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Knowledge, Practice and Self-reported Symptoms among Farmers about Hazards of Pesticide Exposure

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Abstract: **Nearly 80% of work force in Egypt are involved in agriculture and exposed to agriculture pesticides. The aimof the present study was to assess knowledge, practice and self-reported symptoms of farmers about hazards of pesticide exposure.Design:A descriptive correlational designwas utilized. Setting and Sample: Simple random sample was used to select one village (Shentena- El-hagar) in Birket El-sab,ei district at Menoufia governorate Egypt. All vegetable growing farmers were selected (86) to participate in the study.Tools; 1- an interviewing questionnaire composed of two parts; socio-demographic characteristics and farmers' knowledge about pesticides exposure. 2- Checklist; the first was used for safety measures and the scond for self reported symptoms.The main results of the present study: It showed that 17.4% of studied farmers had satisfactory knowledge and 12.8% had satisfactory use of safety measures. The majority of studied farmers reported that they suffering from many manifestations; headache 83.7%, dizziness 87.2%, blurred vision 95.3%, nausea 95.3%, cough 94.2%, chest tightness 90.7% and rash 81.4%. Conclusion: the majority of farmers had unsatisfactory knowledge about pesticides and had unsatisfactory use of safety measures. Recommendation: Effective implementation of health education program and proper training was needed to improve awareness, practices of farmers about pesticide use.**

Keywords: **pesticide, farm workers, self-reported symptoms.**

1. INTRODUCTION

Agricultural health is the study of environmental, occupational, dietary, and genetic factors on the health of farmers, farm families, pesticide applicators, and others who work with and are exposed to agricultural chemicals**.** Agriculture and health are linked in many ways. Agriculture is essential for good health; on the other hand agriculture can produce many health hazards as the exposure to pesticides (NIH, 2014).

Pesticides are common chemicals used to eliminate a great variety of unwelcome living organisms, particularly in agriculture. They are widely used in agriculture for the purposes of crop protection and in public health to control vector-borne infectious diseases (Damalas and Koutroubas, 2016). Globally there has been an increase in the incidence of pesticide poisoning from exposure to pesticides every year. According to the World Health Organization (WHO), a minimum of 300,000 people die from pesticides poisoning each year, with 99 % of these from low- and middle-income countries (Okoffo, Mensah and Fosu-Mensah, 2016).

In Egypt, several pesticides including organophosphorus, carbamate, pyrethroid insecticides, fungicides, and herbicides are commonly used to increase agricultural productivity. Pesticides have serious drawbacks on human health as they

affect the immune system, the endocrine system and the nervous system (Gaber and AbdElateef, 2012).The ill effects of agricultural pesticides are getting worse in developing countries because approximately 80% of the pesticides produced annually in the world are used in developing countries (Pimentel et al., 2013).

Most of the applied pesticides get dispersed in the environment and affects the health of un-protected agricultural and industrial workers. The three major routes of entry for pesticides include contamination of the skin, lungs and the gut (Emam et al., 2012). The health effects of pesticide use have become one of the major public health problems worldwide. In developing countries, frequent exposure to pesticides by farmers and farm workers is very common. The frequent exposures to pesticides result in both short-term (acute) and long-term (chronic) illnesses. Scientifically confirmed pesticide-related acute illnesses include headaches, stomach pains, vomiting, skin rashes, respiratory problems, eye irritations, sneezing, seizures, and coma. The chronic illnesses include cancer, asthma, dermatitis, endocrine disruption, reproductive dysfunctions, immunotoxicity, neurobehavioral disorders, and birth defects. Furthermore, deaths resulting from direct exposure to pesticides are also common (Macharia, 2015).

Occupational health nurse has a major role in identifying occupational hazards, determining workers health problems, early case finding, management and referral to the appropriate community health resources. As well, the occupational health nurse analyzes each job task to detect task situations that place employee at risk through assessment and surveillance of the workplace to identify potential hazards increasing with the work, reducing risk, and minimizing risk problems by designing and implementing the health education programs (Harkness and Demarco, 2016).

