Electronic Physician (ISSN: 2008-5842) http://www.ephysician.ir
August 2015, Volume: 7, Issue: 4, Pages: 1168-1173, DOI: 10.14661/2015.1168-1173

The impacts of pesticides on the health of farmers in Fasa, Iran

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Type of article: Original

Abstract

Background: With the growing global population, it is becoming increasingly difficult to ignore the demands for food and energy. A major portion of the food and energy is produced via agriculture and livestock activities. The objectives of this research are to gather information regarding the demographic features of farmers, previous poisoning, and the extent of farmers' knowledge in the use of pesticides and associated hazards in different counties and villages in Fasa, a city located in the Fars province of Iran.

Methods: This cross-sectional study was carried out from March to July 2012 in the Nobandegan and Sheshdeh counties, and villages including Miandeh, Fedshkuyeh, Senan, Rahimabad, and other places in the Fasa suburban countryside. To collect data, an appropriate questionnaire was designed and implemented.

Results: A total of 200 farmers participated in the study. We found that 55% of farmers were illiterate. Approximately 86% of used pesticides were organophosphorus compounds. Around 30% of the farmers used no protective equipment while working with pesticides, and only 22% of farmers had read and understood the instructions on the pesticide containers.

Conclusion: Given the toxicity and hazards of pesticides and their adverse effects on farmers' health, effective measures should be adopted to decrease the amount of pesticides used. Conducting training programs for farmers may help to reduce pesticide exposure risks.

Keywords: Pesticides, Adverse effects, Poisoning, Agricultural

1. Introduction

With an ever increasing global population, demands for food and energy become difficult to ignore and the major portion of available food and energy is produced by agriculture and livestock activities. One of the most significant current discussions in this area is farmers' health. Furthermore, more healthy food is needed. To attain a sustainable development in the agricultural sector, farmers' welfare and health should be considered. Measures taken to protect their health against occupational hazards include identifying hazards and threatening diseases (1). Pesticides can not selectively activate, that is, in addition to affecting targets and pests, they also have side effects on non-target species (including humans) (2).

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Received: March 18, 2015, Accepted: June 14, 2015, Published: August 10, 2015
iThenticate screening: April 25, 2015, English editing: July 31, 2015, Quality control: August 07, 2015

Previous research has indicated that, in the United States alone, more than 2 billion pounds of pesticides have been used in a variety of different sectors, including agriculture and forestry (3). Due to the high consumption rate people have more exposure to pesticides, and, as a result, adverse effects on people's health are becoming more apparent. American Public Health Association (APHA) indicates that many American farmers are exposed to different types of pesticides (4). A significant portion of the pesticides produced globally were used in developing countries (5). Increases in poisoning by agricultural pesticides have been observed due to increased use and high accessibility in these countries, compared to that in developed countries. Poisoning by agricultural pesticide especially organophosphorus pesticides is estimated to cause many deaths among farmers in China (6). As a society, we have resorted to using pesticides as one of the more practical ways for controlling and fighting plant pests to prevent loss of agricultural products. Pesticides consist of chemical components that are often highly toxic to human health and are the active ingredients for controlling the population of plant pests, insects, and vermin (7, 8). The US Environmental Protection Agency (USEPA) had defined pesticides as "any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest" (9). Chemicals play an important role in controlling pests. More than 800 different types of chemicals are used to control insects, weeds, plant pests, and disease-carrying insects. Increases in the amount of agricultural products and decreases in the number of parasitic diseases are the positive outcomes of using such chemicals. About 500,000 cases of pesticide poisoning are reported annually and, in addition, about 5000 cases of death are recorded. Most of the acute poisoning cases occur in lower income countries, which is attributed to the storing pesticides at home near food items (10).

The World Health Organization (WHO) supervises the safety and toxic effects of pesticides. Although all pesticide containers must carry warning labels, due to the lack of proper education and illiteracy of villagers, they have gone unnoticed. With the lack of monitoring of the manufacturing, production, and selling of non-standard pesticides and their high availability in the market, these pesticides are often used improperly, which leads to additional effects on environment and public health in the long run and immediate adverse effects on farmers' health (7). Some researchers have drawn attention to the association between pesticides exposure and some types of cancers, including blood, lymphatic system, lip, stomach, lung, brain, and prostate cancers (11). A prospective cohort study of 57,311 licensed pesticide applicators in Iowa and North Carolina failed to show any relationships between exposure to glyphosate and some types of cancer (12). Children's exposure to pesticides is another important issue (13). Previous research in California failed to show any correlation between pesticide use and cancer incidence, but there were some exceptions, including a correlation between leukemia and Atrazine (r=0.40) and brain cancer and Atrazine (r=0.54) (14). Risk of death in agricultural workers is twice as high as that in other fields. Providing occupational health services, keeping medical records, monitoring agricultural workplaces, and improving quality and production of healthy agricultural products are important components in decreasing threats to farmers' health (10).

