International Journal Of Health Science Vol 2 No. 3 (November 2022) Hal 100-106
E-ISSN : 2827-9603 P-ISSN : 2827-959X

INTERNATIONAL JOURNAL OF HEALTH SCIENCE
Link Page: https://ejurnal.politeknikpratama.ac.id/index.php/ijhs
Page: https://ejurnal.politeknikpratama.ac.id/index.php

THE RELATIONSHIP OF ENVIRONMENTAL FACTORS AND THE EXISTENCE OF LARGER WITH THE EVENT OF Dengue Hemorrhagic Fever (DHF) IN PASURUAN REGENCY

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ABSTRACT

Dengue Hemorrhagic Fever (DHF) is an acute viral-febrile disease, often characterized by headache, bone or joint pain and muscle, and rash as a symptom. In Indonesia in 2011 there were 65,432 cases with 595 deaths. East Java Province has determined outbreaks of DHF since 2015 in 37 districts / cities, with a total of 3,136 cases of dengue fever and 52 deaths. Pasuruan Regency is one of Kabupeten in East Java with the highest death rate from DHF compared to other regencies or cities, which is 28 people in 2020. There are many factors that can affect, pray the only environment and vector. The purpose of this research is to see the relationship of environmental factors and vector with the incidence of DBD in Pasuruan Regency. This research is an observational research with case control design. The sample in this research were 76 respondents consisting of 38 case groups and 38 control groups representing from 3 sub-districts in Pasuruan Regency (Gempol, Beji and Kraton Sub-district). Data analysis with Chi-Square test. The results showed that there was a relationship between water pH in house (p = 0.005, OR = 5,343), indoor air temperature (p = 0.046, OR = 3,221), air humidity in house (p = 0.049, OR = 3,923) and presence of larvae (p = 0.037, OR = 3.032) with the incidence of DHF in Pasuruan Regency. The most influential factor in increasing the risk of DHF incidence in Pasuruan Regency is the pH of water, the temperature inside the house and the presence of larvae around the house. It needs cross-sector cooperation to pay attention to the condition of environmental sanitation so it will not be a good place for Ae mosquito development. aegypti. Providing counseling to people who focus on the source of the problem, and the community in order to prevent the occurrence of transmission of DHF by breaking the chain of transmission.

Keywords: DHF incidence, Environmental Factors, *Ae. aegypti*

Introduction

Indonesia is one of the largest tropical countries in the world and is located at 6°N-11°S and between 95°E-141°E. The tropical climate is a good factor for mosquito breeding so that the mosquito population in Indonesia is difficult to control. Mosquitoes are one of the main vectors for the spread of disease. There are more than 2500 species of mosquitoes worldwide and are divided into 2 subfamilies namely Culicinae and Anophelelinae. The types of mosquitoes that are the main vectors in the spread of disease from the Culicinae subfamily are Culex, Aedes, Mansonia, while the Anopheles spp. subfamily are Anopheles spp. Diseases transmitted by mosquitoes

Received September 30, 2022; Revised Oktober 2, 2022; Accepted Oktober 22, 2022

are Dengue Hemorrhagic Fever (DHF), filariasis (elephantiasis), malaria, chikungunya and encephalitis (Athaillah, 2017).

Dengue Hemorrhagic Fever (DHF) is an acute febrile-viral disease, often characterized by headache, bone or joint and muscle pain, rash, and leukopenia as symptoms. Dengue hemorrhagic fever (DHF) or Hemorraghagic Fever (DHF) is a fever accompanied by an enlarged liver and bleeding manifestations. In severe cases, circulatory failure and the patient may fall into hypovolemic shock due to plasma leakage. Dengue hemorrhagic fever (Dengue Haemoragick Frever or called DHF) is characterized by four main clinical symptoms: high fever, often with hepatomegaly and in severe cases with signs of circulatory failure. (Anggraeni, 2011).

