CORRELATION BETWEEN AIR TEMPERATURE AND HUMIDITY WITH THE PRESENCE OF AEDES AEGYPTI LARVAE

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Abstract: **Dengue Hemorrhagic Fever (DHF) is a disease that spread by mosquito type Aedes aegypti.** The room condition for the water container, such as air temperature and humidity, are factors that influence the presence of *Aedes aegypti* larvae and whether those are favourable for breeding and their growth to be mature and act as DHF vector. This study aims to know the correlation between environmental factors of the location of the water container, assessed from room temperature and humidity with the presence of *Aedes Aegypti* larvae in elementary school in Banjarbaru Utara Regency. This is an observational analytic study. Samples obtained were rooms where water container was located in elementary schools in Banjarbaru Utara Regency. Data were then analysed using chi-square. The results are 19.2% rooms with optimum temperature and 85.9% rooms with optimum humidity for the growth of *Aedes aegypti* larvae. There were 39.1% water containers with no larvae, 12.2% were found few larvae, and 48.7% were found many larvae. From the analysis, there was no significant correlation between room temperature and the presence of Aedes larvae, yet there was found a correlation between air humidity and the presence of Aedes larvae in elementary school in Banjarbaru Utara area.

Keywords: DHF - *Aedes aegypti* larvae – temperature – humidity – water container

INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is one of the health problems mostly found in tropical and subtropical areas. *World Health Organization* (WHO) reported that DHF cases are increasing this past 50 years. Approximately 2-5 billion people living in DHF endemic areas and more than 70% live in Southeast Asia and the West Pacific. Every year there are about 50 million people suffered from DHF and most of them are children. One example of a country with DHF endemic is Indonesia. [1,2,3]

In Indonesia, DHF cases tend to increase every year. Based on data from the Health Department in 2014 showed there were 71.668 DHF cases and 641 of them died from the disease. One of the provinces in Indonesia with DHF endemic is West Kalimantan.[2,4,5] In 2008, DHF cases were increasing with incidence rate (IR) 14,44/100.000 people and case fatality rate (CFR) 1,70%. In 2009 (January-September), the IR was 11.26/100.000 people with CFR 1.91%. Most cases occurred in Banjarbaru, Banjarmasin, and Banjar Regency.[6,7]

In Banjarbaru City, based on Health Board of Kota Banjarbaru, there was reported an increasing number of DHF cases in 2014 to 2015. In 2014 the IR was 40/100.000 people with CFR 0.25% and in 2015 the IR was 267.1/100.000 people with CFR 0.03%. The highest number of cases is in Banjarbaru Utara Regency. In 2015, there were 61 cases and during January-March 2016 there were already 95 cases. The highest incidence was children aged 6-13 years old, which are classified as elementary school-aged children. [8]

The increasing number of DHF case was related to the presence of *Aedes aegypti* as DHF vector. This type of mosquito tends to live around household areas, mostly in water container made by the human. The incidence of DHF was higher in children meanwhile the peak activity of the mosquito is in the morning, when children are at school. This makes the school could be the main place of DHF spread among children. [9,10]

One of factors that affect the incidence of DHF was population number of *Aedes aegypti* larvae. The presence of larvae was influenced by the availability of water containers, such as bathtub, water jar, and flower pot that could be used as their place to breed. The presence of larvae on those places was affected by environmental factors of the room where they were located, such as room temperature and humidity. Average ideal temperature for mosquito growth was 25-29^{0}C, their growth would stop if the temperature was below 10^{0}C or more than 35- 40^{0}C. The best humidity for mosquito was 60-80%. High humidity would support *Aedes aegypti's* growth. Meanwhile low humidity would cause extra evaporation from their body and make them die faster. The density of the Aedes aegypty mosquito larvae changes according to climate change. When entering the rainy season, mosquito larvae breed very quickly so that the density will increase[11,12]. Therefore this research was carried out when it began to enter the rainy season to find out the temperature and humidity at the time when mosquito larvae multiply rapidly.

Because of the high DHF incidence in Banjarbaru Utara Regency, mostly affecting school-aged children and larvae as spreading factor, it was necessary to conduct a study about correlation between environmental factors of room where the water containers are located with the presence of *Aedes aegypti* larvae in elementary schools in Banjarbaru Utara Regency.

