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The Impact of Fogging Activities on Dengue Hemorrhagic Fever (DHF) Prevention in Balocci District

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Abstract. *Dengue Hemorrhagic Fever (DHF) continues to pose a serious public health challenge in Indonesia, particularly in tropical regions with high population density and poor sanitation. The disease, transmitted primarily by Aedes aegypti mosquitoes, has shown a significant increase in recent years. One of the government's primary interventions to reduce transmission is fogging, which targets adult mosquitoes as a rapid control measure. However, its long-term effectiveness remains debated if not combined with source reduction strategies. A quantitative descriptive study with a cross-sectional design was conducted in January 2025, involving 477 community respondents selected through total sampling. Data were collected using a questionnaire on the implementation of fogging and perceptions of its effectiveness via the Kobocollect application. The Chi-Square test confirmed a significant association between fogging implementation and community perceptions of its effectiveness in dengue prevention (0.000; $p < 0.05$). These findings indicate that fogging plays a positive role in controlling dengue transmission. However, its long-term effectiveness requires community participation in mosquito breeding site eradication (PSN 3M Plus) and the integration of environmental management, health education, and sanitation improvements to achieve sustainable dengue prevention.*

Keywords: *Environmental health, prevention, dengue hemorrhagic fever, fogging*

1. Introduction

Dengue Hemorrhagic Fever (DHF), commonly known as dengue, has become a serious global public health challenge. According to the World Health Organization (WHO), dengue cases have increased over the past five years. In 2023, there were 4.6 million reported cases, and by the fourth month of 2024, more than 7.6 million cases had already been recorded (WHO, 2024). The Indonesian Ministry of Health (2023) reported that DHF is one of the leading causes of hospitalization and child mortality in Indonesia, while diarrhea is the second leading cause of under-five mortality after pneumonia.

Dengue fever is a serious disease in Indonesia, caused by the dengue virus transmitted by Aedes aegypti mosquitoes, particularly in coastal areas and densely populated environments (Fadlirahman et al., 2022). As a tropical country, Indonesia provides favorable conditions for the proliferation of Aedes aegypti, Aedes albopictus, and Aedes scutellaris, which are the primary vectors of the disease. According to data from the Ministry of Health in 2024, Indonesia recorded a significant increase in dengue cases, with a total of 60,296 cases and 455 deaths.

Unhealthy environmental conditions, such as stagnant water, unmanaged waste, and uncovered water storage containers, significantly increase the risk of Aedes aegypti larvae breeding. In addition, poor hygiene practices are a major risk factor for the spread of this disease (Juliska, 2023). Therefore, the government needs to strengthen health education

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campaigns and invest in sanitation infrastructure to reduce the risk of dengue fever, with routine fogging and case monitoring playing an important role. Moreover, efforts such as waste management, provision of clean water, and health education can also be implemented (Zaharudin et al., 2024).

Fogging is a method of insecticide spraying aimed at killing adult mosquitoes responsible for dengue transmission. This intervention is usually carried out when dengue cases are detected in an area as a rapid control measure. The effectiveness of fogging in quickly and substantially reducing mosquito populations has been demonstrated in various geographical contexts. Fogging is often used in response to outbreaks of mosquito-borne diseases, such as dengue fever and malaria (Hidayat et al., 2024). However, its effectiveness is frequently debated, particularly when not accompanied by source reduction measures targeting mosquito larvae, such as community-based vector control programs.

Balocci District, Pangkajene and Islands Regency, is an area with a high risk of environmentally related diseases. This condition is influenced by geographical factors, population density, sanitation conditions, and community behavior patterns that potentially increase Dengue Hemorrhagic Fever (DHF). Therefore, this study was conducted to determine the extent to which environmental health programs, particularly fogging activities, play a role in the prevention of DHF in this region. A study on Aedes mosquitoes conducted in Pangkep Regency in 2024 found a total of 110 Aedes aegypti larvae. This indicates that the area may be at risk for Dengue Hemorrhagic Fever (DHF) transmission (Rahmadana, Ka'bah, and Sulfiani, 2024).

In addition, this study is also important to evaluate the effectiveness of fogging as one of the vector control strategies compared to other measures such as mosquito breeding site eradication (PSN) with the 3M Plus method (draining, covering, and burying water containers, along with additional preventive measures), community health education, and environmental improvements. The findings are expected to provide a clear picture of the contribution of fogging to reducing DHF cases and to serve as a consideration for local governments in designing more comprehensive, sustainable, and community-oriented health policies.

