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Impact of Climate on the incidence of Dengue Haemorrhagic fever in Semarang City (Conference Paper) (Open Access)

Khairunisa, U.[a] ✉,   Wahyuningsih, N.E.[a] ✉,   Suhartono[a] ✉,   Hapsari[b] ✉

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Abstract   ⌄ View references (6)

Dengue Haemorrhagic Fever (DHF) is one of major health problems in Indonesia. DHF is a caused by the dengue virus and potentially deadly infection spread by some mosquitos. The mosquito Aedes aegypti is the main species that spreads this disease. The incidence rate of dengue haemorrhagic fever was still increased in 2011 to 2015 in Indonesia. Dengue viruses and their mosquito vectors are sensitive to their environment. Temperature, rainfall and humidity have well-define roles in the transmission cycle. Therefore changes in these conditions may contribute to increasing incidence. The aim of this study was to analyze the relationship between climate factors and the incidence rate of dengue hemorrhagic fever in Semarang City. The type of research was analytic with cross sectional study. The sample used is the climate data from Meteorology, Climatology and Geophysics Agency (BMKG) and the number of dengue cases from Health Office in Semarang City from 2011 to 2016. Data were analyzed using Pearson trials with α=0,05. Base on this study here air temperature and relative humidity were moderate correlation with negative direction on air temperature (p = 0,000 and r = -0, 429), weakly correlation with positive direction on rainfall (p = 0,014 and r = 0,288) and humidity (p=0,001 and r = 0,382) with dengue hemorrhagic fever incidence in Semarang City. The conclusions of this study there were correlation between climate (air temperature, rainfall, and relative humidity) and DHF in Semarang City in 2011-2016. © Published under licence by IOP Publishing Ltd.

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Impact of Climate on the incidence of Dengue Haemorrhagic fever in Semarang City

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Abstract

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Impact of Climate on the incidence of Dengue Haemorrhagic fever in Semarang City

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Abstract. Dengue Haemorrhagic Fever (DHF) is one of major health problems in Indonesia. DHF is a caused by the *dengue virus* and potentially deadly infection spread by some mosquitos. The mosquito *Aedes aegypti* is the main species that spreads this disease. The incidence rate of dengue haemorrhagic fever was still increased in 2011 to 2015 in Indonesia. Dengue viruses and their mosquito vectors are sensitive to their environment. Temperature, rainfall and humidity have well-define roles in the transmission cycle. Therefore changes in these conditions may contribute to increasing incidence. The aim of this study was to analyze the relationship between climate factors and the incidence rate of dengue hemorrhagic fever in Semarang City. The type of research was analytic with cross sectional study. The sample used is the climate data from Meteorology, Climatology and Geophysics Agency (BMKG) and the number of dengue cases from Health Office in Semarang City from 2011 to 2016. Data were analyzed using Pearson trials with α=0,05. Base on this study here air temperature and relative humidity were moderate correlation with negative direction on air temperature (p= 0,000 and r= -0, 429), weakly correlation with positive direction on rainfall (p= 0,014 and r= 0,288) and humidity (p=0,001 and r= 0,382) with dengue hemorrhagic fever incidence in Semarang City. The conclusions of this study there were correlation between climate (air temperature, rainfall, and relative humidity) and DHF in Semarang City in 2011-2016.

Keywords: Dengue Hemorrhagic Fever, Climate, Semarang City

1. Introduction

Dengue haemorrhagic fever (DHF) is caused by the *dengue virus* and potentially deadly infection spread by *Aedes sp*. DHF is characterized by increased vascular permeability, hvpovolaemia and abnormal blood clotting mechanisms. According to report the health ministry of Indonesia, the incidence rate (IR) of dengue haemorrhagic fever was still increased in 2011 to 2015 in Indonesia. IR DHF in 2011 to 2015 in Indonesia were 2011 (IR=25,7), 2012 (IR=31,18), in 2013 (IR=41,25), 2014 (IR=52,75), and 2015 (IR= 89,32). Semarang City in one of the areas in Central Java which has the highest DHF IR in 2014 (IR=92,43). In 2016, the rank of incidence rate DHF in Semarang has decreased to 29th which in 2015 is still ranked 3rd IR DHF.

