EXCELLENT PUBLISHERS

International Journal of Current Research and Academic Review

ISSN: 2347-3215 Volume 2 Number 11 (November-2014) pp. 1-9

www.ijcrar.com

Analysis relationship and mapping of the environmental factors with the existence of mosquito larva *Aedes aegypti* in the endemic area of dengue fever, Makassar, Indonesia

Arsunan, A.A[1*] and Erniwati Ibrahim[2]

[1]Department of Epidemiology, Faculty of Public Health, Hasanuddin University, Indonesia
[2]Department of Environmental Health, Faculty of Public Health, Hasanuddin University, Indonesia

Corresponding author

KEYWORDS

Humidity, Temperature, pH, Larvae of *Aedes aegypti*, Endemic area

A B S T R A C T

Dengue fever is one of the dangerous diseases that can lead to a death in a short time and often lead to outbreaks. It is one of the major public health problems in Indonesia. Dengue is transmitted to humans by the bite of the female *Aedes* mosquito infected with dengue virus. The main transmission vector was *Aedes aegypti* mosquito that is able to proliferate well in many places water shelter. This study aims to determine the relationship and create an environmental mapping with the presence of the *Aedes aegypti* larvae in endemic regions of Makassar. The type of research is analytic survey with a cross-sectional design that conducted by observing the container as a breeding *Aedes aegypti* site in 200 homes of 5 endemic sub regencies. Sampling technique is done by proportional random sampling. The results showed that there was a relationship between the presence of humidity by the larvae of *Aedes aegypti* (p value: 0.027). Whereas no relationship between the temperature and pH to the existence of *Aedes aegypti* larvae (p value; 0, 345 and .514). To sum up, based on the mapping, it was found that the highest level of larvae was in Tamalanrea sub district. It is suggested to the community to reduce the potential breeding sites mainly water containers that used daily

Introduction

Dengue hemorrhagic fever (DHF) disease can lead to a death in a short time and often generate outbreaks. The disease was first discovered in the Philippines in 1953 and the subsequent spread to many countries (Siregar, 2004; Arsunan, 2013). DHF cases in Indonesia was first discovered in the city of Surabaya in 1968, where a total of 58 people were infected and 24 fatalities (CFR = 41.3%). Since then, the disease is widely spread throughout Indonesia. Based on the data obtained from Makassar City Health Office in 2014, from 14 districts in the city of Makassar being recorded. There are 5 districts with the highest number of cases recorded from 2009 to 2013 namely; in the districts of Biringkanaya, Tamalanrea, Panakukang, Tallo and Rappocini. Of the five districts, the region with the highest number of cases were in Tamalanrea villages in the district of Tamalanrea with 37 cases, Gunung sari district in Rappocini with

33 cases, Paccerakkang District in Biringkanaya of 29 cases, Karuwisi sub district in Pannakukang District with 23 cases, and Rappokalling sub district in Tallo district with 9 cases.

Transmission of DHF vector (*Aedes aegypti* mosquito) able to breed in the city's shelters puddles of water in a place or container or around the home or public places (Indonesia, Department of Health, 2005). *Aedes aegypti* is influenced by the presence of human and environmental factors. Environmental factors associated with the presence of *Aedes aegypti*, among others, the type of water shelters, rainfall, temperature, humidity and pH of the water (Indonesia, Department of Health, 2010).

The best way to prevent this disease is to eradicate mosquito larvae or the nest-called Mosquito Eradication of Dengue Hemorrhagic Fever (ME-DHF) (Kemenkes, 2011), therefore, that the implementation of ME-DHF should be run effectively, it takes effort to find out to what extent the role of environmental factors in influencing the level of presence and density of *Aedes aegypti* mosquito larvae. Adults developed a system to create a direct mapping of spatial or a health problem that is known as geographic information systems or GIS. By mapping features, we can easily identify the risk environment, analyzing the health situation in a particular geographic area, analyze the pattern of disease, facilitate public health surveillance and monitoring, facilitate the allocation of health resources, and facilitate the evaluation of a health intervention (Indriasih, 2008). Based on the above description, the authors conducted a study on the relationship analysis and mapping of environmental factors with the presence of mosquito larvae of *Aedes aegypti* in DHF endemic region of Makassar City.

