

Safe action in using pesticide among farmers: A scoping review

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Abstract

Background: Pesticides can poison users if they do not follow pesticide use standards. This is because the active substances in these pesticide products can cause acute pain.

Objective: The study aimed to identify the factors of safe behavior in using pesticides in farmers.

Methods: This study employed a scoping review method. The literature search was carried out on the indexed databases of Google Scholar, Science Direct, Scopus, PubMed, Free Medical Journals, and ProQuest in English. There were 450 research articles, and 15 met the inclusion criteria. From the 15 journals, information was collected from the publication year 2015-2021, article titles, design, population, interventions, and results. Relevant study articles related to the topics were qualitatively analyzed using NVIVO-12 Plus.

Results: The analysis showed that knowledge, safe behavior of using pesticides, farmers' education, and personal protective equipment are the dominant factors influencing the safe behavior of using pesticides on farmers.

Conclusion: Farmers who do not comply with safe behavior will have a higher health risk because of the toxicity of pesticides that can be directly inhaled and enter through the pores of the farmers' skin.

Keywords: safe behavior; pesticides; farmers; scoping review

Background

Pesticides have been used to eliminate pests and weeds in the last few decades with the intention of increasing agricultural product production could improve (Popp, 2018). Still, farmers can be poisoned

by pesticides during mixing, loading, spraying, and cleaning equipment since the active substances in pesticide products could have serious health consequences (e.g., mild or severe intoxication), not to mention the long-term health effects because pesticides do not have specific toxic effects (Sapbamrer & Thammachai, 2020; Suryani et al.,

2020; Tarmure et al., 2020). Most people die from exposure to pesticides every year worldwide. Moreover, this incident happened to farmers who did not attach importance to safe behavior while working (Buckley et al., 2021). A total of 220,000 deaths have occurred in the agricultural sector (Fan et al., 2015; Kaur et al., 2019). Most often reported pesticide-related poisoning symptoms were migraine (73.8%), skin rashes (62.3%), eye pain (32.8%), fatigue (22.4%), and muscle pain (19.1 percent) (Bhandari et al., 2018). In fact, pesticide poisoning ranks in the top five nationally in Indonesia (Mahyuni et al., 2020).

Pesticide misuse is associated with a lack of education on safe behavior in pesticide use and farmers' reluctance to accept the risk of losing crops when not using pesticides (Ali et al., 2018; Coria & Elgueta, 2022; Jallow et al., 2017). A lack of knowledge regarding pesticides' negative consequences and the farmers' lack of concern for their own health exacerbates this condition (Bagheri et al., 2019; Oztas et al., 2018). Research in Iran shows that almost half of the farmers have a negative attitude toward the use of pesticides. Meanwhile, farmers who have experience and use large areas of land show a more positive attitude towards pesticides (Bondori et al., 2018). Farmers' perceptions and attitudes about the benefits of PPE are also closely correlated with the willingness to use PPE as protective behavior (Morad Haseli et al., 2014; Sharifzadeh et al., 2019). There is a much higher chance of implementing pesticide safety uses by commercial farmers who know the color coding on the pesticide label (Sapbamrer & Thammachai, 2020).

Various previous studies on pesticide use behavior have been carried out. However, it is essential to conduct and summarize the literature on the determinants of the low level of safe behavior among pesticide-using farmers. Given the low probability of increasing the problem of unsafe behavior and increasing the risk of poisoning in farmers, farmers' unsafe behavior with pesticides must be addressed immediately. This research is expected to contribute to a deeper understanding of the safe behavior of using pesticides among farmers. The main research question of this review is what are the factors for safe behavior by farmers when using pesticides at work? Therefore, this review aims to investigate and summarize the scientific evidence on the related

factors of the safe behavior of farmers using pesticides. Thus, it can improve the research that has been done previously related to the behavior of using pesticides among farmers.

Methods

Study Design

This study used a methodological framework of Xiao and Watson (2019) to conduct a scoping review.

Search Strategies

This study seeks to find relevant articles related to determinants of safe behavior in the use of pesticides on farmers. Search articles using the journal database indexed by Google Scholar, Science Direct, Scopus, PubMed, Free Medical Journals, Pro-Quest, and search strategies using English keywords ("determinant" OR "impact factor") AND ("behavior" OR "attitude" OR "action") AND ("secure" OR "awake" OR "protected") AND ("pesticide" OR "pest poison") AND ("the farmer" OR "cultivator" OR "planter" OR "peasants").