RESEARCH METHOD

This study design was observational using a cross-sectional method. Samples obtained were rooms and its water container in all elementary schools in Banjarbaru Utara Regency. Measurements were made in each room that had water reservoirs, carried out at 08.00-12.00

hours, beginning with measuring air temperature and humidity using a Thermohygrometer, then proceeding to examine the presence of Aedes aegypti larvae and larvae calculations if Aedes aegypti larvae were found on water reservoirs. To find out the existence of Aedes aegypti larvae carried out by a visual larva method by seeing the presence or absence of larvae in each water reservoir without taking the larvae. Using the observation form and flashlight as a tool to identify Aedes aegypti larvae.

Data were then analysed using a chi-square test with a confidence interval of 95%.

RESULT AND DISCUSSION

The study was conducted in elementary schools in Banjarbaru Utara Regency, which consisted of 23 schools. The results were listed below:

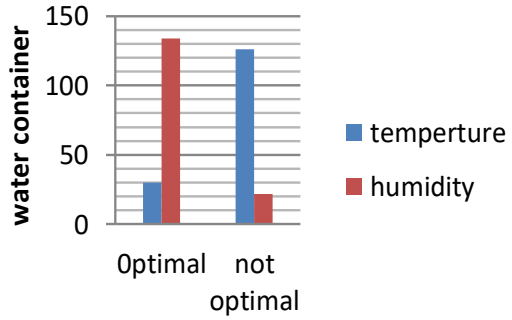

Figure 1. Frequency distribution oftemperature and humidity of the water containers room in Elementary School, North Banjarbaru

Figure 1 showed that from 156 rooms with a water container, their temperature mostly considered not optimum for *Aedes aegypti* larvae (>29^{0}C), which were 126 (80.8%) rooms from 23 elementary schools in Banjarbaru Utara Regency. The temperature inside a house is influenced by season, outside temperature, sunrays, and airflow from ventilation that keep the proper temperature inside the house, so if there were less ventilation, the temperature inside tends to be higher.[13] Also, it could be influenced by the materials and colour of the roof, wall, ventilation, attic corners, and materials of its ceiling. Iron roofing, dark roof, asbestos ceiling, narrow ventilation and roof might cause a higher temperature. [14]

Based on the table above, it was shown that most rooms with water container had high humidity and considered having optimum humidity to support the growth of *Aedes aegypti* larvae. The range of humidity is similarly high (60-80%) in 134 of those rooms. Based on Indonesian Health Ministry Decision No. 829/Menkes/SK/VII/1999, which became requirements for healthy housing, recommended humidity is approximately 40-70%. High humidity will be a right place for the growth of organisms, including *Aedes aegypti* mosquitos and its larvae.[15]

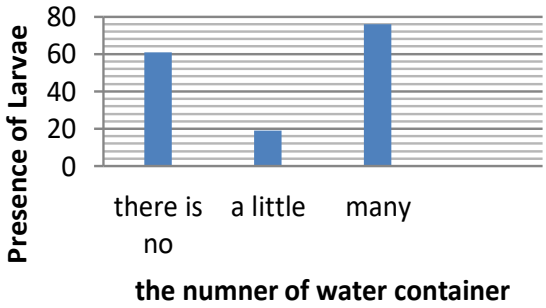

Figure 2. Frequency distribution of the presence of Aedes mosquito larvae at the water containers in the Elementary school, North Banjarbaru

Figure 2 showed that in most water containers in elementary schools in Banjarbaru Utara Regency were found *Aedes aegypti* larvae, most of them are considered many (>5 larvae per water container). This showed that larva free index in water containers in Banjarbaru Utara Regency is only 39.1%, far from national standard, which is 90%.