Material and Method

Type and research area

This observational study applied a cross-sectional design. This study carried out on the territory of endemic of dengue hemorrhagic fever (DHF) in Makassar City, five sub districts with the highest cases of DHF endemic districts in Makassar.

Population and samples

The population in this study was the entire houses in the five districts endemic dengue hemorrhagic fever (DHF) in Makassar. Then, sample in this study were houses located in the five districts that were selected by proportional random sampling, with a total of 200 sample homes.

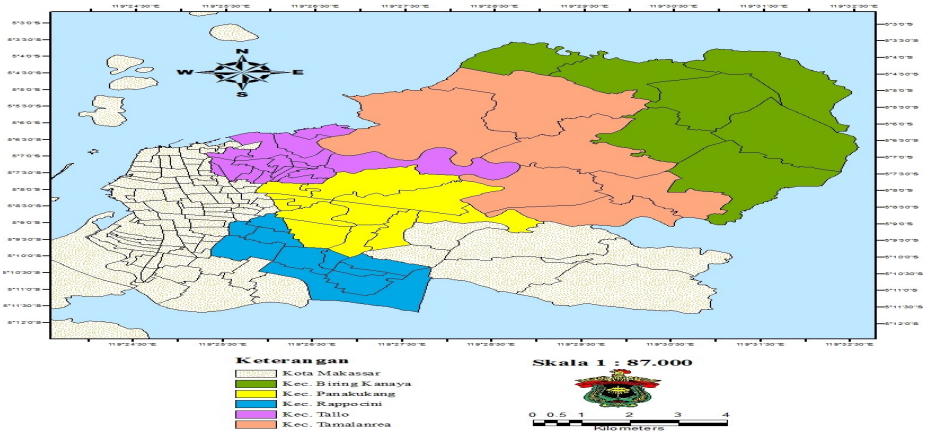

Figure.1 Research sites on dengue endemic region in five districts

Data collections were done by observing the homes in this research sites. The number of homes sampled in this study was 200 homes and a total of 558 containers.

Results and Discussion

The presence of larvae

Table.1 Distribution of *Aedes* Aegyti larvae based of houses in dengue endemic area, Makassar

No	Larvae existence	Houses	
		n	%
1	Exist	40	20.0
2	None	160	80.0
	Total	200	100.0

Table 1 shows that of the 200 houses were inspected, there were 40 homes (20%) found positive *Aedes aegypti* larvae.

Table.2 Distribution of *Aedes aegypti* larvae based of container type in dengue endemic area Makassar

No	Container type	Larvae existence				Number	
		Exist		None			
		n	%	n	%	n	%
1	Bathtub	18	18,6	79	81.4	97	100,0
2	Crock	0	0.0	30	100.0	30	100,0
3	Drum	4	44.4	5	55.5	9	100,0
4	Ember	5	2.6	185	97.4	190	100,0
5	Barrel	10		34		44	100,0
6	Refrigerator mat	2		56		58	100,0
7	Dispenser mat	21	20.8	80	79.2	101	100,0
8	Others	6		23		29	100,0
	Total	66	100	492	100	558	100,0

Table 2 shows that the larvae of *Aedes aegypti* is most prevalent on the dispenser mat with 21 (20.8%) of 101 were examined and did not reveal any larvae in jars (0%) of the 30 jars were examined.

Table.3 Distribution of *Aedes aegypti* larvae based of village of dengue endemic area Makassar

No	Sub district/district	Larvae existence		Total
		Exist	None	
1	TAmalanarea/Paccerakkang/	14	54	68
2	Paccerakkang/	9	16	25
3	Rappokalling	7	49	56
4	Karuwsi	5	11	16
5	Gunung Sari	5	30	35
	Total	40	160	200

Table 3 shows that the larvae of *Aedes aegypti* is most prevalent in Tamalanrea sub district was found in 14 of the 68 homes were inspected, whereas the least amount was found in the Karuwisi and Gunung Sari sub districts with 5 of 11 houses 5 of 30 houses were inspected, respectively.

