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Potential of Rainfall, Humidity and Temperature, Against the Increasing of larvae in Makassar City, Indonesia

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Abstract: ***Cases of dengue hemorrhagic fever are associated with the potential for rainfall, temperature, and humidity. In a month mosquitoes can lay eggs approximately four times. In a month mosquitoes can lay eggs between 400 to 600 eggs. Mosquito eggs can survive, do not hatch, for six months because they do not touch the water. The existence of rainfall, humidity, and the appropriate temperature can accelerate the process of hatching mosquito eggs. Secondary data analysis research methods on BMKG data and Makassar City Health Department data in 2014, 2015, 2016, 2017 and 2018. The data analysis was carried out on 1–8 October 2019. The observation results revealed that high rainfall occurred in January, February, March, April, May and June. In July, August, September the rainfall is very low. Then entering November and December, the rainfall starts to high again. Air temperature does not occur significantly or not too extreme a difference every month. Humidity in the rainy season tends to be high. The incidence of dengue fever in the rainy season tends to increase. The number of mosquito larvae also tends to increase in the rainy season. It is recommended that before entering the rainy season, it should increase awareness of the incidence of dengue fever by reducing mosquito breeding sites through draining, closing, stockpiling. Drain and close the bathtub, and bury cans, plastic, and objects that can become mosquito breeding grounds.***

Keywords: Humidity, Temperature, Rainfall, larvae.

I. INTRODUCTION

Cases of dengue hemorrhagic fever are closely related to the potential for rainfall, temperature and humidity of the air [1]. Where one female larva, will turn into adult mosquitoes within 12-14 days. When laying eggs, adult female mosquitoes can produce 100-150 eggs. In a month mosquitoes can lay eggs approximately four times. In a month mosquitoes can lay eggs
between 400 to 600 eggs. Mosquito eggs can survive, do not hatch, for six months because they do not touch the water. Precipitation, humidity, and the appropriate temperature can accelerate the process of hatching mosquito eggs [2], [3].

Rain causes an increase in air humidity and high rainfall which results in sudden puddles; these mosquito puddles are used as breeding grounds and increase the number of breeding sites which causes an increased incidence of disease. The size of the effect depends on the heavy rain, the type of vector and the type of breeding ground. Rain interspersed with heat increases the likelihood of mosquito breeding [4], [5].

Temperature increase affects the bionomic changes or behavior of mosquito population bites, the average bite level, mosquito reproduction activity is characterized by the development of mosquito breeding and the development of parasitic maturity in the mosquito's body will be shorter. The average optimum temperature for mosquito growth is 25-27 ° C. There is no relationship because the temperature is not directly related to the larvae, or it can be said that the temperature is directly related to the growth of mosquitoes, not the larvae. It can be concluded that there is a significant relationship between humidity with the presence of dengue mosquito larvae. According to the results of measurements of humidity, it is known that the humidity of the respondent's house shows a good category for the development of mosquito larvae (humidity 60-80%) by 60.0% greater than the respondent's house which is not good for breeding mosquito larvae that is 40.0%. Good humidity for breeding mosquito larvae ranges from 60% -80% [6]–[8].

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II. METHODOLOGY

This study uses secondary data analysis on BMKG data and Makassar City Health Department data in 2014, 2015, 2016, 2017 and 2018. The data analysis was carried out on 1 - 8 October 2019.

III. RESULT

The results of observations of rainfall, air temperature, humidity, incidence, and mosquito larvae can be seen in Table 1 below:

Tabel 1. Potential of Rainfall, Air Temperature, Humidity to Incidents and Flies in Makassar City in 2014

Tahun 2014	JAN	FEB	MAR	APR	MEI	JUN	JUL	AGS	SEP	OKT	NOV	DES
Rainfall	836	313	331	282	105	134	30	6			117	673
Air temperature	26.6	27.2	27.6	28.1	28.7	28.2	27.8	27.4	27.8	29	28.9	27.3
Humidity	87	86	85	84	80	81	77	74	67	68	77	87
Incident	11	13	14	19	29	12	11	8	8	5	5	4
+ Flick the House	14	15	15	10	11	11	9	6	6	5	7	6

Source: BMKG South Sulawesi, 2019

Table 1 above illustrates that high rainfall occurs in January, February, March, April, May, and June. In July, August, September the rainfall is very low. Then entering November and December the rainfall starts

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to high again. Air temperature does not occur significantly or not too extreme difference every month. Humidity in the rainy season tends to be high. The incidence of dengue fever in the rainy season tends to increase. The number of mosquito larvae also tends to increase in the rainy season.