Eligibility Criteria

The inclusion criteria in this study are articles published in the 2015-2021 range, full text, and in English, with a cross-sectional design, explanatory sequential, and case studies. Of the 450 journal articles that have been identified from various databases, 15 journal articles meet the inclusion criteria.

Identification and Selection of Studies

Journal articles that are not full text, preprinted journals, and not peer-reviewed are excluded. In addition, manuscripts currently in the proofreading stage are not included because there is a possibility of changes in the results of research reporting. **Figure 1** presents the PRISMA diagram of the procedure for selecting research articles.

Data Extraction from Included Studies

Data extraction was carried out in several steps. The first step was to summarize 15 selected articles, including the name of the author and the year of publication, journal volume, journal title, research methods used, research results, and journal database sources. Then, they were organized in the form of a synthetic matrix table. The second step was to arrange questions related to the topic to make it easier for the author to determine the subtitle

of the discussion by looking at the results of research summaries from 15 journals that have been determined. The third step was to discuss and explain facts, theories, and opinions about the research results and how the research in the article was obtained. Finally, an explanation of the research

results with the relevant theory was explained in the theoretical discussion.

Data Analysis

Relevant study articles related to the identified topics were systematically reviewed and qualitatively analyzed using NVIVO-12 Plus.

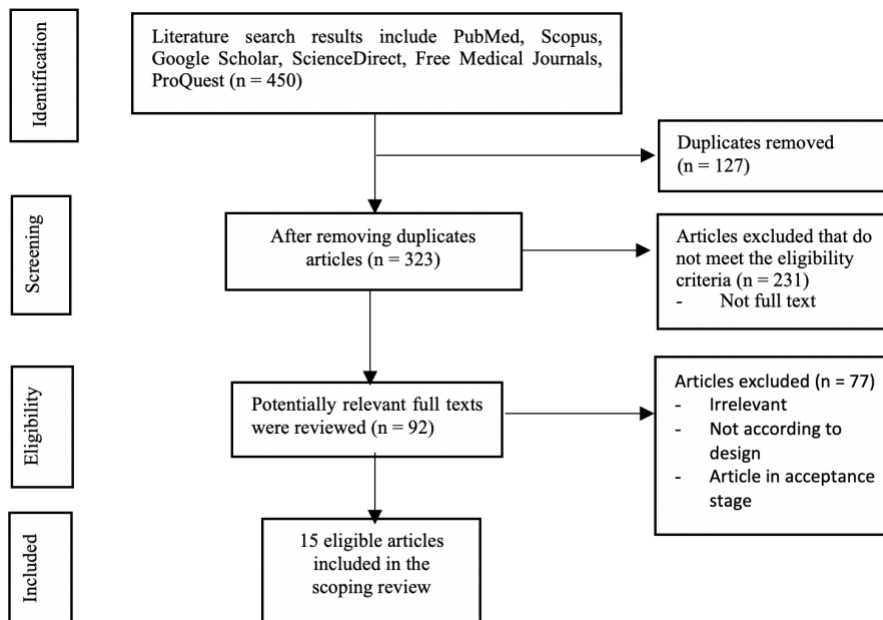


Figure 1 PRISMA Search flowchart

Results

All studies in this review assess the factors that influence how safely farmers may behave when using pesticides. Still, they have to prioritize personal health and safety while working. To avoid

diseases caused by the use of the wrong pesticides and environmental pollution due to excessive use of pesticides, it is necessary to encourage farmers to implement safe behavior by wearing the right PPE when working. **Table 1** shows articles in this study that have met the inclusion criteria published in the 2015-2021 range from various journal databases.

Table 1 Summary of articles that have met the inclusion criteria according to research objectives

| No. | Author (Year) | Method | Results | Database |
|-----|-----------------------|-------------------------------|---|----------------|
| 1. | Hashim et al. (2020) | Cross-Sectional | Attitude is the most influential factor in the behavior of farmers, with an R square of 0.671. Subjective norm contributed to some of the variance in behavior ($\beta = 0.331$) as this factor encourages farmers to apply better farming practices due to social pressure from relatives, friends, neighbors, and government agencies. This is followed by perceived behavioral control with ($\beta = 0.239$). | Google Scholar |
| 2. | Bagheri et al. (2019) | Case Study | The crucial factor influencing apple producers' pesticide usage behavior was knowledge of pesticide use (0.62), attitudes (0.50), and perceptions (0.50). Furthermore, knowledge influenced attitudes toward pesticide usage, and attitudes influenced perceptions. | Google Scholar |
| 3. | Mahyuni et al. (2020) | Explanatory Sequential Design | Even though some farmers demonstrate behavior inconsistent with their attitude, the predisposing factors of knowledge, perception, routine, tradition, and standing in society are significant to dangerous behavior. | Scopus |