Relationship of physical and chemical environmental factors with the presence of larvae of *Aedes aegypti*

Relationship of Physical environmental factors (humidity and average temperature) and chemical environment (pH average) with the presence of *Aedes aegypti* larvae can be seen in the following Table 4.

Table.4 The relationship of physical and chemical environmental factors with the existence of larva *Aedes aegypti* in dengue endemic area Makassar

Physical environmental factor:	Larvae existence				Total		*P Value*
	Exist		None				
Humidity average	n	%	n	%	n	%	
Potential	28	17.1	136	82.9	164	100.0	
Not Potential	12	33.3	24	66.7	36	100.0	
Total	40	20	160	80	200	100.0	
Physical environmental factor:	Larvae existence				Total		*P Value*
	Exist		Exist				
Water temperature average	n	%	n	%	n	%	
Potential	18	23.4	59	76.6	77	100,0	0,345
Not Potential	22	17.9	101	82.1	123	100,0	
Total	40	20	160	80	200	100.0	
Chemical environmental factor: Water pH average	Larvae existence				Total		*P Value*
	Exist		Exist				
	n	%	n	%	n	%	
Potential	34	19.3	142	80.7	176	100.0	0,514
Not Potential	6	25.0	18	75.0	24	100.0	
Total	40	20	160	160	200	100.0	

Table 4 shows that of the 164 homes with potential moisture, it was found that 136 home (82.9%) do not have larvae and 28 homes (17.1%) have larvae. Then, from 36 homes with moisture potential, there were 24 houses (66.7%) do not have larvae and 12 homes (33.3%) have larvae. Furthermore, of the 77 homes with an average water temperature potential, it was found that 59 homes (76.6%) do not have larvae and 18 homes (23.4%) found have larvae. Then, from 123 homes with average water temperature is not potential, 101 houses (82.1%) do not have larvae and 22 homes (17.9%) have larvae. Based on chemical environmental factors, it appears that of the 176 homes with an average pH of water potential, it was found 142 homes (80.7%) contained no larvae and 34 homes (19.3%) found the larvae. Then, from 24 homes with the average pH of the water is not potential, 18 homes (75%) do not have the larvae and 6 (25%) had larvae. Based on the results of the Chi Square test showed that the average humidity average associated with the presence of larvae (p value = 0.027), whereas the average water temperature and the average pH of the water was not associated with existence of *Aedes aegypti* larvae with (p value = 0.345 and 0514).

Here we presented the distribution of larvae based relationship where physical and chemical environmental factors on the sample villages with highest larvae level, which is located in the Tamalanrea District, are presented in Table 5 and Figure 1, 2, 3.

Relationship of physical and chemistry environmental factors with the presence of larvae

Table.5 The relationship of physical and chemical environmental factors with the presence of larvae of *Aedes aegypti* in the Tamalanrea, Makassar.

Physical environmental factor: Humidity average	Larvae existence				Larvae existence	
	Exist		None		Exist	None
	n	%	n	%	n	%
Potential	9	19.6	37	80.4	46	100.0
Not potential	5	22.7	17	77.3	22	100.0
Total	14	20.6	54	79.4	68	100.0
Physical environmental factor: Temperature average	Larvae existence				Total	
	Exist		None		Exist	None
	n	%	n	%	n	%
Potential	5	35.7	9	64.3	14	100.0
Not potential	9	16.7	45	83.3	54	100.0
Total	14	20.6	54	79.4	68	100.0
Chemical environmental factor: pH average	Larvae existence				Total	
	Exist		None		Exist	None
	n	%	n	%	n	%
Potential	12	18.5	53	81.5	65	100.0
Not Potential	2	66.7	1	33.3	3	100.0
Total	14	20.6	54	79.4	68	100.0

