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COMMUNITY PERSPECTIVE ON PREVENTION AND CONTROL STRATEGIES OF DENGUE INFECTION IN MALAYSIA

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ABSTRACT

Dengue is a vector-borne disease caused by a rapidly spreading virus. Dengue vector control is considered the most efficient way for limiting and curbing the spread of the dengue virus. This study aimed to determine the perception of the Malaysian community towards control measures of mosquitoes and the utilisation of biocontrol. A total of 402 respondents in Putrajaya and Selangor participated in the survey. The questionnaire was broadly divided into three sections: knowledge of biological control, respondent profiles, knowledge of dengue fever prevention, and the utilisation of insecticide for mosquito control. Most of the respondents (83.0%) expressed concern regarding the effects of fogging activities on their health, whereas slightly more than half (56.0%) posited that fogging activities may have adverse environmental effects. The fogging method was reported as the most frequent method (29.2%) employed in controlling the mosquito population. Biocontrol with guppy fish scored (15.5%) and Abate® (mosquito larvae insecticide) (28.9%) were the other control measures utilised. Community perspectives revealed that 5.0% of the respondents were aware of biocontrol as a control method for the mosquito population. The biological method was considered safe for public health while guppy was reported as the most effective biocontrol agent. The introduction of novel and successful community programmes is significantly influenced by the perception of control measures for mosquitoes.

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Introduction

The control of dengue has been challenging due to the lack of effective therapy or vaccines for the disease. As a result, vector control remains the most feasible approach to controlling the spread and transmission of the disease in Malaysia. The Malaysian Ministry of Health has demonstrated remarkable interest in the use of fogging, which involves spraying insecticide into residential areas to reduce the population of mosquitoes. In a dengue control programme, mosquito control encompasses three main elements: community participation, vector control and surveillance, and enforcement. In vector control, infected mosquito populations are eliminated or reduced in all reported areas by applying insecticides (Lee, 2015). Since there is no specific cure for the disease and immunisation is not a viable option, vector control and surveillance remain the main strategies for dengue prevention (Selvarajoo, 2020). Although fogging remains the conventional method for controlling and preventing dengue disease in Malaysia, the use of this technique and public awareness campaign against the disease are still ineffective (Amin, 2015).

Materials and Methods

Questionnaires were distributed among the community in selected study locations in Selangor and Putrajaya. The questionnaire was broadly divided into three sections, which comprised respondents' profile or demographic information, knowledge of dengue fever prevention and use of insecticides for mosquito control, and knowledge of biological control. To ensure that respondents fully comprehend the questionnaire, the instrument was developed in both the English and Bahasa Malaysia language. To achieve the aim of this research, the instrument was adapted from the World Health Organisation (WHO, 2019) field surveys on exposure to pesticide standard protocol. Furthermore, the questionnaire was modified in line with the research objectives. The method described by Krejcie and Morgan (197) was employed for the sample size calculation.

Results

Demographic Information

The response rate for this community survey was 86.0% (n = 402/467). The respondents' profile is presented in Table 4.1. Most of the respondents were females (51.0%), aged between 24 and 29 years old (24.0%) and Malay (97.0%). All the respondents had at least a secondary school qualification while 28.0% and 18.0% had a higher educational qualification, either a diploma (28.0%) or a degree (18.0%).

Table 4.1 Profile and demographic information of respondents

Variables	Respondents (n = 402)	
	Frequency(f)	**Percentage (%)**
Gender		
Male	196	49
Female	206	51
Age (years)		
18 to 23	72	18
24 to 29	98	24
30 to 35	83	21
36 to 41	65	16
42 to 47	48	12
48 years and above	36	9
Race		
Chinese	0	0
Malay	390	97
Others	0	0
Indian	12	3

Variables	Respondents (n = 402)	
	Frequency(f)	Percentage (%)
Educational Qualification		
PMR	32	8
SPM	113	28
STPM	36	9
Certificate	35	9
Diploma	104	28
Degree	74	18

Perception of Mosquito Control Measures

A higher proportion of the respondents (29.2%) posited that fogging is the most used strategy for mosquito control, followed by Abate® (mosquito larvae insecticide) (28.9%), and guppy fish (15.5%). Most of the respondents expressed concerns regarding the potentially adverse effects of fogging on human health (83.0%) and the environment (56.7%). Additionally, the predominant effect of insecticide conveyed by respondents was the adverse impact on the environment (25.7%), followed by its expensive nature (26.5%), and its non-specificity by killing other non-target organisms (26.7%). Meanwhile, the impact on animals and other effects were relayed by 19.8% of the respondents.

