

Public Acceptance Towards BTI (*Bacillus Thuringiensis Israelensis*) as a Tool for Dengue Control

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Abstract

In tropical and subtropical countries, *Aedes aegypti* and *Aedes albopictus* is known as the main mosquito-borne disease vector, carrying diseases like dengue and chikungunya. The main approach for containing such infectious diseases is vector mosquito management. The fact that dengue cases are increasing annually is evidence of the inadequacy of current prevention measures like fogging and Abate. However, in the past few decades, Bti (*Bacillus thuringiensis israelensis*) has shown to be a highly selective and safe method for controlling *Aedes* mosquitoes during integrated pest management. The main causes of this are the low chance of resistance growing and the organisms' safety, especially human safety. The 415 respondents were completed validated questionnaires, and data were analysed using SPSS version 23.0. Thus, the aim of this study to observe the acceptance of Bti as the one of prevention techniques in combating dengue. The results showed that that the level of information seeking behaviour, and impact of technology were moderate, while the level of trust on key players was high. Bti technique was perceived as having high perceived benefits, moderate perceived risks and high acceptance.

Keywords: Bti (*Bacillus thuringiensis israelensis*), Dengue, *Aedes* mosquitoes, Factors Affecting, SPSS.

Introduction

Presently, dengue fever stands as the most prevalent insect-borne virus infection worldwide, accounting for between 50 and 100 million cases annually in over 100 endemic countries (WHO 2022). *Aedes aegypti* and *Aedes albopictus* mosquitoes, which are also carriers of West Nile, yellow fever, and other viruses, are the primary vectors of dengue virus (DENV) transmission to humans. The only approach to stop dengue transmission outbreaks is to prevent abrupt increases in the vector population, given there is currently no vaccine. Thus, the main approach for preventing and controlling these infectious illnesses is vector mosquito management.

The use of *Bacillus thuringiensis israelensis* (Bti) is example of microbial larvicides that work by creating crystal proteins that are extremely poisonous to mosquito larvae. One remedy that targets mosquito larvae particularly is the administration of larvicide (Liu et al. 2020). Bohari et al (2020), also investigated the application of Bti using the wide spray approach, which proved to be effective in reaching hard-to-find larval environments. An assessment verified that Bti droplets could pass over obstacles and land in water containers surrounded by thick vegetation, as well as on building first floors as high as five metres (Sulistiwati et al. 2023).

Therefore, it was found that although community people typically had high awareness about dengue sickness, their perception of the disease's danger was significantly lower [Dhar et al. 2016]. Ground level community participation is crucial for this [Naing et al. 2011]. People's understanding, consciousness, and attitude towards this illness play a major role in their ability to participate successfully [Jeelani et al. 2015]. Despite continuous advancements in dengue research worldwide, ensuring appropriate treatment and prevention alternatives remains a challenge in Bangladesh, making effective dengue prevention and control a critical concern today [Lim 2019, Prompetchara 2019].

The conceptual framework used in this was based on two studies: Pardo et al.'s attitude model for biotechnology applications and Brehdahl's (1999), attitude model for genetically modified foods, which was based on Fishbein's (1963), multi-attribute attitude model. The variables are categorised based on their presumed effects on the subsequent variables, with the components that are known to cause attitudes serving as the foundation for the models. The overall attitude towards the deployment of Bit method is influenced by the particular views of benefits and hazards Chen & Li (2007); Grunert et al (2000), and moral considerations (Amin et al. 2011; Gott & Monamy 2004; Sjoberg 2004).

According to other studies Amin et al (2011); Chen & Li (2007), these factors offer causal interpretations for perceptions of risk and benefit as well as general attitude traits like engagement and trust in important players. The parameters listed suggest the kind of framework that needs to be constructed. Even though the conceptual framework has additional complexity due to the incorporation of multiple aspects, the researchers believe that this is the answer to their research questions. Thus, this study's objective is to assess the Bti technique's acceptability in the fight against dengue.

