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Relationship of Environmental Condition, Container and Behavior with the Existence of *Aedes aegypti* Mosquito Larvae in an Endemic Area of Dengue Hemorrhagic Fever, Makassar

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Abstract: In Rappocini District, Makassar City, dengue hemorrhagic fever (DHF) is an endemic area. The high incidence of dengue is closely related to the population of *Aedes aegypti* mosquitoes. This study aimed to analyze the relationship between environmental conditions, container and behavior on the existence of the mosquito of *Aedes aegypti*. This was an observational study with a cross-sectional study design. The sample size was 100 houses and they were selected via simple random sampling. In depth interviews, measurements and observations were conducted to achieve the research objective. Data were analyzed by Chi-square and Fisher's exact tests to determine the relationship of environmental conditions (temperature, humidity), container (container type) and the characteristics of residents (knowledge, attitude and actions) with the presence of *Aedes aegypti* larvae. This study found a significant relationship between humidity ($p = 0.000$), type of container ($p = 0.004$), knowledge ($p = 0.001$) and practice ($p = 0.001$) in the presence of *Aedes aegypti* mosquito larvae. Meanwhile, the air temperature and the attitude of the respondents were not significantly related with the results of the study of *Aedes aegypti* larvae. In conclusion, the environmental conditions, container and community characteristics in Rappocini District, Makassar City are not conducive to mosquito nest cleaning (PSN); thus, the density of *Aedes aegypti* is high in this region. The density of larvae showed high dispersion, i.e., HI = 68%, CI = 30.6%, BI = 82% and DF = 8. Public participation in the eradication of dengue disease via eradication of the mosquito *Aedes aegypti* is recommended and would involve cleaning the environment, especially by draining water stores, which are nests for mosquito larvae.

Key words: *Aedes aegypti*, behavior, environmental, mosquito larvae

INTRODUCTION

Dengue hemorrhagic fever (DHF) is an environmental health problem and the number of individuals with DHF tends to increase in increasingly widespread areas, in line with increased population mobility and population density. DHF is caused by dengue virus, which is transmitted by *Aedes aegypti* and *Aedes albopictus*. *Aedes aegypti* has a role in the transmission of this disease, because it lives in and around human homes. Dengue disease is endemic in Makassar because every year definitive cases of dengue fever are recorded somewhere in Makassar. From 2011 to 2013, the number of reported dengue fever cases increased from 1741 (CFR = 0.5) to 2143 (CFR = 0.2) (Dinas Kota Makassar, 2013). The results of periodic monitoring of larvae (CHD) in 2013 showed that the average of larva-free rate in the Rappocini Sub District, Makassar was 87% that indicating that the density of *Aedes aegypti* was still high at that time (Dirjen PPPL, 2009). The existence of *Aedes aegypti* in a geographic area is an indicator of the existence of an *Aedes aegypti* population in the area. Implementing counter measures for DHF is difficult, because the disease is currently incurable. However, the

best way to prevent this disease is to eradicate vector mosquito larvae through eradication of *Aedes spp* nests. This study examined the impact of the eradication of *Aedes aegypti* mosquito larvae on the incidence of dengue in the Village Rappocini Makassar. In order for this intervention to be successful, the relationship of physical environmental conditions, containers and characteristics of residents with the presence of *Aedes aegypti* mosquito larvae must be determined.

MATERIALS AND METHODS

This experiment was conducted in 100 lived-in houses with containers (water reservoirs) in the Village of Rappocini, District Rappocini, Makassar City. This was an observational study with a cross-sectional study design. The study was designed to analyze the state of the object being observed while at the same time attempting to analyze the existing problems. The independent variables were environmental conditions, including air temperature and humidity; type of container and individuals' characteristics, such as knowledge, attitudes and actions. The dependent variable was the

presence of *Aedes aegypti* larvae in Rappocini Village, Rappocini District, Makassar.