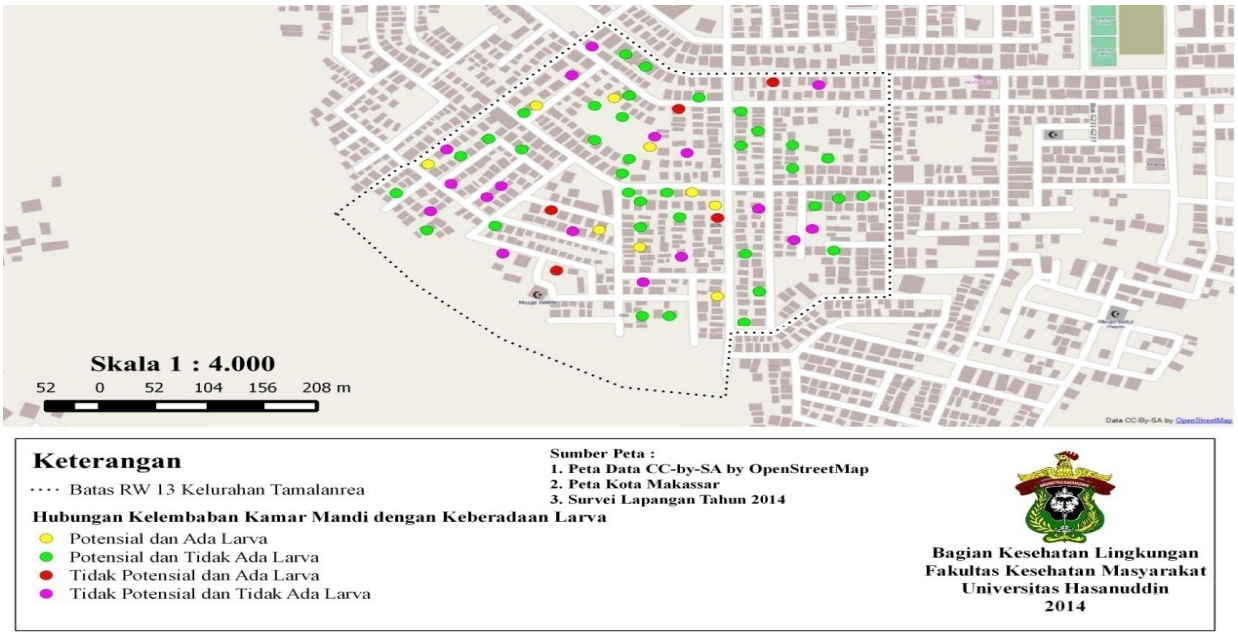

Figure.2 Distribution map of average humidity relationship with the existence of larvae in Tamalanrea

Table 5 and Figure 2 shows that of the 46 homes with an average humidity of potential, it was found 9 (19.6%) were positive for existing homes larvae, and 37 (80.4%) homes that are not contained larvae.

Then, of the 22 homes with an average humidity is not potential, we found 5 (22.7%) home positive and 17 (77.3%) homes that are not contained larvae.

