ADI Journal on Recent Innovation (AJRI)
Vol 4 No. 1 September 2022

p-ISSN : 2685-9106
e-ISSN : 2686-0384

Relationship of Water Temperature and Air Humidity with Aedes Sp. Manggarai Tebet Village South Jakarta in 2022

Indah Restiaty[1], Zulfia Maharani[2], Rojali[3], Wahyu Darmawan[4], and Berliana Yuni Dwi Yanti[5]
Department of Environmental Health, Health Polytechnic Ministry of Health Jakarta II, Indonesia

indah.restiaty@gmail.com, zulfia.maharani@poltekkesjkt.ac.id, rojalijaya@yahoo.com, darmawan19.wahyu@gmail.com, Berlianaydy@gmail.com

Author Notification
05 August 2022
Final Revised
25 August 2022
Published
31 August 2022

To cite this document:
Restiaty, I., Maharani, Z., Rojali, R., Darmawan, W. ., & Yanti, B. Y. D. (2022). Relationship of Water Temperature and Air Humidity with Aedes Sp. Manggarai Tebet Village South Jakarta in 2022. ADI Journal on Recent Innovation, 4(1), 102–109.
DOI : https://doi.org/10.34306/ajri.v4i1.780

Abstract

This study aims to determine the relationship between water temperature and air humidity with the presence of Aedes sp .The total population in this study amounted to 298 houses, while the sample in this study amounted to 75 houses. With the larva-free rate (ABJ) in RW 03 Manggarai Village, Tebet District, South Jakarta of 89.33%, House Index (HI) of 10.67%, Container Index (CI) of 9.73%, and Breteau Index (BI) by 24. In containers with non-optimal temperature (>27 o C) as many as 64 houses (85.30%) and optimal humidity (70-80%) for the growth of Aedes sp. (p-value = 0.000) and there is no relationship between air humidity and the presence of Aedes sp larvae breading place.

Keywords: Aedes sp. larvae, temperature, and humidity

1. Introduction

Environmental-based diseases are still a health problem for the people of Indonesia[1]. One of the diseases caused by environmental sanitation conditions that do not meet health requirements is dengue hemorrhagic fever[2]. Several physical environmental factors such as temperature, air, and the intensity of lighting that enter the house are estimated to strengthen the occurrence of dengue hemorrhagic fever[3].

In this case the physical environment can be an environmental *reservoir* and can determine the population pattern of *Aedesaegypti larvae*[4]. Temperature is an important environmental parameter for vector reproduction, mosquito gonotrophic cycle, increased bite rate, shorter pathogen hatching period, and extended adult mosquito lifespan[5]. Suryaningtyas stated that the average optimum water temperature for mosquito growth is 25-27 ^{o}C. The need for high humidity affects mosquitoes to look for damp and wet places as a place to perch or rest. The humidity required for the embryonication process and the survival of the embryo is around 70 – 80%[6].

Dengue Hemorrhagic Fever is a tropical infectious disease caused by the dengue virus and is transmitted through the bite of the *Aedes aegypti mosquito*[7]. Dengue hemorrhagic fever is often found, especially in tropical areas and often causes extraordinary events (KLB)[8].

Due to the large amount of standing water that can become a breeding ground for mosquitoes, the role of vectors in their distribution is often seen in the rainy season[9]. In addition to climatic and environmental conditions, several studies have shown that DHF is also related to mobility, population density, and community behavior[10].

The presence of mosquito larvae is an indicator that will greatly affect the presence of mosquito populations in a place[11]. The size of the larval density in a settlement is expressed by the larva-free rate (ABJ) where the larva-free rate that meets the requirements is 95%.

Based on the 2019 Indonesian Health Profile, it is known that there are still 320 districts/cities out of 514 that have reached an IR of Rate Dengue Hemorrhagic Fever (DHF) < 49/100,000 population[12]. In the program plan that has been made by the Ministry of Health in 2019 it is 68% of regencies/cities with an IR of DHF < 49 per 100,000 population. However, there are still provinces that have not met the target of Incident Rate Dengue Hemorrhagic Fever (DHF) < 49 per 100,000 population, one of which is DKI Jakarta[13].