WHO has classified agricultural pesticides in three classes: Class I (extremely poisonous), to Class III (mildly poisonous). In fact, WHO advocates the policy of restricting or banning use of Class I pesticides and using fewer pesticides with minimum adverse health effects on individuals (7, 8, 15, and 16). Therefore, given the high levels of pesticide usage, human exposure to these pesticides is almost inevitable, and can occur quite accidentally as a result disposal of pesticides and their containers into the environment (17-20). The incidence of poisoning in developing countries is 13 times greater than that in industrial countries. According to Iran's Census Bureau data, a total of 15,800 tonnes of pesticides were sold in 1996; 27,200 tonnes in 2001; and 20,890 tonnes in 2006. Hence, it can be assumed that in the past half-century, approximately 1 million tonne pesticide has been imported into Iran (21). Agricultural activities are the main activity for people living in Fasa, Iran and are an important source of income for people in this region. The objectives of this research were to gather information about the demographic features of farmers, previous poisonings, and the extent of farmers' knowledge on the use of pesticides and their hazards in the different counties and villages of Fasa, Fars province, Iran.

2. Material and Methods

2.1. Study design and setting

This cross-sectional study was carried out from March to July 2012 in the Nobandegan and Sheshdeh counties, and villages including Miandeh, Fedshkuyeh, Senan, Rahimabad, and others in the Fasa suburban countryside.

2.2. Sampling

The cluster-sampling method was used to select farmers. In fact, a total of 200 farmers were selected according to family records, a list of households with at least one member employed in agriculture (either as a main or secondary

occupation). In this list, the household's numbers were recorded and proportionated to the village population; necessary samples were selected (Sheshdeh with 6204 people; Nobandegan with 2720 people; villages, including Miandeh, with 5603 people; Rahimabad with 646 people; Senan with 1832 people; and Fedshkuyeh with 4638 people).

2.3. Measurement tool

To collect data, an appropriate questionnaire designed by the authors was implemented. The information gathered included:

1) Demographic features (age, working experience, and education levels of farmers)
2) Agricultural products (barley, maize, wheat, canola, cotton, and sugar beet) and acreage under cultivation
3) Type of used pesticides (organophosphate and organochlorine) and the purpose of pesticide use (controlling pests, insects and vermin)
4) Severity of reactions (acute and chronic toxicity of pesticides such as digestive response, eye response, motor response on the basis of hospital records and farmers interview)
5) Any history of poisoning with pesticides (on the basis of hospital admitting and farmers interview)
6) Pesticide spraying methods (man-carried motorized sprayer, tractor-carried sprayer, and hand-held sprayer)
7) Use of personal protection equipment
8) Knowledge of adverse effects of pesticides (knowing about adverse effects of pesticides on human health, environment (air, water, and soil), and other species such as animals and plants)

2.4. Statistical analyzes

The data was analyzed using descriptive statistical testing for determining the mean and standard deviation values with the SPSS 16 statistical software package (SPSS Inc., Chicago, Illinois, United States of America).

3. Results

All participants in the research (200 farmers) were male. The average age was 46.65 years. The average years of work experience was 21 years. Fifty-five percent of all subjects were illiterate. Approximately 86% of them used organophosphorus type pesticides. Endosulfan was a dominant organochlorine pesticide and is being phased out due to its acute toxicity and carcinogenic nature. In addition, the use of endosulfan has been banned (22). Subjects had an average 12 years experience in pesticide spraying. Fasa has 37,500 acres under cultivation. Wheat is the most abundant agricultural product in the studied areas. The dominant mode of spraying was tractor-carried sprayer machine (69%) and the second most common method was man-carried motorized sprayer (26%). Other farmers used hand-held sprayer devices to spraying pesticides (5%). Thirty percent of participants used no personal protection equipment when spraying pesticides and only 32% used personal respiratory protection devices, such as masks, during the activity. It should be noted that farmers used only disposable masks, and others deemed covering their face with a veil to be sufficient. Our findings also indicated that about 22.5% of participants had been poisoned on at least one occasion, with 16.25% going to the doctor at least once due to the adverse effects of pesticides, and with 2% being hospitalized at least once. Regarding the extent of farmers' knowledge of proper use of the pesticides, our findings indicated that only 22% of participants understood the instructions attached to the pesticide containers. Overall, we found out that farmers' knowledge about pesticides usage and associated adverse effects was extremely limited. Forty-two percent of farmers disposed of the empty container in the farmlands and only 31% of them disposed of these containers in a healthy and environmentally friendly fashion. Thirty-three percent of subjects had no information about pesticides hazards. As shown in Table 1, some farmers reported experiencing pesticide poisoning symptoms, including giddiness (50%) and nausea (23%).

