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Personal Protection from Agricultural Chemicals among Older Farmers in Nakhon Pathom Province

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Abstract

Significance: Most of the older persons who work as farmers in Nakhon Pathom Province still use agricultural chemicals to increase productivity and eliminate pests. There is evidence that their physical condition is deteriorating because the process of excreting chemicals from the body is ineffective due to the deterioration of the liver and kidneys. This study aimed to examine personal protection from agricultural chemicals among older farmers in Nakhon Pathom Province. A cross-sectional descriptive study design was employed. Data were collected from 179 older farmers through the questionnaires. Descriptive statistics were used to analyze the data. They showed that most participants had practiced personal protection from agricultural chemicals at a good level. The top three behaviors they practiced were immediately cleansing the body when arriving home after using chemicals (85.5%), wearing long sleeves (83.8%), and separating contaminated laundry (83.2%). The lowest three protection behaviors were wearing a rubber apron at all times (41.9%), visiting a doctor/health worker when there is an illness or discomfort (57.0%), and wearing rubber gloves at all times (58.7 %).

Therefore, the development of chemical labels, innovative gloves, and chemical-resistant rubber fabrics which would be friendly to older people should be recommended. Also, a safe agriculture policy and monitoring of safe agricultural chemicals are recommended.

Keywords: agricultural chemicals, older farmers, older persons, personal protection

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1. Introduction

Farming has been the main occupation of Thailand for a long time; as a percentage of the country's population is engaged in agriculture. According to the data from the National Statistical Office surveying the operational characteristics of the people in 2021, there were 38.07 million occupations in Thailand, 11.15 million of whom were farmers or 29.5%. In 2018, 23.59% of the population of Nakhon Pathom Province were registered as farmers. [1].

Nakhon Pathom Province has 157,301 older persons, 66,624 males, and 90,677 females [2], with 116,874 still working as farmers [3]. Most of the older people in Nakhon Pathom Province who work as farmers still use agricultural chemicals to increase productivity and eliminate pests. Most of the chemicals that farmers use are pesticides, comprising insecticides, herbicides, fungicides, and rodenticides [4]. These chemicals have acute and chronic toxic effects on the health of the body. Acute chemical poisoning will cause symptoms immediately after exposure, such as nausea, vomiting, headache, muscle aches, diarrhea, and shortness of breath. Chronic poisoning will cause cumulative toxicity that can cause diseases or other problems such as cancer, diabetes, paralysis, various skin diseases, infertility, disabilities of the newborn, and sexual dysfunction [5]. Older persons' nature includes a deteriorating body and decreased excretion of waste products from the liver and kidneys. Therefore, the excretion of chemicals from the body is reduced as well. As a result, older persons are at higher risk than adolescents and younger adults of toxic exposure from occupational chemicals that accumulate in the body until acute and chronic toxicity occurs.

Nakhon Pathom Province had the most pesticide use areas, namely Don Tum District, Bang Len District, and Sam Phran District, respectively [6]. Older persons have thinner outer skin and a reduced sense of smell, taste, and touch, making them perceived exposed to agricultural chemicals more slowly. Therefore, more agricultural chemicals are absorbed through the skin [7]. They were causing older persons to be exposed to agricultural chemicals for longer than younger persons. They are more prone to kidney and liver diseases, which are the organs that excrete toxins

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from the body. Therefore, the body can eliminate agricultural chemicals less and increase the danger from chemical residues [8]. Although the chemicals are harmful to the body, the chemical protection behaviors of individual farmers differ according to this literature review of the factors predicting personal protection from agricultural chemicals in working-age farmers. It was found that factors related to chemical protection behaviors were gender, age, knowledge, perceived benefits of wearing protective equipment, and perceived harm of chemicals [9-11].

