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Research Article

where are the most breeding places for aedes aegypti in endemic areas? : the important role of housewives as volunteers in vector control

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Abstract

There is no empirically proven dengue fever vaccination, so vector control is an important measure to prevent dengue fever outbreaks. The involvement of women in vector control has a strategic role in eliminating mosquito breeding places. The purpose of this study is to describe the activities of women's participation as volunteer monitoring larvae in controlling dengue fever in endemic areas. Retrospective cohort study. Observations from April to December 2022. The study population was larvae monitoring volunteers in Kecila Village, Banyumas Regency. a sample of 67 volunteers. The research results show, the participation of women as volunteer monitoring larvae in controlling dengue fever in endemic areas is 94% dominated by housewives, 44.7% have high school education, 70.2% aged between (45-55), 71.6% good knowledge and 79.1% have volunteered to monitor larvae between 1-2 years. Larvae monitoring activities are carried out every 5-7 days, and health education is carried out when monitoring larvae. activity reporting to health center staff and evaluation and dissemination of activities. Container index (1.88-0.7) and house index (2.9-1.21). The most common mosquito breeding places for Aedes aegypti larvae are: bathtubs, barrels and junk. Kecila is an endemic area for dengue fever with a tendency to decrease in the prevalence of dengue fever every year. concluded that housewives have an important role in eliminating mosquito breeding places, which are mostly in: bathtubs, barrels and junk. Volunteers monitoring larvae need to appreciate the role of the local government, so that motivation in vector control activities can be maintained.

Key words: volunteers; larvae; breeding place; aedes aegypti; endemic

Introduction:

Dengue Hemorrhagic Fever (DHF) is a Vector Borne Disease (VBD) which can cause high mortality and morbidity, especially in developing countries. Indonesia as a developing country and a tropical country geographically is a good place for breeding places for *Ae. aegypti* and *Ae. albopictus* as a dengue vector. Ae. aegypti and Ae. albopictus has a dual role because it can transmit dengue virus vertically and horizontally, as the results of a study by Mourya, et al found horizontal transmission of the DENV-2 serotype by infected mosquitoes through vertical transmission [1]. Rapid urbanization and industrialization is one of the risks of increasing the prevalence of DHF. Currently there is no empirically proven dengue hemorrhagic fever vaccination, therefore vector control is an important measure to prevent dengue hemorrhagic fever outbreaks by eliminating the vector's habitat. Previous research concluded that the vulnerability of DHF is indicated by the presence of cases (positive DHF) who live close to the controls (negative DHF), if the spread of the vector is not controlled then the spread of DHF will continue to increase, considering the flight distance of the *Ae. aegypti* mosquito can reach 2 kilometers [2]. Therefore optimizing the community in vector control through mosquito nest eradication activities is important, especially by involving the community component in the household as the key to success in preventing and controlling DHF. The results showed that community organizations, community leaders, community involvement in

health campaigns, public relations with various institutions have a significant relationship with community participation in DHF control, mobilizing local communities and activating local leadership with active participation from the government and non-governmental organizations is a strategy appropriate for control activities [3]. The involvement of women in vector control has a strategic role in DHF control activities. The results of previous studies showed that 66.8% of 370 participants carried out control activities in the household by women [4]. Participation can be done by constantly monitoring the existence of a water reservoir inside or outside the home so that it does not become a breeding place for *Ae. aegypti*. Each family member can play a role in eliminating mosquito breeding places, such as disposing of solid waste outside the home and cleaning the garden area as two risk factors for dengue fever [5]. This shows the importance of vector control by optimizing community participation in mosquito nest eradication activities. The purpose of this study is to describe the activities of women's participation as volunteer monitoring larvae in controlling dengue hemorrhagic fever in endemic areas.