Significance of the study:

The agricultural sector employs an estimated 1.3 billion workers worldwide, that is half of the world's labor force. In terms of fatalities, injuries and work-related ill-health, it is one of the three most hazardous sectors of activity (along with construction and mining). According to ILO estimates, at least 170,000 agricultural workers are killed each year. This means that workers in agriculture run twice the risk of dying on the job compared with workers in other sectors. Agricultural mortality rates have remained consistently high in the last decade compared with other sectors in which fatal accident rates have generally decreased. Millions more agricultural workers are seriously injured in workplace accidents involving agricultural machinery or poisoned by pesticides and other agrochemicals (ILO, 2009).

Aim of the study:

To assess knowledge, practice and self- reported symptoms of farmers about hazards of pesticide exposure**.**

Research questions:

To fulfill the aim of the study, the following research questions were formulated?

Q1: What is the level of knowledge of farmers about hazards of pesticide exposure**?**

Q2: What is the prevalence of self-reported health symptoms related to pesticide exposure?

Q3: What is the rate of using personal protective equipment?

2. METHODOLOGY

2.1 Research Design:

A descriptive exploratory, correlational research design was utilized in the current study.

2.2 Setting: **Setting:**

The study was done in one village of Birket El-sab-ei district at Menoufia governorate.

Participants and Sample size Calculation:

Sample: the sample size was estimated to fulfill the aim of the study, with a 95% level of confidence (error=5 %) and a study power of 80% (error=20%). Using the Epi-info computer software program the required sample size was 86 subjects.

The target population of this study was the vegetable growing farmers in Birket El-sab,ei district. A Simple random sample technique was used to select one village (Shentena-Alhagar); all vegetable growing farmers in this village were selected to participate in the study.

Tools of data collection:

To achieve the aim of the study, data was collected by the following tools:

I. Interviewing Questionnaire: it was developed by the researcher after reviewing the literature to collect the necessary data from workers and include the following:

A- The first part was designed to assess demographic characteristics of the farm workers such as (age, level of education, experience, working hours, income).

B- The second part was designed to assess workers' knowledge about pesticides. It includes the following:

- Knowledge of farmers about health hazards of pesticides exposure. It consisted of 10 questions about accumulation of insecticide in the body, exposure to insecticide leads to: cancer, neurological troubles, depressed immunity, chronic respiratory diseases, poisoning, and abortion for pregnant.
- Knowledge of farmers about the safety practices. It consisted of 11 questions about disposal of containers, spray in wind and rain, spray in hot weather, eating and drinking during spray, etc.
- The last part for farmers' knowledge about the first aides which are needed to decrease the effect of pesticide poisoning. It consisted of which included 23 questions related to five main items as follow (general principles, Skin contamination, Eye contamination, Inhalation, Swallowing).

Scoring system for workers' knowledge:

Each item was scored 1 for correct answer and 0 for incorrect answer. The total score of all questions will be represented in 100% and categorized into two levels, unsatisfactory (< 60%) and satisfactory (≥ 60%).

The Validity; Instruments were reviewed and tested for validity by 5 experts community health nursing, modification were done accordingly to ascertain relevance and completeness. Reliability: The internal consistency of the questionnaires was calculated using Cronbach's alpha coefficients. Test-retest was used. The Cronbach's alpha of the questionnaire was 0.82 indicate good reliability.

II. Observational checklist for farmers':-

A. Observational Checklist for Farmers' use of different personal protective devices such as safety glasses', apron, mask, goggles, etc.

It was developed by the researcher after reviewing the literature to collect the necessary data from workers.

Scoring system:

Each item was scored 1 for use of personal protective devices and 0 for don't use of personal protective devices.

The total score of all questions will be represented in 100% and categorized into two levels, unsatisfactory (< 60%) and satisfactory (≥ 60%).