The presence of larvae acts as an indicator of DHF spread. These larvae may

breed in the housing area and water containers. The availability of water container will affect the presence of *Aedes aegypti* mosquitos. The more water container that available, it was assumed that more larvae would be found. [16]

The high number of larvae in water container in elementary school in Banjarbaru Utara Regency area was correlated with the high number of DHF cases in that area which most of the patients are elementary school students. The increasing number of DHF cases may be caused by the presence of *Aedes aegypti* mosquitos as a vector. This mosquito lives in a household area, mostly on water container. This type of mosquito is diurnal, means actively "hunting" for blood in the afternoon during two peaks, 8-12 a.m. and 4-5 p.m. DHF cases is higher affecting children in the morning when they are at school, which can be the central place of DHF spread among children. [9-10]

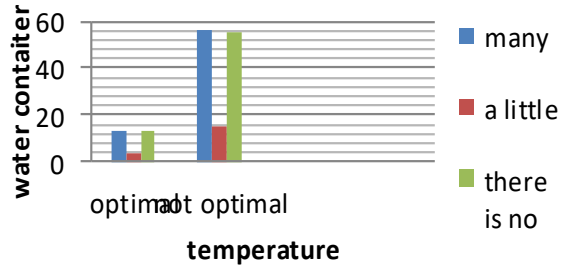

Figure 3. The frequency distribution of the presence of Aedes mosquito larvae is based on the temperature of the water containers room in Elementary School, North Banjarbaru

Figure 3 showed that room where the water container is located, either with optimum temperature or not for the growth of *Aedes aegypti* larvae, were found more larvae. From a statistical test using chi-square were obtained a p-value of 0.967, more significant than 0.05. This showed that there was no correlation between room temperature where the container is located and the presence of larvae.

This study result was consistent to study by Novitasari et al. (2014) which found no correlation between air temperature and presence of Aedes larvae in Sendangguwo Regency Semarang. The result is different from a study by Arifin et al. (2013) which found a correlation between temperature and humidity with a presence of *Aedes aegypti* larvae in dengue endemic area in Kassi-Kassi Village, Makasar.[17-18]

In this study, there were more rooms where the water containers were stored which considered had a high temperature, and in this condition, there were found more larvae of Aedes. In West and East Lereng Muria Mountaineering Central Java was found a species of *Aedes aegypti* that breed in temperature between 32,2-33,7^{0}C.[19] So even generally optimum temperature that is favourable for the growth of Aedes is considered low (25-19^0), nevertheless there was a species that breed in higher temperature. This possibility may also happen in this study area.

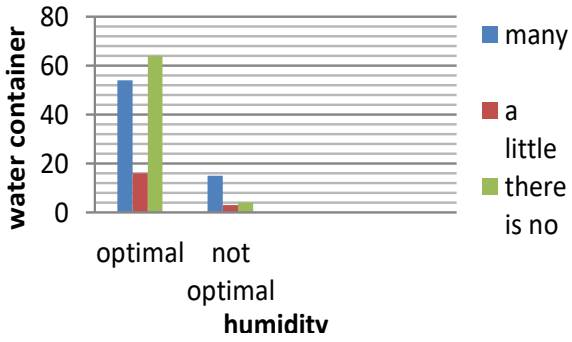

Figure 4. The frequency distribution of the presence of Aedes mosquito larvae is based on the humidity of the water containers room in Elementary School, North Banjarbaru

Based on figure 4 we can see that in a room with optimum humidity was found more Aedes larvae, as much as 54 rooms with many larvae and 16 rooms with only a few larvae.

This high humidity was favourable for *Aedes aegypti* to breed and produce many larvae which live on the water in that room. Meanwhile, low humidity easily caused evaporation which makes mosquitos die faster. [11-12,19-21]

From a statistical test using chi-square, the p-value is 0.007. This value is lower than an alpha value (0.05). This showed that there was a significant correlation between humidity TPA with Aedes larvae in elementary school in Banjarbaru Utara Regency.

This is consistent with a study from Novitasari et al. (2014) that showed there was a correlation between humidity with Aedes larvae Aedes in Sendangguwo Regency Semarang. The same result was also found in a study by Arifin et al. (2013) which showed that there was a correlation between temperature and humidity with larvae of *Aedes aegypti* in dengue endemic area in Kassi-Kassi Village Makasar City.[17]

CONCLUSION

Based on the study, we can conclude that: there was no significant correlation between room temperature of where the water container is located and the presence of *Aedes aegypti* larvae in elementary school in Banjarbaru Utara Regency; and there was a significant correlation between room humidity where the water container is located and the presence of *Aedes aegypti* larvae in elementary school in Banjarbaru Utara Regency.

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