



Characteristics of Dengue Hemorrhagic Fever Vectors in North Kembangan Sub-district, Kembangan District, West Jakarta City

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ABSTRACT

Dengue fever is a health problem in Kembangan Utara urban village, Kembangan sub-district. There were 136 cases of DHF in September 2022 with a population of 68,841 with an IR of 197.6. Considering the high number of cases, it is necessary to coordinate vector density survey and Dengue virus examination in *Aedes aegypti* mosquitoes. Objective: To coordinate activities for vector density surveys and Dengue virus testing in *Aedes aegypti* mosquitoes. Observational research methods were carried out by observing the presence of *Aedes aegypti* larvae in terms of breeding sites. Observations were made using observation sheets. Statistical analysis to describe the description of breeding sites, density, and types of breeding sites that are dominantly preferred by *Aedes aegypti* mosquito larvae. The results of the mosquito larva survey in 100 houses showed that 31 houses were positive for larvae (ABJ: 70%), meaning that the area of North Kembangan Village, Kembangan Subdistrict, West Jakarta is at high risk for dengue transmission. Mosquito catching in 100 houses showed that 80 houses found 142 mosquitoes consisting of 123 *Culex* genus, 8 female *Aedes aegypti* mosquitoes and 11 male *Aedes aegypti* mosquitoes. Dengue virus examination of female *Aedes aegypti* mosquitoes from the rearing process showed positive results for Dengue virus. Conclusion Dengue virus examination of female *Aedes aegypti* mosquitoes from the rearing process showed positive results for Dengue virus.

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ABSTRAK

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Demam Berdarah Dengue (DBD) merupakan masalah kesehatan di Kelurahan Kembangan Utara, Kecamatan Kembangan. Terdapat angka kejadian DBD September 2022 136 kasus dengan jumlah penduduk 68.841 dengan IR sebesar 197,6. Melihat tingginya kasus tersebut, maka perlunya kegiatan koordinasi survei kepadatan vektor dan pemeriksaan virus Dengue pada nyamuk *Aedes aegypti*. Tujuan penelitian: Terlaksananya koordinasi kegiatan untuk survei kepadatan vektor dan pemeriksaan virus Dengue pada nyamuk *Aedes aegypti*. Metode penelitian observasi yang dilakukan dengan mengamati keberadaan jentik *Aedes aegypti* ditinjau dari tempat perindukan. Observasi dilakukan dengan lembar observasi. Analisis Statistik untuk mendeskripsikan gambaran tempat perindukan, kepadatan, dan jenis-jenis tempat perindukan yang dominan disukai jentik nyamuk *Aedes aegypti*. Hasil survei jentik nyamuk di 100 rumah menunjukkan 31 rumah positif jentik (ABJ:70%), artinya wilayah Kelurahan Kembangan Utara, Kecamatan Kembangan, Jakarta Barat termasuk risiko tinggi terjadinya penularan DBD. Penangkapan nyamuk pada 100 rumah menunjukkan 80 rumah ditemukan nyamuk 142 ekor yang terdiri dari genus *Culex* yaitu 123 ekor, nyamuk *Aedes aegypti* betina yaitu 8 ekor dan nyamuk *Aedes aegypti* jantan yaitu 11 ekor. Pemeriksaan virus Dengue nyamuk *Aedes aegypti* betina dari proses rearing menunjukkan hasil positif virus Dengue. Kesimpulan pemeriksaan virus Dengue nyamuk *Aedes aegypti* betina dari proses rearing menunjukkan hasil positif virus Dengue.

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INTRODUCTION

Dengue Hemorrhagic Fever (DHF) represents an acute febrile condition instigated by the dengue virus, transmitted to humans via *Aedes aegypti* mosquitoes without regard to age, and can result in fatalities (Iskandar, 2017). Frequently, other illnesses are misidentified as DHF. It is approximated that there are 390 million dengue virus infections each year, with a 95% reliable range of 28-528 million, out of which 96 million (67-136 million) manifest clinically with varying degrees of severity. According to data, the World Health Organization (WHO) has noted an escalation in new dengue fever cases over the last two decades. The count of DHF cases surged from 960 in 2000 to 4,032 in 2015 (WHO, 2020). In 2017, the 5-9 age group exhibited the highest number of DHF cases at 92 (31%), a decline from the previous year's 507 cases. In the 10-14 age group, there were 87 cases (29%). Conversely, in 2018, Indonesia experienced an Incidence Rate of 24.75%, which soared to 51.48% in 2019, accompanied by a Case Fatality Rate of 0.71% (Kemenkes RI, 2019).