B. Checklist for self -reported symptomsof acute pesticides poisoning,was used to assess its prevalence; it included 20 questions related to five systems as follow (nervous system, GIT, respiratory system**,** dermatological, cardiovascular system).

Scoring system:

- Each item was scored 1 when worker reported that he had the manifestations and 0 for if no.
- The **validity** was done through five experts from Faculty members of Community Health Nursing Department at Menoufia University and members of chest department at faculty of medicine Beni-Suef University.Necessary modifications were done. **Cronbach's alphatest** will be used to measure the internal consistency reliability of the questionnaire (0.78).

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3. METHOD

- Data collection extended from November 2015 to the end of April 2016.

Approval:

- An official letter from the faculty of nursing was delivered to the director (s) of the intended study setting (agricultural association in the selected village). A full explanation about the aim of the study was explored. Official permission to conduct the study was obtained from the responsible authorities.

- Workers consent obtained before starting collecting data. Approval from the ethics committee also was obtained to carry out this study.

Ethical consideration

The study wasconducted with careful attention to ethical standards of research and rights of participants Verbal consent was taken from each worker to participate in this study. During the initial interview, the purpose of the study and the procedures were explained to the workers. The subjects were assured that all information would be confidential and used for the research only to assure the confidentiality of the participants. The participation in the study was voluntary and that they can withdraw from the study at any time and can refuse to participate in the study. It would be explained that there were no costs to participate in the study.

Data Collection Procedure:

- At the beginning the researcher visited the agriculture sector at the selected village to get list of vegetable farmers and their addresses.

- The researcher visited the farmers at their homes and introduceshimself; explain the aim of the study to each farmer to gain their cooperation to share in the study.

- Tools developments: tools were developed by the researcher after reviewing the literature to collect the necessary data from workers. Tool **validity test** was done through five experts. They were Faculty members of Community Health Nursing Department at Menoufia University and members of chest department at faculty of medicine Beni- Suef University) and necessary modifications were done.**Cronbach's alphatest** will be used to measure the internal consistency reliability of the questionnaire (0.78).

- **Pilot study:**

A pilot study was carried out on 10% (10 workers) to test the content of the questionnaire as well as to estimate the time needed for data collection and the necessary modifications was done. Those who shared in the pilot study were excluded from the study sample.

- The researcher initiated data collection by interviewing each participant for assessing workers socio-demographic data, personal health habits and working characteristics by using a structured interviewing questionnaire. Also, each subject was asked to answer certain questions to evaluate his knowledge about pesticides. The interview conducted whenever possible in privacy and using simple language, the average number per day around 5-10 farmers and each farmer took an average 20-30 minutes.

- The researcher arranged another visit in their farms at a time in which the farmers would participate in pesticide application to observe the farmers use to safety measures and to fill the self-reported symptoms checklist

Statistical analysis:

The collected data were organized, tabulated and statistically analyzed using SPSS version 19 (Statistical Package for Social Studies) created by IBM, Illinois, Chicago, USA. For numerical values the range mean and standard deviations were calculated. The differences between two mean values before and after intervention were used using paired t test. For categorical variable the number and percentage were calculated and differences between observations before and after intervention were tested by Wilcoxon's singed ranks test. For testing factors affecting level of knowledge and safety

practices, presented as satisfactory and unsatisfactory, chi square test was used. When chi square test was not suitable due to presence of observations with small number, Monte Carlo exact test was used The correlation between total score of knowledge and safety practices and age in years, educational level and experience in farming was calculated using Pearson's correlation coefficient. The level of significant was adopted at $p<0.05$.

4. RESULTS

Table (1) shows the distribution of socio-demographics of studied workers. The table shows that, 30.2% of the studied workers were 20 years to less than 30 years old and the same percentage was among workers who were 50 year or more. As regards monthly income, 41.9 % of studied workers didn't earn enough monthly income. Also the table reveals that 67.4% of the studied workers reported that they didn't practice exercise. Regarding tobacco smoking, more than half of the studied workers (58.1%) reported that they didn't smoking, however about one quadrant (25.6%) smoked 10 to 20 cigarettes per day.