Tabel 2. Potential of Rainfall, Air Temperature, Humidity to Incidents and Flies in Makassar City in 2015

Rainfall	926	255	306	204	9	55	-	-	-	-	148	619
Air temperature	26.8	27.2	27.5	27.8	28.3	27.7	27.4	27.3	27.6	29	29.4	27.9
Humidity	89	87	87	84	77	79	72	70	71	69	78	86
Incident	10	22	25	17	16	16	11	7	7	5	3	3
+ Flick the House	11	22	19	9	9	16	9	10	9	4	6	6

Source: BMKG South Sulawesi, 2019

Table 2 above illustrates that high rainfall occurs in January, February, March, April, May, and June. In July, August, September the rainfall is very low. Then entering November and December the rainfall starts to high again. Air temperature does not occur significantly or not too extreme difference every month. Humidity in the rainy season tends to be high. The incidence of dengue fever in the rainy season tends to increase. The number of mosquito larvae also tends to increase in the rainy season

Tabel 3. Potential of Rainfall, Air Temperature, Humidity to Incidents and Flies in Makassar City in 2016

Rainfall	385	727	224	121	44	47	14	0	79	425	150	547
Air temperature	28.6	27.7	28.5	28.8	29.2	28.6	28.1	28.3	28.6	28.4	28.7	28.6
Humidity	83	87	86	85	79	79	78	75	75	80	82	85
Incident	16	53	48	36	34	24	15	6	3	4	6	2
+ Flick the House	20	62	49	38	27	26	16	7	3	4	5	2

Source: BMKG South Sulawesi, 2019

Table 3 above illustrates that high rainfall occurs in January, February, March, April, May, and June. In July, August, September the rainfall is very low. Then entering November and December the rainfall starts to high again. Air temperature does not occur significantly or not too extreme difference every month. Humidity in the rainy season tends to be high. the incidence of dengue fever in the rainy season tends to increase. The number of mosquito larvae also tends to increase in the rainy season.

Tabel 4. Potential of Rainfall, Air Temperature, Humidity to Incidents and Flies in Makassar City in 2017

Rainfall	735	405	448	225	75	195	23	52	68	91	459	955
Air temperature	27	27.6	27.6	28.1	28.6	28	28	27.8	28.6	29	28.2	27.7
Humidity	88	86	88	85	82	82	76	71	71	76	83	86
Incident	11	24	22	12	23	6	9	9	5	4	3	5
+ Flick the House	11	25	13	11	22	6	9	9	7	4	3	3

Source: BMKG South Sulawesi, 2019

Table 4 above illustrates that high rainfall occurs in January, February, March, April, May, and June. In July, August, September the rainfall is very low. Then entering November and December the rainfall starts to high again. Air temperature does not occur significantly or not too extreme difference every month. Humidity in the rainy season tends to be high. The incidence of dengue fever in the rainy season tends to increase. The number of mosquito larvae also tends to increase in the rainy season.

Tabel 5. Potential of Rainfall, Air Temperature, Humidity to Incidents and Flies in Makassar City in 2018

Rainfall	773	719	616	164	33	103	47	1	1	12	156	825
Air temperature	27.4	26.8	27.3	28.4	28.7	27.7	27.6	28.1	28.3	29.2	28.8	27.6
Humidity	86	86	85	80	80	82	78	70	73	72	80	85
Incident	10	21	36	33	44	17	13	27	21	7	8	9
+ Flick the House	7	10	26	23	21	2	19	12	10	7	6	7

Source: BMKG South Sulawesi, 2019

Table 5 above illustrates that high rainfall occurs in January, February, March, April, May, and June. In July, August, September the rainfall is very low. Then entering November and December, the rainfall starts to high again. Air temperature does not occur significantly or not too extreme a difference every month. Humidity in the rainy season tends to be high. The incidence of dengue fever in the rainy season tends to increase. The number of mosquito larvae also tends to increase in the rainy season.