DHF cases in Indonesia during 2019 were 138,127 cases. This figure resulted in an increase in cases from the previous year[14]. In addition to the increase in incidence, there was also an increase in the *case fatality rate* (CFR) from 0.65 to 0.94. While the case data from 2020 to July found 71,633 cases[15].

The number of DHF sufferers in DKI Jakarta Province in 2019 was 8,705 cases, with an *incidence rate* (IR) of 82.45% per 100,000 population and DHF cases in South Jakarta amounted to 1,976[16]. Based on data from the Manggarai Village Health Center, there were 37 cases of dengue fever in the Manggarai Village in 2020-2021 which were recorded in the DHF case report[17].

In the results of research conducted by Hardianti in 2017 it was obtained that the P-Value was smaller than alpha, namely 0.05, so it can be said that there is a significant relationship between the temperature in the container and humidity. environment with the presence of Aedes aegypti mosquito larva[18].

Disease is basically the result of an interactive relationship between humans and the environment, between behavior and environmental components that have the potential for disease[19]. Therefore, understanding related to disease risk factors rooted in population factors can reduce the occurrence of risk factors themselves[20]. The diseases that are usually suffered are often non-specific, *multiple agents* and *multiple symptoms* which make it difficult to determine which is the cause and effect. Therefore, with the analysis of the relationship, it can provide a high level of relationship between various symptoms and environmental parameters or poor basic sanitation[21].

Based on the background and data above, the researcher is interested in conducting research on "The Relationship between Water Temperature and Air Humidity with the Presence of *Aedes sp.* in RW 03 Manggarai Village, Tebet District in 2022".

2. Research Method

This research is an analytic study with a cross sectional study design[22]. With the aim of finding the relationship between the independent variables, namely temperature and humidity, on the dependent variable, namely the presence of larvae and providing an overview of the analysis of the independent variable (Independent) and the dependent variable at the same time[23]. This research was conducted in RW 03 Manggarai Village, Tebet District, South Jakarta[24]. The population of cases in this study were all houses of residents of RW 03 Manggarai Village, as many as 298 buildings[25].

The sampling technique used in this study is the probability sampling method, all elements in a population have the same opportunity to be selected in the sample[26]. In this method the method of selecting the research sample used is the cluster random sampling method, meaning that every house from the population has the same opportunity to be selected as a sample and also the sampling technique with the cluster random sampling method is often used in various researches in the health secto[27]r. By using the cluster random sampling technique, we get an even distribution of the number of samples for each Rukun Tetangga (RT)[28].

3. Findings

Table 1 Density of Aedes sp. based on ABJ, HI, CI, and BI on Positive Houses and Containers in 2022

No.	The presence of *Aedes sp* .	House		Container	
		Amount	Percentage (%)	Amount	Percentage (%)
1.	There is	8	10.70	19	10.74
2.	There isn't any	67	89.30	158	89.26
Amount		75	100	177	100

Based on table 1, it can be seen that the results of observations on the presence of *Aedes sp.* Of the 75 respondents' houses that have been observed, there are 8 houses (10.67%) with *Aedes sp.* and 67 houses (89.33) without *Aedes sp*[29]. In addition, there were 177 *containers* inspected. For the number of positive *containers for Aedes sp* . related to the presence of *Aedes sp*[30]. there were 19 *containers* (10.74) with *Aedes sp.* in the house and 158 *containers* (89.26) there were no *Aedes sp* . inside the house[31].

The larva-free rate (ABJ) in RW 03 Manggarai Village, Tebet District, South Jakarta is 89.33%, the *House Index* (HI) is 10.67%, the *Container Index* (CI) is 9.73%, and *the Breteau Index* (BI) is 24.