The number of dengue fever in Indonesia still increasing. Increasing the incidence of DHF is influenced by various factors one of which is the climatic factor. Climate change is one of the most

important environmental changes population. Temperature, rainfall and relative humidity are thought as important climatic factors contributing towards the growth and dispersion of the mosquito vector and potential of dengue outbreaks. Temperature is also capable of affecting patogen replication, maturation and period of infectivity. Climate change is one of the most important environmental changes populations will face in the coming decades. This study was carried out to analyze the relationship between climate and dengue cases in Semarang City in 2011 to 2016.

2. Methods
This type of research is an analytical approach with cross sectional study. The research was conducted in April-May 2017 and located in the Semarang City by using secondary data. Data on the number of dengue cases from the Semarang Health Office reports. Climate data used temperature, humidity and rainfall obtained from Meteorology, Climatology and Geophysics Agency (BMKG) in Semarang City from 2011-2016. Data were analyzed using Pearson with $\alpha=0,05$.

3. Results and Discussion
In this study we have presented an analysis of the association between dengue incidence and climate variables in Semarang City.

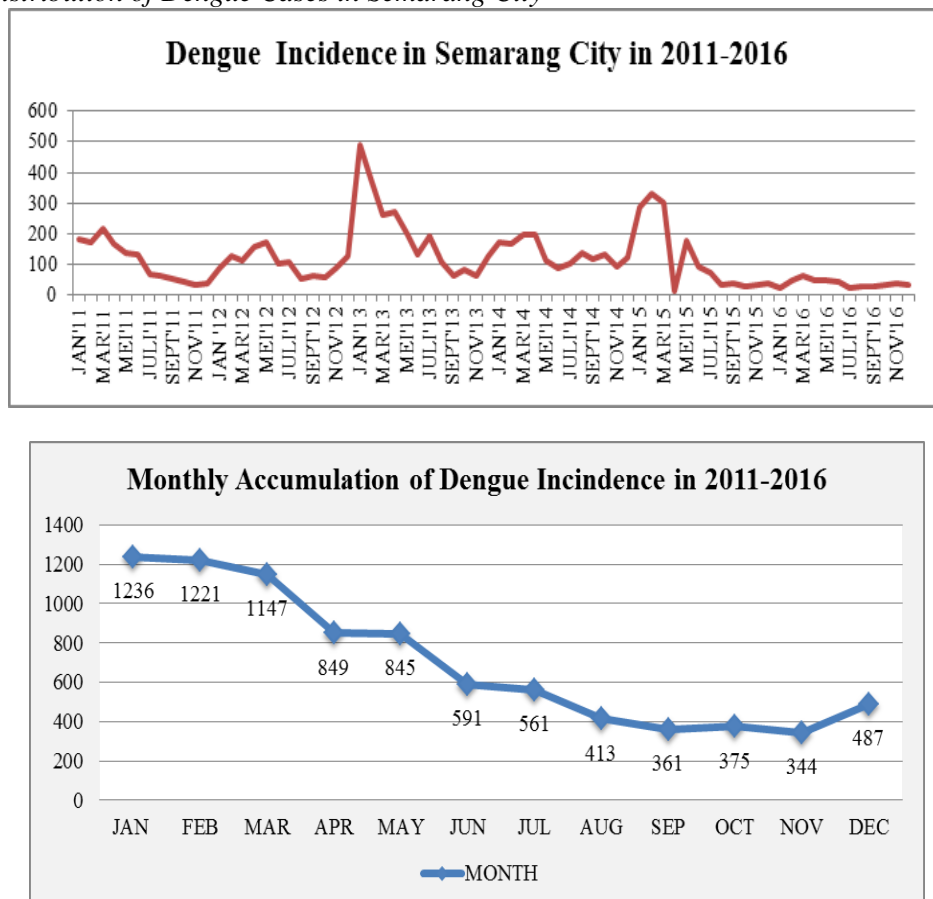*3.1 The Distribution of Dengue Cases in Semarang City*

Figure 1. The Distribution of Dengue Incidence in Semarang City in 2011-2016

Based on the above graph it is known that dengue cases in Semarang from 2011 to 2016 tend to decline. The highest incidence of DHF during 2011-2016 occured in January 2013 which was 48 cases and the lowest number of cases occured in July 2016 which was 21 cases.

Monthly incidence of dengue during the years 2011-2016 showed that increase incidence of dengue consistently occured during January to March with the highest cases were found in January (1236

cases). After March the incidence of dengue declined until December and lowest in November (344 cases).

