



## **Analysis Of Environmental Factors With The Incidence *Dengue Hemorrhagic Fever (Dhf)* In The Working Area Of Public Health Center Mranti Purworejo Regency**

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### **Abstract**

*Dengue Hemorrhagic Fever (DHF)* is a disease that happened in Purworejo Regency which the number of cases each year is quite high and fluctuating. Public Health Mranti is a Public Health Center in Purworejo that has most DHF cases. The purpose of this study was to analyze environmental factors with the incidence of DHF in the working area of Public Health Center Mranti. The type of this research was an analytic observational study with cross sectional approach. The population were

all family who lives in the working area of Public Health Center Mranti. The sample were people as many as 74 respondents who were selected using simple random sampling. This research used univariate and bivariate analysis (*chi square*) to analyze the data. During the study, 103 containers positive larvae and 407 containers negative larvae were found. The results from *chi square* analysis, indoor temperature (p-value=0,038, PR=2,692), outdoor temperature (p-value=0,008, PR=3,343), indoor and outdoor humidity (p-value=0,294, PR=0,514), existence of breeding places (p-value=0,794, PR=0,818), presence of hanging dirty clothes (p-value=0,018, PR=4,592), presence of darkroom (p-value=0,012, PR=3,167), presence of vegetation (p-value=1,000, PR=1,377), House Index (p-value=0,000, PR=3,242), Container Index (p-value=0,012, PR=2,211), Breteau Index (p-value=0,481, PR=2,125), and Larva Free Rate (p-value=0,859, PR=1,200). In conclusion, variables associated with the incidence of DHF were indoor temperature, outdoor temperature, presence of hanging dirty clothes, presence of dark rooms, House Index (HI), and Container Index (CI)

**Keywords:** *DHF, Temperature, Humidity, Breeding Places, Resting Places*

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## Introduction

DHF is a disease caused by the *Dengue* virus from the genus *Flavivirus*, family *Flaviviridae*, which is transmitted by *Aedes* mosquito. (Kemenkes, 2010). The World Health Organization estimates that the world's population at risk for dengue disease reaches 40% (2.5 billion), especially those living in urban areas in tropical and subtropical countries. (Dewi & Azam, 2017) The continent that ranks first with the most dengue cases is Asia. From 1968 until 2009, WHO noted the country with the highest DHF cases in Southeast Asia is Indonesia. (Kementerian Kesehatan RI., 2015)

In Indonesia, in the year of 2015 was 129,650 DHF cases with Incidence Rate (IR) of 50.75 and a Case Fatality Rate (CFR) of 0.83%. Then in 2016 it increased to 201,885 cases with an IR of 73.96 and a CFR of 0.79%. From 2020 to July, dengue cases in Indonesia reached 71,633. One of the ten provinces with the highest number of cases is Central Java. Based on data from the Central Java Provincial Health Office, IR DBD Central Java Province in 2018 was 10.2 and in 2019 increased to 25.9. CFR in 2018 of 1.1% and in 2019 there was an increase to 1.5%. The number of dengue cases was in third place in Purworejo Regency.

From the data of the Purworejo District Health Office, in Purworejo Regency, the number of DHF cases was 265 cases in 2016 (IR 37.18 per 100,000 population and CFR 1.5%), 104 cases in 2017 (IR 14.55 and 0% CFR), 93 cases in 2018 (IR 12.98 and 0% CFR), and 141 cases in 2019 (IR 19.62 and CFR 2.8%). Meanwhile, in 2020, up to week 45, there were 125 dengue cases recorded in Purworejo Regency. From these data, it can be seen that the cases of dengue fever are still increasing every year. This shows this disease that needs attention and treatment.