Table 1 (Cont.)

| | | | | |
|-----|--|-----------------|---|-----------------------|
| 4. | Fan et al. (2015) | Case Study | Grain farmers have a lower degree of education and expertise than vegetable and fruit growers, and fruit growers are less eager to use fewer pesticides due to concerns about low earnings, a lack of faith in the government, and a distrust of pesticide diluents. Farmers were significantly affected by their perceived behavioral consequences. | Science Direct |
| 5. | Berni et al. (2021) | Cross-Sectional | With a high level of pesticide knowledge and the perceived severity of the related health hazards, adherence to safety practices when handling pesticides increased dramatically. On the other hand, uncertainty regarding the hazards of pesticide use was linked to a decreased chance of implementing safety measures. | Science Direct |
| 6. | Jallow et al. (2017) | Case Study | Pesticides are a risk to the environment and human health, with younger farmers being more concerned than older farmers. | Scopus |
| 7. | Mazloomi Mahmoodabad et al. (2019) | Cross-Sectional | Participants got 60% on the test with a mean score of 25.64 out of 38. Perceived susceptibility was 32.72 out of 55, perceived severity was 33.53 out of 55, perceived benefits were 25.99 out of 30, and perceived obstacles were 17.99 out of 30. | Free Medical Journals |
| 8. | Sharifzadeh et al. (2019) | Case Study | Overall, four aspects of safety behavior had higher mean ratings for importance than for current usage, showing that farmers' judgments of the relevance of various types of safety precautions during pesticide application were not completely reflected in their behaviors. | Science Direct |
| 9. | Bhandari et al. (2018) | Case Study | Farmer education affects the safety behavior. Most farmers do not wear PPE properly because of feeling hampered while working. Around 82% did not receive training for Farming with Pesticides because no program made good training on the use of pesticides. | Science Direct |
| 10. | Pan et al. (2020) | Case Study | Farmers' views of pesticide dangers to profit-maximizing criteria, such as food quality and human health, can reduce pesticide spending. Their opinions of environmental dangers, such as soil deterioration, water pollution, and air pollution, on the other hand, are not significantly linked to pesticide spending. | Science Direct |
| 11. | Ali et al. (2018) | Case Study | Pesticides were known to be very dangerous to the quality of agricultural products, the environment, and human health by the majority of vegetable growers, but not by rice or mixed crop growers. In general, perceptions of the effects of farmers' behavior and knowledge of pesticide usage influenced PBs favorably, whereas knowledge of pesticide use influenced PBs adversely. | Science Direct |
| 12. | Miyittah et al. (2020) | Case Study | The farmers had varying degrees of health-related problems. Headaches, burning feelings, fever, wet eyes, chest pains, and other health problems are all possible side effects. | ProQuest |
| 13. | Gesese et al. (2016) | Cross-Sectional | Among the participants, at least one pesticide control approach was known by 54.4 percent (95 percent confidence interval: 50.7–58 percent), and 53.7 percent had good sentiments concerning the safe use of pesticides. The average attitude score was found to be 3.9 (0.4). The names of pesticides, pest control methods, and the use of gloves during pesticide exposure were found to be an independent predictor of farmers' attitudes about the safe use of pesticides. | ProQuest |
| 14. | Oztas et al. (2018) | Cross-Sectional | Only 4.3% farmers used designated trash cans or facilities to dispose of empty pesticide containers; 84.0% believed pesticides were harmful to human health, 5.0% had had a medical condition, and 1.0% had been poisoned after using pesticides. | ProQuest |
| 15. | Rostami et al. (2019) | Cross-Sectional | Burning eyes and dizziness were the most prevalent pesticide poisoning symptoms. However, the majority of them lacked appropriate information. Many farmers had the right mindset when it came to using personal protection equipment. However, 37.4 percent of them said it is difficult to wear personal protective equipment. Farmers' use of personal protection equipment was shown to be related to their knowledge and attitude ($p < 0.001$). | ProQuest |

Figure 2 shows 15 articles that met the inclusion criteria, and as many as 31.33% were published in 2020. Most of the research designs used a case study research design of 53.33%. The sampling

technique was quite diverse, and the most widely used was the simple random sampling technique, as much as 53.33%.