2. Methods

This study employed a quantitative descriptive approach with a cross-sectional research design. It was conducted in Balocci District, Pangkajene and Islands Regency, during January 2025. Data collection involved direct observation, interviews with respondents, and the collection of information relevant to the research objectives. The study population consisted of all residents in Balocci District. A total of 477 community respondents were included as the sample. The sample was selected using a total sampling method while considering the predetermined inclusion criteria.

The research instrument used was a questionnaire on the implementation of routine fogging and perceptions of its effectiveness, administered through the Kobocollect application. The questionnaire consisted of 25 items covering aspects of dengue prevention behavior, knowledge, and perception of fogging effectiveness. Response options included multiple choice and a 5-point Likert scale. Prior to the main study, the questionnaire was pilot tested on 30 respondents to assess its validity and reliability. The reliability test yielded a Cronbach's alpha value of 0.81, indicating that the instrument was sufficiently reliable.

Data were analyzed using univariate and bivariate analyses. In addition, the Chi-Square statistical test was employed with a significance level of $p \leq 0.05$. The results of the analysis are presented in tabular form and explained narratively to address the research objectives

3. Results and Discussion

Based on the research conducted, data were obtained regarding t The Impact of Fogging Activities on Dengue Hemorrhagic Fever (DHF) Prevention. The following are the results of the cross-tabulation.

Table 1. The Impact of Fogging Activities on Dengue Hemorrhagic Fever (DHF) Prevention in Balocci District

Fogging Activities	DHF Prevention				Total	*p*
	Effective		Non Effective			
	n	%	n	%		
Routinely Conducted	420	95.5	20	4.5	440	
Not Routinely Conducted	28	75.7	9	24.3	37	**0.000**
Total	**448**	**93.9**	**29**	**6.1**	**477**	

This study indicates that fogging is still perceived by the community as one of the effective interventions for dengue prevention. The high perception of success (95.5%) is consistent with the findings of Sulastri (2021), who reported that fogging can suppress adult mosquito populations, thereby reducing the risk of transmission. However, fogging only targets adult mosquitoes and does not interrupt the breeding cycle of larvae. Consequently, without being accompanied by source reduction measures such as draining, covering, and burying water containers (the 3M method), new mosquito populations will continue to emerge. The World Health Organization (WHO, 2022) emphasizes that fogging should serve as a supplementary strategy rather than the sole approach to dengue prevention.

The cross-tabulation results showed that the majority of respondents (95.5%) who reported that fogging was routinely implemented also perceived it as effective in preventing dengue. Conversely, among respondents who indicated that fogging was not routinely implemented, only 75.7% perceived it as effective. The Chi-Square test confirmed a significant association between fogging implementation and community perceptions of its effectiveness in dengue prevention ($(\chi^2(1) = 18.45, p = 0.000$). This finding is consistent with the study by Naim et al. (2024), which reported that fogging provides direct benefits to the community by reducing the population of dengue-carrying mosquitoes and lowering the risk of disease transmission. Thus, fogging has been proven to play a role in breaking the chain of dengue transmission, although it still needs to be supported by the PSN 3M Plus program.

The high level of community satisfaction (95.5%) with environmental health programs also reflects the success of community-based interventions. However, fogging alone is insufficient if not accompanied by proper household waste management and improved access to clean water. Environmental factors and community health practices also influence the spread of dengue, such as the use of mosquito repellents, avoiding the habit of hanging clothes carelessly, and maintaining household cleanliness, all of which can reduce the risk of dengue infection. Therefore, enhancing community awareness through health education and outreach is a key strategy in reducing the incidence of dengue (Rochmawati et al., 2021).

As this study only assessed perceptions of fogging effectiveness, it did not evaluate entomological or epidemiological outcomes. Future research should examine the actual impact of fogging on mosquito populations and dengue incidence

Conclusions

Based on the findings of this study, it can be concluded that fogging has a positive effect on dengue control in Balocci District, Pangkajene and Islands Regency. However, its long-term effectiveness requires support from community-based the PSN 3M Plus program. The government needs to enhance community participation in the PSN 3M Plus program to achieve more effective dengue prevention.

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Conflicts of Interest

The authors declare no conflict of interest.

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