No.	Type of Watershed	Amount				Total	%
		Better	%	Exis	%		
1.	Bathtub	12	6.78	2	1.13	14	7.91
2.	Bucket	119	67.23	16	9.04	135	76.27

3.	crock	10	5.65	1	0.56	11	6.21
4.	Flower vase	2	1.13	0	0	2	1.13
5.	Water Dispenser	15	8.47	0	0	15	8.47
6.	Refrigerator water reservoir	0	0	0	0	0	0
Total		158	89.26	19	10.74	177	100

Table 2 Distribution of Water Storage Places by Type and Presence of *Aedes sp.* in RW 03 Manggarai Village, Tebet District, South Jakarta in 2022

Based on table 2, it can be seen that of the 177 TPAs found in the house, the most common types of TPAs found were 135 buckets (76.27%), 14 bathtubs (7.91%), water dispenser reservoirs as many as 135 units[32]. 15 pieces (8.47%), 11 jars (6.21%) and 2 flower vases (1.13%). The most abundant *Aedes sp.* are 16 buckets (9.04%) and 2 tubs (1.13%).

Table 3 Results of Water Temperature Measurement in RW 03 Manggarai Village, Tebet District, South Jakarta in 2022

No.	Water Temperature	Frequency	Percentage (%)
1.	Optimal (25 ^{o}C-27 ^{o}C)	11	14.70
2.	Not Optimal (>27 ^{o}C)	64	85.30
Amount		75	100

Based on table 3, it can be seen that from 75 respondents' houses, water temperature measurements were carried out in containers which were known to be the optimal water temperature for the growth of Aedes sp[33]. as many as 11 houses (14.70) and each container which is known to have a suboptimal temperature of 64 houses (85.30)[34].

Table 4 Results of Air Humidity Measurement in RW 03 Manggarai Village, Tebet District, South Jakarta in 2022

No.	Humidity	Frequency	Percentage (%)
1.	Optimal (70-80%)	67	89.30
2.	Not Optimal (<70% or >80%)	8	10.70
Amount		75	100

Based on table 4, it can be seen that from 75 respondents' houses, humidity measurements were made around the water *container* which was known to be optimal for the growth of *Aedes sp*[35]*.* as many as 67 houses (89.30) and the humidity of the air around the water *container container Water containers such as bathtubs, jars, buckets, etc* which is known to be the air humidity is not optimal as many as 8 houses (10.70)[36].

Table 5 Relationship of water temperature with the presence of *Aedes sp* . in RW 03 Manggarai Village, Tebet District, South Jakarta in 2022

Water Temperature	Exis/no				Total		P value	OR
	Exis		No					
	N	%	N	%	N	%		
Optimal (25 ^{o}C-27 ^{o}C)	7	63.6	4	36.4	11	100	0.000	110,250 (10,767-1128,936)
Not optimal (>27 ^{o} C)	1	1.6	63	98.4	64	100		

Based on table 5, it can be seen that the results of the analysis of the relationship between the temperature of the container water and the presence of mosquito larvae obtained the results of the optimal water temperature without larvae as many as 4 houses (36.4%), for the optimal water temperature there were Aedes sp. as many as 7 houses (63.6%) and the water temperature is not optimal, there are no larvae as many as 63 houses (98.4%), for the water temperature is not optimal there is 1 house larva (1.6%).

Based on the results of statistical tests of the relationship between container water temperature and the presence of Aedes sp. obtained a p-value of 0.000 0.05 , it can be said statistically Ho is rejected, which means that there is a significant relationship between water temperature and the presence of Aedes sp. in RW 03 Manggarai Village, Tebet District, South Jakarta in 2022. From the results of the study in the table above, the OR value is 110.250, which means that the optimal temperature has a 110.250 times chance to become a breeding ground for larvae compared to the non-optimal temperature.

Table 6 Relationship of Air Humidity with the Presence of *Aedes sp* . in RW 03 Manggarai Village, Tebet District, South Jakarta in 2022

Humidity	Exis/No				Sum		P *value*	OR
	Exis		No					
	N	%	N	%	N	%		
Optimal (70-80%)	8	11.9	59	88.1	67	100	0.588	0.881 (0.806-0.962)
Not optimal (<70% or >80%)	0	0	8	100	8	100		

Based on table 6, it can be seen that the results of the analysis of the relationship between the humidity of the air around the container and the presence of mosquito larvae obtained optimal humidity results in no larvae as many as 59 houses (88.1%), for optimal humidity there were Aedes sp. as many as 8 houses (11.9%) and humidity that is not optimal there are no larvae as many as 8 houses (100%), for humidity that is not optimal there are 0 houses (0%).