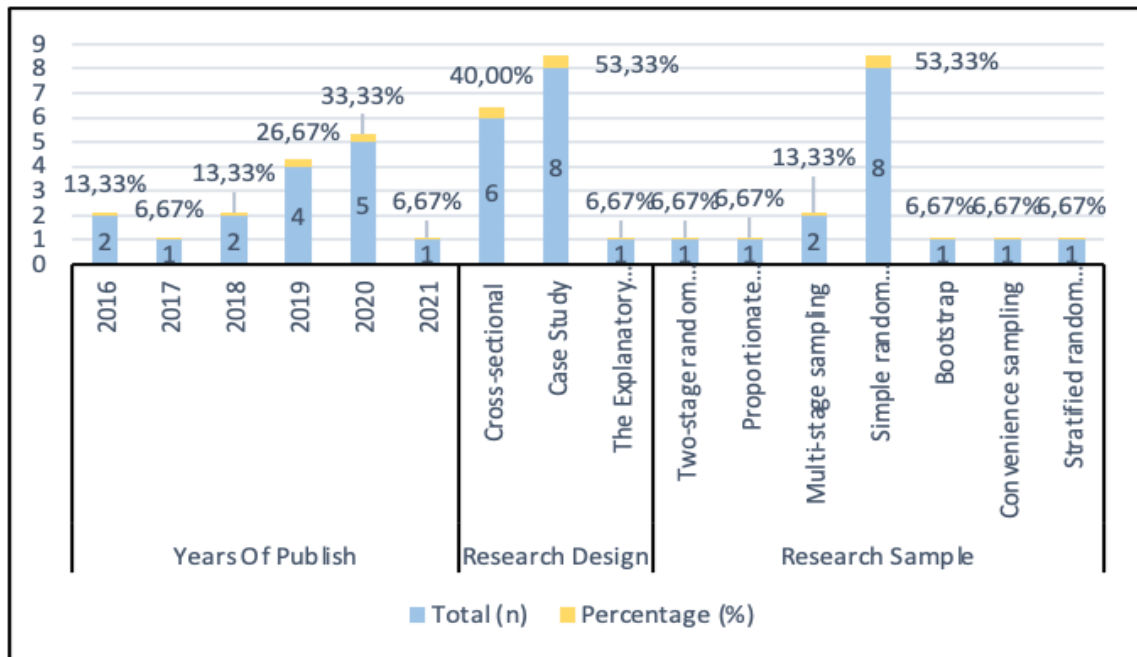


Figure 2 General characteristics for study selection (n = 15)

Table 2 shows the parameters affecting farmers' safe pesticide use from various reference sources. In the study of [Hashim et al. \(2020\)](#), subjective norms contributed to some of the variances in behavior ($\beta = 0.331$). This factor encourages farmers to implement better agricultural practices with social support from relatives, friends, neighbors, and government agencies and refers to the ability of farmers to meet good application guidelines for pesticides. Finally, the perception of vulnerability with ($\beta = 0.073$) means that farmers who feel vulnerable to specific health problems will engage in behaviors to reduce health risks when applying pesticides to their crops. In addition, the study by [Pan et al. \(2020\)](#) shows their perception of food quality and human health risks can also reduce the effect and have a positive attitude toward pesticide spending.

Furthermore, the study by [Bhandari et al. \(2018\)](#) about safe work behavior in farmers shows that individuals are less likely to follow suggestions for healthy behavior if they do not feel the benefits of the behavior. This then makes the perception that benefits affect safe work behavior and is

strengthened by the Chi-Square test results ($p = 0.025$), meaning a relationship exists between perceived benefits and safe work behavior. In addition, the Chi-Square test results of self-efficacy ($p = 0.000$) are also essential in encouraging someone to perform safe behavior. The same is supported by the research of [Fan et al. \(2015\)](#), which states that the level of farmer confidence (self-efficacy) should be increased again. Pesticide sellers should provide clear information on pesticide use standards to farmers.