The presence of Dengue Hemorrhagic Fever continues to pose a health challenge, particularly in West Jakarta's Kembangan District. As of September 2022, the DHF incidence in Kembangan District, West Jakarta, was as follows: in North Kembangan Sub-district, there were 136 cases among a population of 68,841, with an Incidence Rate (IR) of 197.6; in South Kembangan Sub-district, 133 cases were reported among 33,573 people, resulting in an IR of 396.2; Joglo Sub-district recorded 97 cases with a population of 51,460 and an IR of 188.5; North Meruya Sub-district had 81 cases, a population of 54,934, and an IR of 147.4; South Meruya Sub-district documented 80 cases, a population of 40,807, and an IR of 196.0; Srengseng Sub-district reported 66 cases with a population of 57,219 and an IR of 115.3 (Buku Register Demam Berdarah Dengue, 2022).

The most effective strategy for controlling DHF incidence is to disrupt the mosquito breeding cycle. This can be accomplished through routine cleaning of potential breeding sites, sealing water storage containers tightly, and clearing discarded items that can accumulate water and serve as mosquito breeding grounds (Kemenkes RI, 2011).

Numerous initiatives have been undertaken by the Kembangan District to combat the DHF issue, including epidemiological investigations, mosquito larvae inspections, fogging operations, the "3M plus" campaign, and public awareness drives about DHF. Nevertheless, the incidence of Dengue Hemorrhagic Fever in Kembangan District, particularly in North Kembangan Sub-district, continues to exhibit a high number of cases. To enhance early detection

and avert DHF outbreaks in the region, it is imperative to establish collaborative efforts across programs and sectors in DHF control, including Vector Density Surveys to acquire precise data and insights on vector bionomics, specifically variations in vector density and vector confirmation. This information forms the basis for targeted and efficacious vector control measures. Therefore, researchers are interested in conducting research with the title Characteristics of Dengue Hemorrhagic Fever Vectors in North Kembangan Sub-district, Kembangan District, West Jakarta City.

METHODS

This study is a follow-up analysis of the Vector Density Survey and Dengue Virus Testing conducted on *Aedes aegypti* mosquitoes in North Kembangan Urban Village, Kembangan Sub-district, West Jakarta. The research sample consisted of 100 households in North Kembangan Urban Village, Kembangan Sub-district, West Jakarta that were randomly selected. The data collection method in this study was direct observation of *Aedes aegypti* mosquito breeding sites. The method of collecting *Aedes aegypti* mosquitoes by taking ordinate points of mosquito breeding houses. Mosquito data was obtained from the collection of mosquitoes inside and outside the house where mosquitoes breed.

Adult mosquitoes were captured in between houses in the outer and inner courtyards. Captured mosquitoes were then brought for species identification in the laboratory. PCR testing was conducted for Dengue virus detection in *Aedes aegypti* mosquitoes.

Coordination activities with LP / LP Vector BP2 (Balai Pengendalian Vektor) or vector density survey and Dengue virus examination of *Aedes aegypti* mosquitoes were carried out in the working area of Puskesmas Kembangan, precisely in North Kembangan Village, West Jakarta, at residents' homes in RW 02 North Kembangan Village involving 100 households (KK) located in RT 01, RT 02 and RT 03. This activity was carried out in the morning at 09.00-11.00 WIB and in the afternoon at 15.00-17.00 WIB for 2 days adjusted to the peak hours of *Aedes aegypti* mosquito activity. Coordination efforts were conducted at the residence of the Head of RW 02 and involved officers from the head office (Directorate of Environmental Health), West Jakarta Health Office, Kembangan Community Health Center, and relevant community volunteers. This effort focused on the preparation and implementation of vector density surveys and Dengue virus testing in *Aedes aegypti* mosquitoes.

Table 1 Dengue virus identification results and number of samples used

Location	Capture Time	Mosquito Count	Spesies	Detection Result PCR
North Kembangan Sub-district, Kembangan District, West Jakarta	in the morning at 09.00-11.00 WIB and	123	genus <i>Culex</i>	Negatif
		8	<i>Female Aedes aegypti</i>	Positif
	in the afternoon at 15.00-17.00 WIB	11	<i>Aedes aegypti Male</i>	Negatif

RESULTS AND DISCUSSION

The results of mosquito collection in 100 households in North Kembangan Sub-district, Kembangan District, West Jakarta, showed that 80 households had a total of 142 mosquitoes, consisting of 123 *Culex* mosquitoes, 8 female *Aedes aegypti* mosquitoes, and 11 male *Aedes aegypti* mosquitoes.

PCR testing for Dengue virus on the *Aedes aegypti* mosquitoes captured in the survey area yielded negative results. However, the examination of Dengue virus in female *Aedes aegypti* mosquitoes from the rearing process showed positive results for Dengue virus. This indicates that these mosquitoes act as a trigger for the indicator of Dengue Hemorrhagic Fever transmission in the area, as *Aedes aegypti* mosquitoes containing Dengue virus were found.