Figure (1) shows the distribution of studied farmers by their educational level. The figure shows that 27.9% of the workers were illiterate, and about one third (34.9%) of them had university education. Technical secondary and general secondary represented 23.3% and 14% respectively.

Table (2) describes the distribution of studied workers regarding occupational characteristics. The table reveals that approximately two thirds (62.8%) of the studied sample were exclusively farmers and the rest had other job besides farming. Related number of daily working hours in farming, about one fifth of studied workers (20.9%) engaged in work more than 8 hours per day. The table also shows that 4.7% of studied workers had previous education about insecticide use and 14% have previous education of first aide measures.

Figure (2) showsthe distribution of studied farmersregarding years of experience The figure shows that 37.2% of the studied workers had years of experience exceed 20 years, and 34.9% had years of experience range from 10 to 20 years.

Table (3): shows the mean value of total knowledge score and total score of using safety measures. The data reveals that the highest mean value related to knowledge of studied farmers is about first aid management 10.60+4.57. Related using of safety measures of studied workers the mean value is 3.35+1.63.

Figure (3) shows the distribution of studied workers by their level of total knowledge. The data revealed that the percentage of satisfactory knowledge among studied workers was 17.4%.

Table (4) clarifies the factors affecting level of total knowledge among studied workers. Regarding age of workers, educational level and their experience, the percentages of satisfactory knowledge were significant higher among the youngest studied workers, who had university education and who had least years of experience (34.6%, 36.7% and 37.5% respectively). There were no significant differences between level of total knowledge and daily working hours and monthly income.

Table (5) shows the distribution of studied workers by their level of total use of safety practices. The data revealed that the percentage of satisfactory use of safety practices among studied workers was 12.8%.

Table (6) clarifies the factors affecting level of total safety measures among studied workers before intervention. Regarding age of workers, educational level, and their experience there were no significant differences with level of total safety measures. There were significant differences between level of total safety measures and daily working hours (p0.035).

Figure (4) reveals correlation between total knowledge score of studied farmers and their use of safety measures.The results of current study show that there is no significant correlation between knowledge of studied farmers and use of safety measures p 0.302.

Table (7) shows distribution of studied farmers by self-reporting manifestations after exposure to insecticides. The majority of studied workers reported that they suffering from many manifestations; headache (83.7%), dizziness (87.2%), blurred vision (95.3%), nausea (95.3%), cough (94.2%), chest tightness (90.7%) and rash (81.4%).

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Table (1): Socio-demographic characteristics of studied farmers

Socio-demographic characteristics	Number (n=86)	%
Age in years:		
20-	26	30.2
30-	12	14.0
40-	22	25.6
50+	26	30.2
Monthly income:		
Enough	50	58.1
Not enough	36	41.9
Practicing exercise:		
None	58	67.4
<5 times/week	20	23.3
>5 times/ week	8	9.3
Tobacco smoking:		
None	50	58.1
<10/day	14	16.3
10-20/day	22	25.6

