ORIGINAL RESEARCH

Residential density, behavior and dengue haemorraghic fever (dhf) incidence in Surabaya, Indonesia

Ika Prastiani; Corie Indria Prasasti

Abstract

Dengue Haemorraghic Fever (DHF) has been one of the leading cause of morbidity and mortality in Indonesia. Surabaya has been one of the districts in East Java Province categorized as dengue endemic, particularly the Gunung Anyar Subdistrict. The purpose of this study is to analyze the relationship between the presence of larvae, residential density and public behavior, with the incidence of dengue in Gunung Anyar Village, Subdistrict of Gunung Anyar, Surabaya. The type of study is observational with cross sectional study design, with the primary data obtained from observation and interviews with 50 respondents, and the secondary data from The Local Health Clinics and Health Department. The samples are obtained with cluster random sampling. The results showed that variables related with the presence of larvae is residential density (p=0.018), knowledge (p=0.007) and attitude (p=0.000). However, the study found no correlation between the presence of larvae with the incidence of dengue (p=0.190). The study concludes that residential density and public behavior correlate with the larvae presence, but the larvae presence does not correlate with the incidence of dengue in Gunung Anyar Village, Surabaya. The Public Health Center and the Health Department should make innovation in method and public counseling media to increase public knowledge about dengue incidence and prevention.

Keywords: Residential density, behaviour, dengue incidence

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Introduction

Cases of *Dengue Haemorraghic Fever* (DHF) have been increasing in more than three decades and have been the focus of world health issues. *Dengue Haemorraghic Fever* (DHF) is an infectious disease caused by viruses infected through *Aedes* mosquito, indicated with such symptoms as sudden fever within two to seven days, weakness and exhaustion, restlessness, pain in the solar plexus followed with skin eruption, nosebleeding, bleeding diarrhea, bleeding vomiting, shock and others. [1]

Dengue Haemorraghic Fever (DHF) is caused by flavivirus dengue virus, belonging to Arbovirus grup B. There are four types of DHF virus serologically: type 1, type 2, type 3 and type 4. [2] Type 3 has been the most severe. Infection of one type may cause immunity of the type, but not of the other types. *Aedes aegypti* and *Aedes albopictus* are the DHF infecting vectors.[3] *Aedes aegypti* are commonly found in urban areas while *Aedes albopictus* in rural areas. [4]

DHF has been the focus of world public health issues. DHF cases have been increasing in

more than three decades. DHF are commonly found in most tropical and sub-tropical areas.[5] DHF epidemic has spread to almost all countries in the world, such as India, Myanmar, Singapore, Cambodia, China, Laos, Malaysia, Vietnam, Sri Lanka, Thailand and Indonesia.[6]

Indonesia has the high risk of DHF disease spreading since the dengue virus and *Aedes aegypti* mosquito as the infecting vectors have widely spread in all areas of Indonesia, from rural to urban, both in residential and public areas. Areas in Indonesia having lower risk of DHF transmission include those higher than 1000 meter above sea level.[7]

DHF has been an annual public health issue in almost all areas/cities in East Java Province. The data from the Health Department of East Java Province in 2016 shows that DHF incidence in East Java reached 14,534 cases with mortality rate of 146 in 2013. A decrease occurred in 2014 with 9,609 cases and mortality rate of 108. In 2015, however, there was a substantial increase to reach 20,129 cases and mortality rate of 283. Surabaya City has been one area in East Java Province with annual DHF cases.[8]

DHF was first identified in Jakarta and Surabaya in 1968, and in a relatively short time has spread and cases have increased throughout Indonesia.[7] Efforts have been done to eradicate DHF disease and its vectors, yet they have not reached optimum success. Some areas of Surabaya city have still been declared DHF endemic.

Control over vectors is necessary to reduce the vector population to the minimum that the risk of DHF disease spread may be prevented. One form of vector control is monitoring or survey of mosquito larvae. This survey is conducted by inspecting the presence of larvae in all places or containers potential for *Aedes aegypti* mosquito breeding. Residential areas are potential areas for DHF spreading because the population may come from different areas or some of them may be carriers.