One of the Public Health Center in Purworejo Regency which has a working area with the most cases of DHF is Public Health Center Mranti. In 2020 in the working area of the Public Health Center Mranti there were 38 cases of dengue fever. Many cases of DHF are caused by areas that vary from lowland to highland. Some areas in the highlands are in the middle of the mountains so that there are lots of trees where these areas are suitable as resting places for the *Aedes aegypti*. The lowlands are in the middle of a district with a high population density so that there are many places that can be breeding grounds and resting places for mosquitoes that cause DHF. A very close distance from one house to another can spread disease easily and quickly. Factors that association with the DHF incidence include host, environment, and agents factors. (Nurdin & Zakiyuddin, 2018)

Environmental factor divided into physical environment consisting of home distance. humidity, temperature, climate, TPA (Water Storage Place), and Rainfall. Other environmental



factor is Biological Environment. That affects the transmission of DHF is mainly the number of plants and garden plants, which affect humidity and lighting in the house. (Prasetyani, 2015)

Breeding place is a potential water reservoir as a breeding places for mosquitoes. The main breeding places for the *Aedes aegypti* is a pool of water collected in a place or vessel in or around the house or public places, usually not more than 100 meters from the house. *Aedes aegypti* mosquitoes cannot breed in standing water that is in direct contact with the ground. (Puteri, Tika Adelia, 2018) Examples of Breeding places are used tires, coconut shells, dispensers, jars, drums, used cans, bird drinking containers, flower vases, discarded bottles. any place can allow stagnant water because it is not grounded. (Sulistyo & dkk, 2018)

Resting Places are places where *Aedes aegypti* mosquitoes rest when they are full of blood to digest protein, blood, water and salt. After resting for 1-2 hours, *Aedes aegypti* will return to determine a shady, damp, and uninterrupted place until the egg ripening process is complete (half-gravid and gravid). (Suwandono, Agus, 2019) Resting places for *Aedes aegypti* mosquitoes include hanging clothes, dark rooms, and on vegetation (plants) at home. (Puteri, Tika Adelia, 2018)

Various efforts have been made by health workers from the Health Office to health workers from Public Health Center. However, the incidence of DHF in the Public Health Center Mranti working area is still increasing every year. The incidence of DHF and its environmental factors are still a problem in handling dengue fever in Purworejo Regency, especially in the working area of Public Health Center Mranti which makes researchers interested in analyzing how environmental factors can influence occurrence of DHF cases in the Public Health Center Mranti working area. The purpose of this study was to analyze environmental factors with the incidence of DHF in the working area of the Public Health Center Mranti

## Method

This research use analytic observational study with cross sectional approach. Research emphasizes on numerical data which will be processed using excel and SPSS. The population was all family who lived in the working area of the Public Health Center Mranti in 2020. The sample in this study was calculated using the *Lemeshow* formula and produced a minimum sample of 74 respondents who were selected using simple random sampling by lottery technique. The independent variables in this study were temperature inside and outside the house, humidity inside and outside the house, the presence of breeding places for mosquitoes, the presence of resting places for mosquitoes, *House Index (HI)*, *Container Index (CI)*, *Breteau Index (BI)*, and *Larva Free Numbers (ABJ)*. The dependent variable is the incidence of DHF in the Working Area of the Public Health Center Mranti. Data obtained from primary data (interviews and observations and secondary data from



related agencies. This research used univariate and bivariate analysis with *Chi Square Test* to analyze the data

## Result

Public Health Center Mranti is health center located in Purworejo District, Purworejo Regency which has a working area of 8 sub-districts. The working area of Public Health Center Mranti is 11.05 km<sup>2</sup> with a topography that varies from lowlands to hills with a wet tropical climate. The average temperature is 19-30°C while the humidity is between 70-90%. Annual rainfall is 2318 mm/year. The population in the Public Health Center Mranti in 2020 is 30,904 people with a population density of 27.89 people per hectare. Incidence of DHF in Public Health Center Mranti working area fluctuates. In 2018 there were 20 cases with an IR of 6,47 and a CFR of 0%. Then in the following year, 2019 there were 39 cases with an IR of 12,61 and a CFR of 0%. Then in 2020 there were 38 cases with an IR of 12.29 and a CFR of 0%. Respondents in this study were 74 with the most ages in the range of 17-25 years, namely 35.1% (26 respondents). For gender, the majority of respondents are women by 51.4% (38 respondents). The education level of the most respondents is SMA/SMK, which is 60.8% (45 respondents). the type of working of the respondents that was mostly students was 25.7% (19 respondents).