The primary data were obtained through interviews and observations. The existence of *Aedes Aegypti* larvae at the homes and the type of container were determined by observation according to the Technical Instructions manual for the eradication of mosquito-borne dengue fever (Dirjen, 2009). Interviews were conducted with the head of the household or its representative at the homes being sampled to determine the characteristics and behavior of members of the society in response to the presence of *Aedes aegypti* larvae. Air temperature data were obtained using a thermometer and air humidity data were obtained using a hygrometer. Secondary data were obtained from the Provincial Health Office of South Sulawesi, Makassar City Health Department, Rappocini Health Center, District Office and Rappocini village and included geographic data, demographics, government and the incidence of dengue hemorrhagic fever (DHF).

RESULTS AND DISCUSSION

Characteristics of respondents: Most respondents were female. Most respondents were between 46 and 55 years of age (38.38%) and 11 respondents (4%) were 15-25 years of age. The education level of the respondents varied; most respondents finished junior level school (35.35%), while only 3 respondents (3%) graduated from a university. Most respondents were house wives who did not work and, thus, had an important role in the mosquito nest eradication program for the prevention of dengue hemorrhagic fever (PSN-DBD) and dengue disease.

Density of *Aedes aegypti* larva: Examination of *Aedes aegypti* larvae in Rappocini sub district, Makassar was conducted by visually examining containers in and outside the home.

Table 1 shows that 100 houses were inspected: 58 (58%) were positive for *Aedes aegypti* mosquito larvae and 42 (42%) were not, resulting in a house index (HI) of 58. Regarding container inspection, of the 268 containers inspected, 82 (30.6%) contained *Aedes aegypti*, resulting in a container index (CI) of 30.6 and a Breteau index (BI)

Relationship between air temperature and *Aedes* mosquito larva: Of 58 homes that contained larvae, 25 (43.1%) had an air temperature conducive to the development of *Aedes aegypti* larvae and 33 (56.9%) did not. Forty percent of homes had an air temperature conducive to the development of *Aedes aegypti* larvae (20-30°C), while 60% had an air temperature that was poor for the development of *Aedes aegypti* larvae. This is because the measurement was only conducted once at the time of the survey, which was between approximately 08:00 and 11:00. The Chi-Square test

Table 1: Distribution of total larvae based on existence of *Aedes aegypti* mosquito larvae in Rappocini Village Makassar in 2014

Checked	Total	---- LQ ----		HI	CI	BI	DF
		Yes	No				
House	100	58	32	58	30.6	82	7
Container	268	82	186				

LQ: Larvae quantity

resulted in a p value = 0.591 ($p > \alpha$), indicating that there was no significant relationship between air temperature and the presence of *Aedes aegypti* larvae in the Village of Rappocini, Makassar.

Air humidity: In addition to air temperature, air humidity is another environmental condition that can affect the development of *Aedes aegypti* larvae. According to (Glen, 2008; Ramesh *et al.*, 2010; Brisbois and Ali, 2010; Barrera *et al.*, 2006) humidity in the range of 81.5 to 89.5% is optimal for the embriosasi process and mosquito embryo survival.

Container type: The container types observed in the respondents' homes were divided into 3 categories: shelter water for everyday purposes and natural shelter water not for everyday purposes (WHO SEARO, 2004). Of those numbers, about 252 containers (94.0%) were filled for daily use whereas 16 (6%) were not.

Relationship between container type and presence of *Aedes* spp: Two hundred fifty-two containers were filled for daily use and 82 of them were positive for mosquito larvae. This is because the Village of Rapocini, Makassar is a dense residential area with slums and poor environmental sanitation, such that many breeding sites for *Aedes aegypti* mosquito larvae that are present, such as bathtubs, toilets, reservoirs and jars, are rarely cleaned. The mentioned sixteen containers that contain some water were not used for daily drinking purpose, but they were used for vases and for pets drinking and none of them were positive for mosquito larvae. The lack of mosquito larvae in those containers was because the water in them was replaced every day. This is supported by research conducted by Glen (2008) in Manila, Philippines. This study involved several surveys conducted in several cities in Indonesia and showed that the containers with the highest potential for mosquito breeding were those that were used day-to-day, such as drums, jars, bathtubs, toilets, buckets and the like.