Methods

The research design used a retrospective cohort study, observations from April 2022 to December 2022. The study population was larvae monitoring volunteers in Kecila Village, Banyumas Regency. Sampling with a total sampling of 67 people. The project team obtained written consent from the respondents. The instrument used was a questionnaire, with interviews including data on age, employment, length of time volunteering, monitoring time, implementation of health education, evaluation of activity implementation and knowledge of dengue fever. Knowledge of dengue fever adopted from a valid questionnaire, with a validity value between 0.449-0.691 and a reliability of 0.881 [2]. The results of the index container, house index, and dengue prevalence were obtained from the results of activity reports submitted to local health officials. Descriptive analysis of data with percentages.

This study was approved by the ethics committee of the by the Health Research Ethics Commission, Muhammadiyah University of Purwokerto, by Number: KEPK/UMP/20/II/2023.

Results

1. Characteristics of Volunteers

No	Variable	Frequency	%
1	Respondent's occupation		
	Housewife	63	94.0
	Self-employed	3	4.5
	Educator	1	1.5
2	Education Level		
	Elementary school	11	16.4
	Middle school	19	28.4
	High school	30	44.7
	College	7	10.5
3	Age		
	<45	7	10.4
	45-55	47	70.2
	56-66	13	19.4
4	Dengue Knowledge		
	Less Knowledge	19	28.4
	Good Knowledge	48	71.6
5	Long time as a volunteer		
	1-2 Years	53	79.1
	> 3 Years	14	20.9

Table 1: characteristics of larva monitoring volunteers, Kecila Village, Banyumas, Indonesia

2.Larvae Monitoring Activities

No	Activity Description	Description
1	Implementation of Larvae Monitoring	Every 5 – 7 days
2	Health education about dengue fever control	Volunteers monitoring larvae conduct health education during the implementation of larva monitoring activities
3	Reporting of monitoring results	Volunteers monitoring larvae submit the results of monitoring larvae to health workers, to be recorded at the Puskesmas, especially in the field of infectious disease control
4	Evaluation and dissemination of activities	Evaluation and dissemination of larva monitoring implementation attended by local government, private sector, non-governmental organizations, community leaders and religious leaders coordinated by health officers from community health centers
5	Evaluation time	Once every 6-12 months

Table 2: Vector control activities through monitoring *Aedes aegypti* larvae

Characteristics of larva monitoring volunteers as shown in Table.1 shows that 94% work as housewives with the education of mostly senior high school (44.7%), the age of most is in the range of 45-55 (70.2%), most of the knowledge about DHF is good (71.6%) and most have volunteered between 1-2 years (79.1%). Table.2 shows that larva monitoring activities are carried out once a week (5-7 days), there are health education activities for the houses visited every time they carry out larva monitoring and reporting to health workers under the working area of the puskesmas and there is evaluation and dissemination of larva monitoring implementation activities to the government local government, private institutions, non-governmental organizations, community leaders, religious leaders in coordination with local health workers.