The most important thing for creating safe practices for farmers using pesticides is the knowledge described in previous studies ([Ali et al., 2018](#); [Berni et al., 2021](#); [Fan et al., 2015](#); [Gesese et al., 2016](#); [Hashim et al., 2020](#); [Mahyuni et al., 2020](#); [Miyittah et al., 2020](#); [Rostami et al., 2019](#)), which states that knowledge about the use of pesticides has a significant role. This indicates that to promote safe pesticide handling practices, farmers' knowledge about pesticide usage should be the primary focus of interventions, which should be complemented by skills, technology, proper applications, and infrastructure.

Table 2 The related factors of safe behavior of farmers using pesticides

| Related Factors | Main Empirical Sources |
|---|--|
| Behavior, behavior control, farmers' ability to meet pesticide application standards, knowledge, and law enforcement. | Hashim et al. (2020) |
| knowledge, education, family support, and training. | Bagheri et al. (2019) |
| Farmers' training, knowledge, provision of PPE, work tools, and support from community leaders. | Mahyuni et al. (2020) |
| Knowledge, level of education, use of PPE, age, government support and training, and self-efficacy. | Fan et al. (2015) |
| Knowledge, perceived health consequences, social support, and training. | Berni et al. (2021) |
| Integrated pest control training, education level training. | Jallow et al. (2017) |
| Level of consciousness, sensitivity, level of education, use of PPE. | Mazloomi Mahmoodabad et al. (2019) |
| Government support for the provision of PPE, education, self-consumed produce, perceived health risks, routine health checks, and training for farmer skills development. | Sharifzadeh et al. (2019) |
| Education, the role of pesticide sellers as providing information on appropriate use, perceived health risks | Bhandari et al. (2018) |
| Attitude, risk perception | Pan et al. (2020) |
| Knowledge level, perception of health consequences, government support, and the role of pesticide sellers in providing information on appropriate use. | Ali et al. (2018) |
| Knowledge and the role of pesticide sellers in providing information on proper use. | Miyittah et al. (2020) |
| Knowledge, awareness of the use of PPE, awareness of the adverse effects of pesticides, and attitudes. | Gesesew et al. (2016) |
| Use of PPE and personal hygiene, training on the use of pesticides. | Oztas et al. (2018) |
| Knowledge, attitude | Rostami et al. (2019) |

Discussion

All studies in this review assess the parameters that affect farmers' safe use of pesticides and still have to prioritize personal health and safety while working. To avoid diseases caused by the use of the wrong pesticides and environmental pollution due to excessive use of pesticides, it is necessary to encourage farmers to implement safe behavior by wearing the right PPE when working.

Knowledge of Safe Behavior Using Pesticides

Of the 15 journal articles in the literature review, there are 11 articles describing the knowledge factor on the inappropriate use of pesticides. Farmers' lack of information and incorrect activity can impair their health by exposing them to pesticides and causing disorders linked to diet owing to pesticide residues in produce ([Damalas et al., 2006](#)). Several symptoms that appear acute and chronic are considered the leading causes of farmer failure, such as research by [Gaber and Abdel-Latif \(2012\)](#), which states that 4.0% of farmers have experienced poisoning, and [Hurtig et al. \(2003\)](#) reported that acute poisoning affected 51.8 percent of farmers. In

addition, age is also an essential factor for farmers concerning years of service in using inappropriate chemical pesticides. Thus, it is widely accepted that knowledge, age, and years of service encourage pesticide use behavior ([Akter et al., 2018](#)). They were measured based on their knowledge of pesticide overuse, reading of pesticide packaging labels, knowledge of pesticide toxicity, and health risks posed to agricultural workers. Farmers in Palestine know the practice of using pesticides that are wrong and have a terrible impact on health as much as 85%, while in Brazil, as many as 92% of farmers have knowledge about pesticide practices and state that the use of wrong pesticides will affect health ([Recena et al., 2006](#); [Zyoud et al., 2010](#)).

The high impact of pesticides occurs on female farmers with poor health status with long-term planting work. Meanwhile, male farmers are more involved in the agricultural management decision-making process. Female farmers only work as workers due to a lack of education and less familiarity with pesticide application technology, so they use pesticides more in agricultural production. For farmers, improper or excessive pesticide use

does not result in greater crop yields. However, when the number of pesticides used by farmers exceeds the recommended dosage on pesticide product labels, the potential for adverse effects on human health and the environment increases (Jallow et al., 2017). Therefore, knowledge of pesticide use is the most crucial aspect influencing farmers' willingness to utilize pesticides. Thus, a high degree of pesticide awareness among farmers will have a major impact on pesticide use. The study of Damalas and Koutroubas (2017) said that farmers who are well-informed about pesticides are likely to be able to act safely in the use of pesticides to achieve safe behavior. They can also avoid the dangers of using pesticides that are not appropriate, and the behavior of these farmers will vary from region to region. The study by Ahmed et al. (2011); Shammi et al. (2020) shows that each group of farmers will have different perceptions about the use of pesticides and attitudes because they have different families and neighbors.