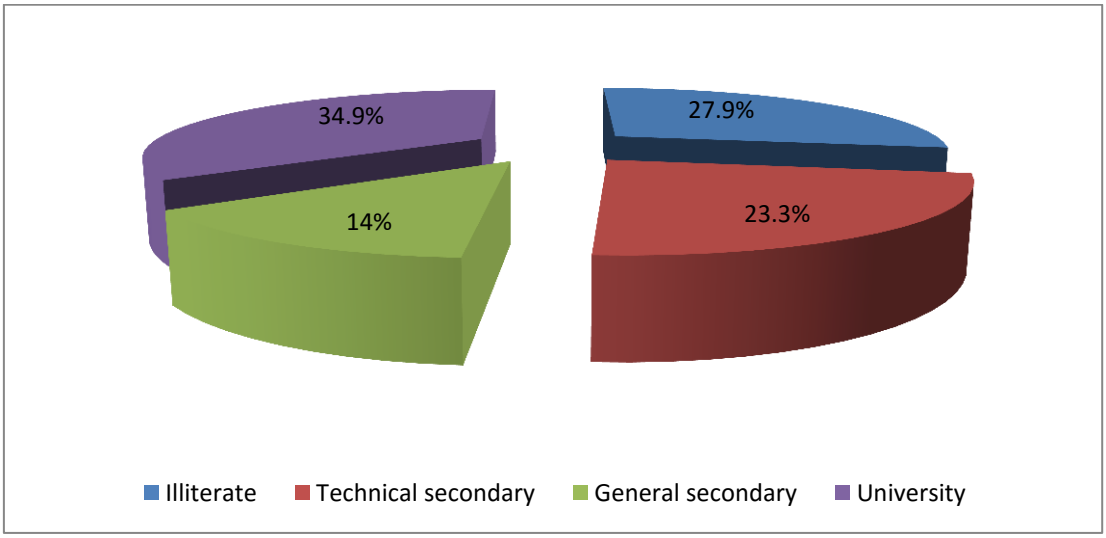

Figure (1): Educational Level of Studies Sample of Farmers

Table (2): Occupational characteristics of studied farmers

Variables	Number (n=86)	%
Occupation:		
Exclusively farmer	**54**	**62.8**
Other job beside farming	**32**	**37.2**
Number of daily working hours in farming:		
<6	**32**	**37.2**
6-8	**36**	**41.9**
>8	**18**	**20.9**
Previous education about insecticides use	**4**	**4.7**
Previous education of first aid measures	**12**	**14.0**

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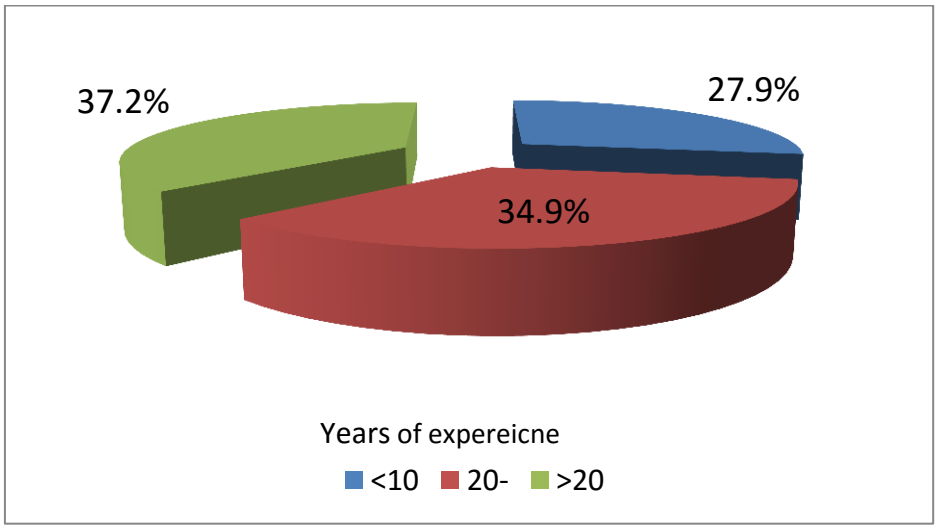

Figure (2): Distribution of studied participants by their experience in farming in years

Table (3): Mean value of total knowledge score and total score of using safety measures

Item of knowledge on pesticide	Mean
General knowledge	5.53+1.39
Safety precautions	4.92+2.28
Health hazards	4.63+1.98
First aid management	10.60+4.57
Use of safety measures	3.35+1.63