### 1. Temperature and Humidity

Table 1. Frequency Distribution of Temperature and Humidity

| No. | Variables                 | N  | %    | Mean | Min  | Max  |
|-----|---------------------------|----|------|------|------|------|
| 1.  | Indoor temperature        |    |      |      |      |      |
|     | At Risk (25-30°C)         | 39 | 52,7 | 29,2 | 27,9 | 29,9 |
|     | Not risk (<25°C or >30°C) | 35 | 47,3 | 30,7 | 30,1 | 32,9 |
| 2.  | Outdoor temperature       |    |      |      |      |      |
|     | At Risk (25-30°C)         | 35 | 47,3 | 29,2 | 27,9 | 29,9 |
|     | Not risk (<25°C or >30°C) | 39 | 52,7 | 30,8 | 30,1 | 33,1 |
| 3.  | Indoor Humidity           |    |      |      |      |      |
|     | At risk (≥60%)            | 70 | 94,6 | 75,7 | 68   | 82   |
|     | Not risk(<60%)            | 4  | 5,4  | 57,8 | 57   | 58   |
| 4.  | Outdoor Humidity          |    |      |      |      |      |
|     | At risk (≥60%)            | 70 | 94,6 | 75,7 | 68   | 82   |
|     | Not risk(<60%)            | 4  | 5,4  | 57,8 | 57   | 58   |

From Table 1, it can be seen that as many as 39 respondent's houses (52.7%) have an indoor temperature that is at risk as a breeding places for mosquitoes, while the other 35



respondents (47.9%) have an inside air temperature that is not at risk. For outdoor temperature, 39 respondents (52.7%) have an outside air temperature that is not at risk as a breeding places for mosquitoes, while, 35 respondents' houses (47.3%) had outside air temperatures that were at risk. For indoor and outdoor humidity, as many as 70 respondents (94.6%) have humidity inside and outside the house which is at risk as a place for mosquito breeding , while 4 respondents (5.4%) have humidity inside and outside the house that is not at risk

## 2. The Existence of Breeding Places

Table 5 The existence of breeding places in the respondent's house

| <i>Container Type</i>          | <b>Positive Larvae</b> |              | <b>Negative Larvae</b> |              | <b>Total</b> |            |
|--------------------------------|------------------------|--------------|------------------------|--------------|--------------|------------|
|                                | <b>n</b>               | <b>%</b>     | <b>n</b>               | <b>%</b>     | <b>n</b>     | <b>%</b>   |
| Bathtub                        | 22                     | 31,88        | 47                     | 68,12        | 69           | 100        |
| Bucket                         | 43                     | 25,30        | 127                    | 74,70        | 170          | 100        |
| Crock                          | 0                      | 0            | 9                      | 100          | 9            | 100        |
| Drums                          | 3                      | 42,86        | 4                      | 57,14        | 7            | 100        |
| Water Tank                     | 0                      | 0            | 12                     | 100          | 12           | 100        |
| Fish Pond                      | 2                      | 7,40         | 25                     | 92,60        | 27           | 100        |
| Dispenser                      | 14                     | 26,92        | 38                     | 73,08        | 52           | 100        |
| Pet Drinking Bin               | 2                      | 3,13         | 62                     | 96,87        | 64           | 100        |
| Disposal of refrigerator water | 0                      | 0            | 5                      | 100          | 5            | 100        |
| Secondhand                     | 17                     | 20,24        | 67                     | 79,76        | 84           | 100        |
| Bamboo Pieces                  | 0                      | 0            | 11                     | 100          | 11           | 100        |
| <b>Total</b>                   | <b>103</b>             | <b>20,20</b> | <b>407</b>             | <b>79,80</b> | <b>510</b>   | <b>100</b> |