Perception of Biocontrol Agent uses to Control Mosquito Population

The use of biocontrol to reduce mosquito populations was investigated in part D of the questionnaire. A little over half of the respondents (56.0%) claimed to be aware of the biocontrol strategy followed by those who were unsure (27.0%) and unaware (17.0%). Most respondents (47.9%) were unsure of the biological method effectiveness in mosquito control, whereas 52.9% opined that the environment is not polluted when biological methods are utilised. Likewise, 53.6% of them affirmed biological methods are safe for human health while 42.5% were not sure. Based on the community perspectives, most respondents considered guppy as an effective biocontrol agent for mosquito control, followed by 14.3% who viewed the use of toxic mosquitoes as one of the biological control methods. Only 4.4% of the respondents selected dragonfly nymph.

Discussion

Perception of the use of Control Measures for Mosquitoes

This study recorded a response rate of 86.0%, which is considered acceptable following Richardson (2005). Other researchers also conceded that a minimum response rate of 50.0% is acceptable in quantitative research or surveys (Cook et al. 2000; Dommeyer et al. 2002; Watt et al. 2002; Ballantyne, 2003; Nair et al. 2005). Most of the respondents in this study were aware of fogging activities as a common control measure for mosquito populations in Malaysia. Their perception of available control measures is pertinent to successfully implement new community programmes for mosquito population control. According to WHO (1983), comprehending the community's views about mosquitos, control measures and the appropriate ways for communities to participate in mosquito control initiatives are important to access the success rate of community programmes. Fogging was reported as the most common control strategy used by communities in reducing the mosquito population. Nevertheless, some researchers highlighted that the most effective methods of controlling mosquito populations are by source reduction or eliminating mosquito breeding sites (Yohannes et al. 2006; Singh et al. 2013). Kumar and Gururaj (2005) documented that most communities are unaware of mosquito control measures, whereas only 12.5% of rural inhabitants and 29.8% of urban residents were aware that maintaining a clean environment is a direct mosquito control approach. Based on this study, the respondents did not apply their knowledge despite having a sound understanding of source reduction or eliminating mosquito breeding sites as effective control measures.

According to Davis (2009), *Aedes* breeding search and destroy operations were undertaken in Malaysia in 2008 by the Ministry of Health, and a remarkable success was achieved with an 84% decrease in dengue cases in suburban areas. Jose and Craig (1995) revealed that restricting the availability of larval habitat is the most efficient strategy for managing *Ae. albopictus* and other *Stegomyia* species. The control of *Ae. aegypti* mosquito has been an important factor in dengue disease prevention and control.

The WHO (2013) described vector control as actions employed to successfully control a vector. In the present context, vector control refers to the control of mosquito – a vector responsible for the transmission of any of the four dengue viruses. Insecticides, such as synthetic pyrethroids, resin and malathion were used as sources of fogging during an outbreak of dengue disease to eliminate adult mosquitoes in the affected area (Yap, 1984). Despite fogging being advantageous for killing adult mosquitoes, the preparation consumes a large amount of organic solvent, which may have an irritating smell and leave stains. Fogging is also less cost-effective due to the usage of diluent and spraying methods and unfriendly to householders since they have to close their doors and windows to prevent fog penetration and the risk of fire from machines with extremely high operating temperatures and flammable solvents (WHO, 2003). The combination of these events heightens the risk of traffic hazards in urban and suburban areas. According to Karaunaratne et al. (2013), the primary methods of controlling mosquito vectors: *Ae. aegypti and Ae. albopictus,* entailed the use of insecticides in space spraying or fogging, larviciding, and source reduction.