Based on the data from Surabaya City Health Department of 2015, the trend of annual DHF cases in each area has shown significant increase and decrease. In 2014 there occurred 816 cases with *incidence rate* (IR) 28.82 per 100.000 population. This number has shown a decrease when compared to the previous year, showing 2.207 cases with *incidence rate* (IR) 78.35 per 100.000 population. The CFR rate has shown an increase, however, when compared to the CFR of 2013.[9]

Based on the data from the Surabaya City Health Department, the DHF cases in Gunung Anyar Subdistrict belong to high category for it reaches the third highest in Surabaya City per August 2015. Besides, DHF cases in the subdistrict have also shown both extreme increase and decrease. In 2014, DHF cases in this subdistrict decreased twice as many as in 2013, yet also increased twice as many as in 2015.[9]

Based on the data from Gunung Anyar Public Health Center in 2016, there occurred 59 DHF cases until December 2015. Gunung Anyar and Rungkut Menanggal villages showed the highest DHF incidence in Gunung Anyar Subdistrict. In 2013, DHF incidence in Gunung Anyar village reached 15 cases, and in Rungkut Menanggal 18 cases. In 2014 a decrease was shown in both areas. DHF incidence in Gunung Anyar village decreased to 11 cases and in Rungkut Menanggal to 7 cases. However, in 2015 an extreme increase occurred in both areas. DHF incidence in Gunung Anyar and Rungkut Menanggal villages increased to 21 cases.[10] This phenomenon has called for a study on the relationship between the presence of mosquito larvae, residential density and public behavior, with DHF incidence in Gunung Anyar village of Gunung Anyar Subdisctrict, Surabaya City.

Method

The study type was observational with cross sectional research design. The study was conducted in Gunung Anyar Village, Gunung Anyar Subdistrict, Surabaya City. Samples were 50 heads of households. The samples were collected with cluster random sampling technique. The study has obtained approval from the Ethical Commission of Health Research, Faculty of Public Health, University of Airlangga No: 60-KEPK. The dependent variable of the study was the presence of *Aedes aegypti* mosquito larvae in Gunung Anyar Village, Gunung Anyar Subdistrict, Surabaya City. The independent variables were residential density, public behavior comprising of knowledge and attitude. Data collection was conducted with observations and interviews. Data on residential density and public behavior were gained through questionnaire-based interviews and prepared observational sheet. Interviews were conducted to the housewives or other family members (age ≥ 20 years old) who

were assumed to know and understand the condition of the house and its surroundings. The presence of larvae was observed with visual method in the house with any containers potential for mosquito breeding based on technical instruction issued by the Department of Health, Republic of Indonesia.[11] Analysis was conducted with statistical test, namely *Chi Square test.* Data were presented in tables and narration.

Result

Based on the results of interviews, data were obtained that the majority of respondents' age was 41-50 years (32%), with the youngest was 22 years old and the oldest was 80 years old (Table 1).

Table 1.
Distribution of Respondent Characteristics in Gunung Anyar Village

No.	Characteristics	Total	Percentage (%)
Age (year)			
1.	20-30	10	20
2.	31-40	8	16
3.	41-50	16	32
4.	51-60	11	22
5.	>60	5	10
Total		**50**	**100**
Sex			
1.	Male	33	66
2.	Female	17	34
Total		**50**	**100**
Occupation			
1.	Housewives	23	46
2.	Entrepreneurs	10	20
3.	Employees	7	14
4.	Others	10	20
Total		**50**	**100**
Level of Education			
1.	No education	2	4
2.	Elementary School	13	26
3.	Junior High School	14	28
4.	Senior High School	17	34
5.	Higher Education	4	8
Total		**50**	**100**

Source: Primary Data, 2016

The above result shows that the respondents' age is categorized as adult. The majority of the respondents were female, namely 33 respondents (66%) (Table 1). This may be due to the fact that when the study was conducted, the males who are the heads of the households were at work. Most of the respondents' occupations were housewives, namely 23 respondents (46%) (Table 1). This may also be because most respondents were females with Senior High School educational level, namely 17 respondents (34%) (Table 1). This shows that the respondents educational level in Gunung Anyar Village is relatively high.

Table 2.
Distribution of DHF Incidence in Gunung Anyar Village, Surabaya City

DHF Incidence	Total	Percentage (%)
Once infected	12	24
Never infected	38	76
Total	**50**	**100**

Table 2 shows, 12 respondents (24%) were once infected with dengue/DHF, while the other 38 respondents (76%) were never infected with dengue/DHF (Table 2). The majority of respondents suffering from dengue/DHF had the disease prior to the past three months. The mosquito larvae survey was conducted in 50 houses of the respondents in Gunung Anyar Village. Furthermore, survey in the 50 houses was also conducted on the larvae presence in 102 containers including drums, bath tanks, water jar, bucket, and others.

