

FARM WORKERS KNOWLEDGE AND PRACTICE REGARDING HAZARDS OF PESTICIDES

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Abstract

Background: Pesticides are major contaminant of our environment that is associated with higher risk of acute and chronic health effects. Pesticides are the most economical approach to control various pests. Farm workers are exposed to pesticides during handling. Most of farm workers have insufficient level of knowledge regarding pesticide use. They are seriously unaware of real pesticide risks. Identification of their knowledge, and practice would provide guidance for actions that increase their adherence to safe handling of pesticides. **Aim of the study:** To investigate the knowledge and practice of farm workers about pesticides hazards, and proper protection. **Methods:** Cross sectional design was used in this study. The study was conducted at 8 villages of Mansoura district at Dakahlia governorate. The sample size was 127 farm workers. Three structured interview sheets were used in data collection. **Results:** (58.2%) of the study group aged from 30 years to less than 50 years, and more than half of them were illiterate. Most of farm workers showed poor score level of knowledge related to pesticide effects; and preventive measures, as well as safe pesticides handling.

Conclusion: In conclusion, the majority of farm workers are at serious risk due to heavy and unprotected exposure to pesticides. Their poor level of knowledge regarding pesticide hazards, exposure routes, and effects on human would play a crucial role in their unsafe handling of pesticides.

Key words: Pesticide, Safe pesticide handling, Pesticide exposures, Pesticide hazards, farm worker knowledge

Introduction:

Exposure to pesticides is one of the most important occupational risks among farmers in developing countries [1,2]. The high level of exposure occurs due to occupational exposure and due to exposure to contaminated environment [3,4,5,6]. In Egypt, several pesticides including organophosphorus, carbamate, pyrethroid insecticides, fungicides, and herbicides are commonly used [7].

Farm workers are exposed to pesticides during handling, mixing, loading, and applying pesticides, or during performing duties not involved with pesticide application; such as weeding, harvesting, thinning, irrigating, or planting [8, 9, 10, 11].

Farmers' knowledge and perception about pesticide risks play an important role

in determining the use of pesticides protection devices [12]. Many studies revealed that farm workers had insufficient knowledge regarding handling and use of pesticides and they are seriously unaware of real pesticide risks [13, 14]. In addition, these workers do not take each protection measures [15].

In Egypt, there is lacking of information about the impact of pesticides on health among farm workers and pesticides dealers [11].

Identification and consideration of their knowledge, and practice would provide guidance for actions that increase their adherence to expert advice [16]. Therefore, the aim of this study is to investigate the knowledge and practice of

farm workers about pesticides hazards, and proper protection.

Material and methods:

Research design

The design used in this study was cross sectional design

Setting

The study was conducted at eight villages of Mansoura district at Dakahlia governorate. The selected villages were Badine, Mahalet Damanah, El Nesimiah, El Nasrah, El Malha, Shoha, Kafer Tanah, and Kom Bany Maras.

Subjects and Methods

Subjects

Farm workers working at selected villages of Mansoura district at Dakahlia governorate.

Sampling

Multi stage sample technique was used in this study. The study was conducted at Mansoura district which includes 67 villages. These villages were arranged in descending order according to the cultivating areas. Villages that have more than 1000 acres are 22 villages, out of them eight (8) villages cultivate rice and cotton were selected. The largest cultivation areas were selected because they require intensive pesticide application by a large number of workers who were intensively exposed to pesticides.

Sample size

$\alpha=0.5\%$, Population size=205 farm workers, Desired precision=6%, Expected prevalence of correct knowledge and safe practice to be 50%, Design effect=1, The minimum required sample size is 117 farm workers. A total number of subjects sample was 127 farm workers

(pesticide applicators and farmers) were interviewed and observed for their practice in handling pesticides.

Study tools

Data was collected by using three tools that were developed by the researcher as following:

Tool I: Demographic and occupational data structured interview sheet:

This sheet was used to investigate demographic data (Age , sex, and educational level) and occupational data (Nature of work, duration and frequency of pesticide exposure, number of acres sprayed/ day and duration of pesticide exposure/ day).