The preceding information revealed that older persons in Nakhon Pathom Province continue to engage in agriculture at a higher rate than other age groups and often use chemicals in agriculture. Previous research on chemical protection behaviors was done on working-age people [9-11]. Therefore, this research will focus on personal protection from agricultural chemicals among the older farmers who are still farming in Nakhon Pathom Province for planning and implementing activities that help to avert the entrance of chemical pesticides into the body. This study may enable older persons to continue their occupations with enhanced safety. This research aims to study personal protection from agricultural chemicals when using chemicals in farm work among older person farmers in Nakhon Pathom Province.

2. Methods

This research was a descriptive study. The population was farmers aged 60 years and over, with a total number of 116,874 persons in 51,024 households [2-3]. The sample was older people engaged in agriculture and using chemicals in agriculture. The sample size was calculated from a computer program according to the power analysis principle by determining the test power of 0.90, the effect size of 0.15, and the level of statistical significance at the 0.05 level. The sample size to be studied was calculated for 179 people [12]. Inclusion criteria were: 1) being age over 60 years, 2) having currently engaged in agriculture or planting for at least one year, 3) having used chemicals in agricultural work, 4) living in Nakhon Pathom Province, 5) having good consciousness and can communicate in Thai, and 6) having consented to participate in the research by signing or fingerprinting. Exclusion criteria included 1) being diagnosed with COVID-19 or classified as a high-risk group on the day of participation and 2) having an acute illness or inability to provide information.

For the sample selection procedure, a multi-stage sampling method was employed. The first stage was randomly drawn from 3 out of 7 districts by simple random sampling: Mueang district, Kamphaeng Saen district, and Bang Len district. In the second stage, by simple random sampling, Sa Katiam Subdistrict was obtained from Muang District; Thung Khwang Subdistrict was obtained from Kamphaeng Saen District, and Bang Phasi Sub-district was obtained from Bang Len District. The third stage was accomplished by simple randomization by spinning the wheel until the older farmers were obtained according to the specified amount.

The research instruments were the personal characteristics questionnaire and the questionnaire on personal protection from agricultural chemicals when using chemicals in agricultural work. The second questionnaire consisted of 20 items, divided into three parts as follows: 1) before spraying chemicals, four items; 2) during spraying chemicals, nine items; and 3) after spraying chemicals, seven items. It is a three-rating scale questionnaire that asks for personal protection practices when using chemicals in agriculture before, during, and after spraying. The questionnaires allowed the participants to explore themselves and assess their events or actions. The participants were asked to choose only one answer for each question. The scoring criteria were as follows: “practice every time” got three points; “ practice sometimes” was two points; and “never practice” was one point. The scores and interpretation of personal protection from agricultural chemicals practice are as follows.

The personal protection from agricultural chemicals practice mean scores can be divided into three levels [13] as follows:

2.50 – 3.00 refers to the practice at a good appropriate level.

1.50 – 2.49 refers to the practice at a moderately appropriate level.

0.00 – 1.49 refers to the practice at an inappropriate level.

For interpretation of personal protection from agricultural chemicals practice sum scores, the score of 20-35.4 means inappropriate behavior, 35.5-47.4 means moderate appropriate behavior, and 47.5– 60.0 means good appropriate behavior.

Before spraying chemicals, the sum score of4.0-7.0 refers to inappropriate behavior, 7.1-9.4 refers to moderate appropriate behavior, and 9.5 – 12.0 refers to good appropriate behavior.

During spraying chemicals, the sum score of 9.0-15.9 refers to inappropriate behavior, 12.5-16.6 refers to moderate appropriate behavior, and 16.7 – 21.0 refers to good appropriate behavior.

After spraying chemicals, the sum score of 7.0-12.4 refers to inappropriate behavior, 16.0-21.3 refers to moderate appropriate behavior, and 21.4 – 27.0 refers to good appropriate behavior.