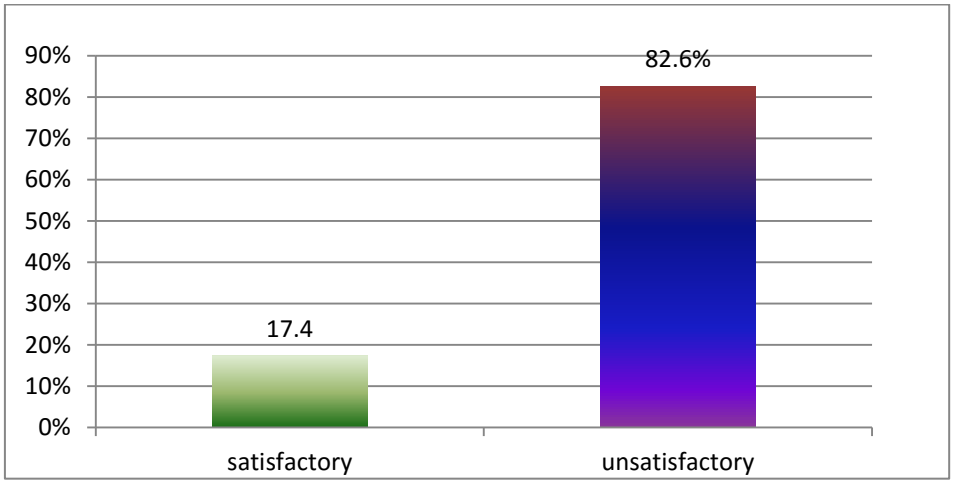

Figure (3): distribution of studied workers by their level of total knowledge

Table (4): Factors affecting level of total knowledge among studied farmers

Variables	Unsatisfactory		Satisfactory		X^2	P
	N	%	N	%		
Age in years:					MCET	0.001*
20-	17	65.4	9	34.6		
30-	8	66.7	4	33.3		
40-	20	90.9	2	9.1		
50+	26	100.0	0	0.0		

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Educational level:					**MCET**	**0.001***
Illiterate	**22**	**91.7**	**2**	**8.3**		
Technical secondary	**18**	**90.0**	**2**	**10.0**		
General secondary	**12**	**100.0**	**0**	**0.0**		
University	**19**	**63.3**	**11**	**36.7**		
Experience in farming:					**9.841**	**0.007***
<10	**15**	**62.5**	**9**	**37.5**		
10-20	**26**	**86.7**	**4**	**13.3**		
>20	**30**	**93.8**	**2**	**6.3**		
Daily working hours					**4.811**	**0.090**
<6	**25**	**78.1**	**7**	**21.9**		
6-8	**28**	**77.8**	**8**	**22.2**		
>8	**18**	**100.0**	**0**	**0.00**		
Monthly income:					**0.172**	**0.678**
Enough	**42**	**84.0**	**8**	**16.0**		
Not enough	**29**	**80.6**	**7**	**19.4**		

***SignificantMCET= Monte Carlo Exact Test**

Table (5): Distribution of total practice of safety measures of studied workers before and after intervention

Total Practice of safety measures	**No.**	**%**
Unsatisfactory	**75**	**87.2**
Satisfactory	**11**	**12.8**
Z	**8.124**	
P	**0.001***	

***Significant**

Table (6): Factors affecting level of total safety measures among studied farmers before intervention

Variables	**Unsatisfactory**		**Satisfactory**		**P**
	N	**%**	**N**	**%**	
Age in years:					**0.314**
20-	**21**	**80.8**	**5**	**19.2**	
30-	**12**	**100**	**0**	**0.0**	
40-	**18**	**81.8**	**4**	**18.2**	
50+	**24**	**92.3**	**2**	**7.7**	
Educational level:					**0.465**
Illiterate	**20**	**83.3**	**4**	**16.7**	
Technical secondary	**18**	**90.0**	**2**	**10.0**	
General secondary	**12**	**100.0**	**0**	**0.0**	
University	**25**	**83.3**	**5**	**16.7**	
Experience in farming:					**0.302**
<10	**19**	**79.2**	**5**	**20.8**	
10-20	**28**	**93.3**	**2**	**6.7**	
>20	**28**	**87.5**	**4**	**12.5**	
Daily working hours					**0.035***
<6	**25**	**78.1**	**7**	**21.9**	
6-8	**32**	**88.9**	**4**	**11.1**	
>8	**18**	**100.0**	**0**	**0.0**	