IV. DISCUSSIONS

Climate change causes changes in rainfall, air temperature, humidity, rainy days so that it affects the terrestrial and oceanic ecosystems and influences health, especially the vector breeding of diseases such as Aedes mosquitoes, malaria and others. Erratic climate change is suspected. Erratic climate change is suspected to be a cause of increased puddles of clean water which is a breeding ground for Aedes mosquitoes which indeed like laying eggs in clean and stagnant water, thus becoming one of the triggers for the outbreak of dengue fever [9]–[11].

Risk factors for dengue cases are not only influenced by climate elements but also influenced by population density. Population density results in overcrowding so that dengue fever transmission is faster. Growth in population that does not have a certain pattern led to the emergence of slums with poor infrastructure and sanitation systems, resulting in breeding sites for mosquitoes [12]–[15].

The mild form of dengue fever attacks all age groups and manifests more severely in adults than in children. Infants and children with this disease suffer from a low-grade fever accompanied by a maculopapular rash. In adults known as triad syndrome in the form of high fever, pain in the limbs such as head, eyeball, back, joints, and the emergence of maculopapular rash [16].

The main clinical symptoms in dengue fever are fever and manifestations of bleeding that occur both spontaneously and after the tourniquet test. Clinical symptoms of dengue fever are as follows: Sudden high fever that lasts for 2-7 days, manifestations of bleeding, Hepatomegaly, rapid and weak pulse, decreased pulse pressure (<20 mmHg) or palpable pulses, cold skin, and feeling restless.

The case of dengue hemorrhagic fever is predicted to be high along with weather forecasts that will continue to rain. Because in the rainy season the Aedes Aegyptus mosquito eggs develop more quickly. Places that can become a mosquito breeding ground at home are the bathroom and toilet tubs, water reservoirs, refrigerator disposal containers, drinking places for birds, and used water dispensers. For this reason, the eradication of mosquito nests (PSN) must be intensified [17].

Adult mosquitoes in 12-14 days. When laying eggs, the adult female can produce 100-150 eggs. In a month mosquitoes can lay eggs approximately 4 times. So in a month mosquitoes can lay eggs between 400 to 600 eggs. Mosquito eggs can survive, do not hatch, for six months because they do not touch water. According to him, the rain could accelerate the process of hatching mosquito eggs. If there is a pond in the park you should place larvae-eating fish such as tilapia or betta fish. Also consider a variety of used items, such as buckets, cans, or tires that can hold water when it rains [18].

Air temperature is a measure of the magnitude of the degree of hot and cold air of the environment and the instrument used to measure temperature is the thermometer as a benchmark with the amount of °C (Celsius degrees). Thermometers are the most valid

tools for measuring temperature.5 Temperature directly affects the stages of mosquito life and replication of dengue virus directly. High temperatures increase virus replication and shorten the extrinsic incubation period of the vector. Dengue transmission is abundant in the tropics and subtropics due to low temperatures in non-tropical / non-subtropical regions characterized by temperatures below 0 ° capable of killing A.aegypti larvae and eggs. Meanwhile, temperatures that rise to 34 ° C will affect mosquito breeding sites due to warm water temperatures that can affect the breeding of eggs produced by mosquitoes. Eventually the eggs become larvae quickly [17].

Humidity is the total amount of water vapour in the air. Another understanding of humidity itself is the ratio between the amount of water vapour present in the air at a given time and the maximum amount of water vapour in the air at the same pressure and temperature. (Assembly B. 2002). Air humidity affects the survival of mosquitoes. Low humidity shortens mosquito life while high humidity extends mosquito life. The lowest limit of air humidity is 60%, less than this percentage will extend the life of mosquitoes [18].

V. CONCLUSIONS

This study concludes that high rainfall occurs in January, February, March, April, May, and June. In July, August, September the rainfall is very low. Then entering November and December the rainfall starts to high again. Air temperature does not occur significantly or not too extreme difference every month. Humidity in the rainy season tends to be high. Incidence of dengue fever in the rainy season tends to increase. The number of mosquito larvae also tends to increase in the rainy season. The study recommends that before entering the rainy season it should increase awareness of the incidence of dengue fever by reducing mosquito breeding sites through 3M (draining, closing, stockpiling). Then drain and close the bathtub, and bury the garbage cans, plastic, and objects that can become mosquito breeding grounds.

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