Tool II : Farmers' knowledge structured interview sheet:

This interview sheet was used to assess farm workers' knowledge about pesticide hazard and protective safety measures.

The tool was classified into 6 categories; all of these categories are composed of 115 questions. The total scores of the knowledge ranged from 0 to 115, one point for each correct answer. The knowledge level was categorized into three categories:-

- Poor= scores less than 50% of total scores (0 - less than 57.5)
- Fair= scores 50% to 75% of total scores (57.5- less than 86.25)
- Good= scores more than 75% of total scores (more than 86.25)

Tool III: Farmers' practice in handling pesticides:

The practice was assessed by structured interview sheet:

This interview sheet was used to explore the farmers' practice in handling pesticides as described by farm workers.

The tool was classified into 8 categories that are composed of 97 questions to include safety measures during:

1. Pesticides marketing
2. Pesticides preparation
3. Pesticides spilling
4. Spraying
5. Pesticide cleaning up
6. Pesticide disposal
7. Pesticide storage

Results:

Demographic characteristics

Table (1) shows the distribution of farm workers according to their socio-demographic data. Results reveal that 51.2% of the farm workers age ranged from 30 years to less than 50 years, with mean age of 41.3 ± 12.1 years. More than half of farm workers (52%) were illiterate.

Occupational characteristics

Occupational characteristics of the farm workers are presented at Table (2), indicate that (40.9%) are pesticide sprayers and (74.8%) of them are farmers. The majority of those farm workers (98.4%) are exposed to pesticides for more than 2 years, and (62.2%) are exposed to pesticide for more than two hours per day. The long duration of daily pesticides exposure due to the heavy workload, as 40.9% of sprayers sprayed more than 3 acres /day and every acre consumed 30 minutes to be sprayed.

Farm workers knowledge about pesticide hazards and protective safety measures

Generally, table (3) reveals that farm works gain a poor score level of knowledge about hazardous pesticides, routs of exposure, their effects on human and environmental health, as well as protective measures, with mean knowledge scores of 17.2 ± 6.1 points. However, the majority of studied farm workers (97.6%) have poor scoring level regarding prohibited pesticides. Ferdan, D-2,4, and Pethermerin (Copex) were mentioned as prohibited pesticides by 29.1%, 11%, and 5.5% of farm workers respectively. In relation to exposure routes of pesticides 64.6% of farm workers showed poor score level of knowledge. Most of them (80.3%) know that direct skin and mucosal contact is one of pesticides' exposure routes, followed by inhalation and swallowing (58.3% and 14.2%), respectively. On the other hand, all of farm workers showed poor score level of knowledge related to

pesticides effects on human and environmental health, required personal protective measure, alternative pets control methods as well as first aids of pesticide poisoning.

Table (4) show that 75.5% of farm workers consider their neighbors and relatives the main source of pesticides information, while only 22.8% obtain information from experts at agricultural unit.

Practice and handling of pesticides as reported by farm workers

Table (5) illustrates farm workers' practice during marketing and preparation of pesticides solutions. Regarding to safe practice, only (9.4%) of farm workers do not buy prohibited pesticides and only 1.6% buy the less toxic pesticides. Most of farm workers (81.1%) prepare a single use of pesticide solution. Nearly half of them (52%) reported that they do proper technique in preparation of pesticides solution; either for concentration calculation or steps of mixing water with pesticides. On the other hand, farm workers reported many risky behaviors they commit during preparation of pesticides solution. More than two thirds of farm workers mix different types of pesticides and mix pesticides with bar hands.

Regarding farm workers' safe practice during spraying of pesticides, table (6) shows that (44.9%) of farm workers spray pesticide at morning and 47.2% of them spray with wind direction. Also 73.2% of them spray pesticides within a short distance away from targeted plants. Only 12.6% of farm workers stop spraying of pesticides when rains fall. On the other hand, results illustrate the farm workers' risky behaviors during spraying of pesticides. More than one third of farm workers (34.6%) spray pesticides at afternoon and evening, while 64.6% of them spray pesticide oppositely to wind direction. Moreover, 47.2 % of farm

workers spray pesticides at stormy and rainy days. Most of farm workers spray the entire field including flowery plants and birds nets during spraying of trees. More than one third of them (38.6%) clear the blockage of machine hose by their mouths. Some farm workers (21.3%) do not care about the presence of children in the field during spraying of pesticides and 63% of them irrigate the field immediately after spraying.