From table 5 it can be seen that a total of 510 containers were found with details of 103 positive larva containers and 407 negative larva containers

## 3. The Existence of Mosquito Resting Places

Table 6 Existence of resting places at home respondents

| <b>Resting Places</b>             | <b>Yes</b>       |                   | <b>No</b>        |                   |
|-----------------------------------|------------------|-------------------|------------------|-------------------|
|                                   | <b>Frequency</b> | <b>Percentage</b> | <b>Frequency</b> | <b>Percentage</b> |
| Presence of Hanging Dirty Clothes | 49               | 66,2              | 25               | 33,8              |
| Presence of Darkroom              | 36               | 48,6              | 38               | 51,4              |
| Presence of Vegetation            | 68               | 91,9              | 6                | 8,1               |



From Table 6 it can be seen that there were 49 respondents (66.2%) who had hanging dirty clothes, 36 respondents (48.6%) have dark rooms, and 68 respondents (91.9%) have vegetation as a resting places

4. The Existence of Larva

Table 7 The Average Calculation Existence of Larva for each hamlet (RW) in each village

| Village            | House Index<br>(HI) | Container<br>Index (CI) | Breteaux<br>Index (BI) | Larva Free<br>Rate (ABJ) |
|--------------------|---------------------|-------------------------|------------------------|--------------------------|
| Pangen Juru Tengah | 37,33               | 17,84                   | 11                     | 32,67                    |
| Mudal              | 44,44               | 11,86                   | 9,67                   | 22,22                    |
| Keseneng           | 28,75               | 13,91                   | 7,25                   | 21,25                    |
| Sindurjan          | 17,71               | 4,12                    | 18,5                   | 57,29                    |
| Pangenrejo         | 34,67               | 17,74                   | 9,5                    | 25,33                    |
| Mranti             | 26,67               | 15,71                   | 6                      | 53,33                    |
| Doplang            | 25                  | 9,4                     | 5                      | 37,5                     |

From Table 7 it can be seen that all villages have average of HI>10% that means there are 7 village that average of HI each halmet (RW) high risk of dengue cases. For CI, as many as 5 villages have average of CI>10% and 2 villages have average of CI<10% that means there are 5 village that average of CI each halmet (RW) high risk of dengue cases. For BI, all villages have average BI<50%. that means there are 7 village that average of BI each halmet(RW) high risk of dengue cases. Then, for Larva Free Rate (ABJ), all village have ABJ < 95% that means there are 7 village that average of ABJ each halmet(RW) high risk of dengue cases.

5. The Result of Environmental Factor Test with DHF Incidence

Table 8 Recapitulation of Environmental Factor Analysis Results with DHF Incidence

| No | Variable                          | p-value | PR    | 95%CI        |
|----|-----------------------------------|---------|-------|--------------|
| 1. | Indoor temperature                | 0,038   | 2,692 | 1,091-6,645  |
| 2. | Outdoor temperature               | 0,008   | 3,343 | 1,354-8,250  |
| 3. | Indoor humidity                   | 0,294   | 0,514 | 0,179-1,481  |
| 4. | Outdoor humidity                  | 0,294   | 0,514 | 0,179-1,481  |
| 5. | Existence of Breeding Places      | 0,794   | 0,818 | 0,385-1,739  |
| 6. | Presence of Hanging Dirty Clothes | 0,018   | 4,592 | 1,156-18,237 |
| 7. | Presence of a Darkroom            | 0,012   | 3,167 | 1,283-7,817  |
| 8. | Presence of Vegetation            | 1,000   | 1,377 | 0,229-8,282  |
| 9. | House Index (HI)                  | 0,000   | 3,242 | 1,642-6,401  |



|     |                       |       |       |             |
|-----|-----------------------|-------|-------|-------------|
| 10. | Container Index (CI)  | 0,012 | 2,211 | 1,272-3,840 |
| 11. | Breteaues Index (BI)  | 0,481 | 2,125 | 1,588-3,716 |
| 12. | Free Larva Rate (ABJ) | 0,859 | 1,200 | 0,574-2,509 |