Ased on the results of statistical tests, the relationship between the humidity of the air around the container and the presence of Aedes sp. obtained a p-value of 0.588 > 0.05, statistically Ho failed to be rejected, which means that there is no significant relationship between air humidity and the presence of Aedes sp. in RW 03 Manggarai Village, Tebet District, South Jakarta in 2022. From the results of the study in the table above, the OR value is 0.881, which means that even though optimal humidity has a 0.881 times chance to become a breeding

ground for larvae, compared to non-optimal humidity. The results of this study are in line with research conducted by Dudy Affiandy, Akhmad Arif Amin and Yusuf Ridwan, humidity has no relationship with the presence of mosquito larvae (P = 0.561). Then the research conducted by Obin Sarwita, Bachti, Alisjahbana and Dwi Agustian The results of the study There was no relationship between temperature and the presence of produced larvae (P = 0.244), and humidity had no relationship with the presence of mosquito larvae (P = 0.275).

4. Conclusion

Based on the results of research on "The Relationship between Water Temperature and Air Humidity with the Presence of Aedes sp. In RW 03 Manggarai Selatan Village, Tebet District, South Jakarta in 2022", it can be concluded as follows:

The results showed that there were 8 houses found with larvae (10.70%) and larvae were found in 19 *containers* (10.74%). The type of landfill that found the most larvae was buckets totaling 16 (9.04%). The larva-free rate (ABJ) has not met the requirements set by the Ministry of Health 95%, the *House Index* (HI) has not met the WHO standard 10%, the *Container Index* (CI) has not met the WHO standard 5%, and the *Breteau Index* (BI) already meet the WHO standard 50. The value of the *Density Figure* in RW 03 Manggarai Village, which is 3, is included in the yellow area category, namely the degree of disease transmission carried by vectors is moderate.

Houses with optimal water temperature (25-27 C) found *Aedes sp* . Houses with optimal air humidity (70-80%) for the growth of *Aedes sp* . Only larvae were found in 8 of the 67 houses that had optimal humidity. There is a significant relationship between water temperature and the presence of *Aedes sp* . Houses that have optimal water temperatures have a risk of 110.250 times greater than the house where there is the presence of *Aedes sp.* compared to houses with suboptimal water temperatures.There is no significant relationship between air humidity and the presence of *Aedes sp* . Houses that have optimal air humidity have a 0.881 times greater risk of having *Aedes sp.* compared to houses that have not optimal air humidity.

Acknowledgment

The authors would like to thank the Institute for Research and Community Service (LPPM). Health Polytechnic Ministry of Health Jakarta II.

References

[1] M. J. George *et al.*, “Procoagulant in vitro effects of clinical cellular therapeutics in a severely injured trauma population,” *Stem Cells Transl. Med.*, vol. 9, no. 4, pp. 491–498, 2020.

[2] V. Nayaka GV, P. Reddy G, and M. Kumar R, “Nutrient Dynamics of Rice Cultivars under Different Irrigation Regimes and Systems of Cultivation,” *Commun. Soil Sci. Plant Anal.*, pp. 1–17, 2022.

[3] A. Poran *et al.*, “Combined TCR repertoire profiles and blood cell phenotypes predict melanoma patient response to personalized neoantigen therapy plus anti-PD-1,” *Cell Reports Med.*, vol. 1, no. 8, p. 100141, 2020.

[4] M. P. A. Sailakshmi, M. R. Prabhu, S. Prabhakara, K. Anbazhagan, and B. M. Rupakala, “Congo red dot test in the early prediction and diagnosis of pre-eclampsia in a tertiary health care centre in India,” *Pregnancy Hypertens.*, vol. 25, pp. 225–229, 2021.

[5] S. Basel, K. U. Gopakumar, and R. Prabhakara Rao, “Testing club convergence of economies by using a broad-based development index,” *GeoJournal*, vol. 86, no. 5, pp. 2351–2365, 2021.

[6] H. W. Caplan *et al.*, “Human cord blood-derived regulatory T-cell therapy modulates the central and peripheral immune response after traumatic brain injury,” *Stem Cells Transl. Med.*, vol. 9, no. 8, pp. 903–916, 2020.