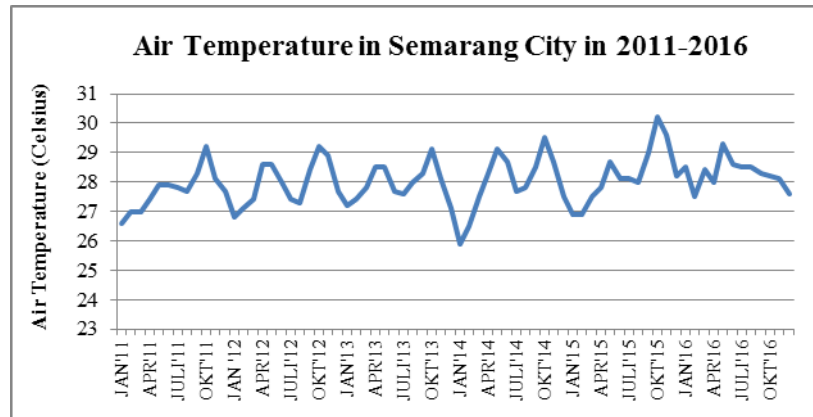*3.2 Air Temperature Relationship with the Incidence of DHF in Semarang City*

Figure 2. Air Temperature in Semarang City in 2011-2016

Figure 2 showed that the air temperature in Semarang City in 2011-2016 tend to increase in each periode of February-May and September-October. The highest air temperature occurred in October 2015 which was 30,2^{o}C.

Table 1. Description Air Temperature in Semarang City in 2011-2016

Year	Mean	Median	Modus	SD	Min-Max
2011-2016	28,021	28,000	28,5	0,7863	25,9-30,2

In the table showed that the average temperature was 28,021 ^{o}C . The lowest temperature was 25,9 ^{o}C and the highest temperature was 30,2 ^{o}C.

Table 2. Results of Air Temperature Correlation Test with Dengue Cases in Semarang City in 2011-2016

Variable	Dengue Cases			Results
	r	*p*	n	
Air Temperature	-0,429	0,000	72	There is correlation

Table 2 showed that air temperature with the incidence of DHF in Semarang City in 2011-2016 is meaningful with *p* value = 0,000. The *r* value of -0,429 shows negative correlation with moderate strength, therefore increasing temperature is followed by a decrease in the incidence of DHF. The results of this study is similar to the research of Arcari, et al (2005) which shows the relationship of temperature with dengue fever in most provinces in Indonesia.
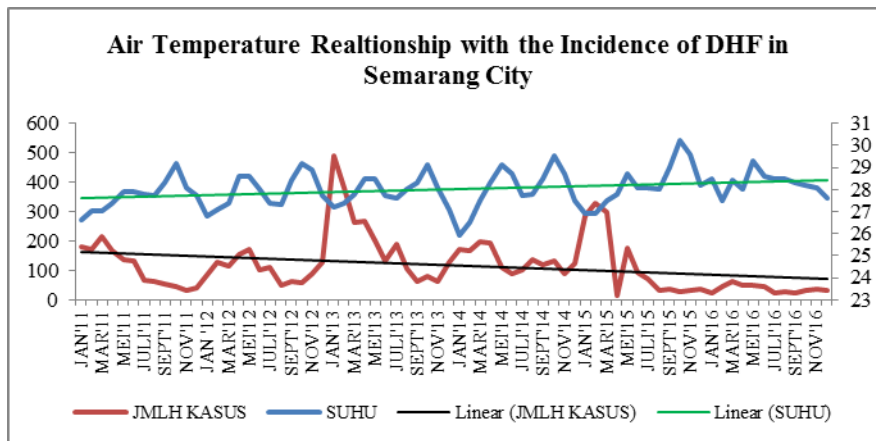
Figure 3. Air Temperature Relationship with the Incidence of DHF in Semarang City in 2011-2016

Based on the above graph, the trend of air temperature during period of 2011-2016 increases while the trend in the incidence of DHF decreased. The range of temperature during 2011-2016 is between 25,9-30,2^{o}C. The pattern of increasing or decreasing the incidence of DHF was significantly followed by temperature.