The combination of knowledge, behavior, and years of service of incorrect and excessive pesticide use among farmers has created a danger of declining performance and has a high impact on health (Singh & Gupta, 2009). The lack of knowledge of using Personal Protective Equipment (PPE) related to pesticides can also damage the environment through spraying and soil seepage activities. The study by Ali et al. (2018); Berni et al. (2021); Mahyuni et al. (2020); Oztas et al. (2018) reported that many respondents in their study had less education and also high illiteracy rates pesticide-using farmers. Therefore, it poses an increased health risk in some developing countries, such as Egypt at 55%, Kenya at 24%, and China at 22.8% (Ibitayo, 2006; Kimani & Mwanthi, 1995; Yang et al., 2014). Farmers' lack of knowledge about using personal protective equipment at work, personal hygiene behavior at work, and smoking and eating habits when using pesticides may result in farmers being exposed to skin/eye irritation. This is because they are unsafe at work, like watermelon growers in the Central region of Ghana and grain growers in Northern China (Fan et al., 2015; Miyittah et al., 2020). Experienced farmers believe that long-term use of pesticides is not harmful to them. They also consider themselves immune to the harmful effects of pesticides. As a result, they do not take necessary preventive actions into account.

Lack of farmer knowledge, education, awareness of safe pesticide use behavior, and length of service will harm farmers' quality of life, health, and safety. Therefore, an occupational health program must be supported, which is an effective option for addressing agricultural problems. Village heads, community leaders, families, relatives, and local communities can support farmers. This activity aims to improve the safety of farmers by creating appropriate training programs. The primary goal of programs to promote safe pesticide use practices is to raise knowledge, reduce excessive pesticide use and improve public health status and can protect farmers from the dangers of pesticides (Berni et al., 2021; Jallow et al., 2017; Mazloomi Mahmoodabad et al., 2019; Oztas et al., 2018).

In other words, increasing knowledge, awareness, and skills could protect farmers from the dangers of pesticides. It also increases self-efficacy in the safe behavior of using pesticides. With good self-efficacy, farmers have an entire purpose and commitment to implementing safe behavior using pesticides. Farmers with a high degree of insight and knowledge make them better comprehend the pesticide bottle label's instructions that inform the safe use of pesticides. Therefore, the government should provide outstanding support for the safe use of pesticides. In addition to the farmer education enhancement program, financial aid is offered to farmers to help them purchase PPE and other protective equipment. Understanding the benefits of using PPE is a prerequisite for increasing farmer compliance with the use of PPE when applying, cleaning, and mixing suitable pesticides (Berni et al., 2021; Gesesew et al., 2016). Moreover, good pesticide use behavior must be supported by skills, support, the technology used, appropriate application, and the infrastructure (Hashim et al., 2020).

Education of Farmers

Education of farmers is a factor found in five articles from 15 works of literature reviewed. Education is a process of developing abilities, attitudes, and behavior in a society. Therefore, education is one factor that influences the safety behavior of farmers when working with pesticides and can help overcome the adverse effects of using pesticides. This demonstrates that farmers with greater knowledge are more likely to practice safety and hygiene, especially when receiving information

about pesticides, cleanliness after using pesticides, and knowledge about how much pesticides are used. Conversely, lower levels of education are associated with the dangers of pesticide exposure due to excessive use of pesticides, resulting in soil degradation, water pollution, and air pollution due to excessive use of pesticides found in Morocco (Benaboud et al., 2014; Pan et al., 2020). In addition, excessive pesticide use among female farmers was associated with increased yields (Jallow et al., 2017; Pan et al., 2020). The same thing is found in Thailand and several other developing countries (Grovermann et al., 2013).

Concerns about pesticides' detrimental health consequences are growing in developing nations, owing mostly to poor levels of education and inadequate training. Researchers found a relationship between farmers' education level and the risk of occupational poisoning symptoms caused by exposure to pesticides on farmers. Furthermore, there is a relationship between farmers' education level and the decision to use personal protective equipment. This is due to the insufficient knowledge of farmers in handling pesticides which can result in a greater risk of farmers being exposed to pesticides. Therefore, intensive education must be started by various institutions to educate farmers.