From Table 8, it can be seen that the variables indoor temperature, outdoor temperature, the presence of hanging clothes, the presence of a dark room, HI, and CI have a association with the incidence of DHF. While the variables indoor humidity, outdoor humidity, the presence of breeding places, the presence of vegetation, BI, and ABJ do not have association with the incidence of DHF.

### Discussion

Air temperature is said to be risky if the measurement results show between 25-30°C, while it is said to be not at risk if the measurement results show <25°C or> 30°C. The result *p-value* of the indoor temperature is 0.019 ( $p \leq 0.05$ ), that means there is a association between the indoor temperature and the incidence of DHF. For outdoor temperature, *p-value* = 0.008 ( $p \leq 0.05$ ), that means there is a association between the outdoor temperature and the incidence of DHF. Temperature is an important environmental parameter in increasing vector breeding, gonotropic cycle of mosquitoes, bite rate, shortens the incubation of pathogens and extends the lifespan of adult mosquitoes. In addition, higher temperatures can increase the development rate of larvae. In adult mosquitoes, higher temperatures can increase mosquito bite rates and reduce the time it takes for the virus to replicate in the mosquito's body. (Gama & Nakagoshi, 2013).

Humidity is said to be risky if 60% and said to be not at risk if <60%. From the Chi Square test, the *p-value* is 0.294 ( $p > 0.05$ ) which has no significant association between humidity in the house and the incidence of DHF. For outdoor humidity, *p-value* is 0.294 ( $p > 0.05$ ), which means that there is no association between outdoor humidity and the incidence of DHF. Humidity is not associated with dengue cases but affects the transmission of vector borne disease. Mosquito are sensitive with the humidity. Humidity associated with the mosquito's respiratory system that uses trachea with spiracle is in an open condition so that sensitives with the humidity in the environment. If the humidity in the environment is low, the water evaporation from the mosquito's will make the mosquito lack body fluids. (Putri & Dkk, 2020) Humidity also affects the time of mosquito eggs to hatch. So the higher the humidity, the higher the population of the *Aedes aegypti* mosquito. (Herawati, Y., dan Utomo, S.W., 2014)

The existence of Breeding Places is an index of measuring the presence of places that have potential as breeding places for mosquitoes. From the Chi Square test, *p-value* = 0.794 ( $p > 0.05$ ), that means there is no association between the presence of Breeding Places and the incidence of DHF. Many houses of respondents without DHF have Breeding Places in their houses. Meanwhile,



some respondents with DHF had far fewer Breeding Places than non-DHF patients and after being observed there were no larvae in the houses and container. This shows that breeding places are not related to the incidence of DHF, since it could be influenced by other influential factors like temperature.

The existence of hanging dirty clothes habits has  $p\text{-value} = 0.018 (<0.05)$ , that means there is a association between the presence of hanging dirty clothes habits and the incidence of DHF. Most of the research respondents had a habit of hanging dirty clothes at their homes. The existence of hanging dirty clothes is a favorite place for mosquitoes to rest after sucking blood. *Aedes aegypti* mosquitoes like hanging clothes that have been worn because in these clothes there are several substances that can attract mosquitoes including amino acids, lactic acid and other substances. Mosquitoes are attracted to the smell of the human body because carbon dioxide is the result of breathing. So if there are hanging dirty clothes, it will increase the mosquito population that lives in the house and can be associated with the incidence of DHF.

