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Farmers' Pesticide Using Behaviors: A Case Study on Pistachio Farms in Kerman, Iran

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Background: Improper use of pesticides has become a serious in regard to human health in recent years. Overlooking safety regulations, using pesticides creates many problems and health hazards for people.
Objectives: This paper aimed to investigate the use of pesticides by pistachio farmers in Kerman, Iran.
Materials and Methods: This study was conducted in Chatroud County, Kerman Province, Iran. A total of 278 respondents were enrolled in this cross-sectional study to investigate pattern of pesticide use among pistachio farmers. An ANOVA test and Pearson coefficient correlation were used to compare the score of function in applying pesticide and the correlation between quantitative variables.
Results: Most of the farmers were illiterate or low-literate (completed primary school) (82%). About 58% of the interviewees had used at least one item of safety equipment during their work with pesticides. The mean score of practice showed a reverse correlation with working years. ($r = 0.37$, $P < 0.001$). There was a significant correlation between poisoning and the role of children in spraying ($r = 0.31$, $P < 0.001$).
Conclusions: The low level of farmers' education resulted in the improper use of pesticides. It is necessary to introduce appropriate methods for using pesticides to this group and to train them accordingly.

Keywords: Pesticides; Inhalation Exposure; Behavior; Prevention and Control

1. Background

The use of pesticides in agriculture for different applications like crop protection has increased worldwide (1). Pesticide exposure can cause problems for human health, and this has become a serious concern in recent decades. These chemicals can pollute the ecological environment through different ways, such as; improper disposal of empty pesticide containers (2, 3), improper use of safety equipment, and spillage of pesticide residues into water canals or adjacent rivers (4, 5). This pollution subsequently leads to contamination of the food chain (6). According to existing documents, large amounts of applied pesticide residue remain in the environment, crops and derived foods (7). Hence, vegetables, fruits, water and food products are important sources of remaining pesticides (8), which can cause illnesses, such as; cancer, kidney diseases, stomach diseases, skin and eye irritations, and central nervous system related problems (9).

Based on existing studies, the probability of cancer and congenital deformities (10) in children whose parents have been exposed to pesticides is high. Users may be exposed to pesticides through different ways, such as dermal contact (absorption through the skin or eyes); inhalation (absorption through the lungs); or ingestion (through the mouth) (11). Ignoring safety regulations and instructions can result in many problems. Moreover, user's carelessness, along with unexpected accidents, may lead to exposure and subsequent poisoning by pesticides. Absorption through the skin is the most common method of pesticide exposure among farmers, so it is necessary to use protective covers such as; safety shoes, protective gloves, masks, glasses, and hard helmets, when using pesticides (1). Different procedures for protecting farmers and minimizing their contact with toxins have been designed, and include explaining the hazards related to pesticide-exposure and their safe usage. However, farmers continue to use pesticides improperly in order to protect and increase their crop yields. In Iran, as in other countries, the consumption of pesticides is increasing. In 1996, the total sale of agricultural pesticides was 2.28 thousand tons and it had reached 8.15 thousand tons in 2001 which illustrates the upward trend in pesticide use. Moreover, in the second half of

Implication for health policy/practice/research/medical education:
The findings of this study demonstrate that farmers and their families are at high risk of pesticides not only from acute but also cumulative effects. Farmers' children are more vulnerable than others. However based on the children's role, training them and their families might be beneficial. Ignoring appropriate information in the application of pesticides leads to exposure to these chemicals that can have detrimental effects on their health.

the 20th century, approximately one million tons of pesticide have entered into our natural environment (12). Nonetheless, little attention has been paid to this public health problem in our country.

2. Objectives

To fill the knowledge gap in farmers' functions, the present study investigated farmers' behaviors when using pesticides on pistachio farms in Kerman Province, Iran.

3. Materials and Methods

This cross sectional study was conducted during the summer of 2012 in Chatroud County, Kerman. Kerman is a province located in the southeast of Iran with a variety of agricultural products such as pistachios. The main product in the Chatroud County is pistachios. A total of 278 respondents participated in this study. The sample size of this study was calculated based on a pilot study in order to have a 95% confidence and limit of 5% maximum errors, the standard error was estimated to be 6 and absolute precision was considered as 0.5. Farmers were included in the study by random sampling approach in different farm locations. However, because of peak farm work time, some farmers were reluctant to participate in the study. In this situation to avoid missing data and the creation of potential errors, other farmers in the area were recruited into the survey. All participants consented to be interviewed verbally. All interviews were conducted face-to-face on the farms. In order to minimize biases related to data collection, one investigator who had a bachelor degree in public health was employed and trained to interview the farmers. A standardized questionnaire based on prior studies was designed and used (4,13,14). The questionnaire included three dimensions: using safety equipment, safety practice, and proper disposal of pesticide containers. A trained interviewer explained the purpose of the study. The questionnaire included 17 items. The scores of the questionnaire were as follows: the correct answer = 1 and the wrong answer = 0. If a respondent answered all questions correctly he gained a total score of 17. Descriptive statistical analysis was carried out using SPSS (version 16). In addition, Pearson correlations and ANOVA tests were used to assess the association between the quantitative variables.