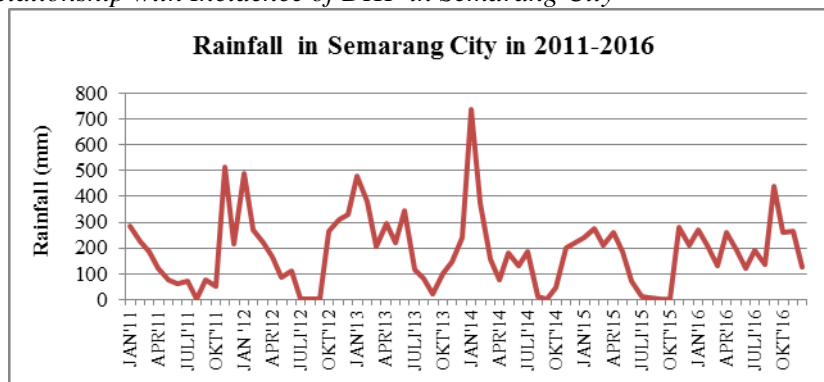*3.3 Rainfall Relationship with Incidence of DHF in Semarang City*

Figure 4. Rainfall in Semarang City in 2011-2016

The figure showed that known the rainfall in Semarang City in 2011-2016 tends to increase every January, October and November. The highest rainfall occured in January 2014 at 736 mm and the lowest rainfall occured in August 2011 and 2012, September 2014, October 2015 at 0 mm.

Table 3. Description of Rainfall in Semarang City in 2011-2016

Year	Mean	Median	Modus	SD	Min-Max
2011-2016	186,240	185,500	0	147,2787	0-736

In the table showed that the average rainfall of Semarang City during 2011-2016 was 186,240 mm. The lowest rainfall was 0 mm and the highest rainfall was 736 mm.

Table 4. Results of Rainfall Correlation Test with Dengue Cases in Semarang City in 2011-2016

Variable	Dengue cases			Results
	r	*p*	n	
Rainfall	0,288	0,014	72	There is correlation

Table 4 showed that there is a meaningful relationship between rainfall with the incidence of DHF in Semarang City in 2011-2016 with *p* values = 0,014. The *r* value of 0, 288 shows positive correlation with weak strength means that there is a direct relationship between rainfall with the incidence of DHF, in case of increased incidence of DHF will be followed by increased rainfall. The results of this study is similar to the research of Djati, Anggun, dkk (2012) which shows the relationship of rainfall with dengue fever (*p* value = 0,000) in Gunung Kidul.
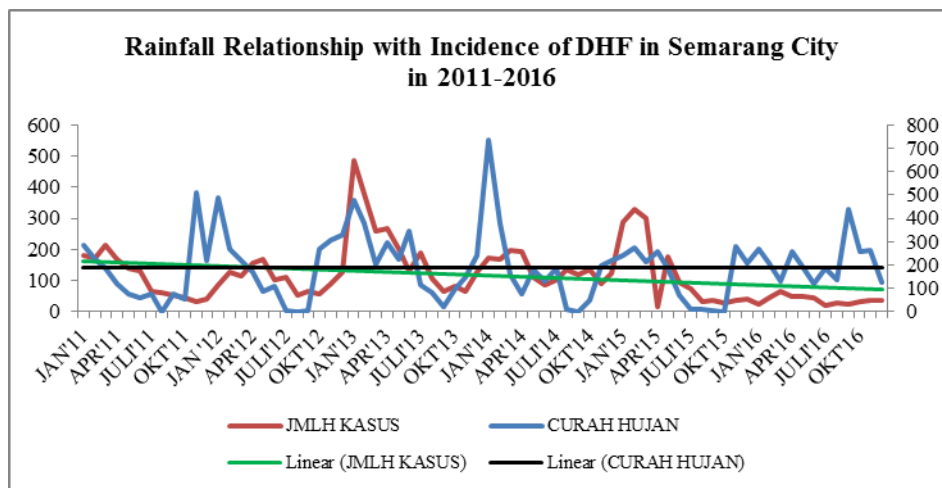

Figure 5. Rainfall Relationship with Incidence of DHF in Semarang City in 2011-2016

Based on the above graph it can be seen that the trend of rainfall increases and the incidence of DHF decreases during the period of 2011-2016. In the figure show that only partial pattern of increased DBD incidence corresponds with the increase of rainfall.