***Significant**

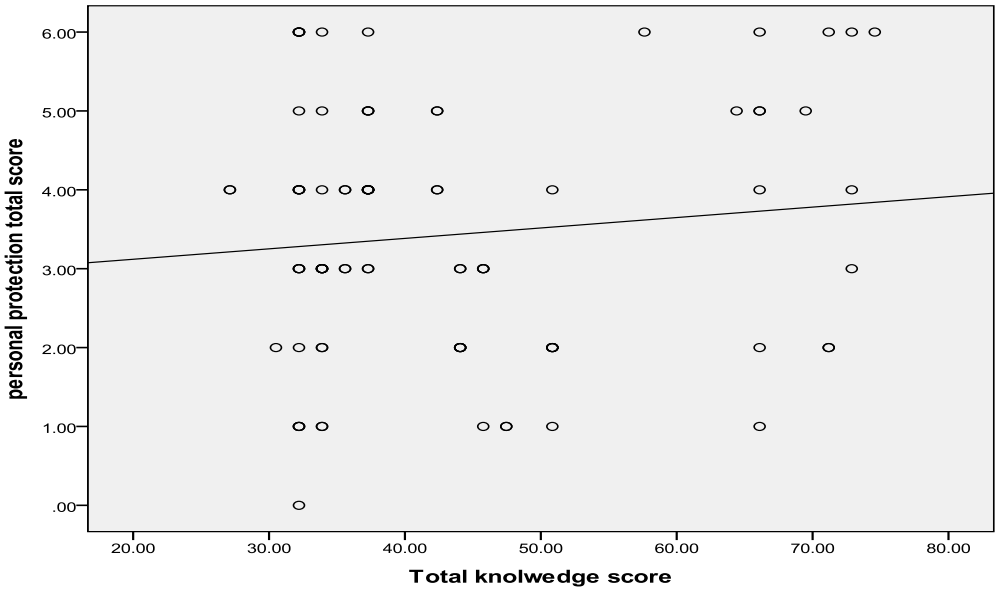

Figure (4): Correlation between total knowledge and safety practice score.

Table (7): Distribution of studied farmers by self-reporting manifestations

Self-reported symptoms	n	%
Nervous system:		
Thirst	28	32.6
Frequent urination	46	53.5
Excess saliva	20	23.3
Headache	72	83.7
Dizziness	75	87.2
Excess sweating	20	23.3
Blurred vision	82	95.3
Excess secretion of tears	68	79.1
Gastrointestinal system:		
Colic	48	55.8
Nausea	82	95.3
Vomiting	24	27.9
Diarrhea	64	74.4
Respiratory system:		
Cough	81	94.2
Chest tightness	78	90.7
Chest pain	57	66.3
Skin:		
Dermatitis	48	55.8
Itching	48	55.8
Rash	70	81.4
Cardiovascular system:		
Tachycardia	57	66.3
Bradychardia	6	7.0

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5. DISCUSSION

Pesticides are widely used in agricultural production to prevent or control pests, diseases, weeds, and other plant pathogens in an effort to reduce or eliminate yield losses and maintain high product quality. On the other hand exposures to pesticides produce several health problems to farmers and their families as acute and chronic toxicity, cancer, respiratory problems, liver diseases and renal diseases (Damals, 2011). So the aim of the current study was to assess knowledge, practice and self-reported symptoms of farmers about hazards of pesticide exposure.

Research question 1: What is the level of knowledge of farmers about hazards of pesticide exposure**?**

The current study revealed that the majority of studied workers had unsatisfactory level of knowledge. These results of current study in harmony with Xu, (2016) who conducted study to collect information on their knowledge, attitude, and behavior related to pesticides in the Anhui province, south of China. He revealed that most of farmers had poor information about pesticides. Additionally Oesterlund etal., (2014) who conducted study to "assess Pesticide knowledge, practice and attitude and how it affects the health of small-scale farmers in Uganda: a cross-sectional study". They revealed that the "farmers had poor knowledge about pesticide". On the other hand Baksh, Ganpat, and Narine, (2015) who conducted study to "assess Farmers' knowledge, attitudes and perceptions of occupational health and safety hazards in Trinidad". They revealed that "about two thirds of the farmers have satisfactory knowledge about pesticides". The differences in the current study might be related to the majority of studied workers didn't attend any previous educational program about pesticides.

