How to Cite:
Wanti, W., Rahmawati, E., Respati, T., & Sila, O. (2022). Density of Praimago Aedes sp and its relationship with dengue haemorrhagic fever in Kupang City, East Nusa Tenggara Province, Indonesia. *International Journal of Health Sciences*, *6*(S9), 724–731.
https://doi.org/10.53730/ijhs.v6nS9.12320

Density of Praimago *Aedes sp* and its relationship with dengue haemorrhagic fever in Kupang City, East Nusa Tenggara Province, Indonesia

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***Abstract*---**East Nusa Tenggara (NTT) is still endemic for DHF, as in Kupang city. This study aim was to analyze the relationship between *Aedes sp* praimago density and the DHF incidence in Kupang City. This observational analytic study with a case control design was conducted in 25 urban villages in Kupang City using Cluster sampling. The independent variables were the density of praimago such as House Positivity (HP), Number of Larvae in House (LH), Number of Pupa in House (PH), and Total Eggs (TE), and the dependent variable was the DHF incidence. Data were obtained by entomological surveys to see the density of eggs, larvae and pupae of *Aedes sp* per house, and then analyzed by independent t test, and Pearson correlation. House positivity (HP) was found to be significantly associated with the DHF incidence (p 0.001; OR 3.519). Larvae in House (LH) and total eggs were also correlated with the DHF incidence, but pupae in house (PH) was not correlated. The conclusion drawn is that the density of *Aedes sp* mosquito larvae such as HP, LH and TE in a house can be used to estimate the risk of dengue incidence from family members living in the house.

***Keywords*---**Aedes sp, House Positivity, Larva in House, Pupa in House, Total Eggs, Dengue Haemorrhagic Fever.

Introduction

Dengue Hemorrhagic Fever (DHF) is a vector-borne disease caused by the Dengue virus (Ditjen PP & PL, 2005). This disease is still a major problem in tropical and subtropical regions, including Indonesia. Disease burden, high mortality, poverty and social burden are impacts that can be caused by DHF (Ali, Asha, & Aneesh, 2014; Halstead, 2008; Unicef, 2009; Young-S, Moo-Key, & Young-joon, 2002). The Province of East Nusa Tenggara (NTT) is an endemic area of DHF, as well as the City of Kupang as the capital of the Province of NTT from year to year which has a high DHF Incidence Rate (IR) and is even higher than the national figure. The numbers are 78.9 per 100,000 population in 2016, 26.1 per 100,000 population in 2017 and 24.8 per 100,000 population in 2018 (Dinkes Kota Kupang, 2019; Kemenkes RI, 2019). Prevention and control of DHF is always carried out in Kupang City, but the incidence of DHF remains constant high.

The high number of dengue cases in Kupang City and the presence of dengue cases in both the dry and rainy seasons indicate that the risk of dengue transmission in Kupang City is high. Mosquito density can describe the bionomics of *Aedes sp* and the risk of disease transmission. However, mosquito density is more difficult to measure so we can use praimago (egg-larvae-pupae) density to predict mosquito density. Previous research has also proven that there is a relationship between the presence of larvae and the incidence of DHF with an Odds Ratio (OR) of 5 (Sari & Darnoto, 2012).

The implementation of the DHF program and research so far have used House Index (HI), Container Index (CI), Breteau Index (BI) and Pupa Index (PI) to calculate the density of *Aedes sp* praimago and the risk of an area to dengue transmission, or other indices such as Pupal per Container Index (PCI), Pupal Per Person (PPP), Egg Density Index (EDI), larval per container index (LCI), and Larval Density Index (LDI) (Bhat & Krishnamoorthy, 2014; Focks, Brenner, Hayes, & Daniels, 2000; Weeraratne, Perera, Mansoor, & Karunaratne, 2013; Yotopranoto, 2013; Zeidler, Acosta, Barreto, & Cordeiro, 2008). However, it is also necessary to look for an index that describes the individual risk of DHF transmission. Another reason for the need for information on the DHF vector density index based on individual risk is that mosquitoes will not fly and bite people who are outside the distance. ability to fly, so that people who live near mosquito breeding places will be more at risk of being bitten and infected with the dengue virus. So the purpose of this study was to analyze the relationship between praimago density and the incidence of DHF in Kupang City.

Method

This observational analytic study was conducted with a case control design. The study was conducted in 25 urban villages in Kupang City with case samples were DHF patients and control samples were non-DHF patients living around DHF patients within a radius of 100 meters in the same village. The sample size is 20

houses for each village or 500 houses from 12 villages in the dry season and 13 kelurahan in the rainy season. The sample was taken by cluster sampling because the cases of DHF were few and spread in several villages.