Knowledge: Fifty-three respondents (91.4%) had a poor level of knowledge and had larvae in their homes. In contrast, only 5 respondents (8.6%) had a good level of knowledge. This finding was supported by the results of the Chi-Square test, which obtained $p = 0.001$ ($p < \alpha$), indicating a significant relationship between the level of

knowledge and the presence of *Aedes aegypti* in homes in the Village of Rappocini Makassar. A study by Notoatmodjo (2005); EHP (2008) showed that knowledge of the cognitive domain is very important for the formation of one's actions (overt behavior) and that behavior that is based on knowledge is more lasting than behavior that is not based on knowledge. If a person does not fully understand how mosquito eradication is achieved and is not aware of the factors that affect the existence of larvae, then he/she cannot take appropriate actions; thus, the homes of such unknowledgeable respondents contained *Aedes aegypti*.

Attitude: A good attitude with regard to efforts towards mosquito nest eradication, more than abatisation, was observed in 89% of the respondents. This is because the respondents always answered that their efforts towards PSN are acceptable. The respondents answered "no" when asked whether they approved of the draining of the water reservoirs, despite being conscious of the purpose, namely, to remove *Aedes aegypti* larvae. However, this response is related to the poor condition of the water. The attitude of the respondents was that the question of draining the reservoir remains closed and that it was an unrealistic option; consequently, they agreed with the implementation of PSN efforts and abatisasi despite these efforts not necessarily being in accordance with the respondent's attitude. The results of the Fisher's exact test ($p = 0.113$) ($p > \alpha$) supported this finding and showed no significant relationship between respondent attitudes and the presence of *Aedes aegypti* larvae in the Village of Rappocini, Makassar.

Action: Among respondents with unfavorable actions, 65.5% had *Aedes aegypti* larvae in their homes, while for all respondents 34.5% had *Aedes aegypti* larvae in their homes. This shows that the action of the respondents are very closely linked to the presence of larvae in their homes. The Chi-Square test statistic obtained a $p = 0.001$ ($p < \alpha$), indicating a significant correlation between the actions of the respondents with the presence of *Aedes aegypti* mosquito larvae. According to WHO-SEARO (2004); Gubler *et al.* (2001) people's behavior has an effect on the environment because the environment is an area for the development of such behavior. If people are willing to perform mosquito nest eradication regularly and continuously, they can prevent the growth *Aedes aegypti* mosquito larvae and prevent the illness dengue hemorrhagic fever.

Conclusions: The density of *Aedes aegypti* larvae in the Village of Rappocini, Makassar measured by the parameters HI = 58%, CI = 30.6%, BI = 82% and DF = 7

indicates an increasingly high transmission of *Aedes aegypti* mosquitoes, that is sufficiently fast to enable the spread of the disease DHF. No association was found between temperature and humidity and the presence of larva. The type of container used by the people in the village of Rappocini Makassar was related to the presence of *Aedes aegypti* mosquito larvae. The knowledge and action to reduce or suppress the density of *Aedes aegypti* mosquito larvae were related to the presence of *Aedes aegypti* mosquito larvae. However, the attitudes of the respondents were not related to the presence of *Aedes aegypti* larvae in the Village of Rappocini, Makassar.

Suggestion: The members of the urban Village Community of Rappocini Makassar need to take a more active role in the eradication of dengue disease through eradication of *Aedes aegypti* mosquito breeding by 3 M, especially in draining water reservoirs with regular base and wall brushing and sprinkling abate powder into containers that cannot be drained. These methods of eradication should be disseminated throughout the Village of Rappocini, Makassar via the mass media, schools, places of worship, "PKK/Dasa Wisma/Jumantik" cadres and other community groups.

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