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Training on producing eucalyptus and betel leaf oil for dengue fever prevention

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ABSTRACT

Dengue Hemorrhagic Fever (DHF) remains a significant public health issue in Indonesia and is endemic in nearly all provinces. The mortality rate from DHF continues to rise each year. To address this, health education on dengue fever prevention is essential. One preventive measure involves the use of natural ingredients. Betel leaves, in particular, can kill mosquito larvae due to the toxic substances they contain, which are especially harmful to mosquito larvae. Therefore, community service activities are necessary to raise awareness and provide practical solutions. This activity was conducted in Jetis Village, Sukoharjo, targeting 30 Family Welfare Program (PKK) women from the local community. The implementation included the preparation of pre-test and post-test, as well as training sessions. The questionnaire used in this activity assessed participants' skills through a pretest, followed by training in making eucalyptus and betel leaf oil, and concluded with a post-test. The results showed a significant improvement in the participants' skills, with most moving from "moderately competent" to "competent," as indicated by a P-value of 0.001. It can be concluded that the oil-making training effectively improved the skills of the PKK women.

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1. INTRODUCTION

Dengue Hemorrhagic Fever (DHF) remains a significant public health issue in Indonesia, where it is endemic in nearly all provinces, with the mortality rate increasing each year. DHF is transmitted by the Aedes Aegypti mosquito, which breeds in humid environments, areas with high rainfall, and stagnant water both inside and outside homes (Hariyadi & Wibowo, 2022). The high incidence of DHF in some communities may be attributed to a lack of environmental awareness, leading to insufficient efforts to implement the 3M Plus method for eradicating mosquito breeding grounds. Efforts such as mosquito nest eradication (PSN) and the use of abate powder need to be intensified to combat dengue fever. These preventative actions, which can be carried out independently by the community (Wirantika & Susilowati, 2020), are crucial since there are no drugs or vaccines available to eliminate the virus (Mukono, 2008). Reducing the incidence of DHF requires empowering communities. This involves developing human

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resources by enhancing creativity, competence, and critical thinking, thus enabling communities to take more effective action.

According to the World Health Organization (WHO), the world's population is estimated to be at risk of dengue fever reaching 2.5-3 billion, especially those living in urban areas in tropical and subtropical countries. Currently, it is estimated that 50 million dengue infections occur throughout the world every year. It is estimated that in Southeast Asia there are 100 million cases of dengue fever and 500,000 cases of dengue fever that require hospital treatment, and 90 percent of sufferers are children under 15 years old and the number of deaths from dengue fever reaches 5 percent with an estimated 25,000 deaths each year (WHO, 2018). The high and low levels of contact with the Aedes aegypti mosquito are influenced by 2 things, namely environmental factors and lack of concern for the practice of Mosquito Nest Eradication (PSN). Dengue fever is greatly influenced by the environment and human behavior because the cause of this disease is a virus that can spread through a vector, namely the Aedes aegypti mosquito (Nurcahya et al., 2024). In reality, this lack of knowledge has an impact on people's attitudes in dealing with this problem. Implementation of efforts to eradicate mosquito nests (PSN) that is not carried out optimally can result in unkempt rubbish becoming a nesting place for dengue fever mosquitoes. Due to the large amount of rubbish that becomes a nest for mosquitoes, people are exposed to dengue fever. Dengue fever that occurs in society cannot be separated from people's awareness of maintaining the cleanliness of their environment (Baihaqi et al., 2023). This problem also occurs in Jetis Village.

The Family Welfare Program (PKK) women in Jetis Village have expressed concerns about house cleanliness and the abundance of mosquitoes during the rainy season. Additionally, many empty lots and yards around their homes are left uncleaned by their owners. Interviews with the PKK women revealed that while they had received information about preventing and managing Dengue Fever, their efforts were limited to the distribution of abate powder from the community health center, yet mosquito infestations remain prevalent. Furthermore, they had never received formal training from the health center on preventing Dengue Hemorrhagic Fever (DHF).

Interviews with staff from the community health center and village midwives indicated that health promotion activities regarding DHF have been conducted, but coverage has not been comprehensive across all villages due to limited funding and human resources. The community empowerment activities related to the Mosquito Nest Eradication movement (PSN 3M Plus) have not been fully effective, and it remains challenging for residents to maintain cleanliness, with many areas of standing water still present. According to health center data, this village is categorized as having high DHF endemicity due to unsanitary conditions, stagnant water, and the presence of mosquito larvae, especially around toilets. Geographically, the area falls within a village setting.