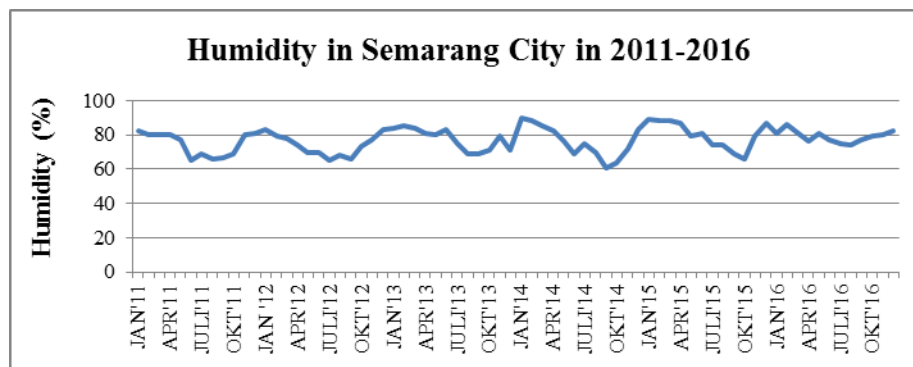*3.4 Humidity Relationship with Incidence of DHF in Semarang City in 2011-2016*

Figure 6. Humidity in Semarang City in 2011-2016

Figure 6 showed that the air humidity in the city of Semarang in 2011-2016 tend to increase every January. The highest humidity occurred in January 2014 which was 90% and the lowest humidity occurred in September 2014 which was 61%.

Table 5. Description Rainfall in Semarang City in 2011-2016

Year	Mean	Median	Modus	SD	Min-Max
2011-2016	76,92	78,50	69	7,045	61-90

Table 5 showed that the average air humidity of Semarang City in 2011-2016 is 76.92%. The lowest air humidity that occurred during the year 2011-2016 amounted to 61% and the highest temperature of 90%.

Table 6. Results of Humidity Correlation Test with Dengue Cases in Semarang City in 2011-2016

Variable	Dengue Cases			Results
	r	p	n	
Humidity	0,382	0,001	72	Theres is correlation

Table 6 showed that there is a meaningful relationship between humidity with the incidence of DHF in Semarang City in 2011-2016 with p values = 0,001. The r value of 0,382 shows positive correlation with weak strength means that there is a direct relationship betwee humidity with the incidence of DHF, in case of increased incidence of DHF will be followed by increased humidity. The results of this study is similar to [6] which shows the relationship of humidity with dengue fever (p value = 0,006) in Gunung Kidul.
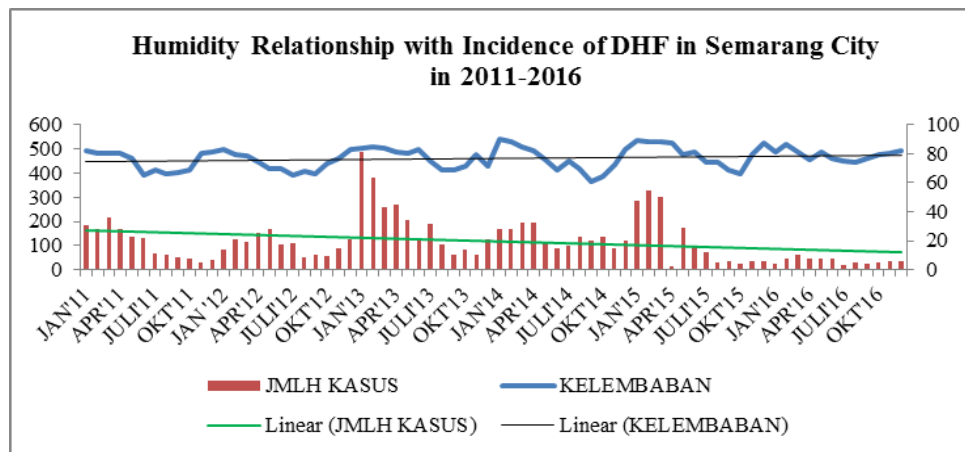

Figure 7. Humidity Relationship with Incidence of DHF in Semarang City in 2011-2016

Based on the above graph it can be seen that the air humidity trend increases while the incidence of DHF decreases during the period of 2011-2016.

4. Conclusion

The highest number of DHF incidence each year was found during the month of January to Maret. Climatic condition showed that higher air temperature reduced the incidence of DHF (p= 0,000 dan r= -0,429), but higher rainfall (p= 0,014 dan r = 0,288) and humidity (p = 0,001 dan r = 0,382) increased the incidence of DHF.

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