The independent variable is the density of praimago such as the presence of larvae and pupae in the house or House Positivity (HP), Number of Larva in House (LH), Number of Pupa in House (PH), Total Eggs (TE) while the dependent variable is the incidence of DHF. Praimago density can be determined by conducting an entomological survey in the form of a survey of eggs, larvae and pupae of *Aedes sp*. The tools needed are ovitrap, ovistrip, scoop, pipette, gamadotik (a tool to take larvae and pupae in large containers), flashlights, bottles, label paper, stationery and examination forms. Larvae and pupae surveys were carried out in the same house as the house where the eggs were collected. All the larvae in each house placed in small bottles or plastic and labeled, then brought to the laboratory to be identified using an identification key (Cutwa & O'Meara, 2008). Collected data were processed to see the density of eggs, larvae and pupae per household. The processed data was then analyzed statistically, namely bivariable analysis using frequency distribution, independent t test, and Pearson correlation.

Result

This study found that house positivity (HP) in the dry season was significantly associated with the incidence of dengue fever (OR=3,519 p=0.001) or houses that were positive for larvae and pupae, so that the occupants were at risk of getting dengue fever 3,519 times compared to houses that were not positive for larvae and pupae, as shown in Table 1.

Table 1
Relationship of House Positivity (HP) in Patients and Non-DHF Patients with DHF Incidence in Kupang City

HP	Patient	Not Patient	Total	P value	OR (95% C.I.)
Positive	27 (73%)	201 (43.4%)	228 (45.6%)	0.001	3.519 (1.665 – 7.439)
Negative	10 (27%)	262 (56.6%)	272 (54.4%)		
Total	37 (100%)	463 (100%)	500 (100%)		

The number of larvae and pupae in the observed house or Larva in House (LH) was 32,937 larvae, and statistically there was a difference in the number of larvae in the houses of patients with non-DHF patients. Pupa in House (PH) or the number of pupae per house ranged from 0 - 203 pupae in non-DHF patients and only 0-102 in DHF patients, and apparently PH was not associated with the incidence of DHF. Likewise, the number of eggs or Total Eggs (TE) in DHF patients was found to be more than non-DHF patients, and statistically there was a significant relationship between TE and the incidence of DHF, as shown in Table 2.

Table 2
Relationship of Positive Container (PC) in Patients and Non-DHF Patients with DHF Incidence in Kupang City

Variable	Status	Sampel (n)	Mean PC	S.D.	Min - Max	Nilai p
LH	Patient	37 (7.4%)	204.1	328.57	0 – 1221	0.009
	Not Patient	463 (92.6%)	54.8	114.39	0 – 1305	
PH	Patient	37 (7,4%)	10.2	20.60	0 - 102	0.195
	Not Patient	463 (92.6%)	6.1	18.72	0 - 203	
TE	Patient	37 (7.4%)	31.3	30.05	0 – 108	0.010
	Not Patient	463 (92.6%)	17.6	23.85	0 – 160	

Discussion

The determinants of the incidence of vector borne diseases are humans, the environment, agents and vectors, so that if the vector, in this case the *Aedes sp* larvae, is at home, the likelihood of dengue disease occurring will be greater than in homes where *Aedes sp* larvae are not found. this is possible because the flight distance of *Ae aegypti* in urban areas is generally only about 50 m from breeding (Honório et al., 2003). The existence of *Aedes sp* larvae which will later become adult *Aedes sp* mosquitoes plays a role in the transmission of DHF disease, because DHF can only be transmitted through *Aedes sp* mosquitoes, which in In Indonesia, there are 2 species that are generally known, namely *Ae. aegypti*, *Ae. albopictus*, while *Ae. scutellaris* is also found but still in Eastern Indonesia (Ditjen PP & PL, 2013).

The presence of larvae in the house (HP) was associated with the incidence of DHF with p≤0.05 and OR 3.519, which means that in a positive house where larvae were found, the risk of family members being affected by DHF was 3.519 times higher than that in a house that was negative for larvae. This is consistent with previous studies in Bandarlampung and in Kolaka which found a relationship between the presence of larvae in the landfill and the incidence of DHF (p≤0.05) (Amrieds, Asfian, & Ainurafig, 2016), and Parida *et al.* (2013) also found that in Medan there was a relationship between the presence of *Ae. aegypti* with the incidence of DHF (p≤0.05).

The number of larvae in each house (LH) in this study in Kupang City was found to be associated with the incidence of DHF (p≤0.05), while the number of pupae in each house (PH) was not associated with the incidence of DHF (p>0.05). Based on Dibo *et al.* (2008), the number of mosquitoes is an important factor affecting the intensity of transmission of vector borne diseases. The number of larvae can describe the number of high adult mosquito density levels, so it can also describe the risk of dengue incidence. The more larvae will affect the more adult mosquitoes and also the greater the risk of dengue transmission. The average larvae in this study in Kupang City were more in the homes of DHF sufferers; this indicates the risk of DHF incidence in Kupang City is greater in people whose homes have found more larvae.