Figure 1. Survey of partner problems

Based on Figure 1, the environmental conditions in Jetis Village are shown to be unsanitary, with stagnant water and mosquito larvae present in vacant lots. Figure 1 illustrate the presence of mosquito larvae in bathtubs and water reservoirs. Housewives are a key group that can be empowered to improve family health and participate in small and medium business activities (Fatmasari et al., 2023). One method of empowerment is by teaching them to produce betel leaf and eucalyptus oil. This process involves drying eucalyptus and betel leaves, placing them in a refining pan, and extracting the oil, which can then be used as a natural pesticide (Porusia & Septiyana, 2021).

The betel leaf plant (*Piper betle L.*) can kill mosquito larvae for dengue fever because the plant contains substances that are toxic to insects, especially mosquito larvae. Betel leaves are known to contain alkaloids and other compounds such as essential oils, cineol, and tannins. This alkaloid compound is responsible for killing mosquito larvae, and its mechanism of action is similar to detox powder. 95 percent ethanol extract (polar solvent) from dry betel leaf powder is reported to kill Aedes aegypti larvae at a concentration of 100 ppm (Gani et al., 2022)

The eucalyptus plant is one of the producers of essential oil which is widely used for various health or pharmaceutical products. Eucalyptus leaves (*M. leucadendra*) contain cineol, terpineol, terpinene, and limonene compounds which are useful as insecticides and repellants. These leaves have the potential to be a vegetable larvicide . The use of plant-based insecticides provides many advantages, namely that they are environmentally friendly and do not hurt health (Smith & Idris, 2019). The aim of this community service is training in the skills of eucalyptus oil leaves and betel leaves as a spray for dengue fever mosquitoes.

2. METHODS

The partner in this community empowerment project is Jetis Village, Baki subdistrict, Sukoharjo district. Close to Surakarta Muhammadiyah University, only 10 km away and 25 minutes' drive. This activity was carried out by the community service team for the Nursing Department, Public Health Department, and Management Economics Department. This community service program only has one target, namely the Jetis Village area. The targets for this service were 30 PKK mothers in Jetis Village. The method for implementing community service activities consists of 4 processes, as shown in the Figure 2.

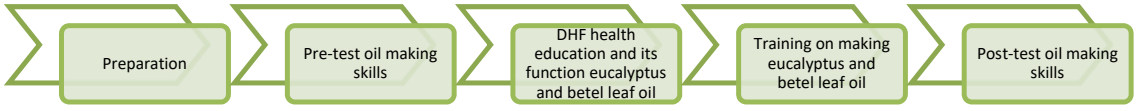

Figure 2. The stages of implementing work to resolve the problem

Preparation Phase

The community service team analyzes the situation and assesses existing problems, then the team and partners discuss and decide on priority problems to be faced and solved. The following activities are carried out to analyze partner situations and problems, as shown in the Table 1.

Implementation Stages

To overcome priority problems agreed upon with partners, this community service is carried out in several stages. The Following are the implementation stages: (1) Implementation of the Pre-Test: The Pre-Test is conducted before health education is carried out, through PKK mothers being asked to fill out

a skills questionnaire; (2) Providing health education about Dengue Hemorrhagic Fever and the Benefits and objectives of Eucalyptus Oil Leaves and Betel Leaves; (3) Training in making eucalyptus oil leaves and betel leaves, by: (a) The process for selecting betel leaves and eucalyptus leaves is: Participants are explained how to select eucalyptus leaves and betel leaves by; dry fresh green leaves by leaving them in the open air for 2 x 24 hours, then in the process mix them by putting 1.5 kg of eucalyptus leaves and 0.5 kg of betel leaves into a pan then adding plain water at the same level as the height of the leaves. Next, heat it on the stove using low heat, until water vapor comes out; (b) If water vapor does not come out of the pan, this refining process occurs, so water and oil will be separated. Next, we discard the water in the Erlenmeyer tube and take the oil. The next process is to measure the amount of oil using the method of 1.5 ml of oil mixed with 60 ml of 70 percent alcohol then put into a spray container; (c) The results of mixing oil with alcohol are ready to be used.