Table (7) shows the practice of farm workers during handling of pesticides residues and spillages. Regarding safe handling of pesticides' residues 74% of farm workers reuse pesticide residues,

while only 4% of them seal pesticides' container, 9.4% purified pesticide containers and 4.6% put dust on the pesticide spillage.

However, workers commit risky behavior during handling pesticide residues and spillages. Throwing pesticides' residues in the water canal is committed by 69.3%, of farm workers and 57.5% of them throw residues into the general sewage system. About one third of farm workers (36.2%) store pesticides residue in the food and drinks bottles.

Table (8) shows the distribution of self-reported toxicity symptoms among farm workers. Results shows that nervous system manifestations represent the highest pesticides toxicity symptoms in terms of with drowsiness (34.6%), followed gastrointestinal disturbance in form of nausea and vomiting (33.9%). while chest pain and breathing difficulty reported by 19.7% , as well as skin and mucus membrane irritation reported by 12.6% and 9.7% of farm workers

Table 1: Distribution of farm workers according to socio-demographic data

| Item | N=(127) | % |
|---------------------------|-------------|------|
| Age/ years | | |
| 15- < 30 | 23 | 18.1 |
| 30- < 50 | 74 | 58.2 |
| 50 and more | 30 | 23.7 |
| mean± S.D | 41.3 ± 12.1 | |
| Level of education | | |
| Illiterate | 66 | 52 |
| Read and write | 22 | 24.5 |
| Educated | 39 | 30.7 |

Table 2: Distribution of farm workers according to their pesticides exposure

| Item | N=(127) | % |
|---|---------|------|
| Work nature* | | |
| Sprayer | 52 | 40.9 |
| Farmer | 95 | 74.8 |
| Time of pesticide exposure | | |
| During preparation | 110 | 86.6 |
| During spraying | 114 | 89.9 |
| Duration of pesticide exposure | | |
| ≤ 2 years | 2 | 1.6 |
| > 2 years | 125 | 98.4 |
| Duration of pesticide exposure per day | | |
| ≤ 2 hours | 48 | 37.8 |
| > 2 hours | 79 | 62.2 |

* The total number can be more than 100% as an individual can do both activities

Table 3: Distribution of farm workers according to their knowledge about pesticides hazards and protective safety measures

| Item | N= 127) | % |
|--|------------|------|
| Identification of common names of prohibited pesticides | | |
| Ferdan | 37 | 29.1 |
| D-2,4 | 14 | 11 |
| Pethermerin | 7 | 5.5 |
| Scoring level of common names of prohibited pesticides (3) | | |
| Poor | 124 | 97.6 |
| Fair | 3 | 2.4 |
| Knowledge about routes of pesticide exposure | | |
| Direct contact with skin and mucosa | 102 | 80.3 |
| Inhalation | 74 | 58.3 |
| Swallowing | 18 | 14.2 |
| Knowledge scoring level of pesticide exposure (4) | | |
| Poor | 82 | 64.6 |
| Fair | 26 | 20.5 |
| Good | 19 | 15 |
| Knowledge scoring level of effect of pesticide on human and environmental health (46) | | |
| Poor | 127 | 100 |
| Knowledge scoring level of required protective safety measures (12) | | |
| Poor | 127 | 100 |
| Knowledge scoring level of alternative pest management methods (4) | | |
| Poor | 127 | 100 |
| Knowledge scoring level of first aids of pesticide poisoning (35) | | |
| Poor | 127 | 100 |
| Total score of knowledge = 115 points | | |
| mean± S.D | 17.2 ± 6.1 | |

Table 4: Distribution of farm workers according to their previous sources and places of pesticides information

| Item | Frequency N= (127) | Percentage % |
|--|-----------------------|-----------------|
| Sources of pesticides information | | |
| Neighbors and relatives | 96 | 75.5 |
| Experts and Meeting Agricultural unit | 29 | 22.8 |
| Shop owner | 2 | 1.6 |