Breedingplace was detected positive for Aedes aegypti larvae

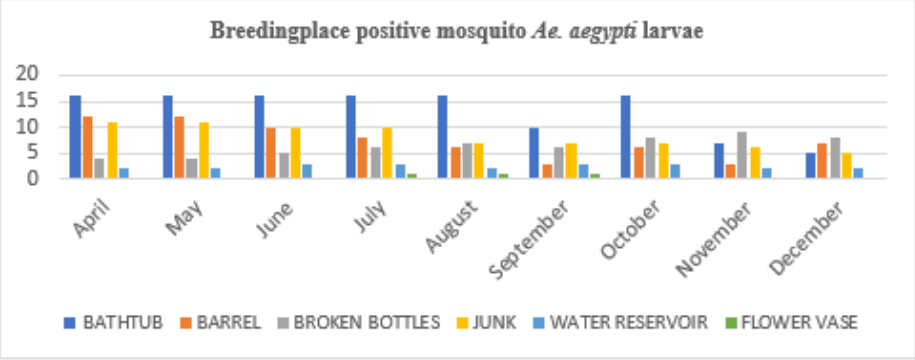

Figure. 1 Characteristics of *Aedes aegypti* breedingplace

2.House Index and Container Index

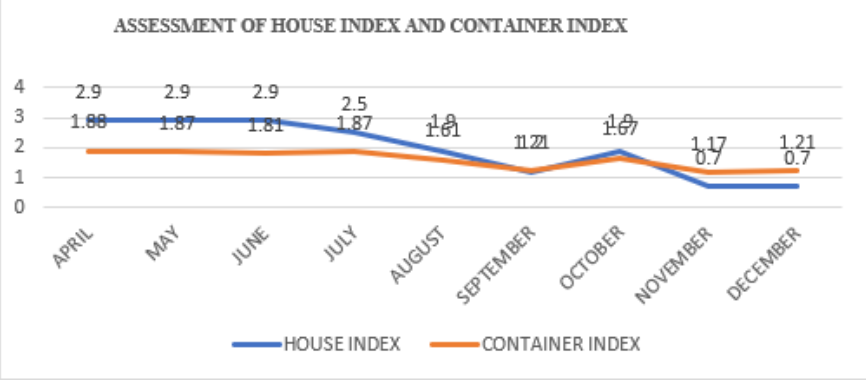

Figure. 2 The value of the container index and house index

5. Prevalence of DHF in the Work Area of the Kemranjen Public Health Center

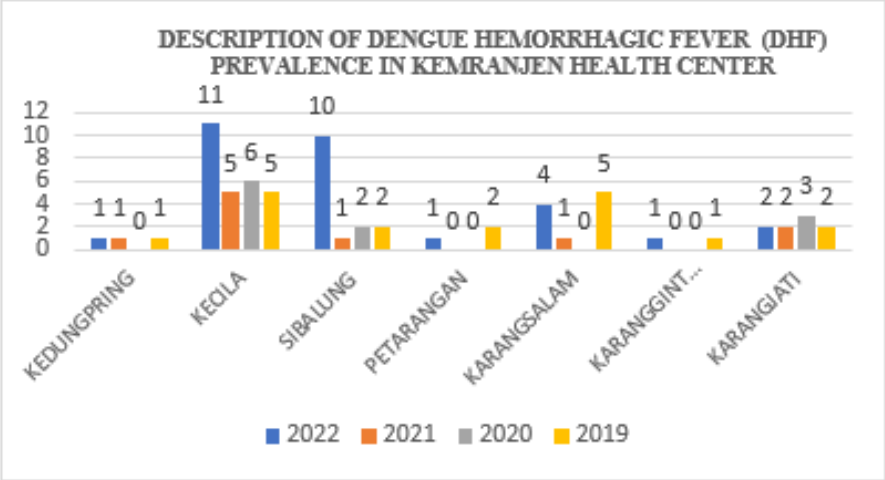

Figure. 3 Prevalence of DHF in Kemranjen Health Centers (2019-2022)

The results of monitoring the type of breeding place most frequently detected *Ae. aegypti* larvae were bathtubs, followed by barrels and junk (Figure 1). Figure.2 shows a decrease in the container index (CI) and house index (HI) and for 9 months. Based on the prevalence of DHF, Desa Kecila is a DHF endemic with a high incidence rate compared to other areas, and the trend for the last 4 years has been a decrease in prevalence (Figure.3).