The results of the mosquito larvae survey in 100 households showed that 31 households had positive larvae (House Index: 70%). This suggests that the North Kembangan Sub-district, Kembangan District, West Jakarta, is at high risk of Dengue Hemorrhagic Fever transmission as it does not meet the vector standard quality criteria (Permenkes 50/2017), where a House Index of >95% indicates a safe environmental condition.

DISCUSSION

The adult *Aedes* sp. mosquitoes are small in size, black in color with white spots on their bodies, and have 12 white rings on their legs. Their body is composed of the head, thorax, and abdomen. The wings are approximately 2.5-3 mm long, black-scaled, and covered with wing scales following the veins. The wing margin also has a series of hairs called fringe. Female *Aedes aegypti* mosquitoes are the vectors of dengue fever. The morphological difference between female and male mosquitoes lies in the structure of their antennae. Female mosquitoes have pilose-type antennae, while males have plumose-type antennae. Adult female mosquitoes can survive for 2 to 3 months, with an average of about 1 month, depending on the temperature and humidity in the surrounding environment. On the other hand, male mosquitoes can only survive for 6-7 days, especially after mating, and then they will die shortly after (Haditomo I, 2010).

The coordination activities with the Vector LP/LS BP2, or the vector density survey and Dengue virus examination on *Aedes aegypti* mosquitoes, were carried out jointly with Central Team Coordination (Directorate of Health Quarantine Surveillance, Ministry of Health Republic of Indonesia) in collaboration with the West Jakarta Health Office, Kembangan Community Health Center. This coordination aimed to prepare the workforce, materials, tools, collect DHF case data, conduct larval surveys, and capture *Aedes aegypti* mosquitoes. The activities took place in the jurisdiction of Kembangan Community Health Center, specifically in North Kembangan Sub-district, West Jakarta. Coordination efforts were centered at the residence of RW 02 neighborhood leader (Mr. Mursan Jamin) and involved personnel from the central office (Directorate of Environmental Health), West Jakarta Health Office, Kembangan Community Health Center, and relevant community volunteers, in preparation for and during the execution of the vector density survey and Dengue virus examination on *Aedes aegypti* mosquitoes.

Mosquito capture activities on *Aedes aegypti* mosquitoes were conducted in the homes of residents in RW 02, North Kembangan Sub-district, involving 100 households in RT 01, RT 02, and RT 03. These activities took place from 09:00 AM to 11:00 AM in the morning and from 03:00 PM to 05:00 PM in the afternoon for two days, aligning with the peak activity hours of *Aedes aegypti* mosquitoes. Mosquitoes were captured while resting inside and outside houses, particularly in areas where *Aedes aegypti* mosquitoes were potentially found. Additionally, larval surveys were conducted at every potential mosquito breeding site, including water storage containers (TPA), both inside and outside houses. Larvae or *Aedes aegypti* mosquitoes found were then collected and transported to the entomology laboratory or insectarium of the Directorate of Environmental Health for rearing into adulthood, enabling PCR-based Dengue virus examination.

The results of mosquito capture in 100 households in North Kembangan Sub-district, Kembangan District, West

Jakarta, showed that 80 households had a total of 142 mosquitoes, consisting of 123 *Culex* mosquitoes, 8 female *Aedes aegypti* mosquitoes, and 11 male *Aedes aegypti* mosquitoes. PCR testing for Dengue virus on the *Aedes aegypti* mosquitoes captured in the survey area yielded negative results. However, the examination of Dengue virus in female *Aedes aegypti* mosquitoes from the rearing process showed positive results for Dengue virus. This indicates that these mosquitoes act as a trigger for the indicator of Dengue Hemorrhagic Fever transmission in the area, as *Aedes aegypti* mosquitoes containing Dengue virus were found. Therefore, early vigilance through vector control (PSN) is necessary.

Research conducted by Zahara Fadilla et al. on the bioecology of DBD vectors and Dengue virus detection in *Aedes aegypti* and *Aedes albopictus* in the DBD-endemic Bantarjati Sub-district, Bogor City, indicated that the majority of larval habitats for *Aedes aegypti* were non-TPA containers (60.61%). *Aedes aegypti* mosquitoes were found to primarily feed indoors (60.53%), with peak density observed from 10:00 AM to 11:00 AM (0.42 mosquitoes per person per hour). *Aedes albopictus* mosquitoes were more commonly captured outdoors (77.27%), with peak blood-feeding activity at 10:00 AM to 11:00 AM (0.42 mosquitoes per person per hour). *Aedes aegypti* mosquitoes tended to rest indoors, while *Aedes albopictus* mosquitoes preferred resting outdoors. Dengue viruses DEN-1, DEN-2, and DEN-3 were not found in female *Aedes aegypti* mosquitoes (Fadilla, 2015).