Table 5: Distribution of farm workers according to their practice during marketing and preparation of pesticide solution

| Item | N=(127) | % |
|---|---------|------|
| Safe practice during pesticides marketing | | |
| Buy less toxicity pesticides | 2 | 1.6 |
| Do not buy prohibited pesticides | 12 | 9.4 |
| Safe practices during pesticides preparation | | |
| Using personal protective measures | 3 | 2.4 |
| Prepare single use amount of pesticide solution | 103 | 81.1 |
| Calculate accurate concentration of pesticide solution | 66 | 52.0 |
| Add pesticides in the mixing box before adding water | 55 | 43.3 |
| Recover pesticides bottles | 91 | 71.7 |
| Risky behavior during marketing and preparation of pesticides solution | | |
| Buy pesticides of high toxicity level | 21 | 16.5 |
| Mix different types of pesticides | 84 | 66.1 |
| Mix pesticide with bar hands | 80 | 63.0 |
| Smoke during pesticide preparation | 47 | 37.0 |
| Eat during pesticide preparation | 30 | 23.6 |
| Use tongue test to ensure solution concentration | 22 | 17.3 |

Table 6: Distribution of farm workers according to their practice during spraying of pesticides

| Item | N= (127) | % |
|--|----------|------|
| Safe spraying technique | | |
| Spray pesticides at morning | 57 | 44.9 |
| Spray pesticides with wind direction | 60 | 47.2 |
| Spray pesticides within a short distance away from targeted plants | 93 | 73.2 |
| Spray pesticides for diseased plants only | 30 | 23.6 |
| Stop spraying in rainy weather | 16 | 12.6 |
| Risky behavior during spraying of pesticides | | |
| Spraying at afternoon/ evening | 44 | 34.6 |
| Spraying oppositely to wind direction | 82 | 64.6 |
| Spraying during stormy and rainy days | 60 | 47.2 |
| Spraying the whole field | 104 | 81.9 |
| Spraying flowery plants | 122 | 96.1 |
| Spraying birds' nests during spraying trees | 106 | 83.5 |
| Clearing blocking of the machine hose by mouth | 49 | 38.6 |
| Farm workers spray pesticides even they are ill | 40 | 31.5 |
| Spraying in presence of children | 27 | 21.3 |
| Irrigate fields immediately after spraying | 80 | 63.0 |
| Not adhered standardized reentrance time to the sprayed field | 113 | 89.0 |

Table 7: Distribution of farm workers according to their practice during disposal of pesticides residues and spillage

| Item | N=(127) | % |
|---|---------|------|
| Safe handling of pesticide residues and spillage | | |
| Reusing of pesticide residues | 94 | 74.0 |
| Sealing of pesticide containers | 6 | 4.7 |
| Purifying of pesticide mixing containers | 12 | 9.4 |
| Putting of dusts on spilled pesticides | 6 | 4.6 |
| Risky behavior of handling pesticide residues and spillage | | |
| Throwing pesticide residues into water canal | 88 | 69.3 |
| Throwing pesticide residues into general sewage system | 73 | 57.5 |
| Store residues in food bottles | 46 | 36.2 |
| Through residues in fields | 3 | 2.4 |
| Store foods and drinks in empty pesticides' containers | 26 | 20.5 |
| Keep spilled pesticides to dry | 97 | 76.4 |
| Mop spilled pesticides | 21 | 16.5 |
| Wash area of spilled pesticides | 10 | 7.9 |