Table 3.
Correlation between *Aedes aegypti* Larvae Presence and DHF Incidence in Gunung Anyar Village of Surabaya City

Larvae Presence	DHF Incidence				p-value
	Yes		Not present		
	n	%	n	%	
present	11	22	28	56	0.190
Never present	1	2	10	20	

Source: Primary Data, 2016

Table 3 shows that the larvae presence was identified in the majority of houses under survey, comprising 12 houses, and in 78 containers.
Table 4 shows that the *Aedes aegypti* larvae density can be calculated with *House Index* (HI),*ContainerIndex* (CI)and *Breteau index* (BI) approaches, as follows:

Table 4.
Distribution of *Aedes aegypti* larvae density in Gunung Anyar Village of Surabaya City

Objects under examination	Total	Larvae Incidence		HI	CI	BI
		present	Not			
Houses	50	39	11	78%	45,1%	92
Containers	152	102	50			

Examination on the presence of *Aedes aegypti* larvae density in houses and containers shows that larvae were identified in majority of the houses, namely 39 houses and 102 containers. Eleven (11) respondents (22%) once infected with dengue incidence showed larvae presence in their houses and one (1) respondent (2%) infected with dengue incidence showed no larvae presence in the house.

The *Aedes aegypti* larvae density can be calculated using *House Index* (HI), *Container Index* (CI) and *Breteau index* (BI) approaches. The calculation shows HI result is 78%, CI 45.1% and BI 92 % (Table 4). It can be concluded that HI, CI and BI are categorized as relatively high. The *chi square* statistical test shows p=0.190 (p>0.05), meaning that there is no correlation between the larvae presence and DHF incidence in Gunung Anyar Village of Gunung Anyar Subdistrict, Surabaya City (Table 3).

Residential density is categorized into two: satisfactory and poor. Twenty (20) respondents show poor residential density. The majority of respondent's residential density reaches 9.4 m^2/person. The study shows that the highest rate of satisfactory residential density was 195 m^2/person resided by two persons in a house, while the respondents' poor residential density reaches the lowest rate of 2.67 m^2/person resided by three persons in a house.

The result of the *chi square* statistical test shows the value of p=0.000 (p<0.0018) is significant, meaning that there exists correlation between the residential density and the larvae presence in Gunung Anyar Subdistrict of Surabaya City (Table 5). The result was based on the fact that larvae were positively found in 39 houses, that 19 respondents (95%) had poor residential density (<10 m^2/person). However, 31 houses with satisfactory residential density also show larvae presence.

Table 5.
Correlation between Independent Variable and Larvae Presence in Gunung Anyar Village of Surabaya City

Independent Variable	Larvae Presence				p-value
	Present		Not present		
	n	%	n	%	
Residential Density					
Poor (<10 m^2/orang)	19	95	1	5	p= 0.018
Satisfactory (≥10 m^2/orang)	20	66.7	10	33,3	
Knowledge					
insufficient (≤55%)	39	81.3	9	18.8	p= 0.007
sufficient (56%-75%)	0	0	2	100	
Good (76%-100%)	0	0	0	0	
Attitude					
insufficient (≤55%)	0	0	0	0	p= 0.000
sufficient (56%-75%)	30	96.8	1	3.2	
Good (76%-100%)	9	47.4	10	52.6	

Source : Primary Data, 2016

The behavior variable being evaluated in relation to the DHF disease and Mosquito Breeding Place Control comprises knowledge and respondents' responses. The knowledge variable comprises 7 questions and the respondents' responses 11 questions. The respondents' knowledge and attitude are categorized into three groups: insufficient, sufficient and good. The majority of the respondents show insufficient level of knowledge, namely 39 respondents (81.3%) and sufficient attitude, namely 30 respondents (96.8%). The majority of respondents gained 42.86% mark on knowledge with correct answers on 3 questions and incorrect answers on 4 questions. The majority of respondents gained 63.64% mark on attitude with correct answers on 7 statements and incorrect answers on 4 statements.

The result of the *chi square* statistical test shows the value of p=0.007 (p<0.05) is significant, meaning that there exists correlation between the respondents' knowledge and the larvae presence in Gunung Anyar Subdistrict of Surabaya City. The result is based on the fact that larvae were positively found in 39 houses, all respondents are categorized into having insufficient knowledge

(Table 5). The result of the *chi square* statistical test shows the value of p=0.000 (p<0.05) is significant, meaning that there exists correlation between the respondents' attitude and the larvae presence in Gunung Anyar Subdistrict of Surabaya City. The result is based on the fact that larvae were positively found in 39 houses, the majority of respondents are categorized into having sufficient attitude, namely 30 respondents (96.8%) (Table 5).