Relationship of average water temperature with presence larvae

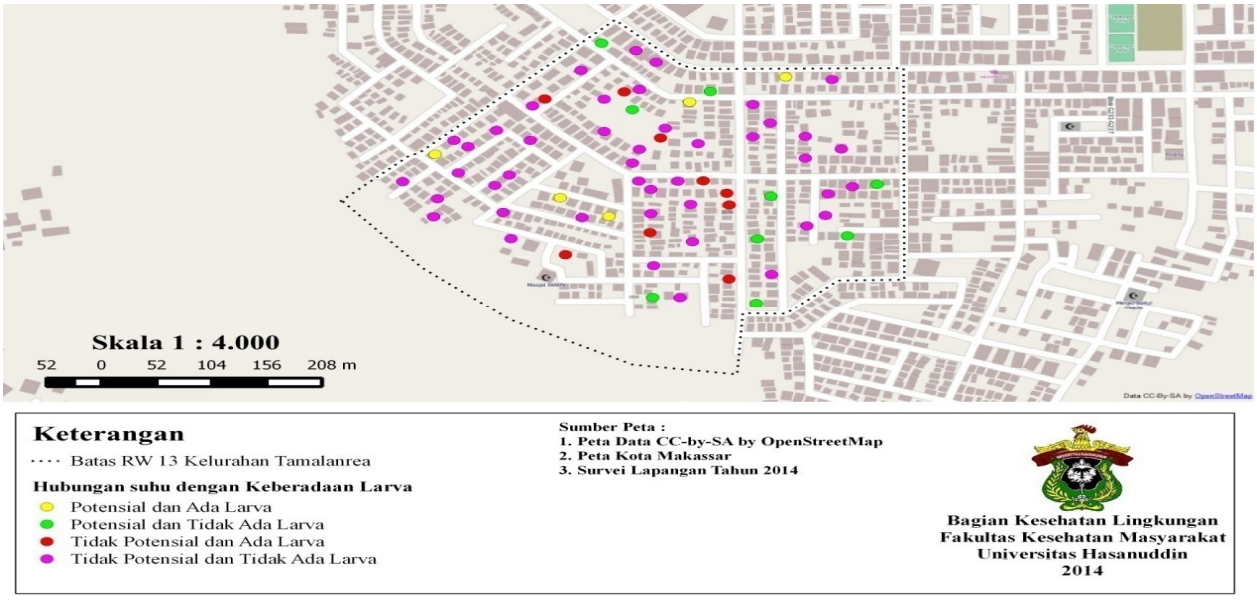

Figure.3 Distribution map of average temperature relationship with larvae existence in the Tamalanrea

Table 5 and Figure 3 shows that of the 14 homes with an average temperature potential, found 5 (35.7%) were positive for existing homes larvae, and 9 (64.3%) homes that are not contained larvae. And of the 54 homes with an average temperature of no potential, found 9 (16.7%) positive home there are larvae and 45 (83.3%) homes that are not contained larvae.

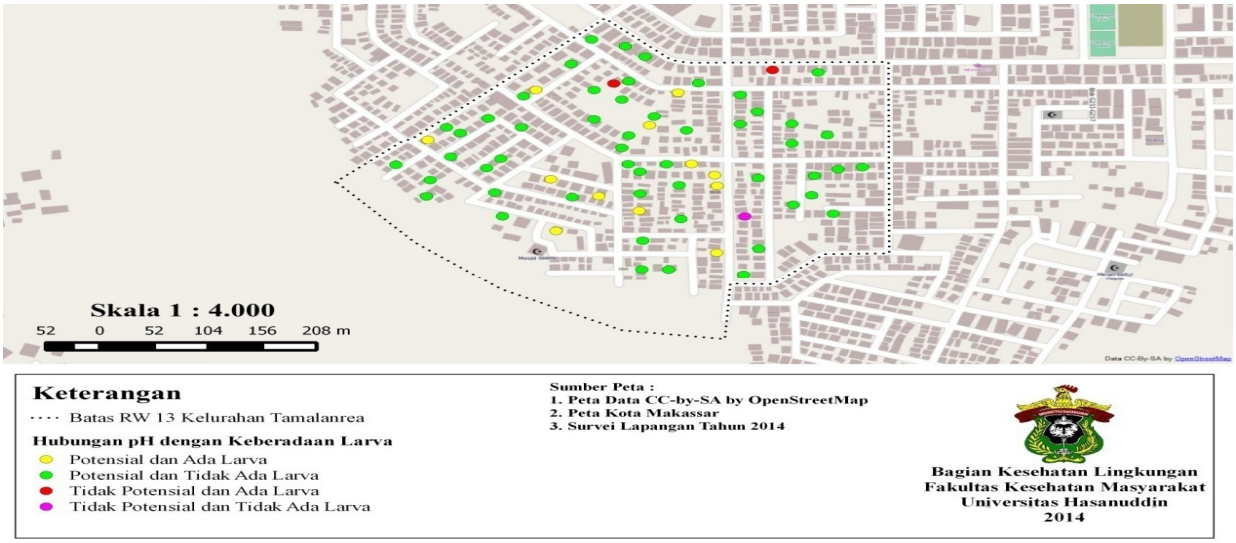

Figure.4 Distribution maps of average water pH relationship with larvae existence in Tamalanrea

Relationship of average pH with presence larvae

Table 5 and Figure 4 shows that of the 65 homes with an average pH of water potential, it was found 12 (18.5%) positive for existing larvae, and 53 (81.5%) homes that are not contained larvae. Then, from 3 homes with an average pH of water is not a potential, found 2 (66.7%) positive home with are larvae and 1 (33.3%) homes that are not contained larvae.