Table 1. Situation analysis and problem solving

	Analysis
Licensing	- Preparation and signing of memorandum of understanding with partners. - Make a list of problems and prioritize them with partners including village midwives and people in charge of the Dengue Fever program at community health centers to find solutions to these identifications. - Submit a permit application to the Baki Community Health Center and the Jetis Village Government
Preparation for Community Service	- Identifying and prioritizing partner problems, including providing information on the importance of environmental health to reduce the number of Aedes Aegipty mosquitoes and making eucalyptus leaf oil which can increase the creativity of PKK mothers. - Prepare questionnaires as material for pre-test and post-test. The questionnaire used in this community service is a skills assessment questionnaire with a score scale including: a score scale of 81-100 very competent, 69-80 competent, 60-69 quite competent, and <60 not competent. - To make tools used in simple distillation, the materials needed are: Pan, stove, plastic basin, gas cylinder, gas hose, measuring cup, stand, clamp holder, glass separating funnel, glass beaker, and measuring cup.
Time	- Implementation from June 14 to June 30 2024 - For four meetings, each meeting lasts 4 hours

Stages Evaluation

The evaluation stage is carried out at the end of the activity to evaluate the impact of the PKK mothers' skill level in making eucalyptus and betel leaf oil. Evaluation to measure changes in PKK mothers' skills towards training materials uses SPSS program analysis to determine the pre-test and post-test. The question items given to determine skills include preparing a distillation place, selecting eucalyptus and betel leaves according to the measurements, 3 kg of eucalyptus leaves are mixed with 1 kg of betel leaves, adding water to a pan that has been given leaves as high as the number of leaves, heating until air and oil come out in the Erlenmeyer flask, separating air and oil, mixing oil with 70 percent alcohol, attaching the packaging label to the spray bottle, disinfectant is ready to use.

3. RESULTS AND DISCUSSION

Based on the results of community service in Jetis Village, several 30 PKK women, it was found that their knowledge of skills regarding making eucalyptus and betel leaves oil as an effort to prevent dengue fever before the training was carried out showed that they were not yet competent.

Pre-Test PKK Mothers' Evel of Skills

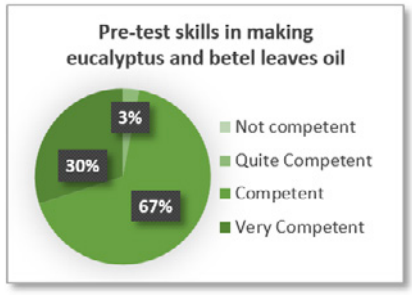

Figure 3. PKK mothers' skills pretest before training
Figure 4. Pre-test results before training

Based on Figure 3, it can be seen that the PKK mothers did a pre-test on skills, questions related to skills to describe the extent to which the PKK mothers had received training on making oil other than making eucalyptus and betel leaf oil. Based on Figure 4, the results on the obtained level of data skills, 3 percent of PKK mothers regarding dengue fever were not competent, which means they have never known anything about eucalyptus oil making training, 67 percent were quite competent, which shows that their PKK mothers have been exposed to oil making training, and 30 percent were competent, which means that PKK mothers are able to make oil using the distillation method.

Providing Training to PKK Women on How to Distill Oil from Eucalyptus and Betel Leaves

This activity consists of explaining how to make oil. Next, the PKK women were asked to practice with assistance. These activities can be seen in the Figure 5 and 6. Based on picture 5, it can be seen that the PKK mothers choose eucalyptus leaves and betel leaves, then put them in a pan, then add water that is as high as the leaves. Based on Figure 6, it can be seen that the distillation process is taking place. In this simple distillation process, the maximum distillation time is 6 hours. During the distillation process, we gradually remove water through the Erlenmeyer flask. This activity aims to separate water from oil. Based on Figure 7, is the process of mixing oil with alcohol with a ratio of 1.5 ml of oil to 60 ml of alcohol. the activity is the last process, then the mixture is put into a spray bottle and is ready to use.

Figure 5. The process of selecting betel leaves and eucalyptus leaves
Figure 6. Distillation and mixing process

Figure 7. Mixing the oil with alcohol

Implementation of Post Test

Implementation of skills post-test after done training making eucalyptus and betel leaves oil, then PKK mother asked for make in a way independent. Figure 8 shows the post-test process. This activity is to determine the level of understanding of the training on making eucalyptus and betel leaf oil that the community service team has taught. The results of the posttest after the training on making eucalyptus and betel leaf oil showed that 56.7 percent were competent and 33.3 percent were very competent, which means that PKK mothers were able to make oil with assistance and following the training until the end. For PKK mothers whose post-test results showed a very competent value, it means that they were able to carry out these skills independently without assistance from the community service team.

