UNIVERSITI TEKNOLOGI MARA

ASSESSMENT OF DERMAL EXPOSURE TO PESTICIDES AMONG OIL PALM PLANTATION WORKERS

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ABSTRACT

The use of pesticides by agricultural workers, particularly in the oil palm industry, poses significant health risks, especially through dermal exposure, a route often overlooked. Despite the use of gloves, improper selection, use, and maintenance may still lead to exposure. This study focuses on pesticide handlers, assessing glove effectiveness, the risk of cross-contamination, and the impact of pesticide exposure on blood cholinesterase levels. A laboratory glove permeation test, field observational study using the DREAM method, and blood cholinesterase tests before and after exposure were employed. Statistical analyses included a t-test to assess the significant difference in cumulative permeation through the gloves. The findings showed no significant difference in glove permeation and potential skin contact, indicating that cross-contamination could occur during pesticides handling, with approximately 78.21% (183 workers) affected and 37.96% (89 workers) at risk of torso back exposure. Additionally, while 68% of workers had normal cholinesterase levels, 6% exhibited severe overexposure despite using personal protective equipment (PPE). The Kruskal-Wallis test was applied to identify opportunities for cross-contamination, while ordinal logistic regression was utilized to evaluate the impact of varying pesticide handling practices on workers' cholinesterase levels. This study highlights the need for better glove inspection and maintenance practices and emphasizes the importances of refining standard operating procedure (SOPs) to address work practices and behaviours that may contribute to pesticide exposure. These measures are essential to enhancing worker safety and reducing health risks in the oil palm plantation sector.

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CHAPTER 1

INTRODUCTION

1.1 Research Background

While the use of pesticides has successfully controlled pest invasion, they are not always selective for their intended target species. Adverse health effects, mortality and morbidity are possible in non-target species, including humans. In developing countries, deaths due to pesticide poisoning is more than due to infectious diseases. However, pesticides are still widely used in Malaysia, due to the high toxicity, efficiency, and low cost, presenting a persistent challenge to worker safety and environmental health.

The Malaysian palm oil industry is a significant economic driver, with Crude Palm Oil (CPO) production rising 1.9% from 18.12 million tonnes in 2021 to 18.45 million tonnes in 2022 (Ahmad Parveez, 2023). The significance of upholding good practices to maintain the sustainability of oil palm plantations including in the management of pest control will exhibit a discernible correlation with heightened productivity levels. As the world's leading producer committed to ensuring high yield of the commodity, most oil palm plantations use Organophosphates (OPs), a highly potent anticholinesterase agent to combat bagworms and caterpillars. However, its use has also resulted in various health implications on humans (Jaga & Dharmani, 2003; Kaur & Kochar, 2018). Agricultural workers face a high risk of pesticide exposure due to limited awareness, inadequate training, and unsafe work practices and behaviours.

The major route of exposure during pesticide handling is dermal absorption (Jurewicz et al., 2009), which is often overlooked. This research is anticipated to provide a better understanding of dermal exposure to pesticides for predictive risk assessment models and optimizing control measures. The research is designed to identify opportunities and risks for cross-contamination of pesticides among oil palm plantation workers. This will be achieved by testing the breakthrough of pesticides, which can also be predicted from the glove performance test. To identify opportunities for cross-contamination of pesticides on oil palm plantation workers while handling the