Relationships of moisture to the presence of larvae of *Aedes aegypti*

From the Chi Square test results obtained from cross-tabulation between the presence of moisture with *Aedes aegypti* larvae found there is a relationship between the presence of moisture larvae (P value = 0.027). The lowest humidity recorded was 34% and the highest humidity recorded was 99% and average humidity measured was 73.58%.
This study is in line with research conducted by Arifin (2013) who also said that there is a relationship between the presence of *Aedes aegypti* and moisture, as well as a similar study conducted by Yudhastuti *et al.* (2005) also expressed the same results.

According to Azhari (2004) states that the requirements for breeding *Aedes aegypti* larvae are conducive to moisture is between 60%–80%. Based on the distribution map of environmental factors and their relationship with the presence of larvae in the Village Tamalanrea, Table 5 and Figure 1 show that out of the 46 homes with an average humidity of potential, 9 homes found having larvae and 37 homes not having larvae. And of the 22 homes with an average humidity is

not potential, found no larvae positive 5 houses and 17 houses that are not contained larvae of humidity measurements performed on each house inspected we can see that the majority of homes have moisture potential and can support the existence of *Aedes aegypti* larvae. This can increase the potential for mosquito breeding *Aedes aegypti*. This means that the moisture is in the location of research supports the existence of larvae. Fathi *et al.* (2005) explains that the survival of *Aedes aegypti* which is caused by a low metabolic process is slow due to low temperatures and moisture that can lead to death of the larvae. Based on this we know that moisture is not eligible will result in death of the larvae, thus reducing the possibility of the discovery of the larvae.

Relationships of average water temperature with the presence of larvae of *Aedes aegypti*

Based on the results of the Chi Square test found that there was no relationship between the temperature of the water with the presence of larvae (p value = 0.345) in the endemic area of the city of Makassar. The results of this study conflict with the research conducted by Arifin (2013) which states that there is a relationship between the temperatures of the water in the container with the presence of larvae. Based on distribution maps can be seen that the house has an average water temperature as a potential mosquito breeding places are 14 homes but not all homes with an average temperature of that potential can be found larvae. There are only 5 houses which have an average temperature and a positive potential is found larvae of the distribution map we can see that most of the water temperature in the container is checked at every home has a water temperature that is not potentially as a larval development. This is one of the factors that lead to a lack of positive containers found there are larvae.

According to Boesri et al (2001) water temperature is one factor that can influence the development and survival of larvae of *Aedes aegypti*, the water temperature suitable for the development of larvae of *Aedes aegypti*. The same thing is expressed by Oktaviani (2009) that one of the environmental parameters that significantly correlated with population density of *Aedes aegypti* mosquito larvae is the water temperature. Water temperature plays a role as a determinant for the success of larval growth. It added that the growth of mosquitoes would be stopped altogether when the temperature is less than or more than 40°C 10°C.

Relationship of average water pH by the presence of larvae of *Aedes aegypti*

Chi Square test results obtained from cross-tabulation between pH with the presence of *Aedes aegypti* larvae could be identified that there is a relationship between the temperature of the water with the presence of larvae (p Value = 0514). Water pH measurement results obtained show that the number of containers in the house with a pH that is potentially larger than the number of containers in the house with a pH that is not potential. The pH of water can be affected by sources of water used. Based on observations in the homes inspected in mind that most of the water used in every home are water taps water taps which is supposed to refer to the Minister Regulation No. 492 / Menkes / PER / IV / 2010 which require that the pH of water should have been 6.5 to 8.5. pH is a factor of life consequences for *Aedes aegypti* larvae. pH of the water that is too acidic or too alkaline will easily result in the death of larvae. One of the factors that may affect larval survival is the availability of food. pH is too acidic expected to inhibit the

growth of plankton, while it is known that plankton is one of the largest food source for the larvae, with reduced larval food source for the larvae to maintain his chances are very small (Hadi, 2006).