[7] M. F. Bashir *et al.*, “Correlation between environmental pollution indicators and COVID-19 pandemic: a brief study in Californian context,” *Environ. Res.*, vol. 187, p. 109652, 2020.

[8] H. Spínola, "Correlations between environmental literacy components (knowledge, attitude and behavior) in Madeira Island (Portugal) 9th grade students," *Online J. New Horizons Educ.*, pp. 28–36, 2020.
[9] S. N. Adithya, K. C. Sachin, and U. S. Meda, "Review on the correlation between mixing, microstructure and strength of cementitious products with nanoparticles," in *IOP Conference Series: Earth and Environmental Science*, 2021, vol. 822, no. 1, p. 12005.
[10] A. Tsatsakis *et al.*, "COVID-19, an opportunity to reevaluate the correlation between long-term effects of anthropogenic pollutants on viral epidemic/pandemic events and prevalence," *Food Chem. Toxicol.*, vol. 141, p. 111418, 2020.
[11] O. J. Brady and S. I. Hay, "The global expansion of dengue: how Aedes aegypti mosquitoes enabled the first pandemic arbovirus," *Annu. Rev. Entomol.*, vol. 65, pp. 191–208, 2020.
[12] O. W. Lwande *et al.*, "Globe-trotting Aedes aegypti and Aedes albopictus: risk factors for arbovirus pandemics," *Vector-Borne Zoonotic Dis.*, vol. 20, no. 2, pp. 71–81, 2020.
[13] J. Näslund, C. Ahlm, K. Islam, M. Evander, G. Bucht, and O. W. Lwande, "Emerging Mosquito-Borne viruses linked to Aedes aegypti and Aedes albopictus: global status and preventive strategies," *Vector-Borne Zoonotic Dis.*, vol. 21, no. 10, pp. 731–746, 2021.
[14] J. E. Crawford *et al.*, "Efficient production of male Wolbachia-infected Aedes aegypti mosquitoes enables large-scale suppression of wild populations," *Nat. Biotechnol.*, vol. 38, no. 4, pp. 482–492, 2020.
[15] N. Melo *et al.*, "Geosmin attracts Aedes aegypti mosquitoes to oviposition sites," *Curr. Biol.*, vol. 30, no. 1, pp. 127–134, 2020.
[16] H. Yao, P. Zhang, Y. Huang, H. Cheng, C. Li, and L. Qu, "Highly efficient clean water production from contaminated air with a wide humidity range," *Adv. Mater.*, vol. 32, no. 6, p. 1905875, 2020.
[17] M. Xenochristou, Z. Kapelan, and C. Hutton, "Using smart demand-metering data and customer characteristics to investigate influence of weather on water consumption in the UK," *J. Water Resour. Plan. Manag.*, vol. 146, no. 2, p. 4019073, 2020.
[18] S. Garcia-Segura *et al.*, "Disparities between experimental and environmental conditions: Research steps toward making electrochemical water treatment a reality," *Curr. Opin. Electrochem.*, vol. 22, pp. 9–16, 2020.
[19] M. J. Al-Kheetan, S. H. Ghaffar, O. A. Madyan, and M. M. Rahman, "Development of low absorption and high-resistant sodium acetate concrete for severe environmental conditions," *Constr. Build. Mater.*, vol. 230, p. 117057, 2020.
[20] M. J. Matson *et al.*, "Effect of environmental conditions on SARS-CoV-2 stability in human nasal mucus and sputum," *Emerg. Infect. Dis.*, vol. 26, no. 9, p. 2276, 2020.
[21] N. Mazur-Panasiuk and G. Woźniakowski, "Natural inactivation of African swine fever virus in tissues: Influence of temperature and environmental conditions on virus survival," *Vet. Microbiol.*, vol. 242, p. 108609, 2020.
[22] L. Ding, R. Mao, S. Ma, X. Guo, and L. Zhu, "High temperature depended on the ageing mechanism of microplastics under different environmental conditions and its effect on the distribution of organic pollutants," *Water Res.*, vol. 174, p. 115634, 2020.
[23] M. Park, E. Anaza, H. Shin, S. M. Pack, and M. Chitiyo, "Relationship between physical activity and quality of life in older adults: A meta-analysis," *J. Phys. Educ. Sport*, vol. 20, no. 6, pp. 3467–3477, 2020.
[24] K. Wang, Y. Yang, T. Zhang, Y. Ouyang, B. Liu, and J. Luo, "The relationship between physical activity and emotional intelligence in college students: the mediating role of self-efficacy," *Front. Psychol.*, vol. 11, p. 967, 2020.
[25] Y. Shang, H.-D. Xie, and S.-Y. Yang, "The relationship between physical exercise and subjective well-being in college students: The mediating effect of body image and self-esteem," *Front. Psychol.*, vol. 12, p. 658935, 2021.
[26] K. A. Hopperstad, M. F. Sallam, and M. H. Reiskind, "Estimations of fine-scale species distributions of Aedes aegypti and Aedes albopictus (Diptera: Culicidae) in Eastern Florida," *J. Med. Entomol.*, vol. 58, no. 2, pp. 699–707, 2021.
[27] O. L. Schultes, M. H. F. Morais, M. da C. M. Cunha, A. Sobral, and W. T. Caiaffa, "Spatial analysis of dengue incidence and Aedes aegypti ovitrap surveillance in Belo Horizonte,