Discussion

This research shows the important role of housewives as volunteers to monitor larvae in DHF disease control activities. An important role in maintaining the health of the environment around where they live, such as keeping the house clean, managing household waste so that it does not become a breeding place for mosquitoes and environmental pollution which has a negative impact on human health and the occurrence of various diseases. In Indonesia, involvements of community on fight dengue are conducted through the 3M campaign (Menutup, Menguras, and Mengubur) - which means covering and cleaning water containers, and burying discarded containers - aimed to cut the mosquito life cycle by eliminating their breeding habitat [6]. The study found that one of the failures of the 3M program was the community's lack of motivation to carry out activities [7]. Therefore optimizing housewives as volunteer monitoring larvae can be a solution for the success of the program. The results of previous studies indicate that the role of housewives has more value in health practice. Participants who are housewives were less likely (OR 0.535, 95%CI 0.289–0.950) to have a high increment in practices score compared to the other occupation category [8]. The participation of housewives as larva monitoring officers must be continuously increased, bearing in mind that vector control as primary prevention is often hampered due to low community support. Community participation for successful prevention is related to awareness, knowledge, attitudes about disease, modes of transmission and mosquito breeding sites [9]. The participation of housewives in DHF prevention is the main resource in the family as the key to the success of community-based prevention. The involvement of communities and households was successful. Waste management with the elimination of the most productive water container types (bowls, tins, bottles) led to a significant reduction of pupal indices as a proxy for adult vector densities [10]. Empowering women into leadership and decision-making roles is one of the successful implementations of various programs [11]. The education of most of the volunteer monitoring larvae was middle and above, this certainly contributed to a better level of knowledge. This was shown from the assessment of the level of knowledge about DHF from the volunteers, most of whom were in the good category. The results of previous studies concluded that people with higher education have a high knowledge score compared to people with lower levels of education ($\beta = -2.78$, $p = 0.003$) [12]. Furthermore, good knowledge will contribute to good attitudes and practices in DHF prevention, as the results of research that get a picture of the percentage of good knowledge and good attitudes and practices in prevention with research results of 53.5% of the population who have a good knowledge score, 64.1% had good attitude and 68.4% good practice towards DHF prevention [4].

Respondents have become volunteer monitoring larvae 79.1% between 2-3 years, this is done in order to reduce endemicity by increasing the number of volunteers. The addition of this volunteer is a synergy between the needs of the Community Health Center and the Kecila village government. Therefore the Community Health Center through Health officers in their working area is obliged to provide guidance, assistance and increase knowledge in the prevention and control of DHF for volunteers. This is in accordance with the results of previous research that 87.9% of female volunteers for disease vector control and 48.8% worked as village health cadres for 11–20 years and the Odds Ratio of village health volunteers with a good level of understanding about dengue fever and the system surveillance index larvae were 1.064 and 1.504 times more likely to live in a village at risk of DHF, respectively (odds ratio [OR] = 1.064, 95% confidence interval [CI]:0.798–1.419, $p = 0.672$ dan OR = 1.504, 95% CI:1.044–2.167, $p = 0.028$). The conclusion from this study is village health volunteers need ongoing training to increase awareness of monitoring, prevention and control as well as surveillance systems, especially in villages at risk of DHF [13]. Joint motivation is needed between health volunteers and the community in vector control activities. One of the main challenges for health volunteers in vector control is the community's refusal to monitor larvae when their homes are monitored. For this reason, joint participation is needed to protect and maintain environmental health [14].

Routine monitoring activities every 5-7 days are in accordance with the bionomics of the Ae. aegypti mosquito as the main vector. The Ae. aegypti mosquito goes through four stages in its life cycle: egg, larva, pupa and imago (adult). The time needed to reach maturity from eggs is around 10-14 days, depending on the ambient temperature, so the implementation of 5-7 days is oriented towards larva control. Control of dengue fever based on larvae control in breeding places is an effective control, because it does not cause environmental pollution and vector resistance as control using insecticides. This is in line with the results of research showing that the use of insecticides has had a resistance effect,

both to Ae. aegypti as the main vector and Ae. albopictus as the co-vector [15]. Global epidemiology, approximately 40%-50% of the world's population (2.5 to 3 billion people) is estimated to be at risk of dengue infection and one in every 100 people catches dengue virus each year [16]. Indonesia, since 2000, DHF infection rate (IR) increased significantly and peaked in 2009 and 2016. Several explanations for this trend include the rapid change of serotype dominance in Indonesia in the 2000s from DENV-3 to DENV -1 and DENV-2 as well as high findings of several serotypes in most areas in Indonesia during the last five decades. These findings suggest a significant increase in IR in Indonesia with a cyclic pattern that peaks approximately every 6 to 8 years while the annual CFR (crude fatality rate) decreases over time [17]. Simultaneous implementation by larva monitoring volunteers is expected to suppress the development of dengue hemorrhagic fever vectors as well as vectors of other important arboviral diseases, such as chikungunya, yellow fever, Rift Valley fever and Zika. The results of previous studies showed that Ae. aegypti, Ae. albopictus and Ae. vittatus were found in the same habitat in the field as in ovitraps, both outdoor and indoor ovitraps [18]. In addition, based on the flying distance of mosquitoes, simultaneous control is expected to suppress vector breeding together in all areas. The results of research with a unique design through mosquito ponds marked with stable isotopes to estimate the average distance traveled using three different approaches (Net, Strip or Circular) show that Ae. aegypti adults spread further than reported [19]. Carrying out larva monitoring in people's homes with health education activities is one of the efforts to increase public knowledge about dengue hemorrhagic fever prevention. The results of research on educational interventions for the control and prevention of diseases transmitted by Ae. aegypti in the city of Yucatan, Mexico showed the benefits of health education on behavior change on innovation adoption ($p < 0.05$) measured before and after the intervention [20].