Others allegedly close relationship between pH and the presence of larvae state that the formation of the cytochrome oxidase enzyme in the body that functions larvae in the process of metabolism. The formation of these enzymes is influenced by the high and low levels of dissolved oxygen in the water. The atmosphere is too acidic will cause rapid growth of microbes which will also lead to reduced oxygen levels in the water. This is thought to inhibit the formation of cytochrome oxidase enzyme in the larval body can also affect the survival of larvae (Hidayat, 1997).

The conclusion of the study is out of the 200 homes were observed, it was found that 40 homes (20%) were positive for *Aedes aegypti* larvae. *Aedes aegypti* larvae most commonly found in the type of container mat dispenser of about 21 (20.8%). Of 101 were examined and did not reveal any larvae in jars (0%) of the 30 jars were examined. Factors associated with the presence of moisture larvae (p value = 0.027), whereas the temperature factor and the average pH of water is not associated with the presence of larvae of *Aedes aegypti* (p value = 0.345 and 0.514). Based on the mapping results, it appears that the area of endemic villages with a positive number of homes found any *Aedes aegypti* larvae are most numerous in the Village Tamalanrea, Tamalanrea districts.

References

Arifin, Asrianty. 2013. Hubungan karakteristik lingkungan fisik dengan keberadaan larva Aedes *aegypti* di wilayah endemis DBD di kel. Kassi-kassi kec.Rappocini Kota Makassar tahun 2013. Fakultas Kesehatan Masyarakat. Universitas Hasanuddin, Makassar.

Arsunan, A.A. 2013. Epidemiologi demam berdarah di Indonesia. Masagena Press, Makassar, Indonesia

Azhari, Muslim. 2004. Faktor Lingkungan yang Berpengaruh Terhadap Kejadian Infeksi Virus Dengue (Studi Kasus di Kota Semarang). Program Pasca Sarjana. Universitas Diponogoro, Semarang.

Boesri, H., Suwasono, H., Buwono, D.T., dan Raharjo. 2001. Pengaruh Pengabutan Alpha cypermethrin 30 EC dan Lambda Sihalothrin 25 EC Terhadap Larva Aedes *aegypti*. Cermin Dunia Kedokteran. Vol. 41, No. 131.

Fathi, Soedjajadi, Keman, dan Chatarina Umbul Wahyuni. 2005. Peran Faktor Lingkungan dan Perilaku terhadap Penularan Demam Berdarah Dengue di Kota Mataram. Jurnal Kesehatan Lingkungan, 2(1): 1 – 10.

Hadi, dkk. 2006. Habitat Jentik Aedes aeigypti pada Air Terpolusi di Laboratorium. Jurnal Kesehatan Fakultas Kedokteran Hewan: Institut Pertanian Bogor

Hidayat, dkk. 1997. Pengaruh pH Air Tempat Perindukan Terhadap Pertumbuhan dan Perkembangan Aedes aegipty pra Dewasa. Cerminan Dunia Kedokteran

Indriasih, Endang. 2008. Sistem Informasi Geografis (SIG) dalam Bidang Kesehatan Masyarakat. Buletin Penelitian Sistem Kesehatan 11(1): 99–104

Oktaviani, N. 2009. Faktor-faktor yang berpengaruh terhadap densitas larva nyamuk Aedes *aegypti* di Kota Pekalongan. Skripsi. Fakultas Ilmu Kesehatan Universitas Pekalongan

Siregar, Faziah A. 2004. Epidemiologi dan Pemberantasan Demam Berdarah Dengue (DBD) Di Indonesia. Artikel: [online]. http://library.usu.ac.id/ download/fkm/ fkmfazidah3.pdf. [diakses 13 Februari 2014]

Yudhastuti, Ririh and Anny Vidiyani. 2005. Hubungan Kondisi Lingkungan Kotainer, dan Perilaku Masyarakat dengan Keberadaan Jentik Nyamuk Aedes egypti di Daerah Demam Berdarah Dengue Surabaya. [online] http:// journal.unair.ac. id/filer PDFKESLING-1-2-08.pdf/ [diakses 14 Februari 2014].