Furthermore, educational training to deal with unsafe pesticide use and its impact on farmers' well-being needs to be carried out. Programs such as Integrated Pest Control (IPM) training, training on the use of pesticides, and safe handling, are structured, systematic, and focused. Thus, farmers ensure they are always committed to good pesticide handling and improving education through farming experience (Hashim et al., 2020; Jallow et al., 2017). As a result, people are aware of the detrimental impact of pesticides on health and the environment and are taking precautions to safeguard themselves, their families, and the community (Damalas & Koutroubas, 2017).

Furthermore, pesticide merchants play a vital role in disseminating knowledge about pesticides and how to use them by exhibiting high levels of safety. For this reason, it is critical to have an adequate education and supervision program for pesticide sellers to provide accurate information to farmers (Yang et al., 2014).

Use of Personal Protective Equipment (PPE)

Four articles from the literature review showed that poor use of personal protective equipment (PPE) during pesticide use contributed to pesticide exposure in farmers and the induction of farmers' health problems. They also said that wearing PPE was inconvenient for them as it interfered with their comfortable movement and ability to spray pesticides. Thus, to encourage the excellent use of PPE, the convenience of farmers must be considered when using PPE (Morad Haseli et al., 2014). On the other hand, bad behavior in using PPE is a determining factor that pollutes the environment. It increases poisoning due to pesticide exposure that enters directly through the skin, mouth, and respiratory system, which mostly occurs when mixing and spraying pesticides (Mahyuni et al., 2020). In addition, the main obstacle to using PPE for farmers is the high cost of buying personal protective equipment. It makes farmers not prioritize their safety (Damalas et al., 2006; Morad Haseli et al., 2014; Yuantari et al., 2015). This finding is in line with the research of Rezaei et al. (2018), which shows that almost half (49.5%) of farmers in Iran do not carry out safe behaviors related to PPE use because they do not want to spend money to buy it. Therefore, to avoid or minimize the risk of exposure to pesticides, what needs to be done is support from the government through financial assistance to help farmers buy PPE and other facilities required for safe behavior in the use of pesticides. This aims to avoid exposure to pesticides while working, which is realized by complying with the use of personal protective equipment (PPE) at work while maintaining personal hygiene behavior both at work and after work will provide benefits that are felt directly by farmers (Mazloomi Mahmoodabad et al., 2019). In several studies, safe work behavior that has not been carried out correctly is caused by several supporting factors, both internally and externally. This aligns with the Health Belief Model theory, which states that internal factors such as individual perceptions can affect health behavior.

Good communication allows farmers to discuss with their families and remind each other about self-confidence and safe work behavior when using pesticides (Mahyuni et al., 2020; Rostami et al., 2019). Therefore, large family support has a strong correlation and influence on the safe work behavior of farmers. This occurs due to increased perceived risk and health implications after using pesticides,

which impact high improving compliance with safety behavior (Berni et al., 2021; Jallow et al., 2017).

Conclusion

Farmers using pesticides are significantly at risk of exposure to hazardous substances that harm health. It causes health problems both acutely and chronically. Several factors cause farmers' bodies to be exposed to pesticides, such as lack of knowledge, lack of family support, low farmer education, to ignoring safe behavior when working with pesticides. Farmers who do not comply with safe behavior will have a higher health risk because of the toxicity of pesticides that can be directly inhaled and enter through the pores of the farmers' skin. Therefore, there must be support from the government, family, and community leaders to improve safe behavior and not be exposed to pesticides. Practical activities can be in the form of conducting training on pest control under agricultural procedures. It also includes maintaining personal hygiene by not smoking, eating, or drinking while working with pesticides or not using pesticides excessively. The will from within the farmers themselves is also needed.

If possible, the government can also provide subsidies for PPE. This will affect the motivation of farmers because most farmers object to the cost of buying PPE. Pesticide vendors are also responsible for disseminating information regarding pesticide use because pesticide packaging labels written in foreign languages are generally difficult for farmers to understand. With some of the precautions above, farmers will understand how to use suitable pesticides because using the wrong pesticides has a destructive impact on farmers' health. As a result, farmers can suffer materialist and welfare losses.

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Author Contribution

All authors met the contribution criteria for authorship and approved the final version of the article to be published.

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