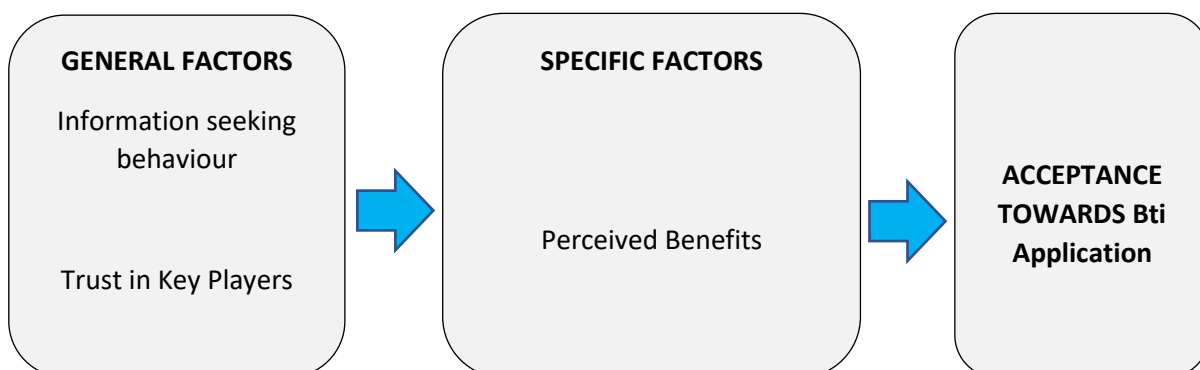


Figure 1. illustrates the conceptual framework of the research model that contains three major constructs in influencing public acceptance towards Bti application. The first construct is called general factors, and it consists of three components (information seeking behaviour, trust in key players and impact of technology). The second construct are also consisting of three components of specific factors (the perceived benefit, the perceived risk, and the perceived moral concern). While the final and the main construct of this study refers to acceptance towards Bti application in combating dengue.

Result

Table 1.1

Mean score and standard deviation analysis for factors influencing public acceptance towards Bti application.

Technique	Information seeking behaviour	Trust in key players	Impact of technology	Perceived benefits	Perceived risks	Acceptance
Bti	4.09 + 1.36	5.23 + 0.94	4.93 + 1.32	5.13 ± 1.30	3.60 ± 1.42	5.71±1.07
interpretation	Moderate	High	Moderate	High	Moderate	High

General Factors

1) Information seek behaviour

According to Yusof et al. (2017) and Hamid et al. (2015), supervision during monitoring is also required to establish successful preventative measures in the community. Knowledge and awareness of dengue fever are insufficient on their own. According to a study by Hamid et al. (2015), television and radio are the most popular information sources. These results are consistent with those of earlier studies conducted in Malaysia (Bota et al. 2014; Isa et al. 2013; Naing et al. 2011; Al-Zurfi et al. 2015; Hairi et al. 2003), Laos (Nalongsack et al. 2009), the Philippines (Yboa & Labrague 2013), Thailand (Kyu et al. 2005), Pakistan (Itrat et al. 2008), and India (Sugunadevi & Dharmaj, 2017). The general information-seeking behaviour of the public about Bti technique is moderate (4.09). This illustrates that the public's historical involvement in learning about dengue prevention and control methods is still at a reasonable level. According to Mulderij-Jansen et al (2020), the media, which includes radio, newspapers, television, and interpersonal channels of information, significantly contributed to the amplification of individual risk, particularly in the case of chikungunya, based on the participant narratives. The findings are corroborated by a recent study (Chan et al. 2018). According to Chan et al., variations in the amount of information in the media were correlated with a number of shifts in people's perceptions of risk and protective measures against the Zika virus in the US.

2) Trust in the key players

Study by Slovic et al (1991), Finucane et al (2000), and Slovic (1993), revealed a lack of confidence in the government's capacity to control dangers associated with technology-induced risk perception. Public perceptions of any new technology are also significantly shaped by the degree of consumer trust in regulatory bodies. The public is typically forced to depend on data provided by industry experts to assess the benefits and drawbacks of a Bti

application. This happens because the general public is forced to rely on the information provided by these specialists because they usually lack the knowledge, abilities, and time required to fully appreciate the complexity of modern technology. With a mean score of 5.23, indicated that the Malaysian public has a high degree of faith in the primary implementers in preventing and managing dengue. It has been discovered that trust is crucial in predicting how people perceive and behave at danger [Mulderij-Jansen et al. 2020]. When there is mistrust, individuals will question the information the channel is presenting, which can negatively impact risk communication efforts as well as how they perceive and behave at risk. To put it another way, risk communication has to address problems with negative trust.