Monitoring of breeding places is an effort to reduce mosquito density. The results of this study found various types of containers that became breeding places for mosquitoes. The most common breeding places found for Aedes aegypti larvae are bathtubs, barrels and junk. The bathtub is a water storage facility that almost all people have. This is done with the aim that the use of water is more controlled and becomes a water reserve if at any time the flow or supply of water stops. However, many people do not pay attention to the condition of the bath, especially in terms of cleanliness. Many bathtubs are filled with water, but people just leave them alone without routine steps to clean them at least once a week, so they will become breedingplaces for Ae. aegypti. The results of previous studies found the presence of larvae in bathtubs in both urban and rural communities, and more bathtubs in urban areas (21%) were positive for Ae. aegypti larvae than bathtubs in rural communities (7%) (21). Vector and Reservoir Disease Research 2015 and 2016 from 15 provinces found 87.62% of the bathtubs tested positive for Ae. Aegypti larvae from 729 bathtubs examined [22]. Water reservoirs should be a priority for the community to always actively participate in monitoring the presence or absence of larvae by closing water reservoirs, recycling or burying used items so they don't become breeding grounds for mosquitoes. The existence of water reservoirs around the residence has the potential as a breeding place for Ae. aegypti and increase the potential for contact with humans [23]. The results of previous research found several water reservoirs that became breeding places around the community, including: used tires, coconut shells, dispensers, jars, drums, used cans, bird drinking containers, flower vases, bottles that were thrown anywhere so that they could hold water. rain and become a breeding ground for mosquitoes [24]. The activity of eliminating mosquito breeding places with the active participation of the community has proven to be the most cost-effective control of dengue fever, as the results of previous studies concluded, DHF prevention programs based on community participation by closing water reservoirs, is the most cost-effective and productive control, especially in areas with high dengue prevalence [25]. Previous research on entomological surveys in endemic areas found almost the same types of mosquito breeding places, namely in bathtubs, buckets, and used cans with the results of Aedes sp larvae density being, House Index (HI) = 8.8%, BI = 1.70 , Container I = 4.65% and OI = 5.39% and categorized as low density. The average number of eggs inside the ovitrap housing is 1.16 and 0.73 outside [26]. The results of previous studies found differences in larvae in various water reservoirs with different seasons, with a rainy and dry season ratio of 9:1. On average between the two seasons, there was a 75% increase in larval density. During the rainy season, there was an increase in the positive Ae. aegypti and Ae. Albopictus [27]. The importance of increasing public awareness in the behavior of eliminating mosquito breeding places. Various risk factors for DHF, as happened in Indian society, are risk factors for social behavior and lack of public awareness in preventing mosquito breeding, such as awareness of using mosquito nets, traveling to endemic areas, indiscriminate disposal of solid waste such as broken cups, pots, bottles, containers, etc. tires, toilets, coconut shells, etc. and anti-larval behavior that is not routinely carried out [28]. Communities need to be given the right understanding about choosing the color of water reservoirs so that they are not preferred for mosquito breeding. The results of the Aedes sp favorite study concluded that Aedes sp prefers to lay its eggs in dark water reservoirs compared to light colored water reservoirs [29]. The success of community participation was reported from the results of a one-year trial in the Monte Verde area when outbreaks of DHF, Zika, and chikungunya occurred by eliminating mosquito breeding places such as drums, buckets, plastic tanks and the results during the two years of intervention, the number of monthly pupae fluctuated between zero and 0.6% of the 22,984 pupae counted in the baseline survey at the start of the study. Ae aegypti adults decreased to low numbers but did not disappear completely. There have been no recognized cases of dengue, Zika, or chikungunya after June 2018 [30]. The spread of Aedes sp is strongly influenced by population density and also the distance between houses [31]. Based on the index container and house index data, Desa Kecila is in the category of moderate larva density, and has decreased during the nine months of observation, this shows the optimal role of larva monitoring officers in monitoring mosquito breeding places. Based on the existing criteria, if DF (density figure) = 1, it means that the density of larvae is low, if DF = 2-5, it means that the density of larvae is medium and if DF = 6-9, it means that the density of larvae is high [32]. The results of the study found that the distribution of dengue cases was not related to the density of Aedes aegypti larvae. The relationship between larva density as measured by the Breteau Index (BI) and House Index (HI) and DHF cases is non-stationary and not statistically significant, so the conclusion is that the location of DHF cases is not related to vector distribution and vector density [33]. Larval density was strongly influenced by survival, analysis using nonlinear regression, showed that survival-density related factors were strongly influenced by season, location, and species. Mosquito control can be more effective if the survival-density response of the target population is known [34]. Kecila Village is one of the areas with the highest prevalence in the work area of the Kemranjen Health Center. Based on existing trends, there is a decrease in cases every year, this indicates an optimization of the role of volunteers in monitoring larvae, with regular monitoring in the environment in the hope of eliminating mosquito breeding places. The results showed that 78.3% of DHF cases came from bad environmental factors such as: empty yards, uninhabited houses and open land used mostly as garbage dumps. Indiscriminate disposal of solid waste such as broken cups, pots, bottles, containers, tires, toilets, coconut shells, and poor sanitation in households [28]. Based on the results of mosquito breedingplace examinations, most of the larvae were found in bathtubs, the habit of storing water in tubs for bathing purposes and other things is a habit of the people in the village and not many socio-economically they can access water through plumbing which can reduce risks as mosquito breeding places. If the bathtub water is late in cleaning it, it is very risky to become a mosquito breeding place. As the results of previous studies that 98% of cases of DHF are due to the lack