The questionnaire on personal protection from agricultural chemicals of the Division of Diseases from Occupational and Environment, Department of Disease Control, Ministry of Public Health was published for general agencies to use [14]. It is a standard questionnaire that is suitable for those of working age. Therefore, the questionnaire was examined content

validity by five experts: two nursing professors specializing in geriatrics, one measurement and evaluation expert, and two occupational health experts. The index of item objective congruence (IOC) equal to one. This result ensured that older persons could understand the questions and were able to answer. The reliability test of the assessment with 30 older framers in Wang Ta Ku Subdistrict, Mueang District, Nakhon Pathom Province, yielded Cronbach's alpha coefficient of 0.89.

A self-administered questionnaire or face-to-face interviews were used to collect data. The questionnaire was distributed to each participant at home and asked them to answer it themselves. For those inconvenient to answer the questionnaire, such as blurry vision or far-sightedness, the researchers read out, and the participants selected answers by themselves. The duration of the interview was approximately 30 minutes. A total of 197 questionnaires were returned, representing a response rate of 100 percent.

This study is part of a research project on factors predicting agricultural chemicals protection behaviors among older agriculture persons in Nakhon Pathom Province, accredited for human research ethics of the Human Research Ethics Committee, Nakhon Pathom Rajabhat University with a certification number of COA No. 009/2022, dated February 7, 2022. The subjects have been protected following the ethical principles of human research in all respects. All participants have been clarified about the objectives, benefits, and potential risks, including the ability to withdraw from the study at any time without compromising on confidentiality or the overall presentation of the research results. They signed a consent form willingly before data were collected.

3. Results

3.1 General characteristics of the participants

The participants were aged 60-69 years (77.7%), with more males (60.9%) than females (39.1%). More than half (59.2%) of them had congenital diseases, namely high blood pressure (31.1 %) and diabetes (22.4 %). Three-quarters of the participants completed primary education (73.2%), had sufficient family income to cover their expenses (73.2%), and 50.3% of participants grew vegetables and herbs for cooking food. 47.7% of the participants had more than ten years of experience using chemicals, and 9.6% experienced chemical poisoning.

3.2 Personal protection from agricultural chemicals practice

The participants had good overall scores (82.1%). In the three phases—before spraying, during spraying, and after spraying, the scores were at a good level (Table 1). However, for during spraying chemicals, two items were with moderate levels—wearing rubber gloves and a rubber apron. Likewise, for after spraying one item was at a moderate level (landfill use) (Table 2).

According to Table 1, the top two non-practice personal protection that occurred before spraying the chemicals were that one-third (32.4%) of the participants did not wear rubber gloves when mixing chemicals. About a quarter of them (28.5 percent) did not read the detail on chemical container label before purchasing. Regarding personal protection practice during using the chemicals, it was found that the participant did not always practice personal protection. The top two highest scores showed that more than half (58.2%) of the participants did not wear a rubber apron, and 41.3% did not wear rubber gloves all the time when using chemicals in agriculture. It was found that personal protection behaviors were only sometimes practiced. After using agricultural chemicals, the top two rankings showed that 43.9% did not landfill-used containers, and 18.1% did not visit a doctor/health care provider every time when there got an illness or discomfort. The top three behaviors that were the most practiced were immediately cleansing the body when arriving home after spraying chemicals (85.5%), wearing long sleeves and long pants (83.8%), and separating contaminated laundry (83.2%), respectively. The lowest three personal protection behaviors were wearing a rubber apron at all times (41.9%), visiting a doctor/health care provider when got an illness or discomfort (57.0%), and wearing rubber gloves at all times (58.7 %), respectively (Table 2).

4. Discussion

The participants were male, youngest-old, and healthy. However, some had a congenital disease but were still able to carry out their farming similar to a previous study, which found that older persons in Thailand were healthy and still able to work (66.7%) [15].