However, observations regarding the detection of Dengue virus antigen in *Ae. aegypti* mosquitoes indicate that both males and females have been infected with the Dengue virus through the transovarial mechanism. The highest relative infection rate (TIR) is recorded in the female mosquito group, reaching 50.00% (Noshirma et al., 2020). Meanwhile, out of a total of 359 mosquitoes processed to identify the DENV virus, real-time multiplex PCR results indicate that 14 out of 359 tested female mosquitoes show positive results, around 3.9%. Findings from this research emphasize the urgency of DENV surveillance in mosquitoes collected in the field, especially to evaluate the local virus activity in specific time periods and areas (Balingit et al., 2020). Horizontal transmission is the process of Dengue virus spread from infected female mosquitoes, where infection occurs when mosquitoes suck blood containing viremic virus. Afterward, these mosquitoes can transmit the Dengue virus through their bites to healthy individuals (Wijayanti, 2019). Female mosquitoes infected with DEN virus in their ovaries have the capability to transmit the DEN virus transovarially to the next generation (Desiree and Prasetyowati, 2012). To understand the phylogenetic similarity between circulating DENV serotypes in a geographic area, it is advisable not only to consider viruses in severe cases (inpatients) but also in mild cases (outpatients), asymptomatic infections, and even in mosquito populations (Balingit et al., 2020).

The results of the mosquito larvae survey in 100 households showed that 31 households had positive larvae (House Index: 70%), indicating that North Kembangan Sub-district, Kembangan District, West Jakarta, is at high risk of Dengue transmission as it does not meet the vector standard quality criteria (Permenkes 50/2017), where a House Index of >95% indicates a safe environmental condition. Therefore, vector control efforts, especially increasing community education to improve the 3M Plus (Breeding Site Eradication) program, are necessary to reduce the vector population and prevent further DHF cases or outbreaks.

Heni Prasetyowati's research on the Maya Index and *Aedes aegypti* larval density in DBD-endemic areas of East Jakarta revealed that approximately 72.8% of the population

in East Jakarta fell into the moderate category for *Aedes aegypti* breeding potential, with only about 8.36% having a high potential. Regarding environmental sanitation, approximately 95.32% of the population in Jakarta Timur fell into the moderate category. No households were found in the low category. The analysis of the Maya Index also showed that 70.23% of the population was at a moderate risk (Prasetyowati, 2017). This suggests that transmission potential is likely to persist in the area due to the supportive environmental conditions for DBD vector breeding. Residents in the Jakarta Timur area live in an environment with the potential for DBD transmission.

To enhance early vigilance and prevent outbreaks of DBD in the area, it is crucial to foster collaboration across programs and sectors for DBD control through Vector Surveillance. The follow-up plan should include continued implementation of the 3M Plus (Breeding Site Eradication) program to maintain early vigilance and prevent outbreaks. Regular monitoring through Periodic Larval Surveys (PJB) conducted by health center personnel or trained staff is essential. Moreover, public education regarding the DBD control program should be intensified to encourage active participation from the community. This should not be limited to the 3M approach but should also incorporate other methods such as selective larvicides, installing ovitraps, raising larvivorous fish, fogging, and more (Ramlawati et al., 2014).

LIMITATION OF THE STUDY

The study's limitations include a narrow focus on a specific area with a small sample size, potential timing issues with Dengue virus examination, limited exploration of larval presence factors, and lack of in-depth analysis of vector behavior and environmental conditions.

CONCLUSION AND RECOMMENDATION

The results of the mosquito larvae survey in 100 households indicate that 31 households have larvae (Breteau Index: 70%), suggesting that the area of North Kembangan Subdistrict, Kembangan District, West Jakarta is at high risk of Dengue Fever transmission. Mosquito collection in 100 households in North Kembangan Subdistrict, Kembangan District, West Jakarta revealed that 80 households had 142 mosquitoes, with 123 belonging to the *Culex* genus, 8 female *Aedes aegypti* mosquitoes, and 11 male *Aedes aegypti* mosquitoes. The examination of Dengue virus in female *Aedes aegypti* mosquitoes from the rearing process showed positive results for Dengue virus. Therefore, the North Kembangan Subdistrict, Kembangan District, West Jakarta, is classified as an area at high risk of Dengue Fever transmission. For future researchers, it is recommended to explore a valuable research direction that entails conducting a longitudinal study encompassing multiple seasons, expanding the sample size to encompass various regions within Jakarta, and scrutinizing the detailed behavior of *Aedes aegypti* mosquitoes.

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Conflict of Interest Statement

The authors declare that they have no involvement with any external parties and this paper is purely from the sources listed in the bibliography and does not contain plagiarism from any journal article. All sources of writing have been listed in the bibliography

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