DHF is a global health problem because dengue virus infection can cause endemicity. DHF cases in the world have increased to various countries 30 times in the past 50 years. This case is not only found in urban areas but has spread to rural areas. It is estimated that 50 million DHF infections occur annually and 2.5 billion of the world's population live in dengue endemic countries (Prasetyowati, 2010).

In Indonesia, the first dengue outbreak was in Surabaya and Jakarta in 1968. The number of cases of DHF tends to increase and its spread is expanding to various regions every year. Currently, DHF is one of the endemic diseases in almost all provinces (Depkes RI, 2005). The World Health Organization (WHO) classifies Indonesia as one of the high dengue endemic countries. This is due to the occurrence of Extraordinary Events (KLB) of DHF that occurs periodically over a period of 3-5 years and many deaths from dengue occur in children.

DHF is a public health problem in Indonesia. In 2015 there were 65,432 cases with 595 deaths in Indonesia with a DHF Case Fatality Rate (CFR) of 0.91% and an Incident Rate (IR) of 27.56/100,000 population with infected areas reaching more than 78% districts/cities. . The three provinces with the highest dengue cases are the Special Capital Region of Jakarta, East Java, and Central Java (Amien, 2016).

The number of DHF patients in East Java in 2019 reached 9273 cases (Depkes, 2020). Provinces in East Java have established the status of DHF outbreaks since January 1, 2015. There has been an increase in the number of DHF cases. During January 2019 in East Java Province, dengue outbreaks occurred in 37 districts/cities, with a total number of 3,136 cases of dengue fever and a death rate of 52 cases (Kemenkes, 2020).

Pasuruan Regency is one of the regencies in East Java Province. This district consists of 24 districts. As one of the endemic areas of DHF in East Java, there were recorded cases of DHF at the Pasuruan District Health Office in 2019 which always increased from 2014 to 2019. The Pasuruan District Health Office stated that the number of DHF sufferers during January 2019 had increased when compared to the same month in 2018 (Dinkes Kab.Pasuruan, 2020).

The increase and spread of dengue cases may be caused by high population mobility, urban area development, climate change, changes in population density and distribution as well as other epidemiological factors that still require further research (Kemenkes RI, 2010). In addition, the increase in dengue cases every year is related to environmental sanitation conditions where there are many available breeding places for female mosquitoes, namely vessels filled with clear water (bathtubs, used cans and other water reservoirs).

Environmental conditions that allow Ae. aegypti live is a factor that encourages the occurrence of dengue fever. Breaking the chain of transmission of dengue fever is the right way to prevent this disease from occurring. Eradicating mosquito larvae/larvae is the right way to prevent the incidence of DHF, (Ministry of Health, 2020). Based on research conducted by Yudhastuti (2005), it shows that there is a relationship between air humidity, type of container, knowledge and attitude towards the presence of Ae. aegypti in Wonokusumo Village, Semampir District, Surabaya City (Yudhastuti, 2005)

Based on research conducted by Sofia in 2014, it was stated that environmental factors influenced the incidence of DHF, namely there was a relationship between temperature (OR=2.9) and air humidity (OR=2.4) with the incidence of DHF in Aceh Besar District (Sofia, 2010). 2014). According to Widodo (2012) that in the epidemiological triangle model (triangle epidemiology) is one of the right models to see the risk factors for the occurrence of DHF. There are three factors in the epidemiological triangle model that play a role in the emergence of a disease, namely the host, disease agent and environment (*host, agent and environment*).

The purpose of this research was to determine the relationship between environmental factors and the incidence of DHF in Pasuruan Regency.

Method

This research is an analytic observational research, which is only made observations or observations during the study and no intervention is carried out on research variables, which is then carried out statistical analysis to examine the relationship between disease and risk factors.

The design of this study used case control, which was to compare the group of DHF patients (cases) with people who were not patients with DHF (controls) and then retrospectively looked at the risk factors, or current observations in case and control groups.