Brazil," *Trop. Med. Int. Heal.*, vol. 26, no. 2, pp. 237–255, 2021.
[28] N. Flaibani, A. A. Pérez, I. M. Barbero, and N. E. Burroni, "Different approaches to characterize artificial breeding sites of Aedes aegypti using generalized linear mixed models," *Infect. Dis. poverty*, vol. 9, no. 04, pp. 97–107, 2020.
[29] R. Ordoñez-Sierra *et al.*, "Spatial Risk Distribution of Dengue Based on the Ecological Niche Model of Aedes aegypti (Diptera: Culicidae) in the Central Mexican Highlands," *J. Med. Entomol.*, vol. 57, no. 3, pp. 728–737, 2020.
[30] N. Nuraini, I. S. Fauzi, M. Fakhruddin, A. Sopaheluwakan, and E. Soewono, "Climate-based dengue model in Semarang, Indonesia: Predictions and descriptive analysis," *Infect. Dis. Model.*, vol. 6, pp. 598–611, 2021.
[31] M. Rubel, C. Anwar, I. Irfanuddin, C. Irsan, R. Amin, and A. Ghiffari, "Impact of Climate Variability and Incidence on Dengue Hemorrhagic Fever in Palembang City, South Sumatra, Indonesia," *Open Access Maced. J. Med. Sci.*, vol. 9, no. E, pp. 952–958, 2021.
[32] L. M. Otero, G. Medina-Martinez, M. Sepúlveda, V. Acevedo, M. Toro, and R. Barrera, "Cemeteries as sources of Aedes aegypti and other mosquito species in southeastern Puerto Rico," *Trop. Med. Int. Heal.*, vol. 27, no. 3, pp. 300–309, 2022.
[33] B. Yang *et al.*, "Modelling distributions of Aedes aegypti and Aedes albopictus using climate, host density and interspecies competition," *PLoS Negl. Trop. Dis.*, vol. 15, no. 3, p. e0009063, 2021.
[34] C. M. C. Sánchez *et al.*, "Modeling and prediction of dengue cases in the short and long term in Villa Clara, Cuba using climatic variables and objective regressive regression," *GSC Biol. Pharm. Sci.*, vol. 18, no. 3, pp. 35–45, 2022.
[35] S. N. Ramadhani and M. T. Latif, "Impact of Climate Change on Dengue Hemorrhagic Fever (DHF) in Tropical Countries: A Literature Review," *J. Kesehat. Lingkung.*, vol. 13, no. 4, pp. 219–226, 2021.
[36] I. M. Kramer *et al.*, "STtech: sampling and transport techniques for Aedes eggs during a sampling campaign in a low-resource setting," *Entomol. Exp. Appl.*, vol. 169, no. 4, pp. 374–383, 2021.