Overall personal protection from agricultural chemicals behaviors

The overall personal protection from agricultural chemicals practice among the participants was at a good level (82.1%). Since the participants had experience in farming for a long time, behaviors on protection from agricultural chemicals were appropriate. It can be explained that older farmers use life experiences to learn positive behaviors by learning from everyday life, which results in behavioral changes with relatively permanent. This change cannot be explained by any particular event [16]. Moreover, they learned by observing others using chemicals to help them increase their productivity as well as avoid getting sick. These personal protection behaviors have become deeply ingrained in older persons. The results of this study could not be reached in other results regarding limited publication found among older

Table 1. Descriptive results of the participants on the personal protection from agricultural chemicals practice (n=179)

Personal protection from agricultural chemicals	Possible score	Min	Max	M	SD	Interpretation	Level of Behaviors N (%)		
							Inappropriate behavior	Moderately appropriate	Good
-Overall behaviors	20-60	20.0	60.0	52.9	6.8	good	3 (1.7)	29 (16.2)	147 (82.1)
-Before spraying chemicals	4-12	4.0	12.0	10.6	1.9	good	13 (7.3)	30 (16.8)	136 (76.0)
-During spraying chemicals	9-27	9.0	27.0	23.2	3.7	good	4 (2.2)	51 (28.5)	124 (69.3)
-After spraying chemicals	7-21	7.0	21.0	19.1	2.3	moderate	2 (1.1)	20 (11.2)	157 (87.7)

Table 2. Interpretation of personal protection from agricultural chemicals practice classified by item of behaviors (n=179)

Personal protection from agricultural chemicals practice	Practice				
	Mean (SD)	Interpretation	Practice every time (3)	Practice sometimes (2)	Never practice (1)
1. Before spraying chemicals, what do you do?					
1.1 Read the details on the chemical label before purchasing	2.6 (0.6)	good	128 (71.6)	38 (21.2)	13(7.3)
1.2 Follow the instructions given on the label	2.7 (0.5)	good	130 (72.6)	44 (24.6)	5 (2.8)
1.3 Wear rubber gloves when mixing chemicals	2.5 (0.8)	good	121 (67.6)	28 (15.6)	30 (16.8)
1.4 Use materials or wood to mix agricultural chemicals	2.7 (0.5)	good	136 (76.0)	37 (20.7)	6 (3.4)
2. During spraying chemicals, what do you do?					
2.1 Wear a facial mask	2.7 (0.5)	good	142 (79.3)	28 (15.7)	9 (5.0)
2.2 Wear rubber gloves at all times	2.4 (.8)	moderate	105 (58.7)	39 (21.7)	35 (19.6)
2.3 Wear long sleeves and long pants	2.8 (0.5)	good	150 (83.8)	24 (13.4)	5 (2.8)
2.4 Wear rubber boots	2.5 (0.8)	good	125 (69.8)	24 (13.4)	30 (16.8)
2.5 Wear a wide-brimmed hat	2.8 (0.5)	good	145 (81.0)	27 (15.1)	7 (3.9)
2.6 Wear a rubber apron at all times	2.0 (0.9)	moderate	75 (41.9)	37 (20.7)	67 (37.4)
2.7 Stand upwind	2.7 (0.5)	good	125 (69.8)	52 (29.1)	2 (1.1)
2.8 Do not eat/drink in the sprayed area	2.7 (0.5)	good	133 (74.3)	42 (23.5)	4 (2.2)
2.9 Do not smoke cigarette/tobacco	2.5 (0.8)	good	125 (69.8)	26 (14.5)	28 (15.6)
3.After spraying chemicals, what do you do?					
3.1 Wash hands immediately before eating/drinking	2.8 (0.4)	good	148 (82.7)	29 (16.2)	2 (1.1)
3.2 Take a shower immediately to cleanse the body when you get home	2.8 (0.4)	good	153 (85.5)	24 (13.4)	2 (1.1)
3.3 Immediate removal of clothing	2.8 (0.4)	good	151 (84.4)	26 (14.5)	2 (1.1)
3.4 Separate contaminated laundry	2.8 (0.5)	good	149 (83.2)	24 (13.4)	6 (3.4)
3.5 Separate containers and equipment for spraying chemicals	2.8 (0.4)	good	147 (81.1)	29 (16.2)	3 (1.7)
3.6 Landfill used agricultural chemical containers	2.3 (0.9)	moderate	116 (58.9)	26 (13.2)	55 (30.7)
3.7 Visit a doctor/health care provider when getting an illness or discomfort	2.8 (0.5)	good	102 (57.0)	25 (14.0)	8 (4.1)