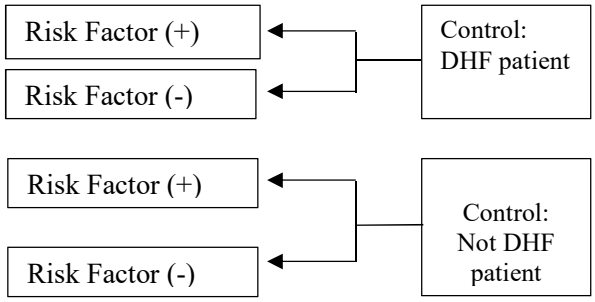

Figure 1. Case Control Research Design

This research was conducted in the 3 highest dengue endemic sub-districts in Pasuruan Regency (Gempol, Beiji and Kraton sub-districts). A sub-district is said to be endemic for DHF if it is found in that sub-district for 3 consecutive years. After calculating the sample size using the sample size calculation application (*Size Determination in Health Studies*) by Lwanga and Lemeshow, a sample of 38 people was obtained. The control sample size was determined in a 1:1 ratio. Therefore, the sample size for each case group and control group was 38 people, so the overall sample size was 76 people.

Results

1. Overview Of Respondents

Table 1. Frequency Distribution of Research Respondents

Characteristics of Respondents	Case		Control	
	n=38	%	n=38	%
Gender				
Male	13	34,21	13	34,21
Female	25	65,79	25	65,79
Age				
5-11 years	7	18,42	7	18,42
12-16 years	10	26,31	10	26,31
17-25 years	8	21,05	8	21,05
26-35 years	5	13,16	5	13,16
36-45 years	6	15,79	6	15,79
46-65 years	2	5,27	2	5,27

Based on table 1, it is known that there are more female respondents than male, as many as 25 respondents (65.79). While the data regarding the age of the respondents were grouped into 6 groups, namely the childhood age group (5-11 years), the early adolescent age group (12-16 years), the late adolescent age group (17-25 years), the early adult age group (26-35 years), the late adult age group (36-45 years), the elderly age group (46-65 years), the elderly age group (>65 years) where in this research the most respondents were the 12-16 year age group (26 ,31%) with the minimum age of the respondent is 12 years.

2. Correlation between environmental factors and the presence of larvae with the incidence of dengue fever

Table 2. Relationship of Environmental Factors and Larvae Presence with DHF Incidence in Pasuruan District

Environmental Factor	DHF incident				Total	%	*p.value*
	Case		Control				
	f	%	f	%			
Water pH							
Optimal For Mosquito Development	33	86,8	21	55,3	54	71,1	0,064
Not Optimal For Mosquito Development	5	13,2	17	44,7	22	28,9	
Indoor Air Temperature							
Optimal For Mosquito Development	31	81,6	22	57,9	53	69,7	0,028
Not Optimal For Mosquito Development	7	18,4	16	42,2	23	30,3	
Air Humidity at Home							
Optimal For Mosquito Development	34	89,5	26	68,4	60	78,9	0,031
Not Optimal For Mosquito Development	4	10,5	12	31,6	16	21,1	
Presence Of Larvae							
There Are larvae	35	92,1	24	63,2	59	77,6	0,005
No Larvae	3	7,9	14	36,8	17	22,4	
Total	38	100	38	100	76	100	

Water pH is an acidic or alkaline condition in waters which is determined based on the pH value (power of hydrogen). The pH value ranges from 0-14, of which pH 7 is normal pH. A pH of less than 7 indicates that the air is acidic, while a pH above 7 indicates that the air is alkaline. Living things or freshwater biota each have different pH conditions.

The results of the study found that there was no relationship between the pH of the water in the water source at home and the incidence of DHF in Pasuruan Regency. This study showed that the water source in the respondent's house in the case group and control group had an optimal pH value for mosquito development (6-7.8). The results of the measurement of the pH of the water at the research location were the lowest 5.8 and the highest 8.2, while the average water pH was 7.008. In this study, the respondent's house on average uses water sourced from dug wells or drilled wells and only a small proportion of respondents use PDAM water sources. The pH of the water in the Regency which has an average pH of acid (high) can encourage the growth of *Ae. aegypti* to be optimal. The state of acidic pH in water sources in Pasuruan Regency is influenced by several factors, one of which is because Pasuruan Regency is far from the sea. The presence of CO2 and the strong alkaline nature of sodium, potassium and calcium ions in seawater tends to change the pH of the water, so that seawater is slightly more alkaline, ranging from 7.5 to 8.4 (Taufiqullah, 2017).