Table1. Distribution of pesticide poisoning symptoms in farmers (n=200)

Poisoning symptoms	Frequency	%
Giddiness	100	50
Nausea and vomiting	46	23
Headache	24	12
Eye and nose irritation	30	15
Itching, burning, and itching of the face and hands	30	15
Diarrhea and muscle pain	30	15

4. Discussion

A major hurdle in the understanding of the adverse health effects of pesticides in agricultural occupational health is illiteracy and the lack of information available to farmers (7). The high rate of illiteracy among farmers leads to their lack of knowledge about the side effects of pesticides and methods to alleviate these side effects (8). It is highly recommended that training courses for farmers should be held to educate farmers on the side effects of pesticides, improve their knowledge, and to encourage them to acquiring literacy (7). The average age of participants (46.65) and high rate of illiteracy (55%) naturally accounts for their lack of knowledge and partially for their poor performance; although, knowledge is necessary for proper performance, it is not sufficient and other factors such as cheap and affordable personal protection equipment need to be considered. Furthermore, introduction of modern methods of controlling pests is necessary (8). The prevalence of symptoms was approximately 22.5%, according to participants' self-reporting, which is quite high and consistent with related figures in developing countries (23-24). Reading and acting according to the instructions on the pesticide containers, using protective devices, keeping pesticides in the original containers, and buying only the amount you need may help to reduce exposure risks (25). Eighty-six percent of the participants used organophosphorus based pesticides, a common and effective pesticide. It is recommended that in every region and depending on the importance and prevalence of using pesticides, instruction booklets should be prepared to make farmers familiar with pesticides, how to use them, and ways to minimize short- and long-term adverse effects under the supervision of a well-defined unit of experts (7). The booklets should be in Persian, which will hopefully result in a better understanding of booklets. It should be noted that only a few people resorted to health and treatment centers after poisoning and only 3-8% of them are diagnosed as occupational poisoning. In many cases, applicators of the pesticides deem the symptoms related to poisoning as coming from fatigue, work pressures, and an integral part of the work, and hence, give little attention to poisoning (7, 8, and 26).

As poisoning via mouth, respiration, and skin absorption is prevalent, and the symptoms often appear as acute poisoning, it seems that the severity of poisoning is higher than the predicted level, which necessitates more research. It is evident that the chronic and long-term effects of poisoning and symptoms, including nervousness, memory loss, dizziness and tremors, lend additional dimensions to the issue (27). Attempts to regulate sale and use of pesticides, decreases in pesticide use and use of other anti-pest methods, changes public attitudes about " pesticide-free products", providing cheap and affordable protective facilities, preparing proper educational material through mass media, training health workers, especially in villages, and education on poisoning symptoms and relevant first aid are recommended (28-30). Encouraging and training farmers to lead a life of organic agriculture would prove effective. Organic farming emphasizes on keeping the ecological balance and improving biological processes, which add to the sustainability of agricultural ecosystems (31).

As mentioned before, the present study indicated that farmers sprayed pesticides in average of 12 years. In other words, every farmer has been spraying in average of 192 days. An extended study in 2004 in the US carried out on 18,782 farmers who using pesticides concluded that there was a link between neurological symptoms in farmers and the number of days when the farmer used pesticides. This research indicates that new strategies are needed to improve farmers' work environment to prevent occupational hazards to the farmers. Monitoring workers' health and preparing and implementing proper regulations are essential parts of a program (7). Our findings also showed that about 30% of participants did not use any personal protective devices. As using effective protection devices is an important approach to prevent poisoning, it is recommended that briefing sessions for farmers should be held to provide information about the ways to use personal protection devices and effects on their health. Another issue is the lack of facilities for spraying farmers and employers' neglect in providing these facilities. Employers are legally bound to provide such facilities to these farmers. The farmers' knowledge of pesticide use is lacking, given that 78% of them did not read and understand the container labels. This can be attributed to their highly specialized language or farmers' illiteracy of foreign languages. Illiteracy played an important role here. With preparing booklets and labels and holding briefing sessions in Persian in a way that meets the farmers' needs to understand the material, the issue could be solved to a great extent. Given the environmental hazards of disposing of containers of pesticides, the issues of regulations, and the farmers' lack of knowledge may give rise to further issues. By providing training for farmers about ways to burn or to dispose of these containers, important outcomes could be achieved. Occupational and safety requirements and trainings could help to promote occupational safety and health in workplaces (32).

5. Conclusions

In summary, given the toxicity and hazards of pesticides and their adverse effects on farmers' health, effective measures should be adopted to decrease in the amount of pesticides used. Conducting training programs for farmers

may help to reduce pesticide exposure risks. Considering the carcinogenic effects of pesticides, it is suggested that the association of these factors is investigated in future studies.

Acknowledgments:
The authors wish to thank Fasa University of Medical Sciences for the technical support, as well as all of the farmers for their kind assistance and contributions.

Conflict of Interest:
The authors declare that they have no conflict of interest.

Authors' contributions:
All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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