The number of eggs (TE) was significantly associated with the incidence of DHF with ($p \leq 0.05$). In contrast to previous studies in Brazil which found egg positivity or the presence of eggs was not associated with the risk of DHF incidence (Dibo et al., 2008). The pupa index is considered better than the larvae or egg index for several reasons, namely: the developmental stage is closer to that of the adult mosquito so that calculating the number of pupae can be more precise describe adult mosquito densities versus counting larvae or eggs; cheaper and faster to do if the aim is to see the adult mosquito species; and low pupa mortality and it has been proven that the number of pupae is related to the number of adult mosquitoes (Focks, 2003).

In contrast to this explanation, it turns out that in this study the number of pupae and eggs was not related to the incidence of DHF because there were very few larvae that had become pupae, besides the possibility of the existing pupae becoming adult mosquitoes so that it could not describe the density of adult mosquitoes, and also could not describe the density of adult mosquitoes risk of DHF incidence based on pupa density.

Total Eggs (TE) was greater in DHF patients than in non-DHF patients. This shows that the higher the number of eggs and the higher the density of egg per ovitrap, the higher the risk of DHF incidence, and conversely the lower the number of eggs and the density of eggs per ovitrap, the lower the risk of DHF incidence. In addition, it is statistically related to the incidence of DHF, so here it is necessary to eliminate mosquito breeding places, namely cleaning or eliminating water reservoirs that have the potential as mosquito nesting places. Seeing the importance of the role of larval density in the incidence of DHF, the community is expected to actively participate in eradicating DHF mosquitoes at home and in their area with 3M plus. 3M plus activities that can be done include always cleaning the landfill at least once a week by scrubbing the inner walls of the small landfill, or controlling the presence of larvae by taking larvae at least once a week. Community also could be provided temephos, giving larvae-eating fish for large-sized landfills or for areas with insufficient water availability, including closing all landfills tightly so that there are no gaps for mosquitoes to enter the landfill. Another ways to control praimago density are reuse a large, unused landfill for trash or a place to plant flowers so that it doesn't become a breeding ground for mosquitoes.

In addition, the government needs to socialize to the public about the importance of dengue surveillance carried out starting from the individual and household scope. The community needs to observe the presence of larvae and pupae of *Aedes sp* and at the same time intervene independently in their homes so that the existing container does not become positive for larvae or pupae, and the existing larvae or pupae do not turn into adult mosquitoes. The Health City Office or Primary Care Office should also distribute observation tools in each Neighborhood Association to facilitate the implementation of independent surveys by the local community.

The HI, CI and BI larvae indices that are commonly used so far still have drawbacks, namely these indices fail to provide adequate data per region or per person and the factors that are known to be related to the level of dengue

transmission. The CI is considered the weakest larval index because this index only describes the proportion of positive landfill in an area and does not consider the number of landfills in a house in an area. The HI index may be better but the HI does not reflect the number of positive landfills per house. The BI index is better than the CI and HI because it combines information about container and houses (Dibo et al., 2008).

Most of the indices as well as dengue control measures are based on the emphasis on mosquito population surveys and not on eradicating mosquito populations. HI and CI figures were obtained only from house and landfill surveys that were positive for larvae and provided recommendations urging the community to routinely clean the landfill and not to take concrete actions to eliminate the larvae and pupae. Officers sometimes distribute temephos directly to homes that are positive for larvae and pupae but do not directly control the use of temephos in the field, besides that long-term use of temephos can also cause resistance in larvae if not given the right dose.

Based on these reasons, in this study a new pre-imaging index was created, namely LH and TE which aims to get a better index to describe the risk of DHF incidence. In addition, the new praimago index in this study also aims to eradicate the larval population because to obtain this index, all existing larvae and pupae must be taken so that this includes concrete steps for eradicating dengue vectors. The act of cleaning larvae and landfill is certainly not the duty and responsibility of health workers, but this can be done together with the community when the officers carry out house surveys.

There are two advantages to the finding of indicators in this study, namely that officers can carry out promotive and preventive activities, namely officers get larvae and pupae indices that can be used to predict the risk of DHF, and at the same time provide counseling to the community to always clean the landfill regularly, while the community also has the direct advantage of being cleaned of all larvae and pupae in the landfill without having to dispose of the existing water.

Conclusion

This study concluded that vector density, namely the density of praimago in a house, can be used to estimate the risk of dengue incidence from family members living in the house. The density of praimago associated with the incidence of DHF is the density of larvae HP, and LH, TE.

Acknowledgments

Thanks are given to Poltekkes Kemenkes Kupang for facilitating the funding and implementation of this research. Thanks also to the Kupang City Health Office for facilitating the implementation of research activities in the community. Don't forget to thank the community and all parties who have contributed so that this research can run well.

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