested in laying eggs in clear colored water reservoirs, wide open and in places protected from sunlight. The shelter with a cover is



a bucket. However, buckets are often not closed tightly, which creates an opening for mosquitoes to enter and causes the room inside to be darker and more humid. This condition is preferred by female mosquitoes rather than open areas. The number of containers has no effect on the presence of larvae⁶¹ (Herawati, 2014)

Most of the landfill conditions with larvae in both endemic and free areas were open landfills, and landfills with tightly closed conditions found the fewest larvae, even in DHF-free areas all landfills that were tightly closed did not find larvae. With the condition of the landfill being open or not tightly closed, it makes it easier for mosquitoes to enter and leave the landfill compared to a landfill that is tightly closed, so that in open and not tightly closed landfills, more larvae are found because mosquitoes can get in and out easily⁶² (Fajrin, 2018).

8. The Relationship Between The Behavior Of Burying Used Goods And The Incidence Of Dengue Fever

The results showed that the statistical test was obtained in the form of p value = 0.672, which means that there was no significant relationship between the behavior of burying used goods and the incidence of dengue fever in Gading Cempaka District, Bengkulu City. While this research is not in line with that carried out by Winarsih, "From the results of statistical tests using Chi-square, a p value of 0.004 is obtained, meaning that there is a relationship between burying used goods and the incidence of Dengue Hemorrhagic Fever in Gajahmungkur Village, Semarang City.

Thus, the community is expected to reduce mosquito breeding places, in this case used goods such as used bottles/cans and used tires by handling solid waste through effective and environmentally friendly techniques such as burying or with the 3R principle (reduce,



reuse, recovery). We can know that the way to control dengue fever is to carry out 3M Plus activities and reduce the risk factors for the breeding of Aedes sp66 mosquito larvae.

The more used goods that can hold water, the more places for mosquitoes to lay eggs and breed, so that the risk of dengue incidence also increases. Communities in the working area of the Pancana Health Center are still found residents who do not bury used goods because they still store these used goods in residential areas on the grounds that they will be reused and there is no vacant land to bury or burn them (CDC, 2014)

Conclusions

Environmental factors showed that the parameters of temperature, humidity, and wind speed obtained an optimal average for the growth of Aedes Ae mosquitoes and there were several variables related to the incidence of dengue fever in Gading Cempaka District, Bengkulu City, including the behavior of hanging clothes, wearing lotion, draining water reservoirs. , closing water reservoirs. Meanwhile, variables that are not related to dengue fever are only the behavior variable for burying used goods.



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