The results of this research are supported by the results of a study conducted by Sallata in 2015 in an endemic area of DHF Makassar City which found 80.7% of houses had a pH that was potential for mosquito growth (Sallata, 2015). pH is a factor that greatly affects the life of Ae. aegypti. The pH of the water that is too acidic or too alkaline will easily lead to the death of the larvae.

Air temperature is one of the factors that can affect the development and life of *Ae. Aegypti* larvae, the air temperature is suitable for the development of *Ae. aegypti* larvae (Boesri, 2007). The rainy season and the dry

season have an influence on the environmental temperature. This influence is local with a certain period of time, this is due to more complex temperature and humidity levels and global, regional and topographical and vegetation phenomena. An increase in temperature will be followed by a decrease in the growth of DHF mosquito larvae which results in a decrease in the number of DHF sufferers. Rising temperatures can shorten the life expectancy of mosquitoes and interfere with the development of pathogens. Egg *Ae. aegypti* attached to the wall surface of a moist water reservoir can undergo a perfect embryonic process at a temperature of 25-30 °C for 72 hours (Sucipto, 2011). The optimal temperature for the development of *Ae. aegypti* is 25ºC–30C (WHO, 2003).

The results of the research found that the air temperature in the house was related to the incidence of DHF in Pasuruan Regency. The house temperature of both the DHF case group and the control group was not much different and optimal for mosquito development, statistical analysis showed a significant relationship. Measurement of temperature in the respondent's house obtained minimum and maximum air temperatures between 27-320C with sunny weather conditions and not much different from the previous months in 2017. Referring to BPS data of Pasuruan Regency, the average air temperature is 28-290C . This temperature is the optimum temperature for the development of *Ae. aegypti*.

The cause of uniformity in temperature in the house is due to the relatively low environmental temperature at the time of the study because the weather is always cloudy and tends to rain. This result is also in line with the results of a study conducted by Sofia in 2014 which found that 70% of the air temperature in the respondent's house in the case group was optimal for the development of mosquitoes (25-270C) in Aceh Besar District (Sofia, 2014).

The results of this study are supported by the results of research conducted by Sofia *et al* (2014) in Aceh Besar District which states that there is a relationship between air temperature and the incidence of DHF. The role of air temperature in the house is very important in every stage of mosquito development and each stage of development requires temperature. different. Namely for hatching eggs requires a temperature of 13ºC, laying eggs requires a temperature of >22ºC and mosquito growth will stop <10ºC or > 40ºC with the optimum temperature for mosquito development is 25ºC – 30ºC (Depkes RI, 2004; WHO, 2003). So that if there is an increase in temperature, it will cause mosquito population density, an increase in the number of disease agents in the mosquito's body and ultimately increase the incidence of DHF.

Air humidity is the amount of water vapor contained in the air expressed in terms of weight of water vapor (g/m3). Because air temperature and air pressure affect air humidity, air humidity is usually measured and expressed as relative humidity. Relative humidity is the percentage of water vapor in the air when the measurement is carried out compared to the saturated air humidity at the same temperature and pressure (Suin, 1999 in Susana, 2011). Low humidity shortens the lifespan of mosquitoes, although it has no effect on parasites. The humidity level of 60% is the minimum limit to allow mosquitoes to live (Suryadi, 2012).

The results of the study found that there was a relationship between humidity in the house and the incidence of dengue fever in Pasuruan Regency. Humidity conditions at the time of field measurements found that almost all houses had good humidity levels for the development of mosquitoes. The results of the measurement of humidity at the research location were the lowest was 56.4% and the highest was 72.3%, while the average humidity was 63.82%. The results of this study are in accordance with the results of research conducted by Sofia in 2014, which is 94% humidity in the respondent's house in the case group, which is good for the development of *Ae. aegypti* in Aceh Besar District. The average humidity at the time of measurement is 88-89%, this result is in accordance with Pasuruan Regency humidity data, namely the average humidity calculated from January - December is 89% (BPS, 2017).