4. Results

A total of 278 farmers were interviewed in this study. The average age of the farmers was 39.5 ± 22 years. In this study, all of the children who worked on the farms were boys and their average age was 12.4 ± 4.2 years. A majority of participants (88%) owned the farms, while the others were tenant farmers. The mean number of years spent working in agricultural fields among participants was 26 ± 14.5 years. Virtually all had used agricultural pesticides (99.6%). Only 10% of participants reported using non-chemical methods and products for crop protection. Most interviewees were illiterate or low-literate (82%). Most of the respondents (84%) had access to an information source, such as a shopkeeper, pesticide label or a combination of both. About 58% of the interviewees had used at least one safety device during their work with pesticides. The majority of participants (94%) had washed their hands after spraying the pesticides. Table 1 presents the characteristics of using personal protective equipment during pesticide handling. Nearly half of the farmers (44%) had not used a mask during pesticide spraying; moreover, some of them smoked during their work (6.5%).

It was found that 42% of respondents had used pesticides in their private gardens and homes, and 85% of chemicals were stored in their place of living. A substantial percentage of farmer's children were involved in the spraying of pesticides (60.8%). Our results showed that nearly 85% of farmers had discarded pesticide container sun intentionally in the fields or surrounding areas. The mean score of safety practice among the respondents was 6.5 ± 1.89 (min = 3, max = 12) and that was slightly higher than that of respondents having a history of poisoning (6.8 vs. 6.5). This score was variable based on the source of information used by the farmers, ($P < 0.001$). The score of function in applying pesticide based on different factors is shown in Table 2. The mean score of practice was higher among those farmers who understood the label by themselves, than those who needed shopkeepers help (mean = 7/2 vs. mean = 5, $P < 0.001$). The mean score of practice showed a reverse correlation with working years ($r = 0.37$, $P < 0.001$). There was a significant correlation between poisoning and the role of children in spraying ($r = 0.31$, $P < 0.001$).

Table 1. Function Dimensions of Farmers on Applying Pesticides [a]

Function	Yes	No
Using at least one safety equipment	161 (57.9)	117 (42.1)
Mask	157 (56.5)	121 (43.5)
Trousers	5 (1.8)	273 (98.2)
Safety wear	26 (9.4)	252 (90.6)
Hat	48 (17.3)	230 (82.7)
Glass	13 (4.7)	265 (95.3)
Gloves	57 (20.5)	221 (79.5)

[a] Data are presented as No. (%).

Table 2. Score of Function in Applying Pesticide Based on Different Factors

	Mean of Function	P Value
Methods of understanding label		< 0.001
Person	7.2	
No information	6.1	
Shopkeeper	5	
Training		0.37
Yes	7	
No	6.5	
Source of information		< 0.001
Shopkeeper	5.8	
Other people	7.2	
Label	7	
Combination of all sources	6.9	
History of poisoning		0.06
Yes	6.8	
No	6.5	

5. Discussion

The use of pesticides, to produce quality products, has increased among farmers. This increase has resulted in adverse effects on people's health, and this has become a major concern in public health (11). Our study showed that a high proportion of farmers have used chemical pesticides. This could be due to the effects of using pesticides on the quality and quantity of their crops (15). Interestingly, the farmers who had longer experience in agricultural activities took fewer practice measures. A possible explanation for this might be the low levels of education among older farmers, which could result in ignoring new information (15). Most interviewees were illiterate or had only finished primary school. In most developing countries, illiteracy has been identified as an important obstacle in the proper use of pesticides, which results in high risks for people's health (16).

In our survey, most respondents had access to some kind of information. However, their performance was poor which could be due to their low levels of education or literacy. Thus, they could not get the necessary information or understand the instructions. In this study, the source of information was a significant factor on safety practice, and this means that if the farmers obtained the correct information, they had a better performance. Other studies showed similar results and illiteracy resulted in both ignoring the health hazards of pesticides and failing to use the correct protective equipment. According to the World Health Organization, only trained people should use pesticides in their farms and gardens (4). Some farmers neglected the use of safety equipment. There are some factors besides a lack of knowledge which can affect this issue, such as hot weather that makes it difficult to wear and use equipment because of the heat. The average temperature in Kerman in the month of June or July may increase to 40°C. Local traditions are other factors which can account for the improper wearing and using of safety clothes and equipment. It was also observed that many farmers threw pesticide containers in the fields or surrounding environment. Improper disposal of pesticide containers has been reported among farmers in Pakistan too (15). This leads not only to environmental pollution, which subsequently endangers public health, but it could also lead to individual health problems due to an increase in pesticide residues in their blood (17).

The most important finding was that farmers' children were involved in the spraying of pesticides. This practice increased the risk of pesticide-exposure for children and as a result they were at increased risk of cancer. Several studies have previously focused on the association between pesticide-exposure and the risk of childhood cancer (18, 19). For example, lymphoma in childhood was often the result of exposure to pesticides (18). Moreover, a number of farmers who used pesticides in their private gardens and homes kept these chemicals in their living places. Based on previous studies, the probability of morbidity and cancer due to exposure to these pesticides among children is high (19). The results revealed that the mean score of practice was slightly higher among respondents with a history of poisoning (6.8 vs. 6.5). According to some studies, there is a relationship between pesticide poisoning and safety practices (20). It may also be due to a lack of awareness of farmers about the adverse effects of pesticides on human health.

An important limitation of our study is that the data was collected from just one area in Kerman Province. The findings mainly apply to the study area and cannot be said to reflect all farmers' behavior in Kerman. However, these results are likely to be representative of many farmers in the province where resources may be restricted. In addition, interviews were scheduled during peak farm activities which could have brought bias to our results. Poor practices of using safety equipment among the farmers highlight the need to schedule training for this group. Due to the role of children, training them and their families might be beneficial. Last but not least, given the low level of education, suitable training materials should be prepared.

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Authors' Contribution

All authors had an equal role in design, work, statistical analysis and manuscript writing.

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