Table 8: Distribution of self-reported pesticides toxicity symptoms among farm workers

| Item | N=(127) | % |
|--|---------|------|
| General effects | | |
| Excessive sweating and fever | 10 | 7.8 |
| Sever fatigue | 2 | 1.6 |
| External effects | | |
| Skin redness and itching | 16 | 12.6 |
| Irritated mucous membrane | 15 | 9.7 |
| Internal effects | | |
| Heart and Lungs | | |
| Chest pain and breathing difficulty | 25 | 19.7 |
| Gastrointestinal | | |
| Nausea and vomiting | 43 | 33.9 |
| Colic and diarrhea | 2 | 1.6 |
| Nervous system | | |
| Drowsiness | 44 | 34.6 |
| Coma | 12 | 9.4 |
| Headache and Bullring vision | 4 | 3.2 |
| Peripheral Numbness and muscle twitching | 4 | 3.2 |
| Insomnia | 2 | 1.6 |

Discussion:

Agricultural pesticides constitute chemicals that are used for controlling of pest and increase crop yield [17, 18]. Using of pesticides has been increased due to wide spread application in agricultural and environmental pest control. The pesticides poisoning is a worldwide problem in developing countries where it is increasingly associated with high mortality and morbidity [19, 20].

In the present study, a high level of illiteracy was recorded among the respondent farm workers, reflecting illiteracy or low formal educational level. Similar results were also reported in other developing countries [21, 22, 23, 24, 25].

As regarding to level of knowledge the present study, shows poor score level of knowledge for the majority of farm workers related to types and prohibited pesticides and their effects on human health. The poor knowledge level could be interpreted in the highlight of previous studies, which concluded that low formal education may be impact of their poor score level of knowledge. Illiteracy or low education level will lead to difficulties in understanding instructions related to use and safety procedures included on the product labels [15, 25, 26].

The results of the present study showed that the majority of farm workers reported poor safety measures during all stages of handling pesticides. The poor practices include purchasing high toxic pesticides, mal practice during preparation, spraying and for measures taken after spraying. These finding is agreement with findings stated by similar studies, which reported that most of farm workers do not practice safety precautions during pesticide formulation and application [26, 15].

In the developing countries, agricultural workers who are engaged in the occupation of spraying pesticides in crops get the direct exposure of pesticides due to

unsafe and non-preventive work practices. They do not use the Personal Protective Equipments (PPE) like safety masks, gloves etc. during the spraying of pesticides [27, 28, 29, 30]. This is in agreement with the present study.

Therefore, occupational exposure to pesticides' hazardous occurs due to misuse, unprotected handling, and application of pesticides. Furthermore, heavy and chronic exposure to pesticides in terms of dose, timing, and duration of exposure increase the ability of a pesticide to cause harm [31, 32, 33].

The present study revealed that farm workers are chronically exposed to pesticides. Most of farm workers use pesticides for more than two years for more than 2 hours/ day. This in agreement with Suleiman I. Al-Khalil et al., 2010 who found that farm workers are working for more than 2hours daily for 2–10 days each month [25].

Exposure to pesticides may results in several acute and chronic adverse health effects. These adverse effects may range from irritating skin and respiratory manifestation to nervous system symptoms [25]. Cancer, adverse effects on immune systems, neurodevelopment dysfunction, metabolic diseases such as diabetes, endocrine system disruption and infertility were also reported as pesticides exposure effects [34, 35, 36].

The present study showed that about one third of farm workers reported toxicity symptoms related to pesticides exposure. These symptoms include sever fatigue, drowsiness, difficult of breathing, chest pain, vomiting, diarrhea and colic. However, these findings assured by previous studies that reported a high prevalence of irritation symptoms, fatigue, headache, and anxiety or depression among 47.4%, 35.5% 40.4% and 27.6% of farm workers respectively. Moreover, among the most frequent self-reported

toxicity symptoms associated with pesticide use headache, excessive sweating and diarrhea (37%, 24.9%, and 21.3%) respectively [25,37].

In conclusion the present study revealed that studied farm workers are lacking for accurate information about pesticides' hazardous, and instructions of safe handling. Furthermore they are heavily exposed to pesticides and are suffering from clinical symptoms that could be linked to this exposure. This high exposure could be coupled to their low educational level. In the highlight of several studies, it is strongly recommended to communicate clearly the potential hazards of unsafe pesticide use to farm workers to overcome the lack of awareness of pesticides health effects and personal protective measures. This could be accomplished by developing a rigors health education package to overcome the high level of illiteracy among them coupled with high level of exposure.

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