of people getting access to water through plumbing (Rasio Odds: 4,69, 95% CI 2,06–10,67). Wealthier areas have a higher dengue burden despite lower mosquito densities than lower-income areas (Rasio Odds : 2,92, 95% CI 1,26–6,72). It is possible that dengue fever was brought in by people traveling from poor areas to work in wealthier homes [35]. The limitation of this research is that there were no interviews with the community regarding the monitoring of larvae that have been carried out by volunteers to monitor larvae.

Conclusion

The participation of women as volunteer monitoring larvae in controlling dengue hemorrhagic fever in endemic areas is 94% dominated by housewives, 44.7% have high school education, 70.2% aged between (45-55), 71.6% good knowledge of DHF and 79.1% have volunteered to monitor larvae between 1-2 years. Larvae monitoring activities are carried out every 5-7 days, and health education is carried out when monitoring larvae. Activity reporting to health workers and evaluation and dissemination of larvae monitoring activities to the local government, private institutions, non-governmental organizations, community leaders, religious leaders with the coordination of the local Puskesmas. The results of monitoring mosquito breeding places, were mostly found in bathtubs, barrels and junk. Nine-month retrospective data from April 2022-December 2022 shows a decrease in the container index (1.88-0.7) and the house index (2.9-1.21). Based on the prevalence of DHF, Kecila is an endemic area for Dengue Hemorrhagic Fever (DHF) with a tendency to decrease in the prevalence of DHF every year. Volunteers monitoring larvae need to appreciate the role of the local government, so that motivation in vector control activities can be maintained.

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Conflict of Interest

The authors declare no potential conflict of interest.

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