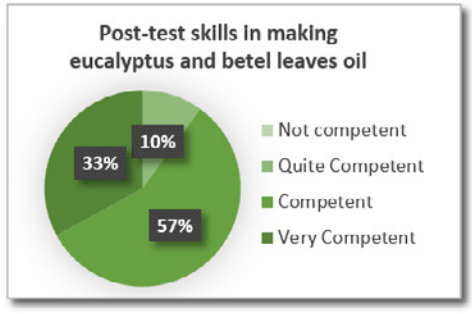

Figure 8. Post-test of PKK mothers' skills after training
Figure 9. Post-test results after training

Data Analysis Results

Table 2. Results of characteristic analysis respondents (N = 30)

	Information	Frequency (n)	Percent (%)
Age	25-40	9	30
	41-55	20	66.7
	56-65	1	3.3
Education	Elementary School	1	3.3
	Junior High School	5	16.7
	Senior High School	13	43.3
	Diploma	5	16.7
	Bachelor	6	20

Based on the Table 2, the majority of PKK mothers who took part in the training ranged from 41-55 years old with a total of 20 participants (66.7 percent). The average age of the residents is those who are still in the productive age, namely 26-55 years, because the productive age is the age that plays the most role and has dense activities and has good cognitive abilities. So, at this age it has an influence on the level of knowledge and skills. The older the age, the level of maturity of a person will be more mature in thinking and working. This also affects a person's cognitive, so that the knowledge and skills obtained are better (Primandari, 2021). The level of education is one of the factors that can influence a person's behavior towards preventing dengue fever, where if the level of education is high, the level of skills and the ability to absorb information is easier than if the level of education is low (Putri & Naftassa, 2017).

The majority of PKK mothers' education was high school, 13 participants (43.3 percent), and the majority of PKK mothers' occupations were housewives, 15. people (50 percent). Higher levels of education can further increase respondents' behavior in participating in preventing Dengue Fever. This is in accordance with Grossman's theory that differences in education levels cause differences in basic health knowledge. The higher the level of education, the easier it is for them to accept and develop knowledge and technology, which will increase productivity which will ultimately improve family health and welfare (Liza et al., 2015)

Table 3. Wilxocon Test Results (The Connection between making oil with level skills)

Skill Level	Mean	Z	P- Value
Before Training Intervention	67.36	-5.30	0.001
After Training Intervention	79.4		

Based on Table 3, it is explained that the results of the Wilcoxon Test show that there is an influence of the skill level before and after training with a P-value of 0.001. This illustrates that the simple distillation training method is very effective in improving the skills of PKK mothers.

Discussion

Based on the results, when the pre-test was given, the results were obtained from 30 respondents with a total percentage of 30 percent competent, 66.7 percent quite competent, and 3.3 percent incompetent. Meanwhile, for the posttest results, the results were 56.7 percent competent, 10 percent quite competent, and 33.3 percent very competent. So based on the results of this training, respondents were given training in making oil leaf wood white and betel The PKK mother of Jetis Village experienced enhancement skills.

There were 3.3 percent of all participants in the eucalyptus and betel leaf oil-making training who showed incompetence, meaning they did not have certain skills. Meanwhile, 66.7 percent of participants had fairly competent skills, including skills in making hand sanitizers, making cakes, and sewing. So at the time of the pre-test, the PKK mothers already had basic skills. Based on involvement in the eucalyptus and betel leaf oil making training, figure 10 shows that 33.3 percent were very competent in making eucalyptus and betel leaf oil. This shows that the training given to the PKK mothers of Jetis Village was very effective and could improve the skills of the PKK mothers.

The implementation of the eucalyptus leaf oil making training is highly dependent on the main raw materials, namely eucalyptus and betel leaves. Eucalyptus leaves cannot be used if they are dry or wet, but the ones that are effective in producing oil are the leaves that are dried at room temperature

for 48 hours after being harvested. Meanwhile, betel leaves are effective for use if they are dried at room temperature for 24 hours after being harvested. Therefore, before conducting the training, the community service implementation team conducted an observation first to the location, namely Jetis Village. Baki District, Sukoharjo Regency to identify materials in the area and the skills and knowledge of PKK mothers. If the knowledge of PKK mothers is lacking in understanding the skills of making an item, it will be difficult for them to be given skills in a short time (Saptutyningsih & Kamiel, 2021)

Based on the data obtained, knowledge about respondents' skills before being given the material was still lacking because previously the PKK women said they had never received training on making eucalyptus leaf and betel leaf oil. This is in line with research conducted by Mukono (2008) A person's level of knowledge is also influenced by information. This statement is in line with research results which show that there are still respondents who have a low level of knowledge. This tends to be due to respondents' limited sources of information, in the form of books, television, and smartphone access, as well as education on dengue prevention from community health centers. According to Munawarah et al. (2020) individual knowledge can also be generated from the results of the surrounding environment, for example, the community environment or health environment, one of which is the role of community health centers in providing information to the community. By providing information regarding the production of eucalyptus and betel leaf oil as a means of preventing Dengue Hemorrhagic Fever.