At humidity less than 60%, the mosquito life will be shorter because when the humidity is low, it causes evaporation of water from the mosquito's body, causing dryness of the body fluids, besides that mosquitoes cannot become vectors because there is not enough time to transfer the virus from the stomach to the glands mosquito saliva. Therefore humidity above 60% make the life of DHF vectors longer and have the potential to breed (Herawati Y et al, 2014).

At the time of flying mosquitoes need more oxygen so that the air is open and this situation causes the air and the mosquito's body to become larger. To keep water reserves in the body from evaporating, the flight distance of mosquitoes is limited. Optimal air humidity will cause mosquito survival to increase (Sucipto, 2011).

The presence of *Ae. aegypti* in an area is an indicator of the presence of *Ae. aegypti* in the region. According to the Indonesian Ministry of Health (2005), if the ABJ < 95% or HI > 5%, it means that there is a population of dengue-transmitting mosquitoes. The high density of *Ae. aegypti* will increase the risk of dengue virus

transmission. As long as the larvae in breeding places are not eradicated, new mosquitoes will hatch and the transmission of the dengue virus will reoccur (Depkes RI, 2005).

The results of the study found that the presence of larvae was associated with the incidence of DHF in Pasuruan Regency. This study found the presence of almost all houses in the case and control groups. The presence of larvae was found more in the case group than in the control group's home. The large number of respondents' houses that were found to be larvae indicated that the possibility of the risk of DHF transmission was still high. The existence of larvae is caused by the fact that the community has not fully implemented 3M practices. The high presence of larvae shows that the mosquito population density is also high, so there is a risk of transmitting dengue disease not only to the home owner but also to the community around the house because of *Ae. aegypti* can fly up to 100 meters.

This is supported by a study conducted by Purba in 2014 on the effect of larval density and PSN with the incidence of DHF in which the presence of the most larvae was found in the case group, namely 61.2% while the control group was 53.1% (Purba, 2014). This study is also in accordance with Pyko's research in 2016 regarding the relationship between the presence of larvae and 3M behavior with the incidence of dengue fever in the Pariaman Health Center work area that most of the respondents in the positive case group found larvae, which was 47.5% higher than the positive control group respondents, which were as many as 20% (Pyko, 2016).

The presence of larvae is generally found in bathtubs and other water reservoirs such as buckets. This is due to the respondent's lack of self-awareness of the cleanliness of water reservoirs. The water reservoir is left alone until the water is used up and then refilled without being closed. Trash cans, used drinking water glasses, used tires located around the yard of the house are also allowed to pool in water, so that they are used as breeding places by mosquitoes. For this reason, it is very important to drain the water reservoir and close the water reservoirs and bury used goods.

Drying of water reservoirs needs to be done regularly at least once a week by brushing and using soap so as not to breed in that place. Drainage is carried out at least once a week because the metamorphosis phase of mosquito larvae into an adult form is 8 days, so to break the mosquito breeding chain, draining is done once a week. Another solution besides avoiding the presence of positive larvae in the respondent's house is to replace the tub with a bucket because using a bucket is easier to drain the water reservoir and it is easier to remove water from the water reservoir than the bath.

Conclusions And Recommendations

The factors that most play a role in increasing the risk of dengue fever in Pasuruan Regency are the pH of the water, the temperature in the house and the humidity of the air in the house. Cross-sectoral collaboration is needed to pay attention to environmental sanitation conditions so that it does not become a good place for the development of Ae. aegypti. Provide counseling to the community that focuses on the source of the problem, and the community in order to prevent the occurrence of dengue transmission by breaking the chain of transmission.

Thank you note

The author would like to thank the relevant parties who have helped so that the implementation of this research can run smoothly.

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