farmers. However, the results were similar to the study of the pesticide use behavior of working-age [17, 18]. But they were different from the study of risk behaviors regarding pesticide use among adult-age farm-

ers, which indicated that only one-fourth to one-third had personal protection behavior of herbicide use at a good level [19, 10]. 95.0% of the labor-age and older farmers had moderate personal protection behaviors [20]. In comparison, the working age group in Ghana used protective measures during pesticide application, around 70% [21].

Before spraying

Participants showed good behaviors of personal protection before spraying chemicals (76.0%). However, some participants had inappropriate personal protection practices, for example, 28.5% did not read the details on the chemical container label before purchasing and 16.8% wore rubber gloves when mixing chemicals. In previous studies, over half of the working-age farmers did not wear protective equipment while mixing pesticides [23, 24] because it made them work slower and more uncomfortable, especially in hot and humid climates [24]. Farm workers in developing countries were limited in reading chemical labels because there were no labels in the local language, agricultural farm workers were illiterate [25], and the words of neighboring farmers [26]. This differs from the study of Thai working-age farmers, which found that 62.0% read chemical labels and well understood the information [19].

During spraying

During chemical spraying, wearing aprons and rubber gloves was a less common practice among participants, which allowed agricultural chemicals to penetrate the body. Furthermore, working-age farmers did not cover their mouths and noses with cloth or wear masks or glasses. They also did not wear socks, gloves, or boots while spraying pesticides [23]. The agricultural farm workers may refuse to use protective clothing for cultural reasons because they feel uncomfortable or lack a way to clean them for reuse [25].

After spraying

Although the participants were highly experienced in using chemicals in agriculture, 47.7% had more than ten years of experience using chemicals, 9.6% of the participants still experienced chemical poisoning. In addition, visiting a doctor/health worker for an illness or discomfort was at a low-level protective behavior among the participants. This information supported those older farmers who were not fully aware of the dangers of chemicals in agriculture, not realizing that these inappropriate behaviors would result in long-term effects. Likewise, the working-age farmers were reported on performing inappropriate safety behavior after using chemicals, e.g., disposing of pesticide containers in the trash, burying their used agricultural chemical containers, using empty pesticide containers to store food [19], and landfilling empty pesticide containers on farms and hazardous waste collection sites [27]

5. Conclusion

Even the personal protection behavior when using chemicals in the agricultural work of elderly farmers is at a good level both before, during, and after spraying chemicals. But more than half of the older farmers wear rubber aprons and rubber gloves. The landfill of all used agricultural chemicals containers could have been at a better level. As a result, older farmers risk to side effects from accumulated chemicals in agricultural work in their bodies beyond the safety limit.

6. Recommendation

Those involved should encourage older farmers to engage in behaviors of wearing a rubber apron, wearing rubber gloves, and landfilled used agricultural chemical containers. They should also promote reading chemical labels before purchase and before use by developing easy-to-read chemical labels with big letter fonts for older persons.

Further research should examine the factors predicting personal protection behaviors for older farmers and their families regarding exposure to agricultural chemicals. Research focuses on a tailored intervention regarding proper use, such as modification of the behavior of farmers and raising awareness of agricultural chemicals' harmful and toxicity, developing and innovating personal protective equipment, e.g., gloves, aprons, and legible product labels that are friendly to older persons should be done. The study results indicated that although the older farmers had high occupational experience, the behavior of using self-protection equipment and disposal of chemical containers was inappropriate. Policymakers can apply the results of this study by encouraging social aging innovation in personal protection equipment, establishing a safety agriculture policy, and monitoring safe agricultural chemicals use.

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