It is possible to increase the awareness of respondents to prevent dengue fever in their area by carrying out environmental cleanliness and self-fogging using eucalyptus and betel leaf oil. Based on research conducted by Nurcahya et al. (2024), increasing 3M plus activities, by draining, tightly closing water reservoirs, recycling used goods, sprinkling abate powder, and carrying out community service in the environment, it can reduce the number of dengue fever diseases. According to by Putri et al. (2021) , the Mosquito Nest Eradication Movement (PSN) using the 3M Plus method really requires the participation of the entire community.

This is because places that have the potential to become breeding habitats for mosquitoes that transmit Dengue Hemorrhagic Fever (Aedes aegypti & Aedes albopictus) are usually found in people's living environments. According to Baihaqi et al. (2023) One disease that has become endemic and has a fairly wide spread throughout Indonesia is dengue fever. Therefore, the participation of housewives that can be mobilized to reduce the incidence of Dengue Hemorrhagic Fever is to increase the eradication of Dengue Hemorrhagic Fever mosquito nests, including by carrying out regular and continuous larva checks and mobilizing the community to eradicate Dengue Hemorrhagic Fever mosquito nests (Masruroh et al., 2023)

According to Munawarah et al. (2020), housewives must also have an income, this is because there is a requirement to meet the needs of their family and to increase income in their household. However, at this time we must be required to develop more creativity to be able to compete. Therefore, there is a need for new and creative ideas that need to be provided to provide business insight to housewives so that they are able to always be productive and earn (Yuniartika & Hidayati, 2021). One business that housewives can do is making oil from essential leaves and betel leaves. The eucalyptus plant is one of the producers of essential oil which is widely used for various health or pharmaceutical products. Wood leaves white (M. Leucadendron) contains cineol, terpineol, terpinene, and limonene are beneficial compounds as insecticides and repellants. This leaf potential become larvicide vegetable (Gani et al., 2022)

The use of plant-based insecticides provides many advantages, namely that they are environmentally friendly and do not have a negative impact on health (Smith & Idris, 2019) Making oil from essential leaves and betel leaves using distillation techniques (Putri et al., 2021). Distillation or purification is a

chemical-physical separation method to obtain essential oils. The principle is based on separating the components of a mixture of two or more liquids based on the difference in vapor pressure or boiling point of the components being connected. Hydro distillation is the process of distilling a material in the form of an immiscible liquid with the aim of separating the components of the material to form two phase or layer. Typically, water or steam is used for this process (Yuniartika et al., 2022).

Several simple tools used to distill essential and betel leaves consisted of a pan, iron tube, and condenser or thick plastic container. This tool produces steam using the heat energy of a stove, and the steam is channeled through an iron pipe through a condensation tank. Pressure capacity This cooker is around 1 kg. Even 1 kg of essential and betel leaves produces around 150 ml of essential oil per hour.

In this service activity, the oil that has been produced from distilling essential leaves will be used as a mosquito repellent because based on research conducted by (Gunawan & Kurniaty, 2021). Based on the results, it can be concluded that the composition of anti-mosquito medicine uses the active ingredient of betel leaf (Piper betel) essential oil. Linn) is effective in repelling mosquitoes, the higher the concentration used, the more effective it is. mosquito repellent with the highest concentration of 17 percent, where one mosquito landed and eight mosquitoes died on the first Efficacy Test observation day, while no mosquitoes landed and eight mosquitoes died on the seventh observation day.

4. CONCLUSION AND RECOMMENDATIONS

The evaluation of community empowerment regarding skills in making eucalyptus and betel leaf oil showed a significant improvement. Pre-test results indicated that the majority of participants were "quite competent," while post-test results demonstrated a shift to "competent," with a P-value of 0.001. Information on producing eucalyptus and betel leaf oil as a preventive measure against Dengue Hemorrhagic Fever (DHF) raised awareness among respondents about the importance of environmental cleanliness and self-fogging using the oils to prevent dengue in their area. However, several challenges were encountered during this community service activity, including low community participation in counseling and training, as well as limited availability of raw materials like eucalyptus and betel leaves for oil-making interventions.

Future sustainability programs are crucial and should focus on providing ongoing counseling to enhance community knowledge, particularly among PKK mothers, about maintaining a clean environment and ensuring safe practices for health. Activities should be scheduled at more suitable times to encourage greater community participation and to better meet program objectives. A holistic approach is essential, involving collaboration between government agencies, the community, and relevant partners to address environmental cleanliness effectively. The oil-making intervention program should be continued, with active collaboration between the government, community, educational institutions, and stakeholders, to maximize the benefits and help the community combat dengue fever.

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