3) Impact of technology

According to Gaskell et al (2010), one crucial factor in painting a picture of how society has developed in relation to biotechnology is the influence of technology. With a mean score of 4.68, the Malaysian public views the technology brought by all dengue prevention and control strategies as having a moderately negative influence. Setha et al (2016), found that Bti also decreased the number of *Ae aegypti* mosquitoes recorded both during and after treatment ($p < 0.05$). Comparing areas that received Bti treatment to those that did not, Bohari et al (2020), found in their research revealed that Bti treatment was effective in lowering the AI (Aedes Index), larval density index (LDI) ($p < 0.05$), ovitrap index (OI) ($p < 0.05$), and incidence rate (IR).

Specific Factors

1) Perceived Benefits and Perceived Risks

Since risk perception dictates which risks people care about and how they respond to them, it is also crucial for risk communication (Mulderij-Jansen et al 2020). While, the concept of perceived benefit refers to how someone feels about taking steps to lessen the risk of illness. Research has indicated that when people's actions have a good effect, they are more inclined to change their behavior (Kamimura et al. 2016). According to Frewer et al (2004), people tend to see a behaviour's or choice's risk as being lower when they experience a benefit from it. Beside, Chen and Li (2007), also discovered that perceived risks and benefits are predicted by social confidence in institutions. With a mean score of 5.13, Malaysians public believe that dengue preventive and control methods that involve the application of *Bti* bacteria offer significant advantages overall. Regarding perception of risk, the public believes that there are still risks associated with the procedure, albeit at a moderate rate (3.60). Study by De Silva & Wickramasinghe (2016), discovered that Bti Trap, a novel approach, was utilised using the same biological control agent. There were no dengue cases reported at the Bti treated site following the study, and the vector population drastically declined during the study period and remained suppressed long after treatment was ceased. This demonstrates that larviciding is necessary to stop dengue epidemics. Under lab settings, Bti proves to be quite efficient against *Aedes* species mosquito vectors that cause dengue, and both tested mosquito species exhibited great susceptibility to the Mosquito Dunk (*Bacillus thuringiensis israelensis* solid form).

2) Acceptance towards Bti application.

It is believed that a person's attitude and perception, as well as their acceptance and support of a technological advance, are tied to their character (Siegrist, 2000). Siegrist (2000), claims that it also involves how certain technologies are seen in terms of their advantages and

disadvantages. Study by Hadioemarto & Castro (2013), in Bandung, Indonesia have showed a strong support for the acceptance and implementation of the dengue vaccine in the future, indicating that the perceived advantages to the community outweigh the perceived risks. The use of Bti bacteria is widely accepted by the Malaysian population (5.71). For example in the case of technology acceptance among residents of possible *Wolbachia*-*Aedes* release sites in Australia is depended on its safety, the existence of governmental control, and community engagement initiatives (McNaughton 2012). In contrast, a study by Azil et al (2018), carried out in Malaysia before the release of *Wolbachia*-*Aedes* mosquitoes found that healthcare personnel accepted *Wolbachia* well. This was linked to their having a stronger background in science, their understanding of dengue, and other potential factors like religiosity, trust in the authorities, and their perception of the benefits of *Wolbachia*-*Aedes* mosquitoes (Arham et al. 2020).

Conclusion

It was found that the Bti formulation provided an easy, reasonably priced, and efficient way to control mosquito larvae. Furthermore, administering larvicide is believed to be a cost-effective and efficient method of controlling these vector mosquitoes' offspring. Considering everything said above, the BTI technique may prove to be a highly advantageous choice for integrated vector management activities. This study has yielded a comprehensive understanding of the aspects that influence the acceptability of Bti as a dengue control strategy, which is helpful in assessing the level of acceptance.

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