Concerning factors affecting level of total knowledge among studied workers before intervention, the current study revealed that the percentages of satisfactory knowledge were significant higher among the youngest studied workers, who had university education and who had least years of experience. The result of current study supported by Zyoud etal., (2010) who"assess the knowledge and practices associated with pesticide use in an agricultural community in Palestine". They revealed that "there were significant relation between farmers' level of knowledge and their educational level & years of experience". While in relation to age and total level of knowledge, they contradict the current study.

Research question 2: What is the rate of using personal protective equipment?

Regarding use of safety practices the results of current study revealed that the three quarter of studied workers had unsatisfactory level of total practice of safety measures. The results of current study were supported by Banjo, Aina and Rije, (2010) who studied "Farmers' Knowledge and Perception towards Herbicides and Pesticides Usage in Fadama Area of Okun-Owa, Ogun State of Nigeria". They found that "the majority of farmers reported not using any preventive measures due to high cost". In the same line Leikei, Ngowi and London, (2014) who conducted study to "assess Farmers' knowledge, practices and injuries associated with pesticide exposure in rural farming villages in Tanzania". They reported that "only one third of farmers reported use of safety measures".

Regarding factors affect use of safety measures among studied workers, the current study showed that there were no significant differences between age of workers, their experience or educational level and level of total safety measures. The results of current study were contradicted by Kumari and Reddy, (2013) who "assessed knowledge and Practices of safety use of Pesticides among Farm workers in India". They reported that "the practice of farmers influenced by their educational level and their experiences". The differences in current study might be related to the majority of studied workers had poor awareness about safety measures and didn't attend any previous training about use of safety measures.
Regarding correlation between total knowledge score of studied farmers and their use of safety measures, the results of current study showed that there was no significant correlation between knowledge of studied farmers and use of safety measures p 0.302. The results of current study supported by Yuantar et al., (2015) who conducted study on Knowledge, attitude, and practice of Indonesian farmers regarding the use of personal protective equipment against pesticide exposure, reported that no significant relationship was found between knowledge and use of personal protective equipment in practice. The results of current study might be due to knowledge and attitudes are not enough to change the behavior of farmers to work in a healthy and safe way.

Research question 3: What is the prevalence of self-reported health symptoms related to pesticide exposure?

Regarding prevalence of self-reported symptoms, the current study revealed that majority of studied workers reported that they suffering from many manifestations; headache, dizziness, blurred vision, nausea, cough, chest tightness, and rash. The current supported by Okonya and Kroschel, (2015) who conducted "A Cross-Sectional Study of Pesticide Use and Knowledge of Smallholder Potato Farmers in Uganda". They reported that "farmers who applied pesticides reported having experienced skin itching, skin burning sensation, coughing, a runny nose, blurred vision, head ache and dizziness".

6. CONCLUSION

The majority of studied workers had unsatisfactory knowledge about pesticides. The knowledge of studied farmers was influenced by their ages, years of experience and educational levels. Regarding use of safety practices the results of current study revealed that the three quarter of studied workers had unsatisfactory level of total practice of safety measures.The current study revealed that majority of studied workers reported that they suffering from many manifestations; headache, dizziness, blurred vision, nausea, cough, chest tightness, and rash.

7. RECOMMENDATION

- Effective implementation of health education program and proper training are needed to improve awareness, practices of farmers about pesticide use
- Perform periodic inspection of farmers' use to safety measures during pesticide application.
- Further researches on Egyptian farmers are needed to produce more accurate data about their knowledge and level of using safety practices during pesticide application

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