For the presense of dark rooms, the result of  $p\text{-value}$  is 0.012 ( $<0.05$ ), that means there is a association between the presence of dark rooms and the incidence of DHF. Many respondents were in the room when the *Aedes aegypti* mosquito had its biting activity, usually at 08.00-13.00. The existence of a dark room has the potential to become a resting place for mosquitoes. The dark room becomes a favorite place for mosquitoes to rest after sucking blood. Then the mosquito will suck again until the mosquito has enough blood for the maturation of its eggs. If mosquitoes rest in a dark room and then move to suck blood from healthy people, dengue virus can be transmitted.

The presence of vegetation, the result of  $p\text{-value}$  is 1,000 ( $> 0.05$ ). that means there is no association between the presence of vegetation and the incidence of dengue fever. Almost all respondents have vegetation / plants in their house, but only a small proportion of these plants use water as their growth media so it doesn't have the potential to be breeding places and not association with DHF.

House Index risky if  $>10\%$  and not risky  $<10\%$ . For the HI, the Chi Square test produce  $p\text{-value} = 0,000 (< 0.05)$  that means there is a association between the House Index and incidence of dengue fever. The house index variable has a significant relationship because the house of the larvae positive case and having many larvae positive water reservoirs will cause the risk of being exposed to DHF. This parameter is weak in the risk of disease transmission because it does not calculate TPA so that to support the HI number, CI numbers can also be measured. (Sunaryo & Pramestuti, 2014). The HI value describes the percentage of houses that are positive for vector reproduction so that it can reflect the number of populations at risk. (Ummi & Dkk, 2017) The higher the HI, the higher the mosquito density so that the risk of people in the area to contact with mosquitoes. (Kinansi & Dkk, 2017)



Container Index risky if  $>10\%$  and not risky  $<10\%$ . The results *p-value* of the  $CI = 0,012 (< 0.05)$  that means there is a association between the Container Index and the incidence of DHF. In areas that have a high CI, there are cases of DHF in there. The higher the density of larvae and mosquitoes, the higher the risk for people in the area to come into contact with mosquitoes and to be infected with the virus, so it needs greater attention because it will affect the continuous increase in the mosquito population. The presence of larvae plays a role in increasing the risk of transmission of dengue fever. A high CI will increase the risk of DHF. The presence of larvae plays a greater role in increasing the risk of dengue transmission, while the main cause of dengue fever is the adult mosquitoes that transmit dengue.

Breitaux Index risky if  $\geq 50\%$  and not risky  $<50\%$ . The result *p-value* of  $BI = 0,481 (> 0.05)$ . that means there is no association between the BI and the incidence of DHF. The BI results are also caused by the fact that many respondent' houses without DHF who have containers in their homes with larvae in it. This shows that BI is not related to the incidence of DHF because DHF case is influenced by other more influential factors, such as house temperature. For estimating vector density, the best index is BI because combines containers and houses. (Purnama & Baskoro, 2012) House that have a high BI category, resulting in a higher density of larvae in the area and increases the risk of transmission of DHF.

Larva Free Rate risky if  $\leq 95\%$  and not risky  $>95\%$ . The result *p-value* of larva-free rate (ABJ)  $= 0,859 (> 0.05)$  that means there is no association between the Larva Free Rate and the incidence of DHF. Larva Free Rate (ABJ) shows the density of larvae in an area. A low ABJ indicates a high larval density and *Aedes aegypti* mosquito population in the region. Low ABJ plays a very important role in the transmission and spread of DHF disease .(Kurniawati & Yudhastuti, 2016) The larva-free rate is an indicator of the success of the DHF prevention program. In accordance with WHO provisions that the House Index should not be more than 5% or larva-free rate (ABJ) 95% or more.(Sayono & Nurullita, 2016)

## Conclusion

Variables that have association with the incidence of DHF are indoor temperature, the outdoor temperature, the presence of hanging clothes, the presence of a dark room, *House Index*, and *Container index*. While, variables that don't have association with the incidence of DHF are indoor humidity, outdoor humidity, the presence of Breeding Places, the presence of vegetation, Breitaux Index, and Larva Free Rate



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