The use of Abate® (mosquito larvae insecticide) and guppy fish were the other control methods reported by both groups. Health personnel is responsible for the provision of Abate® (mosquito larvae insecticide) to the public to control mosquito larvae breeding in containers that are not easily accessible. Both groups acknowledged the use of Abate® as a control measure for mosquito larvae populations, which is similar to the reports in a previous study (Koenraat et al. 2006). Temephos (Abate®), an organophosphate, is commonly utilised in containers for the control of *Ae. aegypti* larvae (Chareonviriyahpap, *et al.* 1999). Phuanukoonon, *et al.* (2005) concluded that the population of mosquito larvae can be effectively reduced by applying strategies that prevent their development in water-holding containers, including the addition of Abate®, placement of larvivourous fishes, and covering the containers. In 1998, Malaysia initiated the large-scale utilisation of Abate® larvicide in high-risk to reduce Aedes larval density (Teng & Singh, 2001).

In the present study, respondents were aware of the implications of insecticides, such as their deleterious effects on human health and the environment, harming and killing non-targeted organisms, and high cost. A previous study demonstrated that over 50.0% of workers believed that insecticides affect the environment, contribute to water pollution, soil depletion, and affect the animals within the surroundings. WHO, 2001 defined pesticides as a range of mixes employed to either control or eliminate several types of pests. Most pesticides cause harm to animals, plants and an extensive range of environments, including ground and surface water. Jansamood (2013) revealed that pesticides were highly efficient but had a negative effect on human health and the environment. The use of certain insecticides, such as DDT, was restricted following the buildup of chemicals in the oceans, air, land, food chain, and freshwater supplies (Mansour 2009, Ogata et al. 2009, van den Berg 2009). Al-Zaidi et al. (2011) who conducted a study in Saudi Arabia found that respondents were aware of the negative effects of using pesticides, such as soil pollution, sub-fertility, and toxication. Cornwall et al*.* (1995) also highlighted the risk of pesticides on the environment and public health in developing countries. The use of pesticides has led to the contamination of a large proportion of the environment, such as the soil, ground and surface water, food commodities, and non-target organisms (Aktar et al. 2009). In economic terms, the impact of pesticides on non-target species (including humans) in developing countries was estimated at $8 billion annually.

Perception of Biocontrol Agent Uses to Control Mosquito Population

Several respondents were aware of the biocontrol method for mosquito population control. However, a higher proportion was unsure about the utilisation of the biocontrol method. Studies conducted in the Gaza Strip found poor knowledge among the respondents concerning biocontrol methods for mosquito control. The persistent use of insecticide was linked to the poor knowledge of vector biocontrol (Yassin, *et al*. 2002). Prior to the introduction of insecticides in the 1940s, biological control measures were commonly used. Nevertheless, the wide usage of insecticides was associated with vector and community resistance and environmental damage (WHO, 2013). Several researchers suggested the use of biocontrol agents in controlling vector populations (Brown, 1981; WHO, 1986; Robert & Andre, 1994; Chareonviriyaphap, 1995).

Most respondents in this study highlighted the use of guppy as the predominant biological control method. Fish are widely used in the control of mosquito larvae, with remarkable potential as a biocontrol agent against the aquatic stages of mosquitoes (Chakraborty *et al.* 2008). Fish are also utilised as the main component of an integrated vector control programme, such as the application of *G. affinis*, *Aplocheilus panchax* and *P. reticulata* in India. Service (2000) also reported that guppy, *P. reticulata,* is the most used biocontrol agent for mosquito control. This approach has been employed successfully in rural areas in Cambodia to control *Ae. aegypti* in domestic water storage containers (Chang, *et al*. 2008). It may be feasible to utilise two or more biological control agents in suppressing vector species, and such an approach may be effective in achieving optimal vector suppression levels (WHO, 1982).

Conclusions

Both groups of respondents in this study highlighted cleaning up mosquito breeding sites as the most common control measure. Human behaviour was reflected as the common factor influencing the perception of factors contributing to higher incidences of dengue cases. Other reported influencing factors were poor knowledge of dengue fever control, less effective control methods, environmental-related factors, and chemical resistance. Respondents also highlighted guppy as the most effective biological control agent.

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