Discussion

The *Aedes aegypti* life cycle has a complete metamorphosis, from eggs, larva, pupa, and imago or adult mosquito.[12] The presence of a great number of larvae may cause high larvae density. With high larvae density, the possibility of the larvae to develop into imago or adult mosquito is also high that increases the risk of DHF spread. This study shows, however, that there is no correlation between the larvae presence and DHF incidence in Gunung Anyar Village of Gunung Anyar Subdistrict of Surabaya City. This finding is in disagreement with Wati's study, who found a correlation between the larvae presence and DHF incidence in Ploso Village of Pacitan Subdistrict.[13] Tahir's study also shows a correlation between larvae density and DHF incidence in the Telaga Biru Public Health Center area. [14]

The container types functioning as the *Aedes aegypti* breeding place may be grouped into Water Containers for daily consumption such as drum, reservoir tank, water jar, bath or toilet tank, bucket and others, Water Containers for non-daily consumption such as birds' drinking places, flower vases, ant traps, and used items (tyres, tins, bottles, plactic containers, and others) and natural water reservoirs such as tree holes, stone holes, leave stems, coconut shell, banana peels, bamboo cuts, and others. [11]

In this study, the majority of respondents owned water containers for daily consumption and only one respondent owned water containers for both daily and non-daily consumptions. The water containers for daily consumption are mostly used as bath tanks. The water containers for non-daily consumption are dispenser spill basin, where larvae were found. The respondents were unaware that the dispenser spill basin can become mosquito breeding place that they rarely cleaned them.

The majority of the respondents owned containers inside the houses and only a few of them were outside the house. In the containers outside the house, only a few larvae were found because, based on the interviews with the respondents, these containers function as bath tanks and buckets for daily bathing and washing that the water is daily refilled and mosquito larvae are rarely bred in them. However, larvae were mostly found in the containers inside the house. Both containers inside and outside the house are potential for mosquito breeding place. Therefore, containers should be always kept clean in any places, that larvae presence can be put at a minimum and can therefore prevent DHF disease. [15]

Some factors related to the larvae presence and density include residential density, knowledge and attitude. The result of the study shows that there exists a correlation between the respondents' knowledge and attitude with larvae presence in Gunung Anyar Village of Gunung Anyar Subdistrict of Surabaya City. The result is in agreement with studies by Yudhastuti and Anny who found the correlation between respondents' knowledge and larvae presence in Wonokusumo Village of Surabaya City.[16] The result is in agreement with Nugrahaningsih's study who also found the correlation between the respondents' attitude and larvae presence in the Northern Kuta Public Health Center area. [17]

Knowledge is the result of the process of knowing that occurs after a person perceives an object and attitude is a reaction or hidden response on an object of stimulus, meaning that attitude cannot be directly observed, but can be interpreted. Knowledge is an important factor in the formation of attitude, because attitude that is based on knowledge may last longer than the one without knowledge. [18]

The respondent knowledge level is categorized as low and the respondent attitude is sufficient upon DHF disease and Mosquito Breeding Place Control. The majority of respondents answer incorrectly to the question related to the causes of dengue disease, namely the virus as the DHF agent and mosquitoes as the DHF vector, and preventions for DHF disease. However, the majority of the respondents have been familiar with dengue symptoms. Besides, the majority of respondents disagree on the statement related to the use of abate powder, larvae-eating fish and frequency of weekly bath tank cleaning for dengue prevention. However, the majority of the respondents have agreed on the importance of the three dengue prevention acts, namely closing, burying and cleaning of possible places for

mosquito breeding places and the role of larvae monitoring controller in preventing DHF disease.

Poor residential density has higher risk for larvae presence. Greater number of residents affects residential density which thus affects larvae presence in containers inside a house. Higher number of residents results in higher number of activities in the residence which has the potential for mosquito breeding places.

The high number of residents causes an increase in the need of water. However, the need of water may not be supported with the sufficient availability of water in Gunung Anyar Village. When the water are less available, the respondents tended to collect or save water for household needs and this may be potential for mosquito breeding places. [19]

Conclusion

Based on the result of the study, data analysis and discussion, the study concludes that the number of respondents experiencing DHF incidence are 12 respondents occurring prior to the past three months. Examination conducted in 50 respondent houses and 102 containers, shows that larvae are found in the majority of houses and containers. The HI result is 78%, CI is 45.1%, *Breteau index* (BI) is 92. It can be concluded that the HI, CI and BI are categorized as high. The temperature in Gunung Anyar Subdistrict supports the *Aedes aegypti* larvae breeding. The majority of respondential density is good. The majority of respondents' knowledge is categorized as insufficient and the majority of respondents' attitude is sufficient. Therefore, residential density, respondents' knowledge and attitude are related to the larvae presence. Besides, there is a correlation between larvae presence and DHF incidence in Gunung Anyar Subdistrict.

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